WHY ARE THE SICKNESS ABSENCES SO LONG IN SWEDEN

Daniela Andrén*

Göteborg University, Department of Economics
Box 640, SE 405 30 Göteborg, Sweden
Tel: +46 31 773 2674, Fax: +46 31 773 1326
E-mail: Daniela.Andren@economics.gu.se

Abstract

Using a sample of 2,789 Swedish residents on working age, this paper analyzes long-term absences from work due to sickness. The database contains all compensated sickness spells in the period January 1986 to December 1991. Earlier studies of work absence due to sickness did not analyze multiple spells of sickness. Moreover, such data requires estimation techniques that were not often used in the previous studies. The analysis is performed using mixed proportional hazard models. The results show that the loss of earnings reduced length of absence, while high regional unemployment increased it. There was more heterogeneity among diagnosis-groups and individual-groups than among regions as groups.

Key words: long-term sickness, absenteeism, multiple spells, unobserved heterogeneity.

JEL classification: J2; J3; J7.

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I Introduction

The increasing number of cases of long-term absenteeism due to sickness registered in Sweden during the 1980s and 1990s has attracted a lot of attention. Several changes concerning social insurance have been taken or proposed in order to combat long-term sickness, specifically with regard to a better specification of the skills required for evaluating the working capacity of employees reporting sick. The basic evaluation procedure remains a (simple) medical evaluation and doctor's certification of illness in the beginning of the spell, which is reviewed at periodic intervals. Improved collaboration between the physician, employer, and social insurance officers has been suggested, with more attention to rehabilitation and consideration of alternative employment.

Even though the political debate covers not only the increased number of cases, but also the increased numbers of days on sick leave, no explicit policy change was formulated with respect to an upper limit for how long a person can be on sick leave. Sweden is the only country in the European Union that has no official upper limit to how long a person may receive sickness benefit, while most of the other countries have a 52-week limit. Therefore, this study has the unique opportunity to report how many persons will be affected if Sweden will choose to adapt to the social insurance rules used by other EU countries. Additionally, using a longitudinal database that includes all compensated sickness spells of the analyzed individuals over a six-year period, we also report how many days pass the one-year upper limit. However, using multiple spells data requires estimation methods that were not used earlier on the analysis of work absence due to sickness. Therefore, this paper contributes to the literature of *work absence due to sickness* at least from three perspectives. First, no earlier study used multiple spells of sickness for working-age population, which is a feature that allows us to test the duration dependency (i.e., the sickness absence length increases by spell). Second, no earlier study used a mixed proportional model to analyze sickness absenteeism; this model incorporates the unobserved heterogeneity, or frailty, components, which allow us to account for the unobserved characteristics in explaining the duration of sickness spells. Third, the institutional setting of *no limit* for the period with sickness benefit makes this study a comparative point for countries that have an upper limit.

II Earlier studies

In earlier studies of employee absenteeism, individuals are often assumed to decide daily on the work or non-work alternative, depending on which gives the highest utility.[1] The conventional labor supply model of absence focuses on the role of contractual arrangement, assuming that the wage rate plays a central role in the decision to work or not work. This is supported by previous studies that have found that economic incentives have a significant impact on absences from work.[2] There are other economic factors that might influence this decision; such as, the replacement rate, the tax rate, and employee sharing plans (e.g., profit-sharing and/or employee share-ownership).

There are also some (long-term) longitudinal studies that measure the effects of various past and current factors on the actual absence.[3] Some other studies have analyzed the *duration of sickness* and estimated the hazard of returning to work and the expected duration of work absence.[4] The results showed that as the relative generosity of sick pay (the replacement rate) increased, there was a clear "disincentive" effect, as the duration of illness lengthened. Other significant factors were wages, the type and severity of injury, the physical demand of the job, the willingness of employers to help the worker return to work, and unemployment rates.[5]

Fenn (1981) and Lindeboom and Kerkhofs (2000) are the most relevant studies for the questions addressed by this paper. The approach taken by Fenn (1981) to the problems of explaining duration of sickness is to adapt Cox's proportional hazards model (1972) as suggested by Lancaster (1979) in order to estimate the conditional probability of returning to work in a given period, which may vary over time, and between individuals. Unlike Lancaster, however a non-parametric estimator of the time path of the hazard is used. The particular problem presented by the data was that of a high number of tied observations. Finally, the use of Cox's proportional hazards model has enabled them to separate the conditional return probability into a function of interpersonal variations and a function of time. Estimates of the latter support the notion that people off work for longer than 6 months are generally much less likely to return in any subsequent period.

