Assessing the effect of a compulsory sickness insurance on worker absenteeism*

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Abstract

The effect of economic incentives on worker absenteeism is analyzed using panel data on work absence behavior for each day during 1990 and 1991 (i.e. 730 observations in the time dimension) for a representative sample of 1,396 Swedish blue collar workers. During the observed time period, a major reform of the sickness insurance as well as a tax reform were implemented, both of which affected the worker's cost of being absent from work. We differentiate between the dynamic dependence conditional on whether the worker is in the work absence state versus in the work presence state. We also control for unobserved heterogeneity. The results show that the cost of being absent has a significant effect on work absence behavior and the importance of considering unobserved heterogeneity when modeling individual work absence behavior.

Keywords: Work absence, panel data, discrete choice.

JEL-classification: C25, C33, J22, J28.

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1. Introduction

Most industrialized economies have some form of compulsory sickness insurance.[1] The aim of such insurance is to replace the foregone earnings if the insured worker has the bad luck of having temporarily bad health which prevents her from doing her regular work. However, it is always difficult, or involves high costs, to monitor whether an insured worker really can work or not. This is especially true for short term sickness spells. The Swedish sickness insurance, which is investigated in the empirical part of this paper, leaves the decision on whether the insured individual is entitled to receive compensation from the sickness insurance for the first seven days in a work absence spell to the individual herself. The insured worker is entitled to compensation from the insurance if her perception of her health is such that, "it does not permit her to do her regular work". To prevent abuse of the insurance, most sickness insurance schemes have some form of co-insurance (see e.g., Lantto, 1991, for a theoretical discussion). In the Swedish sickness insurance, this co-insurance has the form that the insurance do not replace the full loss in earnings when the insured individual is absent from work.

The purpose of this study is to empirically examine how economic incentives in general, and the co-insurance in the sickness insurance in particular, affect individual work absence behavior. To do this, we estimate an econometric model using panel data on individual work absence for each day during the period January 1, 1990, to December 31, 1991. Both the sickness insurance and the income tax systems went through major reforms during the time covered by the data. In short the reform of the sickness insurance implied a quite dramatic decrease in the replacement level of the sickness insurance and the tax reform, a radical cut in the marginal tax rates. Both these reforms created variation in the individual cost of being absent from work and thereby facilitates the estimation of the econometric model.

The average number of days per insured individual compensated by the sickness insurance decreased from 24 in 1990 to 22.5 in 1991.[2] This marked decrease in the aggregate rate of work absence, which coincided with an increase in the individual cost of being absent, can be interpreted as supporting the hypothesis that economic incentives affect work absence. However, the Swedish economy entered a recession in 1991. The unemployment rate increased from 2.1 percent in December 1990 to 4.1 percent in December 1991. That is, the composition of the labor force changed and the recession in itself may have had an effect on work absence. By modelling individual work absence behavior, we may separate how different changes over the observed period of time affected individual work absence behavior.

The construction of the Swedish sickness insurance made it possible to develop a unique data-set for studying work absence behavior. The sickness insurance in Sweden is both compulsory and national; i.e. the insurance is administrated by the National Social Insurance Board, whose rules apply throughout the country. This means that

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

[2] *National Social Insurance Board, Facts on the Swedish Social Insurance 1992.*

we are able to get reliable register information on individual daily utilization of the sickness insurance. These registers have been matched with a large micro data-set (The Swedish Level of Living Survey). Consequently, we are able to obtain detailed information on individual economic conditions, as well as the cost of being absent from work, together with information on work absence during each day in the two years 1990 and 1991, for a representative sample of Swedish workers. The final sample consists of 1,396 Swedish blue collar workers (738 men and 658 women) during the years 1990 and 1991. This means that we have 730 records for each individual; i.e. a total of 1,019,080 observations.

To model the individual work absence we assume that each worker, contingent on her perception of her health status and cost of being absent from work, decides each day on whether or not to be absent from work without planning her future work absence behavior. This is a static model in the sense that it assumes "myopic" individual behavior. However, examining a sequence of individual work absence records, it can easily be seen that individual work absence has a dynamic dependence. This pattern is most likely due to the fact that individual health status changes, slowly, over time. These temporary health changes cannot be observed in our, or in any other (?), data-set. To allow for this behavioral pattern, i.e. for unobserved changes in individual health, the preferences for work absence in our economic model will follow a stochastic process. The duration dependence can be thought of as a serial correlation in the unobserved part of the reduced form for demand for work absence time. A complication is that it is unlikely that the biological process underlying the transition from bad health to good health is the same as that for the transition from good health to bad health. We will therefore model the duration dependence differently depending on the initial state, i.e. work or work absence. We use Kaplan-Meier estimates of the empirical survival function as an aid to decide on how to model the duration dependence.

This study extends two aspects of the previous literature in this area. First, we are able to control for unobserved heterogeneity using a fixed effect regression model. In this context there are several reasons, which will be discussed in detail below, to why there may be an inverse relationship between wages - which with the design of the replacement in the sickness insurance is highly correlated with the cost of being absent from work - and differences in preferences to be absent. Therefore, if unobserved heterogeneity is not controlled for using fixed effects, a spurious correlation between work absence and the cost of being absent from work may occur. Second, we estimate the dynamic structure of work absence behavior. In this context we are able to distinguish the transition from work to work absence from the transition from work absence back to work again.

The main limitation of the study is that our theoretical model is intrinsically static. That is, we do not allow for the individual to plan her work absence behavior more than one day in advance. There are at least two reasons why this should not be the case. First, it is possible that an absence spell may be seen as an investment in the individual's health. A short absence spell may enable the individual to recover faster from a temporary illness. That is, a work absence spell may be seen as an "investment in individual health" and therefore an investment to avoid future work absence (see Gilleski, 1998). Second, the workers future wage may depend on her current work absence behavior. However, estimating a dynamic model, while at the same time controlling for unobserved heterogeneity, is computationally intractable. Therefore, we will leave the issue of dynamic modelling to further research.

Several interesting results emerged from the study. It is found that the cost of being absent has a negative effect on both the incidence of work absence (number of work absence spells) as well as the duration of work absence spells. The latter effect is not found by just looking at the data, by for example studying the effect of the reform of the sickness insurance using Kaplan-Meier non-parametric estimates. It is also found that preference heterogeneity is important to consider when studying the effect of economic incentives on work absence behavior. The hypothesis of no preference heterogeneity can be rejected. The parameter estimates for the local unemployments rate variable change sign in the model which do not control for individual heterogeneity compared to the fixed effect model.

The paper is organized into seven main sections. Section 2 describes the Swedish sickness insurance as well as the income tax system. Both these systems affect the economic incentives of work absence. Section 3 presents some descriptive statistics on work absence behavior. The theoretical framework for individual work absence behavior is described in Section 4. The data for the dependent and explanatory variables are discussed in Section 5. In Section 6 the results from the econometric model are presented and Section 7 concludes.

2. National Sickness Insurance and Income taxes[3]

In this section we describe the Swedish institutions, the National sickness insurance, income taxes and benefits, that affect the individual worker's economic incentives for work absence.

2.1. Sickness insurance

The National sickness insurance is financed through payroll taxes levied on wages. All employees whose employers pay payroll taxes - all except those employed in the "informal sector of the economy - are insured by the sickness insurance. The Sickness Insurance (SI) is regulated in a separate law ("Lagen om allmän försäkring"). It is "National" in the sense that it is administered and decided by the central government, i.e. the same rules applies in the entire country. The SI replaces forgone earnings due

[3] A extensive description of Sweden's tax and social insurance systems are provided in Aronsson and Walker (1997).

to temporary illnesses up to a social security ceiling. The social security ceiling corresponds to 7.5 "basic amounts" (BA). Most social insurances in Sweden are connected to the BA. Although the BA is politically determined it has historically followed the Consumer Price Index (CPI) very closely.[4] In 1995, about 6.7 percent of all insured workers did have an income above 7.5 BA:s.[5]

A worker who has lost her ability to do her regular work, due to temporary health deficiencies, is entitled to compensation from the SI. For continued compensation, the worker needs a certificate from a physician at the seventh day of the work absence spell. This certificate needs to be renewed on the 29th day, and after that each month. The Local Social Insurance Office is responsible for control against abuse of the insurance. However control against abuse, the first seven days of a sickness spell, is very light. This is partly due to the fact that it is very hard, even for a experienced physician, to decide whether or not a worker is in fact entitled to compensation from the insurance.

The worker is no longer eligible for sickness cash benefits if she for health reasons has permanently lost her ability to work. If this is the case, the worker is eligible for Disability Insurance (DI). However, since the compensation level in the DI, which is not more than 65 percent of the workers regular earnings,[6] is much lower compared to the SI, there are strong economic incentives for the long term sick worker to receive sickness cash benefits rather than DI.

The replacement level, the share of the worker's earnings that is compensated from the SI, has been changed on several occasions in recent time. Let us briefly review the changes relevant for this study. The SI went through a major reform in 1987. In this reform, the replacement from the insurance was changed to be more closely connected to the insured worker's regular work hours. Benefit can be claimed only for these work hours. These rules prevail during the entire time period considered in this study. The replacement level was also substantially increased in this reform to 90 percent of foregone regular earnings (below the social security ceiling) from the first day in each sickness spell.

The insured worker is also entitled to compensation from the SI during holidays. However, a certificate from a physician is needed from the first day of the sickness spell. The worker is then able to save these days of vacation that correspond to the days compensated for by the SI.

On March 1st, 1991, the replacement level was decreased to 65 percent of the insured worker's income for the first three days in a sickness spell, to 80 percent from day 4 through 89, and remained at 90 percent from day 90 of the sickness spell. This reform was one of several means taken by the government in order to cut the budget deficit. There were several motives for the design of the reform. The social democratic government was restricted, by a pledge given in the campaign preceding

[4]For a more detailed desctiption of the BA, see Palme and Svensson (1998).

[5]See National Social Insurance Board (1997). In 1997, one BA was 36,300 SEK (about 4,650 US$).

[6]See Palme and Svensson (1998) for a detailed description of the Swedish DI.

the 1988 election, that the SI should continue to compensate forgone earnings from the first day of all sickness spells. The motive for letting the compensation level remain at 90 percent, for the period in the spell exceeding 90 days, was one of income distribution: the budget cuts should not affect the incomes of long term sick people.

In 1992 the responsibility for the SI, during the first ten days in each spell, was taken over by the employer. As the short term sickness spells, after this reform, no longer are administrated by the National Social Insurance Board, it is not possible to obtain data from the source, and not at all possible to obtain as detailed data, as we use in this study after 1991.

Several groups in the Swedish labor market have negotiated sickness insurances in addition to the compulsory national insurance. Furthermore, most white-collar workers have local agreements with their employers for sickness payment. These agreements can generally not be recovered from our data-set. We have, therefore, restricted our analysis to blue-collar workers. The blue-collar worker's sickness insurance plan, AGS which is negotiated by the blue-collar worker's union LO, does not only cover actual members of the trade union, but all workers whose workplace is covered by collective agreements between the trade union and the employers confederation (SAF), which is about 98 percent of all employed blue collar workers.

AGS can only be claimed for sickness spells longer than 7 days; i.e. sickness spells that requires a certificate from a physician. On the other hand, the compensation is payed, for day one to seven retroactively, when AGS is admitted. The AGS plan was substantially changed in the reform of the National SI of March 1, 1991. Before the reform, the replacement was 8.5 percent of the worker's benefit from the National SI for day 1 to day 14 in a absent spell; between day 14 and 90 it was changed to be between 6 and 21 SEK, depending on the size of the benefit from the National SI, for each day; after day 90 it is changed to 6 SEK irrespective of the worker's sickness benefit. After the reform, the AGS was changed to 15.4 percent of the worker's sickness benefit for the first three days in a spell; to 12.5 percent between day 4 and 90; from day 91 AGS was abolished after March 1, 1991. The AGS benefits were also made taxable in 1991.

2.2. Income taxes and benefits

Sweden has an integrated income tax system. Taxes are payed both to the national and to the local governments. The national government determines the tax base for both these taxes. The local government tax is proportional and is 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 26.87 and 33.48 percent while the mean tax rate was 30.3 percent.

Sweden's income tax system was radically changed in the tax reform of 1991. This tax reform encompassed four fundamental changes. First, from being unified in the pre-reform tax system, the tax base was divided into *earned* and *capital* income.

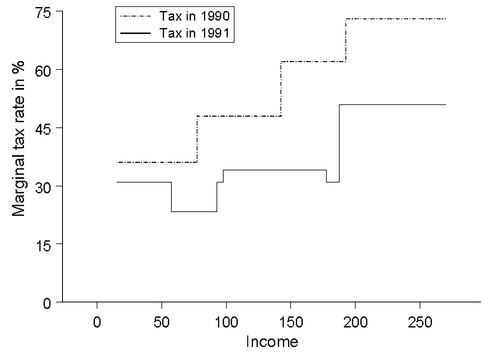

Figure 2.1: Percentage marginal tax rates in the pre and post 1991 Swedish income tax reform regimes respectively. Taxable income in thousands SEK.

Second, the marginal tax rates were substantially decreased.

Figure 2.1 shows the relation between taxable 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 in Figure 2.1, the highest marginal tax rate was reduced from the local government tax rate plus 42 percent national tax rate (with a maximum set to 75 percent in 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 SEK, did receive substantial reductions in their marginal tax rates. The reason why the marginal tax rate decreases in some income intervals in the post reform regime is due to the fact that the basic deduction was made income dependent and increases with income in some intervals and decreases with income in other intervals.

The third main component, of the 1991 tax reform, was a substantial broadening of the tax base. Several previously non-taxed fringe benefits were made taxable after the reform. Also, several services were made taxable for VAT. Finally, the fourth main component of the tax reform, was a substantial increase in the child and housing allowances. The child allowance, which is the same amount per child irrespective of the parents income, was increased by about one third. For example, the child allowance for the first child was increased from 6 720 to 9 000 SEK per year. The housing allowance is, contrary to the child allowance, means tested. The amount is determined by the individual's earnings two years before he or she actually receives the allowance payment, as well as his or her housing costs. The magnitude of the increase of the housing allowance was about the same as that for child allowance.

Table 3.1: Average rates of work absence as well as number of observations in different groups by age and gender. The values within the paranthesis are for the sample used in estimation. (For the males 15, 22, 31, and 31 individuals do not change state from their initial state in work, respectively. For the females the correspondig figures are 10, 8, 14 and 31. Two individuals in both the sub-groups females and males aged 40-49 and three individuals in the sub-groups females and males aged 50-64 do not leave the initial work absence state.)

	Average share absent from work			Number of observations		
Age group	Men	Women	Total	Men	Women	Total
20-29	.0560 (.0606)	.0789 (.0852)	.0652 (.0706)	197 (182)	134 (124)	331 (306)
30-39	.0630 (.0720)	.0800 (.0846)	.0707 (.0779)	177 (155)	147 (139)	324 (294)
40-49	.0673 (.0683)	.0926 (.0892)	.0801 (.0794)	190 (157)	195 (179)	385 (336)
50-64	.1152 (.1209)	.1084 (.1123)	.1117 (.1165)	174 (140)	182 (148)	356 (288)
Total	.0746 (.0786)	.0913 (.0931)	.0825 (.0856)	738 (634)	658 (590)	1,396 (1 224)

3. Descriptive Statistics of Work Absence Behavior

The previous section showed that the SI as well as the income tax system to a large extent influenced the economic incentives of work absence behavior. This section describes, by reporting some descriptive statistics, how these institutions to a large extent determine the pattern of work absence behavior. There are two motives for showing these descriptive statistics. First, it is necessary to take certain aspects of the observed work absence behavior into account when modelling work absence behavior. Second, by first looking at the data, it will be evident which aspects of work absence behavior that we may get a deeper knowledge of by modelling work absence behavior econometrically.

3.1. Duration in Work and Work Absence

For each of the individuals in the sample, we can observe whether or not they were absent from work (compensated from the SI) during 730 days. It is well known that there are several gender differences as well as differences between different age groups in work absence behavior. The average share of individuals absent from work, as well as the number of observations, in different age groups, for both men and women, in the sample are presented in Table 3.1. This Table shows that the rate of work absence is somewhat higher for women in all age-groups except in the oldest, those aged between 50 and 64. It can also be seen that the rate of work absence remains almost constant for both gender groups until the age group 50 to 64, at which point it increases substantially with the change largest for men.

To study differences between these groups in the duration of work absence as well as work presence, we use non-parametric estimates of survival rates in these spells. Figure 3.1 shows the Kaplan-Meier estimates of survival rate in the work state before and after the reform of the SI of March 1st, 1991. This figure reports separate estimates for each of the groups considered in Table 3.1. The corresponding estimates for survival in the work absence state is reported in Figure 3.2.

Figure 3.1 shows a marked increase in the duration of the work presence spells due to the reform of the SI. This can be seen in all age-groups and amongst men as well as women. The largest effect is for men in the oldest age-group. The effect of the reform on the duration of work absence spells seems to be small according to the Kaplan-Meier estimates reported in Figure 3.2. An exception is the two youngest female age-groups, where a small decrease in the duration of the spell after the reform is detected.

A careful examination of Figures 3.1 and 3.2 and Table 3.1 reveals some interesting gender differences. Women have on average a higher rate of work absence. The Kaplan-Meier estimates shows that this difference is primarily due to a shorter duration in the work presence states, i.e. have more frequent work absence spells, although they return from their work absence somewhat faster. In the age group 50-64, the average work absence rate is somewhat higher among men. In this age group, which is evident from Figure 3.2, men return to work considerably slower than women.

By comparing Figure 3.1 with Figure 3.2 it can also be seen that the work absence spells are very different from the work presence spells. The survival rate in the work presence state is much larger compared to the work absence state. As health deficiencies are behind most work absence spells, the explanation for the observed difference is, of course, that there are different biological processes underlying the transition from work to work absence compared to from work absence back to work. This may be a trivial point, but it is important to have in mind when work absence is modelled econometrically.

3.2. Weekday Effects

As we described in the previous section, the worker can only claim benefits from the SI for lost earnings from regular work hours. Most worker's do not work on Saturdays nor on Sundays. As there are no incentives for a worker to begin a sickness spell on a work-free day, the rate of work absence will differ between different week days.

Figure 3.3 shows the distribution of which weekday a work absence spells start on and the distribution of which weekday work absence spells end on. The figure shows exactly what can be expected given the rules for the SI: the relatively large proportion of the sickness spells that begin on Mondays reflect the fact that some health problems may accumulate during the weekends. The large proportion of sickness spells that end on a Saturday has a similar explanation, as recoveries from temporary illnesses also accumulate during the weekends.

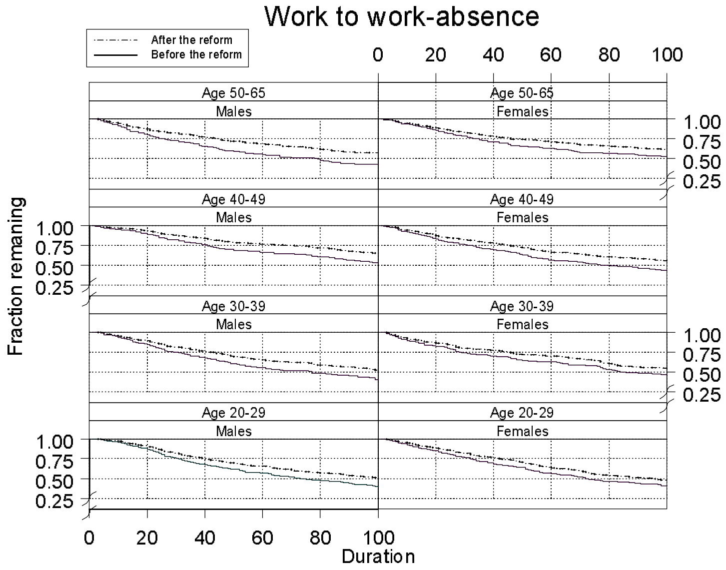

Figure 3.1: Kaplan-Meier non-parametric estimates of survival rates in work spells.