Lindeboom and Kerkhofs (2000) focus on sickness incidence and sickness duration of individual Dutch teachers within a school to assess whether sorting effects or workplace characteristics cause the large variance and clustering in the data. They specify and estimate concentrated- and partial-likelihood models that allow for unobserved workplace effects. The most-flexible model is a stratified partial-likelihood model that allows for nonparametric, school-specific, baseline hazards. They find strong effects of both observed personal characteristics and school characteristics. They also find that the school-specific effects are hardly related to the exogenous variables of the type available in the data.

In sum, there is evidence about the impact of the both individual and macro characteristics on the (length) of absenteeism due to sickness. These are average effects mainly based on observables. However, it might be the case that the part "left out" because of no access to such information (the unobservable) explains better the duration of the absenteeism. Having information about the previous sickness absenteeism of people, can help on counting for such effects. Having access to individual longitudinal data on sickness, this papers control for unobserved heterogeneity using mixed proportional hazard models.

III Sickness insurance rules during 1986-1991

In Sweden, almost everyone in the labor force is covered by sickness insurance (i.e., they are eligible for sick pay or/and sickness cash benefit when absent due to sickness). More exactly, all residents of Sweden, aged 16-64 years, and whose annual income was at least 6000 Swedish krona (i.e., about 1100 US dollars in 1991) were eligible for a sickness cash benefit if they lost income due to sickness. The National Insurance Act gives no general definition of sickness, but according to the National Social Insurance Board's recommendation, sickness is an abnormal physical or mental condition. If it reduces normal work capacity by at least 25%, the afflicted individual can qualify for a sickness cash benefit. Normal work capacity is defined as either the ability to perform the same task, or the ability to earn the same income, as prior to sickness.

Since July 1990, a sickness benefit is available when working capacity is reduced by at least 25%; depending on the extent of working capacity reduction and consequent reduction in working hours, the benefit can be paid at a full, three-quarters, half, or one-quarter rate. Prior to July 1990 there were only two rates, full and 50% of full rate. A medical certificate is required after seven days, and a more detailed certificate is required from the 29th day of absence. A sickness benefit can be paid out for an *unlimited* period, is considered taxable income, and counts towards ones pension base.[6] However, for those over 70 or persons receiving a full old age pension, the period is limited to 180 days. Persons receiving full disability pensions are not entitled to a sickness benefit.

Replacement rates and related rules have changed many times. Under the period studied (1986-1991), there was a uniform replacement rate of 90% of the *income qualifying for sickness allowance*, up to March 1991, and after that, until January 1992, only 65% was paid for the first three days, then 80% from the 4th up to the 90th day, and starting with the 91st day of the sickness spell, the previous rate of 90%. However, most workers also received another 10% from negotiated benefit on the top of the 80%.

As mentioned before, the cash benefit is linked to the income qualifying for sickness allowance, which is the expected yearly earnings from employment. However, there is a fixed ceiling and a lower limit for the income qualifying for sickness benefit. The *upper limit* is 7.5 times the *base amount*,[7] which was SEK 241 500 for 1991 (i.e., about USD 40 000 in December 1991, the end of the period analyzed here), and the lower limit was SEK 6 000. Thus, the income qualifying for sickness benefit was in the interval SEK 6000-241 500 in 1991.

IV Institutional framework and individual decision

Employees with bad health status are defined in this study as persons experiencing a sickness spell of 60 days or more, which means that they experienced a spell of long-term sickness. It is usual that these people may undergo various transitions, as for example, transitions between the labor market states of employment, unemployment, and absenteeism due to sickness. This reflects the dynamic aspects of economic behavior conditional on the employee's health. Data on the duration of compensated sickness illustrate the phenomenon of sickness absenteeism, which involves the individual decision constrained by given rules (of the social insurance) and personal judgment of other agents involved in the process (officers at the social insurance offices, employers, physicians, etc.). Therefore, the duration of the absenteeism due to sickness is the outcome of a decision on the optimal moment for doing the transition to another state (rehabilitation, return to work, disability pension, unemployment, etc.). With such a design, the question is what economic model is suitable to explain individuals' absenteeism due to sickness. The theoretical models most frequently used for reduced-form econometric duration analyses are *search model*s.[8]

As suggested by Fenn (1981), conventional search models used in analyzing the behavior of unemployed people could be relevant for analyzing the behavior of sick people *if* their employment contract were terminated, either at their own initiative, or at that of their employer. In Sweden, employees are protected against contract termination in the case of sickness, but employees can choose to terminate or change their contracts. Employees who experienced a long-term absenteeism due to sickness would like to have afterwards a job and working conditions that fit better their health status.