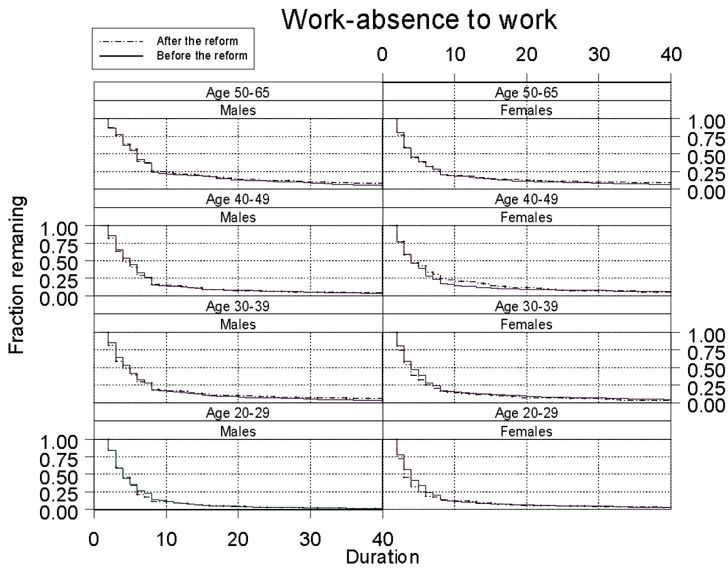

Figure 3.2: Kaplan-Meier non-parametric estimates of survival rates in work absence spells.

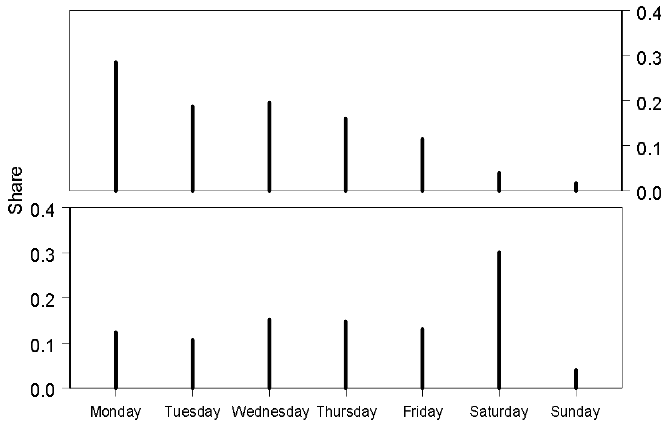

Figure 3.3: Share of sickness spells starting (first panel) and ending (second panel) on different days of the week.

3.3. Seasonal Variation in Work Absence

Figure 3.4 shows the average number of reported SI spells between the years 1987 and 1991 by month. Two properties of the seasonal differences in Figure 3.4 should be noted. First, the work absence seems to be highly inversely correlated with the general seasonal differences in light and outdoor temperature that characterize Sweden's climate over the different seasons of the year. Second, there is a sharp decline in the reported sickness spells in July. This is due to the fact that July is the most common month of summer holiday for workers in Sweden. As describes in the previous Section, although the insured worker is entitled to compensation from the SI during the holiday, a certificate from a physician is needed from the first day of the sickness spell.

4. Modelling Work Absence Behavior

In this Section we will first describe how we model individual work absence behavior. We then explain how different kind of sample heterogeneity is controlled for. Finally, we describe how the model is estimated and how the specification tests are performed.

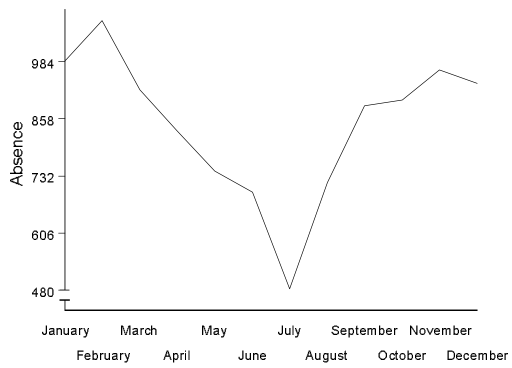

Figure 3.4: Average number (in thousands) of reported sickness spells in different months between 1987 and 1991. Source: National Social Insurance Board, Stockholm.

4.1. Modelling Individual Work Absence Behavior

We assume that each individual each day maximizes a utility function of the following type,

$$u_t = U_t\left(x_t, L_t; \mathbf{s}_t, \varepsilon_t\right), \tag{4.1}$$

where x_t is a composite consumption good with the price normalized to one; L_t is leisure time and consists of two components: contracted leisure time, t_t^l, and t_t^a which is time in work absence (i.e. $L_t = t_t^l + t_t^a$); $\mathbf{s}_t$ is a vector of observable socio-economic variables and ε_t is an individual taste component that may change over time and cannot be observed directly by the econometrician. Changes in ε_t can, but do not need to be, driven by changes in the individual's health perception. It is plausible that the individual's utility of leisure is considerably higher if he or she suffers from a temporary illness than it otherwise would have been. We assume that the contracted leisure time is fixed over the time period studied (two years), i.e. , $t_t^l \equiv t^l$. The sub-index, t, is an index for each day covered by our data-set, i.e. we allow the preferences to be different between days.

The daily demand for time absent is obtained when the individual maximizing the utility function (4.1) subject to the daily budget constraint

$$x_t + \left(1 - \delta_t\right) w t_t^a = w h^* + R_t$$

where h^* is the contracted number of daily working hours, R_t is income from sources other than labor, w is net hourly wage and δ_t is the share of the income the worker receives when absent. h^* can be divided into the desired number of work hours and time absent. This gives the identity $h_t + t^l + t_t^a \equiv 24$.

Assume that the utility function (4.1) has the functional form proposed by Hausman (1980). This will allow us to derive a linear demand functions for time absence

$$\tau_t^a = h^* - \alpha w(1-\delta_t) - \psi(R_t + h^* w\delta_t) - \mathbf{s}_t - \varepsilon_t = h^* + \alpha c_t + \psi\,\mu_t - \mathbf{s}_t - \varepsilon_t,$$

where α and ψ are parameters to be estimated. From the Kaplan-Meier estimates presented in Section 3, it is evident that the survival rate in work absence spells is not independent of the duration of the spell. By comparing the Kaplan-Meier estimates for the work absence spells with those obtained for the work presence spells, it is also obvious that the probability that the worker is absent differs, depending which state the worker is in initially. To be credible, a model for the day-to-day choice of work absence behavior must allow for these particularities in the observed individual behavior.

An explanation for the observed behavior is that individual preferences for being absent from work are dependent on temporary changes in the individual's health status. We cannot observe these temporary, individual health changes over the two years we observe each individual's work absence behavior. It is, however, plausible that the individual preference for work absence, ε_t, will depend on the revealed preference the day before the decision in period t. Therefore, we specify $\varepsilon_t = \lambda^l + u_{it}$, where $l = 1, ...T$ is the duration of the spell the individual is in at time t; λ^l can be specified using different functional forms; u_{it} is an i.i.d. random disturbance with $Var(u_{it}) = \sigma^2$.

To allow for different work absence behavior depending on which state the individual was in the previous time period we specify the demand functions conditional on work or work absence state,[7] i.e. for individual $i = 1, ..., n$ conditional on work absence (WA) we have

$$\tau_{it}^a | WA = \alpha_i + \alpha_{wa} + \gamma_{wa} c_{it} + \psi_{wa}\mu_{it} + \mathbf{z}_{it}\boldsymbol{\gamma}_{wa} + \lambda_{wa}^l + u_{it} = \alpha_i + \mathbf{x}_{it}\boldsymbol{\beta}_{wa} + u_{it}$$

and on work (W)

$$\tau_{it}^a | W = \alpha_i + \alpha_w + \gamma_w c_{it} + \psi_w \mu_{it} + \mathbf{z}_{it}\boldsymbol{\gamma}_w + \lambda_w^l + u_{it} = \alpha_i + \mathbf{x}_{it}\boldsymbol{\beta}_w + u_{it}.$$

α_i is a fixed effect and $\mathbf{z}_{it}$ consist of observables (i.e. $\mathbf{s}_{it}$ is assumed to a linear function of explanatory variables and parameters to be estimated) that we know will affect work absence. The non-parametric analysis suggested that is important to let the duration dependence for the work absence spells to be non monotonic, at least so for the first seven days, whereas it seems reasonable, from Figure 3.1 to assume that $\lambda_w^l \equiv 0$ for all l. It is hence reasonable to specify the first seven days in a work absence spell unrestricted and in order to save degrees of freedom we restrict the following duration dependence to be linear, i.e. $\lambda_{wa}^l = \lambda_{wa} Dur_{it}^{WA}, \quad l = 8, ..., T.$, where $Dur_{it}^{WA} = \sum_{s=1}^{t-1}\prod_{k=1}^{s} d_{i,t-k}$. For the work spells we simply assume a linear specification i.e. $\lambda_w^l = \lambda Dur_{it}^{WA}$ where $Dur_{it}^{W} = \sum_{s=1}^{t-1}\prod_{k=1}^{s}(1 - d_{i,t-k}), \quad l = 1, ..., T.$

[7] Meghir & Whitehouse (1997) study the principal determinants of retirement using a model that allow for different parameters depending on state.

4.2. Controlling for Heterogeneity

There are two kinds of sample heterogeneity that need to be controlled for. First, as is apparent from Table 3.1, the individuals are heterogeneous in their work absence behavior. This can be explained by differences in economic incentives for being absent. It is, however, plausible that they also vary in their preferences for work absence. These differences in preferences cannot be observed directly in the data-set. Second, as is apparent from Figure 3.3 in Section 3, work absence varies between different weekdays and also over different seasons of the year. The origin of these differences are directly observable in the data-set.

To control for individual difference in preferences for being absent, we have chosen a fixed effects approach, i.e. an individual component, a_i, is added to each individual in the sample. The disadvantage with this approach, compared to a random effects model, is that it is less efficient as more additional parameter for each individual in the sample have to be estimated. Furthermore, the identification of the fixed effects model relies on that the included variables change over time.

There are at least two advantages with using the fixed effects model. First, the estimator of the fixed effects model is consistent (if $T \to \infty$) also when state and duration dependence are present and the initial state[8] (work or work absence) is unknown (see e.g. Heckman, 1981). Second, this estimator is consistent when the included explanatory variables are correlated with the individual effects. That is, the choice between the fixed and random effects models depend on to what extent we consider these two advantages to be of relevance in our empirical analysis. On the first item, we believe that we have duration dependence, at least so in the work absence state. On the second item, the relation between wages and absenteeism has been studied in several theoretical as well as empirical studies (see Brown and Sessions, 1996, for an overview). There are at least four independent reasons to believe that there is an inverse relation between wages and work absence.

- *Compensating wage differentials:* A worker with strong preferences for work absence may choose a job that allows him or her to be absent from work to the cost of, ceteris paribus, a lower wage rate. Allen (1981) examines, and finds some support for, this hypothesis empirically.