If medical evaluations show that employees have some limitation in doing their previous job, a change of job may be the optimal alternative, even if it requires the acquisition of new skills through a vocational rehabilitation program. If the medical evaluation shows that they have not yet recuperated at least partially, but it is expected that they will in the future, then, if it is not possible to participate in a rehabilitation program, they remain on sickness benefits.[9] Medical evaluation can also conclude with a recommendation for participating in a rehabilitation program, or with a recommendation for temporary or permanent exit from the labor market with a disability pension, either of which can be either partial or full. If no hope for total or partial or recovery exists, full permanent disability exit will be recommended.

In many cases, people may be able to return to their previous job, doing the same task as before, but some changes in the working conditions may be required (e.g., an ergonomic desk, a better chair, etc). If employees believe that neither these changes will take place, nor other alternative is offered when return to work, it is expected that the duration of their sickness spell would be even longer.

If people return to work with a residual disability, it may also be realistic to assume that their wage offer (w) is higher than the disability benefit (b), so that $w > b$. It may also be realistic to assume that their wage offer (w) can be lower than what they had before sickness (w_0), but still higher than their initial reservation wage (w^r), so that $w^r < w < w_0$ (especially if their job requirements were reduced or their job tasks were changed to other that produce less valued output). It implies that the financial alternative of disability benefit can have impact in the decision of return to work. Therefore, a generous social insurance benefit level can decrease the propensity to return to work, which does not necessarily imply that people who leave the labor market with a disability benefit would be better off in the long-run. Additionally, their health and/or financial dependency would require even more support later on than if they would chose to work at least some hours. If working *some* hours is one avenue for better life, then the problem is to find such jobs.

Unlike the job search process for "healthy" people that can require considerable time and resources, and where the returns of these investments are uncertain, job search for employees with long-term sickness spell can require less effort if the opportunity at his/her current place of employment are sufficiently varied. In addition, there may be less uncertainty because of programs designed to help the employee back to the same place of employment. For example, there is continuous collaboration between social insurance offices, employers and medical personnel. Thus, in this study we will assume that those with "poor health" aim to maximize the expected present value of their income over their lifetime with a subjective rate of discount, anticipating (or not) that the job offer and its distribution, and compensation for earnings loss due to sickness or disability, may change over time. More precisely, one can return to work with the same wage as before, but there is an alternative to change jobs to a lower (and even higher) wage than before; and to work fewer hours than before. Additionally, the financial alternative (disability benefit) can vary over time, which can also affect the expected value or present value of the income of sick employees.

V The data

This paper analyses the Long term Sick Insured Population (LSIP) sample from the Long-term Sickness (LS) database, from the National Social Insurance Board of Sweden. This sample contains 2789 persons that represent all residents in Sweden born during 1926-1966, and who had at least *one* sickness spell of *at least* 60 days during the period 1986-1989. The sample is longitudinal and contains all compensated sickness spells during the period January 1, 1983 through December 31, 1991, including exact beginning and ending dates. However, there is no data on possible long-term sickness spells before 1983, and there is no information on diagnosis for spells that started before January 1, 1986 (except for ongoing spells at this date). All people who died or left the country during the observation period were excluded in this study, resulting in final a sample of 2666 persons, who had 4430 spells of long-term (LT) sickness. Table A1 presents the descriptive statistics, at the beginning of analyzed spells of long-term sickness, by spell (Spells 1-3). Table A2 shows descriptive statistics of sickness variables (days and spells) by individual. The average person in the sample was sick 582 days during the analyzed period, with 1.7 spells of long-term sickness, and 8.9 spells of short-term sickness.

Table 1 presents descriptive statistics regarding the duration of the LT sickness, by spell. Mean duration generally decreases with the number of spells, that is, there is a shorter "waiting time" before exit. This can be due to a combination of factors, including a quicker process for the transition into disability. Less than half of the sample (1088 persons, or about 41%) had more than one spell of LT sickness, while 16% had at least three spells, and about 6% had at least four.

Table 1 Descriptive statistics for the duration (in days) of all long-term sickness spells

Long-term sickness	N	Censored spells (%)	Median	Mean	Std. Dev.	Min**	Max
Spell 1	2666	3.36	136	306.42	371.91	60	3096
Spell 2	1088	12.04	146	271.02	282.61	60	1904
Spell 3	413	20.09	175	282.01	261.77	60	1620
Spell 4	158	26.58	148	230.33	214.62	60	1196
Spell 5	65	30.76	153	235.94	193.90	62	994
Spell 6	28	39.28	138	241.89	293.16	63	1276
Spell 7	8	62.50	118.5	148.38	103.04	60	395
Spell 8	2	50.00	140.5	140.50	82.73	82	199
All spells*	4430	8.60	143	290.90	335.30	60	3096

Note: * There was one person with nine spells and one with ten; ** Long-term sickness is defined as 60 or more days, which account in many cases for the minimum value.

Table 2 presents descriptive statistics regarding the duration of the LT sickness, by spell and "one year upper limit" of sickness spells.

Even though we follow the same persons over time, the percentage of the spells that are longer than one year is relatively high (19-25.9%). The days of sickness compensated over the one-year upper limit represent also a relatively high percentage from the total days compensated by the sickness benefits: 37.9% for those who were LT sick once, 28.4% for those who were LT sick twice, and 25.9% for those who were LT sick three times. Given that these figures refer only to the cohort of those who were on LT sick leave during 1986-1989, we expect that these figures will attain even higher values if we could analyze both the stock and inflows of long-term sick people.

Table 2 Descriptive statistics of long-term sickness spells by "one year upper limit"

	N	Censored durations (%)	Total days	On sick leave more than 365 days		Compensated days over 1 year	
				n	%	Total	% in total days
Spell 1	2666	3.3	816913	691	25.9	309402	37.9
Spell 2	1088	12.0	294875	259	23.8	83876	28.4
Spell 3	413	20.1	116469	102	24.7	30123	25.9
Spell 4	158	26.6	36392	42	19.0	7138	19.6
Spell 5	65	30.8	15336	14	21.5	2564	16.7

VI Econometric modeling

A. Sickness duration modeled by hazard models

Sickness duration can be modeled by specifying a hazard function, which can be viewed as the product of the probability of recuperation (of the loss of working capacity) and the probability of wanting to return to work. The lack of economic theory about the relationship between the hazard rate at any time and elapsed duration of sickness at that point, can lead to incorrect assumptions about *the form* of the baseline hazard, which can potentially bias the estimated effects. Most of the previous studies are based on a model with constant baseline hazard. In our study this model implies that a sick person has each day the *same* probability of becoming healthy (i.e., to return to work) that the sequence of conditional probabilities would be a constant. Instead, it might be (more) appropriate to assume that the "conditional probability" of becoming healthy $h(t)$, *decreases* with the length of spell.[10] The random variable, D, which represents duration of sickness is expressed as the number of days and the hazard function for this random variable, and is defined in terms of the cumulative distribution function $F(t)$ and the probability density function $f(t)$ by $h_D(t) = \frac{f(t)}{1 - F(t)}$ which, considering that $1 - F(t) = S_D(t)$, can be rewritten as $h_D(t) = -\frac{d \log S_D(t)}{dt}$, where $S_D(t)$ is the survival function, or the probability that the sickness spell did not end prior to time t. The evolution of the hazard function in time gives information if the process exhibits positive duration dependence (which means that the hazard of ending sickness any given day increased over time), or negative duration dependence (which means that the hazard of ending sickness decreased over time). A problem in duration analysis, associated in the literature with Heckman and Singer (1985), is that the presence of *unobserved heterogeneity* tends to produce estimated hazard functions that decline with time even when the hazard is not declining for any individual in the sample. This occurs when "high hazard" individuals are "exiting" more rapidly at *all* points in time, leaving in time a risk set that is made up *only* of "low hazard" people. This problem could lead to errors in computing and interpreting the hazard functions and the coefficients for the covariates. Additionally, with longitudinal data with *multiple spells*, another problem is whether, given the observed explanatory variables, the various durations are independently distributed or not.[11]

B. Modeling multiple spells of sickness

Current econometric research often involves the simultaneous analysis of multiple observed spells, of either the same type or of different types of duration for a given individual. In trying to learn more about factors affecting long-term sickness spells, we will here consider "families" of spells, i.e., groups of spells by individual, by diagnosis, and by region. The motivation for these groups is based on the decision process. First, even though health deteriorates by age, the average figures shows that the length of sickness spells do not increase by spell. Therefore, we expect that there are some unobserved factors that might affect the length differently at various ages, for example.

Second, different diagnoses imply different treatment, and cause different behavior across individuals, as for example, people with the same diagnosis and the same observable characteristics have different duration of the absenteeism due to sickness. Having access to detailed diagnoses (3 digits) written by a specialist for each sickness spell, we can estimate how much from the duration of absenteeism due to sickness could be explained by the unobservables.