- *Efficiency wages*: According to the efficiency wage hypothesis (see e.g. Shapiro and Stiglitz, 1984) the employer may pay the employee somewhat more than the market wages in order to elicit the employee not to shirk. Work absence can, to some extent, be interpreted as a form of shirking. As is stressed by, for example Wiess (1985), jobs differ in the cost of absenteeism for the employer. That is, it

[8] If we have duration dependence of length L. Then, for the random effects model to be consistent one would need the marginal distribution for those L dependent variables. One could, though, neglect the initial condition problem. However, for shorter panels this has been shown to be a highly biased estimator (see Heckman, 1981).

may be profitable for the employer to pay some employees more provided that they have a very low work absence rate.

- *Returns to on-the-job training*: An individual with strong preferences for work absence will on average during his or her career be absent more hours. If there is economic returns to on-the-job training, these individuals will, everything else equal, earn less.

- *Returns to good health:* It is a well known empirical fact that workers with bad health on average have a higher work absence rate than workers with no health problems (see e.g. Broström et al., 1998). For some jobs, it is reasonable to assume that workers with bad health are less productive and therefore earn less than workers with good health status.

The empirical studies reviewed by Brown and Sessions (1996) also give in general, an inverse relationship between wages and work absence. Thus not controlling for unobserved heterogeneity will presumably create a spurious correlation between the cost of being absent and the incidence of work absence, as workers with higher wage rate on average have higher costs of being absent from work. As the objective of this study primarily is to study the policy implications of changing the SI it is, in this case, of primary importance to control for the effects of unobserved heterogeneity using a fixed effects approach.

The model specification in Section 4 includes a vector $\mathbf{z}_{it}$, that consists of observable variables, which are likely to affect the individual's work absence behavior and changes over the observed time period. From the descriptive statistics presented in Section 3 it is evident that work absence varies with the weekdays. These are fully observable in our data-set. An indicator variable for each day in the week,except for Tuesdays which is taken as a numerator $(MON; WED; THU; FRI; SAT; SUN)$ is added to the specification.

For similar reason as for the weekday variables an indicator variables for public holidays, HO, (about 7 each year) is included in the model. In addition to this, the variable BH which is an indicator variable for days between public holidays and Sundays or Saturdays if it happens to be only one day between the public holiday and the weekend, is included. There are anecdotal evidence suggesting that work absence is higher for such days. By including BH in the model, we are able to test this hypothesis.

The descriptive statistics, of Section 3, also showed that the rate of work absence vary considerably over the year. Apart from the marked decrease in work absence during July (the vacation period in Sweden), economic incentives are unlikely to generate such variations. It is more plausible that the changes in light and outdoor temperature generate changes in the individual preferences for work absence. An indicator variable for each month $(FEB; MAR; APR; MAY; JUN; JUL; AUG; SEP; OKT; NOV; DEC)$ except for January which is taken as a numerator is added to the $\mathbf{z}_{it}$ vector.

As is described in the Introduction, the Swedish economy entered a recession in the spring of 1991 and the unemployment rate increased rapidly. Several hypothesizes on the relationship between the unemployment rate and work absence has been put forward (see Bäckman, 1998, for an overview). Most of these hypothesizes depart from arguments from the efficiency wage literature. According to for example the model of Shapiro & Stiglitz (1984), a high unemployment rate will work as a worker discipline device. If the worker is caught shirking and dismissed during times of high unemployment rate, the worker's cost of finding a new job, and thereby of getting dismissed, will be higher than it otherwise would have been. Some form of work absence can be seen as shirking. The cost for the employer of work absence is normally likely to be greater than the revenues of not having to pay the worker's wage. A profit maximizing firm wants to get rid of workers with excessive rate of work absence. As the cost of losing the job, and indirectly the worker's cost of being absent from work, increases if the unemployment rate increase, the work absence rate is likely to be inversely related to the unemployment rate. As the unemployment rate varies over the observed period of time, a variable measuring unemployment ($UNEM_{it}$) is added to the $\mathbf{z}_{it}$ vector.

4.3. Estimation

Assume that an individual, i, will be absent if demand for absence is larger than some threshold value k_i. Hence if $\tau_{it}^a|WA \geq k_i$ or $\tau_{it}^a|W \geq k_i$ the individual will be absent day t, for the two states, respectively. The probability to be absent given a work spell (the hazard of leaving work) is

$$\Pr(\tau_{it}^a \geq k_{it}|W) = \Pr(d_{it} = 1|W),$$

where d_{it} is an indicator variable for being absent. Let $a_i = \alpha_i - k_i$ then under the assumption that the errors are logistically distributed we get the following hazard

$$\Pr(d_{it} = 1|W) = \pi_{it}^{01} = \frac{1}{1 - \exp(-a_i - \mathbf{x}_{it}\boldsymbol{\beta}_w)}.$$

The probability to remain in a work absence spell is

$$\Pr(d_{it} = 1|WA) = \pi_{it}^{11} = \frac{1}{1 - \exp(-a_i - \mathbf{x}_{it}\boldsymbol{\beta}_{wa})},$$

with the corresponding hazard

$$\Pr(d_{it} = 0|WA) = \pi_{it}^{10} = \frac{1}{1 - \exp(a_i + \mathbf{x}_{it}\boldsymbol{\beta}_{wa})}.$$

Since we have state dependent intercepts, a_w and α_{wa}, the fix effects a_i are estimated under the restriction $\sum_{i=1}^n a_i = 0$.

The log-likelihood for the WA and W spells are

$$LogL^{wa} = \sum_{i=1}^{n} \sum_{t \in H} d_{it} ln(\pi_{it}^{11}) + (1 - d_{it}) ln(\pi_{it}^{10})$$

and

$$LogL^{w} = \sum_{i=1}^{n} \sum_{t \in T-H} d_{it} ln(\pi_{it}^{01}) + (1 - d_{it}) ln(\pi_{it}^{00}),$$

where H is the set of observations such that $d_{it-1} = 1$, $t = 1, ..., T$ and $\pi_{it}^{00} = 1 - \pi_{it}^{01}$. The likelihood for all observations are equal to

$$\begin{aligned} LogL &= \sum_{i=1}^{N} \sum_{t=2}^{T} d_{it-1} \left\{ d_{it} ln(\pi_{it}^{11}) + (1 - d_{it}) ln(\pi_{it}^{10}) \right\} \\ &\quad + (1 - d_{it-1}) \left\{ d_{it} ln(\pi_{it}^{01}) + (1 - d_{it}) ln(\pi_{it}^{00}) \right\} \qquad (4.2) \end{aligned}$$

5. Data

This section describes how the variables included in the econometric model are measured. We also describe how the sample is selected. Finally, we report some descriptive statistics from the final sample.

5.1. Measurement of the included variables

The data were obtained from the 1991 Swedish Level of Living Survey (SLLS). In this survey, about 6 000 thousand Swedish individuals, aged 16 and 74, were interviewed about economic resources and living conditions in a broad sense (see Fritzell & Lundberg, 1994, for a detailed description of this survey). The interviews were carried out in the spring of 1991. Information from several registers have been matched on to the SLLS survey.

- *Work absence:* The measurement of the dependent variable, day-to-day work absence for each individual in the sample, is obtained from the National Social Insurance board register. This register contains information on the exact dates corresponding to each payment from the SI to each individual in the sample; i.e. we have the exact dates for which each individual in our sample received compensation from the compulsory SI between January 1, 1990 to December 31, 1991.

  It is, of course, possible that the worker is absent from work without receiving compensation from the SI and this will contaminate the validity of our measure of work absence. However, according to studies on time use at workplaces, most of the unplanned work absence is compensated by the SI. One such study, SAF (1986), estimated the fraction of unplanned work absence, not compensated by the SI, to only 2.9 percent. Since actual payments are linked to the data we use, the accuracy of the our measure is likely to be very high. That is, the measurements of work absence is not self-assessed measures that rely on the memory of the respondent; which in this case not would have been possible to use, since the time period we analyze (two years) is comparatively long.

- *The cost and income variables:* Data to construct the cost and income variables, i.e. the different components of the individual's income, are obtained from tax registers. As was discussed in the previous section, as well as in Section 3, the cost and virtual income variables are influenced by the compensation level and by the income tax. Individual income from the social security system is taxed at the same rate as income from labor. To measure the number of hours of work, we use the information obtained in the SLLS interview. We use this measurement for the entire time period considered; we assume that each individual in the sample has the same number of regular work hours as in the spring of 1991. To make the cost and income variables comparable between 1990 and 1991, we use the Consumer Price Index (CPI) provided by *Statistics Sweden*; we use the 1990 price level.

  - The *cost* variable, $c = w(1-\delta)$, where w is hourly net income from labor and $(1-\delta)$ is the share of foregone earnings not covered by the SI.[9] The hourly wage rate is obtained by dividing the potential annual labor income by the number of work hours stated in the surveys. To calculate the potential annual income from labor, we have added the share of income from labor not covered by the SI, $(1-\delta)$, for each day recorded in which the individual has been compensated by the SI.

    The cost of being absent is also influenced by the AGS insurance. To measure the reduction in the cost of being absent from this insurance is problematic, in the sense that it is only paid out for sickness spells that last more than 7 days, although for these spells it is paid out retroactively from the first day. In the theoretical model we use, it is assumed that the individual makes his or her decision on work absence on a day-to-day basis. That is, it does not contain any mechanisms for the individual to anticipate payments after eight days when deciding on whether to be absent from work or not for the first day in the spell. Therefore, we will disregard the AGS benefits for the first seven days and only consider it for the cost of being absent from the eighth day in the spell. However, after the eighth day, we

[9] As the sickness insurance only compensate for earnings below the social insurance ceiling, this is only true for labor earnings below this ceiling. The social insurance ceiling corresponded to an annual labor income of 222,750 SEK in 1990 and 241,500 SEK in 1991. Most employer compensate their employees for forgone earnings above the ceiling. However, as all individuals in our sample, like most blue collar workers, do not have income above the ceiling this is not an issue for this sample.

use the rules for the AGS insurance and calculate the individual benefit from this insurance.

Finally, the cost of being absent is influenced by income taxes. We use the marginal tax rate for each individual that corresponds to their taxable income if they would not have been absent at all during the year. There is a potential endogeneity problem using this procedure. As labor income is not fully compensated by the SI, the marginal tax rate may depend on how many days the individual is absent from work; i.e. it may not be independent of the individual decision whether or not to attend work. However, in practice this is not a severe problem, as most individual in the sample can not change their tax segment due to work absence. If they do, the endogeneity problem will only affect the work absence decision for very few days.