Third, even though the social insurance rules are universal across regions, there is great flexibility in how they are applied. The degree of flexibility can last at the level of the officer at the local social insurance office who handles the case. Unfortunately, we do not have such a detailed data, but the regional data might bring even more information from the interaction of the regional flexibility with other characteristics of the regions (such as the concentration of different industries or other sectors of activities, the share of the private sector, etc.).

Therefore, we consider the impact of unobserved group-level heterogeneity on sickness duration by assuming that spells in the same family share a common set of time-invariant, generalized, unmeasured characteristics that can be captured by an unobserved variable representing the group's propensity to exit from LT sickness. Given otherwise similar characteristics, spells in one group might be longer than spells in another, partly as a result of work motivation, but also because of different nutrition, living conditions and access to healthcare at different times in life. These factors, as well as working conditions, social contacts, job satisfaction and cultural background, are here considered to be part of an unmeasured group-level component (or random effect) that contributes to the risk of exit from LT sickness.

C. A mixed proportional hazard model of sickness absenteeism

Based on the various groups of spells, let T_{i1}, …. T_{iJ} denote the J "waiting times" (or, durations) before exit from long-term sickness in the "family" i. Let x_{ij} denote the vector of fixed and time-varying covariates associated with the j^{th} individual in the i^{th} group. A group-level random effect, or frailty term, (w_i) can be introduced to account for the dependence of "waiting times" before exits from LT sickness within the groups. Conditional on this unobserved "characteristic", event times within groups are mutually independent with the conditional (on heterogeneity) hazard function

$$h(t_{ij} \mid w_i) = h_0(t_{ij})\exp(x'_{ij}\beta)w_i \,,$$

where β is a vector of fixed and time-varying effects, and $h_0(t_{ij})$ denotes the baseline hazard. The group-level random effect (or the unobserved heterogeneity term, or frailty term), w_i, acts multiplicatively on the group i risk of exit from LT sickness so that all spells' risks of ending in a particular group are multiplied by this common factor.

I assume that the frailty term follows a gamma distribution with density function,

$g(w_i) = \alpha^{\alpha} w_i^{\alpha-1} \exp(-\alpha w_i)/\Gamma(\alpha)$, where the distribution is normalized to have a unit mean and a variance of σ, where the estimate of σ can be interpreted in terms of the relative risk of exit from a hypothetical spell of long-term sickness.[12]

To fit this model, I used the EM algorithm, proposed by Demster et al. (1977), and named it EM to describe the Expectation and Maximization steps in each iteration. The EM algorithm is an iterative method for learning maximum likelihood parameters of a generative model, where some of the random variables are observed, and some are hidden. The hidden random variables might represent quantities that we think are the underlying causes of the observables. E-step calculates the distribution $\Pr(t \mid X; \beta)$ over the hidden variables, given the visible variables (X) and the current value of the parameters (β). M-step computes the values of the parameters that maximize the expected log-likelihood under the distribution found in the E-step. Therefore, the E-step involves inferring the distribution over hidden variables, and the M-step involves learning new parameters. In most cases, if these two steps are repeated the true log-likelihood will increase, or stay the same if a local maximum has already been reached.

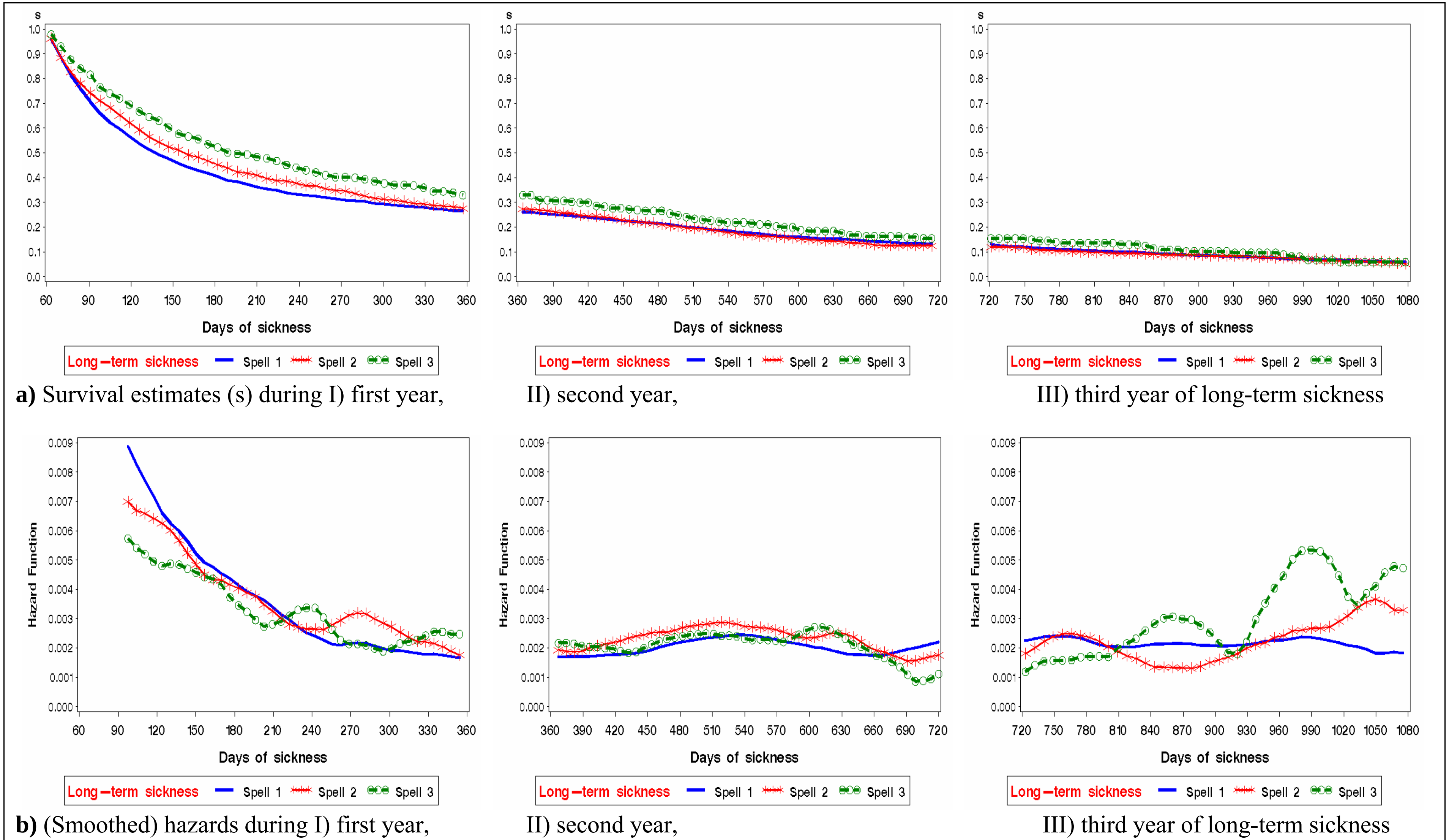
I use the EM algorithm simply because it is a device to enable an iterative procedure to be used where direct procedures are very difficult to carry out. The EM algorithm "insures" that the likelihood function increases, but this safety goes with slow convergence. In the cases where EM is used, straight maximization is almost certain to involve iteration anyhow. However, the EM algorithm would involve an iterative maximization in each of several M-steps, whereas a direct maximization would have just one call to the iterative maximization routine. Nevertheless, it is often the case that the full likelihood is extremely difficult to compute, while the expectation process is simple.

Given our data, the EM algorithm finds a frailty estimate for each group. The frailty distribution parameter, α, is estimated in one step, and is then used to estimate each group's frailty (w_i). The estimated frailty ($\hat{w}_i$) is substituted for w_i, and this process is repeated until the difference in successive estimates of α is negligible.

VII Results

A. Nonparametric survival analysis

Figures 1a and 1b show the survival and hazard functions for first, second, and third spells of long-term sickness, estimated by the life-table method. In order to have a (more) detailed graphical representation, the plots were "truncated" for the first, second, and third years of sickness. Spell durations were also "truncated" into intervals of seven days, so the results can depend to some extent on these arbitrarily defined intervals. In addition, there are relatively large numbers of cases for the first and second spells of LT sickness (2666 and 1080, respectively), and relatively few (413) for the third, which means that the method gives relatively better approximations for the first two spells of long-term sickness. The plots of the survival function (Figure 1a) show estimates of the proportions of sick people who have not yet become better (finished their sickness spell) up to a specific duration calculated from the *first* day of sickness (even though all spells are of at least 60 days). Most notable, the estimated proportion of people remaining sick fell rapidly during the first four months, and then slowed considerably. After one year about 30% of all analyzed people were still recorded as being long-term sick, while about 70% have already exited. Tables A3 (in the Appendix) shows results of tests of whether spells 1, 2 and 3 can be considered "equal". They cannot, which means we cannot pool all spells and treat them as single spells without affecting the parameter estimates and their standard errors. The great variety in the number of spells per individual (Table A2 in the Appendix) also suggested that the analyzed sample is quite heterogeneous. As discussed above, neglected or unobserved heterogeneity across observations can lead to apparent time-dependence and wrong conclusions. Therefore, an unobservable multiplicative random effect shared by spells within a group is considered, and the model is estimated now using *all* spells of LT sickness, grouped by individual, diagnosis, and region. The estimates of the Cox proportional model *without* unobserved heterogeneity for all spells and by spell (only the first three) are presented in Table A4.