– *Virtual income*, $\mu = R + \delta wh$, measures the income the individual receives if he or she is absent from work; i.e. compensation from the SI, income from capital as well as child and housing allowances. If the individual is married or cohabiting, all family income, including observed income from labor of the spouse, is summed and divided by two.

  According to the traditional Haig-Simons' definition, income is the value of the consumption that an individual, or household, can enjoy during a certain amount of time, without that the real value of it's wealth changing. In this study, we use data collected from tax registers, that are based on annual income, while our economic model is based on a daily budget set. To get a measure of daily income, we take the daily average of each individual's annual income; i.e. divide the annual income with 220 (i.e. 365 minus the average number of work free days during a year). This procedure creates two problems. First, as we take the daily average of annual income, the measure of income is contingent on the work absence behavior during the other days of the year. The second problem is that we have to make the unrealistic assumption that the worker does not have access to credit markets, or is able to "borrow from him- or herself", in order to smooth out consumption during the time-period studied.

  An inevitable problem, when measuring income using administrative data is how to measure income from real wealth, such as owner occupied homes or durable consumption goods, as we do not have access to reliable estimates on the worth of these items. We will follow the strategy of *Statistics Sweden* and assume that negative income from capital corresponds to a equal worth income from real wealth. That is, we will not consider negative income from capital, when different income components are combined. This method works well when the interest payments actually correspond to real wealth. However, there are at least two cases where the method does not work well.

First, if the negative income from capital corresponds to a positive, and registered, income from financial wealth. Second, individuals who do not have loans corresponding to their real capital. For these individuals, we will underestimate their income from real wealth.

The SI in Sweden is financed through payroll taxes, although the system during different time periods has been running a deficit as well as a surplus. Overall, the level of the payroll tax is determined by the utilization of the SI, and assuming that at least a part of the incidence of payroll taxes are on wages, the share of the cost of work absence can be attributed to wage earners. However, as we in this study restrict our attention to individual work absence behavior, we will assume that the individual acts as if there are no costs of work absence through the payroll tax.

- *Unemployment rate:* To measure the unemployment rate on each worker's local labor market we use the monthly unemployment rate, in each of Sweden's 24 counties as provided by the *Labor Market Board*. That is, the unemployment rate will vary between individuals and also over the time period observed. One problem, with using the monthly unemployment rate, is that there are seasonal variations in the unemployment rate, which are unlikely to affect the worker's work absence behavior. To account for these seasonal variations we use multiplicative seasonal components provided by the *National Institute of Economic Research*, which were obtained from an ARIMA model estimated on monthly unemployment data for the entire nation between 1988 and 1998.

5.2. Sample selection

As described in the previous Section, the data-set consists of about 6 000 individuals. However, in order to obtain the sample used in the estimations, several selections were made. Table 5.1 shows the number of individuals remaining, after each of the main steps in this selection process. The SLLS contains two sets of information that are very useful in the sample selection process. First, the respondents in the survey, are asked about their occupation and employment status in the week before the survey. Second, they were asked about their employment status during the year 1990.

In the first step of the selection, non-responses (about 15 percent of the original sample) are removed, and as the normal age of retirement is 65 years in Sweden, we have restricted the sample to individuals between age 20 and 65 in 1991.[10] In the second step of the selection, information on the respondents activities the week before the survey were used to exclude unemployed as well as individuals not in the labor force; i.e. students and pensioners (individuals who receive disability or old-age pension). Self-employed, military personnel, and white collar workers were also

[10]The oldest individual in our sample is 64 years old.

Table 5.1: Number of observations in the sample remaining after each step in the sample selection.

	Number of Observations		
	Men	Women	Total
Respondents, age 20-65	2,191	2,106	4,297
Not self-employed, farmers, military personnel and in the labor force in 1991	1,140	1,256	2,396
Blue collar workers in 1991	833	815	1,648
Workers not laid-off or unemployed more than 4 weeks during 1990	812	781	1,593
Taxed annual earnings that are consistent with the stated regular number of hours of work	738	658	1,396

excluded. That is, the study is restricted to employed blue collar workers. Blue collar workers are defined by their socio-economic code included in the SLLS. This group of workers are almost exclusively organized by the blue collar union, LO, and their social rights are collectively agreed with the employers confederation (SAF).

The reason for excluding the groups of individuals, other than blue collar workers, is to limit heterogeneity arising from differences in the SI systems. Information on these differences cannot be obtained from the available data. Some of the white collar worker's unions have collective agreements on sickness insurances on top of the compulsory national insurance, which also covers short term sickness spells. For the group of self-employed, in addition to heterogeneity in the SI, it is also difficult to obtain information relevant income variables, which is essential for this study.

The third step in the selection process was to use the information on activities during 1990 to exclude 55 individuals who were not employed during more than 4 weeks in 1990. Finally, 197 individuals with "inconsistent" observation on their labor earnings during either 1990 or 1991 were removed. That is, the respondents claimed that they worked more than 16 hours each week and did still, according to their taxed income from labor, not earn more than one BA (29 700 SEK in 1990 and 32 200 SEK in 1991). The explanation to these observations can either be measurement errors in at least one of the relevant variables, or that the person works in the "informal" sector of the economy and is therefore not covered by the SI.

5.3. Descriptive statistics

The final sample consists of 1,396 individuals, 738 men and 658 women. From this sample 10 (5 men and 5 women) were absent from work all days which we were able to observe, and 158 (97 men and 61 women) were not absent at all. These observations, individuals that did not change state at all, can not be used in the estimation of the econometric models used in this study. Furthermore, 4 observations (2 men (age 40-49 and age 50-64) and 2 women (age 40-49 and age 50-64)) are left out since they do not change state after their first, left censored work absence spell is removed. See Table 3.1 for description and comparison of the final sample with the original sample. One can a note that there is a age difference with respect to this last selections. There are 15, 22, 30, and 30 males in the age-groups 20-29, 30-39, 40-49 and 50-64, respectively that do not leave their initial work state. For the females the corresponding figures are 10, 8, 13 and 30. For the work absence state 0, 0, 3 and 4 males and females in the age-groups 20-29, 30-39, 40-49 and 50-64, respectively do not leave the initial work absence state. Hence, there is an increasing - with age - heterogeneity in the sample.

The estimation method used in this study requires that the independent variables change over the observed time period. There are four sources of change in c and μ.

- *Income mobility:* As we described in the previous section, the data that builds up the cost and income variables are collected from tax registers. These data measure income flows during a year while, as is well known, income may change month-to-month or even day-to-day. We can, however, observe changes between the year 1990 and 1991. These individual changes will create changes in both the cost and income variables.

- *The 1991 income tax and benefit reform:* The decrease of the marginal tax rates creates a closer link between the worker's income loss when absent from work and his or her net income; i.e. the cost of being absent will increase. The dividing of the tax base will for some individuals, who due to large capital incomes in the pre-reform income tax regime had high marginal tax rates, creates an extra decrease of the tax wedges. Finally, the large increase of child and housing allowances will have an effect on the incomes for some individuals in our sample.

- *The reform of the SI in March 1, 1991:* The sharp decrease in the compensation levels in the SI for primarily the short work absence spells, will, of course, increase the cost of being absent. It will also, although to a smaller extent, decrease the virtual incomes of the individuals in the sample.

- *The design of the post-reform SI:* As we describe in the previous section, the compensation in the post reform SI increased after 3 as well as 89 days in a sickness spell. That is, the cost of being absent from work will change depending on the length of the work absence spell.

Table 5.2 reports means, standard deviations as well as first and third quartile on the economic variables, i.e. costs of being absent from work as well as virtual income.[11] Comparing the average cost of being absent between 1990 and 1991, it can be seen, which is expected, that there is marked increase in 1991 in all age groups. It can also be seen that the virtual income on average is somewhat lower in 1991. This difference

[11] These quartiles are computed from the individual means for each individual.

is due to the higher compensation levels in the SI as well as marginal tax rates in 1990, which make the slope of the budget set steeper.

Table 5.2 also shows that the cost of being absent is higher for men than for women; this is explained by the fact that men on average have higher labor earnings. On the other hand, women have on average higher virtual income. At first sight this may seem non-intuitive, however, most workers in our sample are married or cohabiting; i.e. their spouses earnings are included in their income but only the share of their own income covered by the SI.

Table 5.3 reports some characteristics of the sample. It can be seen that there are some marked differences between men and women. Most men work in the industry sector, while most women work in the service sector. Another large difference is that a much higher share of the men in the sample work full time.

6. Results

This section reports the results. The first subsection presents and discusses the parameter estimates. The second subsection reports the result when the model is used for simulating policy changes.

6.1. Parameter Estimates and Sample Heterogeneity

Tables 6.1 and 6.2 shows the maximum likelihood estimates from the model (4.2) for the male and female sub-sample, respectively.[12] As can be seen in the tables, both the male and the female sub-sample are further divided into four age-groups. These divisions are partly motivated by practical reasons and partly by specification considerations. From the model specification point of view, it can be argued that preferences towards work absence may be different between men and women (see e.g. VandenHeuvel & Wooden, 1995). It can also be argued that it is likely to differ in different phases of life, due primarily to the deterioration of health. The practical reasons follows from the very large amount of data that have to be handled. Furthermore, the large number of observations implies that the precision of the parameter estimates are fairly good even in the eight sub-samples considered.

As described in Section 3, the econometric model allows each variable to have a different effect depending on whether the worker is in the work absence state or in the work state (i.e. state dependence). This means that we get two parameter estimates for each variable included in the model. The duration dependence also

[12]Standard errors are calculated from the negative of the inverse Hessian.

Table 5.2: Daily income and cost of being absent in different sample sub-groups.