a) Survival estimates (s) during I) first year, II) second year, III) third year of long-term sickness

b) (Smoothed) hazards during I) first year, II) second year, III) third year of long-term sickness

Figure 1 Survival and hazard functions of absenteeism due to long-term sickness, by spell, 1986-1991

B. The mixed proportional hazard model

Table 3 shows the estimation results for the conditional hazard function for spells grouped by spells by individual, spells by diagnosis, and spells by regions. In general, the hazard of ending LT sickness was (18-46%) higher for women than men during 1986-1991. The hazard of ending LT sickness was lower for older people: For people aged 36 to 45 it was about 77-81% of the hazard of those aged 35 or younger, while for those aged 46 to 55 it was about 66-74%, and for those aged 56 to 65 it was 55-64%. The hazard of naturalized Swedes to exit LT-sickness was 88-90% of the hazard for Swedish born people.

The hazard to exit LT-sickness for those with higher education was lower (about 77-84%) than the hazard for people with lower education. This result can be explained by several characteristics of the two groups, such us: income, work environment and working conditions, and health capital. Especially in Sweden, where medical insurance is universal, it is possible that the individuals' care for their health is an important factor driving this difference. People with higher education may be more careful with their health, and more receptive to all information related to health issues than less educated people.

People whose spells started in winter showed the highest hazard of exiting from LT sickness. For those whose spells started in a summer quarter, the hazard of exiting from LT sickness was 74-79% of the hazard of those whose spells started during the winter quarter, while for those whose spells started in a autumn quarter it was about 86-87%.

Table 3 Estimation results for *all* spells grouped by individual, diagnosis, and region

Variables	Individuals (J = 2666)			Diagnosis (J = 346)			Region (J =25)		
	Estim.	S.E.	HR	Estim.	S.E.	HR	Estim.	S.E.	HR
Frailty	**0.31**	0.03	1.36	**0.32**	0.04	1.37	**0.01**	0.01	1.01
Female (CG[a]: Male)	**0.38**	0.05	1.46	**0.21**	0.04	1.23	**0.16**	0.03	1.18
Age (CG: < 36 years)									
36-45 years	**-0.26**	0.06	0.77	**-0.21**	0.05	0.81	**-0.25**	0.05	0.78
46-55 years	**-0.42**	0.07	0.66	**-0.30**	0.05	0.74	**-0.35**	0.05	0.70
56-65 years	**-0.59**	0.07	0.55	**-0.45**	0.06	0.64	**-0.47**	0.05	0.63
Citizenship (CG: Swedish Born)									
Naturalized Swede	-0.12	0.08	0.89	**-0.12**	0.06	0.88	**-0.10**	0.06	0.90
Foreign born	0.04	0.08	1.04	0.04	0.06	1.04	-0.02	0.06	0.98
Marital status (CG: Married)									
Unmarried	-0.09	0.06	0.91	-0.07	0.05	0.94	**-0.14**	0.04	0.87
Divorced	-0.06	0.06	0.94	-0.04	0.05	0.96	-0.02	0.04	0.98
Widowed	0.06	0.13	1.07	0.09	0.11	1.10	0.08	0.10	1.08
Educational level (CG: low)									
Medium	-0.02	0.05	0.98	-0.03	0.04	0.97	0.01	0.04	1.01
High	**-0.26**	0.09	0.77	**-0.17**	0.07	0.84	-0.04	0.06	0.96
Quarter (CG: Winter)									
Spring	-0.06	0.06	0.94	-0.04	0.05	0.96	-0.06	0.05	0.94
Summer	**-0.30**	0.05	0.74	**-0.24**	0.05	0.78	**-0.23**	0.04	0.79
Autumn	**-0.15**	0.05	0.86	**-0.15**	0.05	0.86	**-0.14**	0.05	0.87
Year (CG: ≤ 1986)									
1987	**0.12**	0.06	1.13	**0.14**	0.05	1.14	0.17	0.05	1.18
1988	-0.06	0.07	0.95	-0.03	0.06	0.97	0.02	0.06	1.02
1989	-0.13	0.08	0.88	-0.07	0.07	0.93	0.02	0.06	1.02
1990	**-0.22**	0.10	0.80	-0.14	0.08	0.87	-0.05	0.08	0.95
1991	**-0.87**	0.13	0.42	**-0.75**	0.12	0.47	**-0.65**	0.12	0.52
Diagnosis (CG: respiratory)									
Musculoskeletal	-0.12	0.12	0.88				-0.04	0.10	0.96
Cardiovascular	-0.16	0.14	0.85				-0.06	0.12	0.94
Mental	0.00	0.13	1.00				0.03	0.11	1.03
General symptoms	0.17	0.15	1.19				0.13	0.13	1.14
Injuries & poisoning	**0.39**	0.14	1.48				**0.32**	0.11	1.38
Other	**0.24**	0.13	1.27				**0.24**	0.10	1.27
Previous cases [b]	0.00	0.00	*-0.29*	0.00	0.00	*0.10*	0.00	0.00	*0.16*
Daily loss [c] (100 SEK)	**0.03**	0.00	*3.16*	**0.02**	0.00	*2.20*	**0.01**	0.00	*1.22*
Unemployment rate	**-0.07**	0.03	*-6.68*	**-0.06**	0.02	*-5.95*	**-0.05**	0.02	*-4.72*
Region (CG: Göteborg)									
Kronoberg	**0.36**	0.19	1.43	**0.25**	0.15	1.29			
Bohuslän	**-0.30**	0.15	0.74	**-0.29**	0.11	0.75			
Varmland	**0.35**	0.14	1.41	**0.27**	0.11	1.31			
Kendall's TAU	**0.13**			**0.14**			**0.006**		
-2 Log Likelihood [d]									
No frailty	48550			48628			48621		
Fraitly	48323			48340			48603		