	Males				Females			
	Mean	s	Q1	Q3	Mean	s	Q1	Q3
				1990				
				Age 20-29				
c	3.60	0.97	3.15	4.11	3.40	0.92	2.86	3.82
μ	476.1	112.1	399.5	546.9	524.9	160.1	431.7	641.4
				Age 30-39				
c	4.01	0.94	3.63	4.43	3.40	0.78	2.88	3.84
μ	566.2	167.1	464.6	668.3	629.5	140.8	548.5	710.7
				Age 40-49				
c	4.04	0.82	3.56	4.54	3.65	0.87	3.07	4.00
μ	605.9	168.5	522.2	704.2	644.1	173.2	548.0	735.5
				Age 50-64				
c	4.18	1.11	3.57	4.43	3.47	0.94	2.92	3.81
μ	613.6	137.0	506.8	695.6	616.1	172.0	510.9	694.7
				All				
c	3.94	0.98	3.46	4.36	3.49	0.89	2.94	3.91
μ	560.6	157.2	452.0	660.8	608.6	168.6	502.4	700.1
				1991				
				Age 20-29				
c	15.54	3.70	13.85	17.70	13.80	4.37	11.59	15.20
μ	352.3	113.4	274.6	424.9	384.4	119.2	287.5	470.8
				Age 30-39				
c	15.86	3.53	14.60	17.91	14.80	3.64	13.29	16.71
μ	425.5	109.7	331.3	502.7	504.3	150.2	429.2	558.9
				Age 40-49				
c	16.27	3.77	15.09	18.29	15.27	4.26	13.23	17.70
μ	463.7	116.3	364.1	540.5	505.3	171.5	407.2	565.1
				Age 50-64				
c	16.34	5.789	14.42	18.22	15.01	5.015	13.20	17.29
μ	439.4	107.8	359.2	503.9	449.4	162.0	356.9	516.0
				All				
c	15.97	4.235	14.49	18.10	14.79	4.38	12.98	16.86
μ	417.0	119.8	321.5	503.9	465.6	161.2	377.7	531.8

Note: Q1 is first quartile and Q3 third quartile.

Table 5.3: Socio-economic characteristics of the sample.

	Men	Women
Share working in industry sector	0.61	0.11
Share working in service sector	0.39	0.89
Share working "full time" in 1991	0.95	0.53
Share married or cohabiting	0.67	0.76
Share divorced	0.05	0.09
Share with one dependent child	0.19	0.23
Share with two dependent children	0.17	0.21
Share with three or more dependent children	0.07	0.09
Average age	38.5	40.1

differs depending on which state the worker is in. In the work absence state, the specification includes seven indicator variables and a linear component; one indicator variable for each preceding day until day seven and a linear variable starting at day eight. In the state of work attendance, the specification is restricted to a linear variable in duration of the work spell.

If duration dependence is present for either the work or the work absence spells, the sample needs to be restricted to non left censored observations. This means that the first step in the estimation of the model is to test for duration dependence in each sub-sample. To do this, we first estimate the model without the left censored work and work absence spells. For the work absence spells, duration dependence is present in all sub-groups and, consequently, the left censored work absence spells were left out. For the work spells, the situation is less obvious. The hypothesis of no duration dependence for the work spells ($\lambda_w = 0$), is tested using an ordinary Wald test. A small negative duration dependence in the work state is found in three sub-groups: males aged 20-29 ($t = -2.37$) and females aged 20-29 ($t = -3.94$) and 30-39 ($t = -3.49$). For the other sub-groups the model is reestimated, using also the left-censored work spells.[13] As can be seen in Table 6.1 and Table 6.2, the linear duration dependence component in the work state λ_w is left out from the specification in the sub-groups where it turned out to be insignificantly different from zero.

The parameter estimates of the duration dependence in the work absence state are very similar in the different sub-groups; the parameter estimates of the seven indicator variables are in general significantly negative with the largest parameter in absolute value for the seventh day, while the parameter estimates of the linear component are positive, although not significantly so in all sub-groups. The interpretation of this pattern is that the workers are more likely to go back to work given that they been in the work absence spell less than seven days. After that, they are less likely to go

[13]For males 30-39, 40-49 and 50-64 we get $t = -.74, .89$ and $-.82$, respectively. For females 40-49 and 50-64 $t = -.62$ and $-.61$, respectively.

Table 6.1: Parameter estimates for the male sub-samples.

	Age 20-29		Age 30-39		Age 40-49		Age 50-64	
	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$
				Work				
α_w	-4.67	-9.51	-4.93	-16.07	-4.12	-11.33	-4.10	-9.32
c/γ_w $(\times 10^2)$	-0.02	-2.34	-0.05	-5.34	-0.04	-4.17	-0.04	-3.95
μ/ψ_w	0.05	0.94	0.02	0.64	-0.09	-1.80	-0.09	-1.56
$UNEM$	0.03	0.37	0.32	4.40	0.11	1.48	0.23	2.77
HO	-1.82	-5.64	-1.58	-4.90	-1.79	-4.65	-1.16	-3.73
BH	-1.67	-2.85	-1.38	-2.36	-0.30	-0.80	-1.02	-1.73
λ $(\times 10^2)$	-0.91	-2.37						
				Work absence				
α_{wa}	0.70	1.37	1.51	3.95	2.25	5.40	1.54	3.05
c/γ_{wa}	-0.04	-3.88	-0.08	-6.94	-0.08	-5.55	-0.06	-5.14
μ/ψ_{wa} $(\times 10^2)$	0.11	1.98	0.00	0.10	-0.07	-1.38	0.08	1.36
$UNEM$	0.19	3.03	0.30	4.43	0.23	3.18	0.39	5.20
HO	-0.25	-1.11	-0.39	-1.55	-0.53	-1.99	-0.25	-0.93
BH	0.00	0.00	0.00	0.00	1.33	1.24	0.12	0.19
λ_{wa}^1	0.12	0.74	-0.19	-1.07	-0.20	-1.04	-0.32	-1.66
λ_{wa}^2	-0.79	-5.02	-0.87	-4.99	-0.79	-4.17	-0.22	-1.11
λ_{wa}^3	-0.52	-3.20	-0.53	-2.93	-0.79	-4.11	-0.93	-5.12
λ_{wa}^4	-0.66	-3.81	-0.90	-4.92	-0.72	-3.48	-0.49	-2.37
λ_{wa}^5	-0.75	-4.25	-0.74	-3.87	-1.22	-6.20	-1.31	-7.12
λ_{wa}^6	-0.56	-2.63	-0.55	-2.25	-0.99	-4.17	-0.83	-3.50
λ_{wa}^7	-1.77	-9.46	-1.93	-9.93	-2.36	-11.16	-2.26	-11.78
λ_{wa} $(\times 10^2)$	1.53	4.00	1.00	3.09	0.79	2.74	1.13	4.88

Note: 34 indicator variables variable for weekdays and months are also included in the estimation of the model.

Table 6.2: Parameter estimates for the female sub-samples.

	Age 20-29		Age 30-39		Age 40-49		Age 50-64	
	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$	$\widehat{\beta}$	$\widehat{\beta}/s_{\widehat{\beta}}$
Work								
α_w	-4.28	-10.43	-4.55	-2.62	-5.21	-18.41	-4.44	-16.85
c/γ_w	-0.02	-2.18	-0.07	-5.95	-0.03	-3.96	-0.02	-2.87
μ/ψ_w $(\times 10^2)$	0.09	1.67	-0.05	-1.22	0.08	2.43	-0.01	-0.65
$UNEM$	-0.00	-0.09	0.37	4.19	0.25	3.60	0.13	1.67
HO	-2.23	-4.93	-1.15	-3.72	-2.36	-5.23	-1.55	-4.03
BH	-0.78	-1.70	-0.60	-1.30	-0.17	-0.55	-1.01	-1.71
λ $(\times 10^2)$	-1.42	-3.94	-1.39	-3.49				
Work absence								
α_{wa}	0.97	2.13	1.26	0.72	1.27	3.89	2.83	8.04
c/γ_{wa}	-0.04	-3.54	-0.06	-4.60	-0.05	-4.70	-0.06	-5.56
μ/ψ_{wa} $(\times 10^2)$	0.19	3.27	0.12	2.44	0.08	2.40	-0.03	-1.18
$UNEM$	0.28	3.77	0.25	3.26	0.32	5.15	0.36	4.80
HO	-0.20	-0.90	-0.56	-2.33	-0.50	-2.36	-0.07	-0.25
BH	-0.39	-0.72	0.25	0.40	-0.08	-0.17	-0.77	-1.82
λ_{wa}^1	-1.02	-5.97	-0.86	-5.03	-1.06	-7.06	-1.23	-6.93
λ_{wa}^2	-1.41	-8.18	-1.33	-7.91	-1.12	-7.23	-1.38	-7.79
λ_{wa}^3	-1.35	-7.59	-1.20	-6.77	-0.97	-6.03	-1.39	-7.47
λ_{wa}^4	-1.06	-5.38	-1.12	-5.80	-0.81	-4.46	-1.03	-4.83
λ_{wa}^5	-1.54	-7.84	-1.52	-8.11	-1.31	-7.84	-1.17	-5.48
λ_{wa}^6	-0.72	-2.75	-1.06	-4.39	-1.02	-4.78	-1.31	-5.42
λ_{wa}^7	-1.98	-9.15	-1.93	-9.30	-1.72	-9.22	-1.97	-9.21
$\lambda_{wa}(\times 10^2)$	0.85	3.10	0.49	2.38	0.91	4.07	0.65	3.36

Note: 34 indicator variables variable for weekdays and months are also included in the estimation of the model.

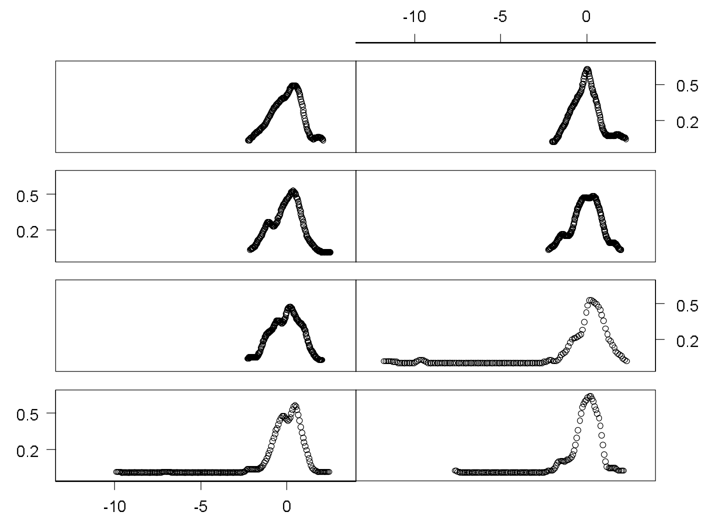

Figure 6.1: Kernel density (Gaussian with bandwith 0.5) estimates of the distribution of the fixed effects in the male (first column) and female (second column) sub-samples by different age-groups. First row: aged 50-64; Second row: aged 40-49; Third row: aged 30-39; Fourth row: aged 20-29.

back to work with an increasing duration in work absence.

Section 4 stressed the importance of considering preference heterogeneity when modeling work absence behavior. When studying the estimation results, two properties should be noted. First of all, can preference heterogeneity be observed? If so, does it affect the parameter estimates of the variables that we are interested in compared to the misspecified model where it is not?

Tables A1 and A2 in the Appendix contains estimates corresponding to those of Tables 6.1 and 6.2 when fixed effects are not included in the model. From these results, it is very easy to perform a likelihood ratio test where the model without fixed effects being the restricted model. The results from such test shows that the restricted model can be forcefully rejected in all sub groups. The results in Tables A1 and A2 also enable us to compare the parameter estimates in order to study to what extent they are affected by the inclusion of fixed effects. We will come back and comment on these differences below, where we discuss the parameter estimates.

Figure 6.1 shows kernel estimates of the distribution of the fixed effects for the eight different sub-samples. Two properties can be noted in these kernel estimates. The heterogeneity is relatively large, with a heavy left tail, for the youngest age-groups for both females and males as well as for the age-group 30-39 for the females.

The distribution of the fixed effects are close to be symmetric in the other five sub-groups. The explanation to the difference between the age groups may be found in two distinct aspects on how the samples used in the estimations are selected. First, a large proportion of the workers with bad health, an preferences for being frequently absent, have by the time they reached the age of the oldest age-group left the labor force and are, consequently, not in the sample. Second, a larger proportion in the oldest age-group is, compared to the other age-groups, either absent all days or present all days during the time-period studied, and have, therefore, been excluded from the sample. Both these items lead to a smaller preference heterogeneity in the older age-group.

The parameter estimate for the cost variable is, as expected from the theoretical model, significantly negative in all sub-groups. This is true, conditional both on the state of work absence and on work presence. Although these results are consistent with the theoretical model, they are at a first sightly contradictory to what we obtained in the Kaplan-Meier non-parametric estimates reported in Section 3.These non-parametric estimates showed no effect on the duration of the work absence spells after the reform of the SI, when the cost of being absent from work increased.

An explanation for these seemingly contradictory results can be found in the change of the composition of work absence spells after the reform. The individuals with relatively low (high) incidence to be absent from work are the same individuals with relatively short (long) work absence spells. This is an implicit feature of the significant individual effects. After the reform, the incidence of work absence spells decreased. This decrease implied that individuals with low incidence of being absent, and few spells, decreased the number of spells after the reform. Also, the individuals with relatively high incidence and long work absence spells shortened their time in work absence. The result of this is that the hazard rate in work absence seemed to be unaffected. However, the econometric model is able to separate out these two effects.

In Section 4 we discussed how a spurious, negative correlation between the cost of being absent from work and work absence may occur as a result of a correlation between the worker's wage rate and preferences for work absence if unobserved heterogeneity is not considered properly in the model specification. As the parameter estimate of the cost variable is significantly negative in the fixed effects model as well as in the model with omitted fixed effects, comparing these results does not give any guidance as to what extent this hypothesis has empirical support. However, as the fixed effects may be observed directly, it is possible to test whether or not there is a correlation between these individual components and the individual wage rate.[14] The result from this tests, for each sub-group, are presented in Table 6.3.[15]

As can be seen from these results, the hypothesis of zero correlation cannot be rejected in any of the sub-groups considered. It is, however, plausible that if the

[14]The wage rate used in the estimation of the correlation is based on labor income in 1989.

[15]The test statistic is distributed as Student's t if the wage rate and the fix effect are bivariate normal. The (natural) logarithm of the wage rate and the individual fixed effects are used in the calculation. Very small differences are found when using the non-transformed wage rate.

Table 6.3: Estmated correaltions between the (natural) logarithm of the wage rate (in 1989) and the estimated fix effects.

Age	Males		Females	
	$\widehat{\rho}$	t	$\widehat{\rho}$	t
$20-29$	$-.10$	-1.30	$-.04$	$-.48$
$30-39$	$-.09$	-1.13	$-.01$	$-.17$
$40-49$	$-.07$	$-.94$	$-.00$	$-.04$
$50-64$	$-.06$	$-.67$	$.05$	$.64$

Note: $t=\widehat{\rho}/\sqrt{(1-\widehat{\rho}^2)/(n-2)}$

male sub-sample were added together we would have obtained a significantly negative correlation. The higher point estimates of the correlation in the male sub-sample is expected since the men in the sample to a larger extent is employed in the private industry sector and women in the public service sector (see Section 5). The element of individual wage setting is larger in the private industry. The higher point estimates of the correlations in the young age groups can, again, be explained by selection of individuals with bad health status out of the labor force at relatively young ages.

The parameter estimates for the virtual income variable are in general insignificantly different from zero in the work state (one exception is for the females aged 40-49). In the work absence state, the estimates are, as expected from the theoretical model, positive and significantly different from zero in three of for age groups in the female sub-sample and in the youngest age-group in the male sub-sample. The interpretation of this result is that workers with relatively high income in these groups can afford to have somewhat longer work absence spells. The frequent insignificant parameter estimates reflect the fact that this parameter is estimated with relatively low precision. An explanation to this may, as is discussed in Section 5, be the difficulties in measuring income.

The parameter estimates of the local unemployment rate variable are in general significantly positive in all sub-groups and in the work as well as in the work absence state. The effect seems to be somewhat stronger in the work absence state. These results are contrary to what is expected from the theoretical discussion in Section 4, departing primarily from the model of Shapiro & Stiglitz (1984). It is also different from what has been obtained in most empirical studies (see e.g. Drago & Wooden, 1992; Johansson & Palme, 1996; or Lantto & Lindblom, 1987), although there are some exceptions (see e.g. Bäckman, 1998).

If these results are compared to those obtained for the local unemployment rate variable in the model without fixed effects, it can be seen that the result changes radically: the parameter estimates are in general insignificantly different from zero. In some sub-groups, in particular in the work state for the female sub-groups, the parameter estimates actually change sign to be significantly negative. As most empirical studies do not control for preference heterogeneity, these results can give some guidance to why we get different results compared to these previous empirical studies.

There are reasons as to why we may observe a spurious relation between work absence and unemployment. It is a well known fact that work absence is lower in small communities in general and on firms with few employees in particular (see e.g. SAF, 1986), due to a more extensive social control. The unemployment rate in Sweden, and in most other countries, is in general higher in small communities. These two unrelated properties may have made up the previously observed negative correlation between work absence and unemployment.

There are at least two explanations to why we may observe a positive parameter estimate for the local unemployment rate variable. First, an increased unemployment rate may create economic stress that may be damaging for the health (see e.g. Vahtera, Kivimäki, and Pentti, 1997). This, in turn, may lead to a higher rate of work absence. Second, when the aggregate demand decreases at the beginning of a recession, firms will try to layoff their workers rather than permanently dismiss them in order to avoid hiring, training and firing costs, if they expect the demand to increase again later on. It is, of course, much cheaper for the firm if the laid off workers claim sickness benefits rather than getting paid from the firm. There is anecdotal evidence that employers may in fact urge their employees to do so. If this is the case, we may also observe a positive correlation between unemployment and work absence in the beginning of a recession, when the unemployment rate is increasing.

In addition to the variables corresponding to the parameter estimates presented in the tables, the model also contains variables to control for differences in the rate of work absence over time. These include indicator variables for each month and each weekday. The parameter estimates for these variables give results that are very much in line with what can be expected from the descriptive statistics presented in Section 3. In order to save space, the parameter estimates for these variables have been left out from the presentation. However, the parameter estimates for the public holiday indicator variable, HO, as well as the indicator for day between public holiday and weekend, BH, are presented in the tables. As can be seen in the tables, the results give no support to the anecdotal evidence on an increased use of the SI on days between public holidays and weekends. The parameter estimates for BH is always negative when a individual is in the work state, however only significant so for the males age 20-29 and 30-39.

6.2. Policy Simulation

The simplest, and most common, form of policy analysis from labor supply studies is to derive elasticities. However, as is well known, it is not possible to directly derive elasticity estimates from the binary choice logit model. An alternative to elasticity estimates, is to simulate the outcome of an hypothetical reform. In this section, we will use the estimated model and simulate changes in the survival functions for work absence as well as work presence spells implied by the increase in the cost of being of the reform of the SI of March 1, 1991. By choosing a reform that actually took place enables us to evaluate how the model predicts this policy change .

The probability to stay in work or work absence for one individual at time period t is

$$\pi_{it}^{00} = \frac{1}{1 - \exp(\mathbf{x}_{it}\boldsymbol{\beta}_w + a_i)} \text{ or } \pi_{it}^{11} = \frac{1}{1 - \exp(-\mathbf{x}_{it}\boldsymbol{\beta}_{wa} - a_i)},$$

respectively. The survival function for a work or work absence spell up to time period τ is then

$$S_{i\tau}^{00} = \prod_{t=1}^{\tau} \pi_{it}^{00} \text{ or } S_{i\tau}^{11} = \prod_{t=1}^{\tau} \pi_{it}^{11}.$$

The survival functions depends on $\mathbf{x}_{it}$. In order to generate the sequences S_{it}^{00} and S_{it}^{11}, $t = 1, ...\tau$; we have to set some initial values. We assume that each spell starts on a Tuesday in January; we also let $BH_{it} = 0$, $HO_{it} = 0$, and $UNEM_{it} = \overline{UNEM}$, where $\overline{UNEM}$ is the average unemployment rate in the period before the reform, $t = 1, ...\tau$. The simulationations are performed for an "average individual" for each sub-group, i.e. $a_i = 0$. The mean of the cost for being absent, $\overline{c} = \frac{1}{T_1}\sum_{t=1}^{T_1} c_{it}$ for each sub-group is used for the pre-reform period and the virtual income is calculated as, $\overline{\mu} = \overline{R} + 0.9\overline{h}\overline{c}$, where $\overline{R} = \frac{1}{T_1}\sum_{t=1}^{T_1} R_{it}, \overline{h}$ is the mean number of working hours and $T_1 = 424$. The survival function after the reform is then calculated with cost, $\overline{c}_r = (1 - \delta_t)\overline{c}/(1 - 0.9)$, and virtual income, $\overline{\mu}_r = \overline{R} + \delta_t\overline{h}\overline{c}/(1 - 0.9)$, where $\delta_t = 0.35, 0.20$ and 0.10 for the work spells and the first three days in a work absence spell, for work absence spells in the range 4-89 and work absence spells longer than 89 days, respectively.

The result from the policy simulations are displayed in Figures 6.2 and 6.3. When interpreting the results, it is important to keep in mind that the level of the predicted survival function are depending on the effect on explanatory variables that are kept constant in the simulation. Hence, it is the difference in the survival function for respectively sub-groups that are of the main interest. However, the most noticeable with Figure 6.2 is the resemblance with the Kaplan-Meier Figure 3.1. The effect of the reform change is quite similar to the Kaplan-Meier estimates in all age groups except for the age-group 30-39 for both sexes where the change in the reform gives a larger effect than in Figure 3.1. The reason for this may be the relatively large positive parameter estimate found for the unemployment rate for these two groups.

Turning to the predictions of the work absence spells shown in Figure 6.3 a quite large difference as compared with the Kaplan-Meier estimates in Figure 3.2 can be seen. First, the over all resemblance of the predictions of the work absence spells are inferior compared to the predictions of the work spells. The model overestimate the hazard from the work absence spells. Second, the effect of the SI reform is larger than

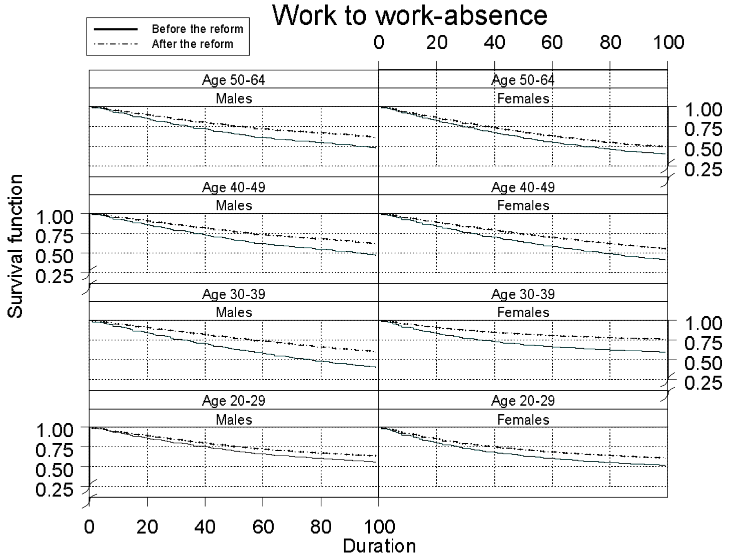

Figure 6.2: Estimated survival function in work for a "mean" individual in the eight sub-groups. (The spell starts on a Tuesday in January)

that seen in 3.2. This difference can be attributed to the negative parameter estimate for the cost parameter discussed above.

Furthermore, it can be seen in 6.3 that the model predict the general pattern of an decreasing hazard with age, which is also seen in the Kaplan-Meier estimates, well. Finally, the simulation shows that the effect of the reform on work absence spells is largest in the oldest age-group. At least a part of the explanation to this difference are due to lower increases in the cost of being absent from work (due to lower wage rates) as well as lower non-labor income pertaining to these younger age groups.

7. Conclusions

In order to evaluate the results obtained in this study, it may be useful to ask whether or not the econometric model used in this study gives a good description of the process that generate the work absence data?

The first issue in this context that needs to be addressed, is if economic incentives at all affect work absence behavior. On this issue, the results of this paper support the results that have been obtained in previous studies, that economic incentives actually do matter for work absence behavior. The parameter estimate of the cost variable is significantly negative in all sub-groups, both for the incidence of work absence

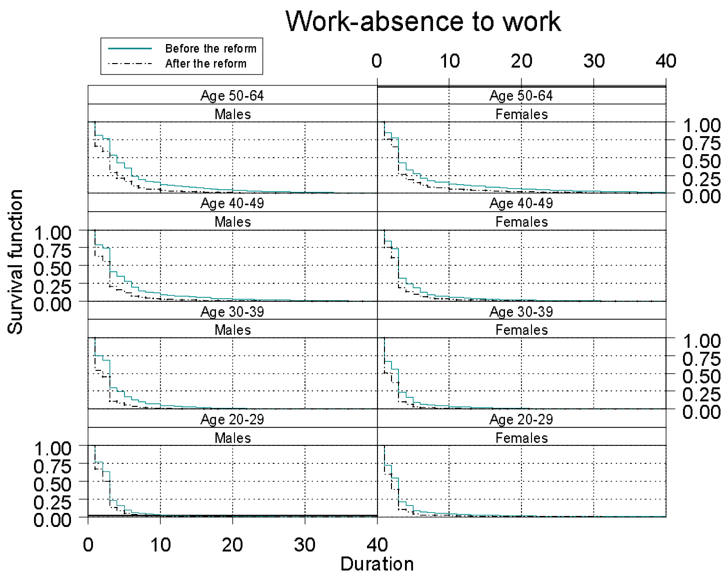

Figure 6.3: Estimated survival function in work absence for a "mean" individual in the eight sub-groups. (The spell starts on a Tuesday in January)

(duration of the work spells) as well as the duration of the work absence spells. The effect of both these results can most readily be seen in the policy simulations in Section 6.2. The results shows that it was the increase in the cost of being absent, rather than the increase in the unemployment level in 1991, that created the marked decrease in aggregate work absence.

The results also support the view that preferences for work absence are heterogenous. This preference heterogeneity seems to be largest in the youngest age groups. The importance of handling preference heterogeneity is evident from the fact that the parameter estimate of the unemployment variable "changed sign" when preference heterogeneity is considered using individual effects, compared to a model where these effects are restricted to zero.

The main limitation of the theoretical model used in this study is, as pointed out in the Introduction, that it does not contain any mechanisms for the individual to look forward and plan his or her work absence behavior. The individual has at least two motives to do that. First, work absence may be seen as an investment in health. By being absent from work when affected by temporary illnesses the worker may maintain a better long term heath status. Second, future wage rates and earnings security may be dependent on the present work absence behavior; i.e. the current wage rate is a function of previous work absence $(w_t = w(\sum_{\tau=0}^{t} t_\tau^a))$.

It is hard to have any definite views on the investment in health motive for work absence from the data used in this study. In the 1991 reform of the SI, the cost of making such investments increased. This may of course discourage the worker from doing such investments. On the other hand, the expected payoff from the investments increased as well, as the cost of long sickness spells also increased after the reform.

The importance of the second motive can to some extent be assessed from the correlations between the wage rates and the individual effects (differences in preferences for work absence) obtained in this study. Unfortunately, the results from this analysis are somewhat ambiguous and no firm guidance on the importance of considering this mechanism in modelling work absence behavior can be attained. The hypothesis of no correlation cannot be rejected in any of the sub-samples. On the other hand, in the male sub-samples the point estimates were negative in all groups and adding together these groups would possibly lead to a rejection of the hypothesis of no correlation between the wage rates and the individual preference to be absent from work. To get a good approximation of the magnitude of this cost would, however, require that the workers work absence behavior are observed over a longer time period than the two years that this study is limited to.

References

Aronsson, T. & J. R. Walker. 1997. "The Effects of Sweden's Welfare State on Labor Supply Incentives." In *The Welfare State in Transition*, eds. R. B. Freeman, B. Swedenborg and R. Topel. Chicago: Chicago University Press.

Allen, S. G. 1981. Compensation, Safety, and Absenteeism: Evidence from the Paper Industry." *Industrial and Labor Relations Review* 34: 77-87.

Bäckman, O. 1998. "Longitudinal Studies on Work Absence in Sweden." Ph.D. thesis, Swedish Institute for Social Research.

Brown, S. & Sessions, J. G. 1996. "The Economics of Absence: Theory and Evidence. *Journal of Economic Surveys* 10(1): 23-53.

Fritzell, J. & Lundberg, O. 1994. "Vardagens Villkor. Levnadsförhållanden i Sverige Under Tre Decennier." Stockholm: Brombergs Förlag.

Gilleskie, D. 1998. "A Dynamic Stochastic Model of Medical Care Use and Work Absence." *Econometrica* 66: 1-46.

Heckman, J. J. 1981. "Estimating a Discrete Time-discrete Stochastic Process." In *Structural Analysis of Discrete Data,* C. Manski, and D. McFadden, 179-195. Cambridge, Mass: MIT Press.

Hausman, J. A. 1980. "The Effect on Wages, Taxes, and Fixed Costs on Women's Labor Force Participation." *Journal of Public Economics* 14: 161-194.

Johansson, P. & Palme, M. 1996. "Do Economic Incentives Affect Worker Absence? Empirical Evidence Using Swedish Data." *Journal of Public Economics* 59: 195-218.

Kangas, O. 1991. "The Politics of Social Rights. Studies in the Dimensions of Sickness Insurance in the OECD Countries." Ph.D. thesis, Swedish Institute for Social Research.

Lantto, K. 1991. "Optimal Deterrents to Malingering." Ph.D. thesis. Department of Economics. Stockholm University.

Lantto, K. & Linblom, E. 1987. "Är Arbetslösheten Hälsosam." Ekonomisk Debatt 15: 333-336.

Meghir, C. & E. Whitehouse. 1997. "Labour Market Transition and Retirement of Men in the U.K." *Journal of Econometrics* 79: 327-354.

National Social Insurance Board. 1992. "Facts on the Swedish Social Insurance 1992." Stockholm: RFV.

Palme, M. & Svensson, I. 1998. "Social Security, Occupational Pensions, and Retirement in Sweden." In eds. J. Gruber & D. Wise "Social Security and Retirement Around the World" Chicago: Chicago University Press.

SAF. 1986. "Tidsanvändningsstatistik." Svenska Arbetsgivareföreningen, Stockholm.

Shapiro, C. & Stiglitz, J. 1984. "Equilibrium Unemployment as a Worker Discipline Device." *American Economic Review* 74: 433-444.

Vahtera, J., M. Kivimäki, & J. Pentti. 1997. "Effect of Downsizing on Health of Employees." *The Lancet*, 350, 1124-1128.

VandenHeuvel, A. & Wooden, M. 1995. "Do Explanations of Absenteeism Differ for Men and Women?" *Human Relations* 48: 1309-1329.

Wiess, A. 1985. "Absenteeism and Wages." *Economics Letters* 19: 277-279.