Note: **Bolds** are significant at the 10%-level; *Italics* for hazard ratio (HR) indicate that for the continuous variables it had been recomputed as *phr* = 100*(*hr*-1); [a] CG is the comparison group; [b] Previous cases of sickness before the analyzed spell, and starting with January 1983, regardless of their duration; [c] Daily earnings loss due to sickness; [d] In all cases, "No Frailty" is rejected at the 1% level.

The hazard for exiting from LT sickness was (13-18%) higher for spells that started in 1987 compared to those that started in 1986 or before (i.e., 1983-1986), while for those started in 1991 it was only 42-52% as high. These were the only years with several highly significant results, and they happen to coincide with two reforms of the social insurance, which occurred under two very different macro trends: the relatively good period of the end of the 1980s, and the beginning of the recession period in the early 1990s. This can be an explanation of the different sign of the estimated coefficients for years 1987 and 1991.

The hazard of exit from LT sickness was (38-48%) higher for those with injuries or poisoning diagnosis, than for those with a respiratory diagnosis; and those with "other" diagnosis were 27% higher. The daily loss of earnings had a significant impact on the duration of absence due to sickness: For each 100 Swedish krona daily earnings loss, the hazard of exit from LT sickness went up by 1.2-3.2%. The regional unemployment rate also had a significant effect: Each additional percentage point was associated with a 4.7-6.0% decrease in the hazard of exit from LT sickness.

There are also geographical differences. The hazard of exit from LT sickness was (29-43%) higher for those living in Kronoberg and Värmland compared to those living in Göteborg, while for those living in Bohuslän it was only about 75% of the hazard of those living in Göteborg. Parameter estimates and hazard ratios for all regions (compared to Göteborg) are shown in Table A5 and Figure A1 in the Appendix.

Judging by Kendall's tau, the intra-group correlation was about 0.13 for spells grouped by individual and by diagnosis, and less than 0.01 for spells grouped by region. Thus there was a relatively low association in the risk of exit from LT sickness among individuals and diagnoses, and almost no association among regions.

VIII Summary and policy suggestions

This paper presented new evidence on the determinants of the duration of long-term sickness for employed individuals in Sweden from mid-1980s through beginning of the 1990s, using longitudinal data from a representative subset of the insured population. The results of this study are supporting the previous findings in the literature, but also bring empirical evidence for previous hypothesis about the lengths of work absences due to sickness.

Using a Cox's proportional hazards model, Fenn (1981) found that people off work for longer than 6 months are generally much less likely to return in any subsequent period. Using a stratified partial-likelihood model that allows for nonparametric, school-specific, baseline hazards, Lindeboom and Kerkhofs (2000) find strong effects of both observed personal characteristics and school characteristics on the sickness absenteeism of Dutch teachers.

Our results show that the estimated proportion of people remaining sick fell rapidly during the first 4 months, and then slowed considerably. After one year, about 30% of all analyzed people are still on sick leave, while about 70% have already exited. Additionally, using a mixed proportional hazard model, I found a relatively low association in the risk of exit from sickness among individuals and diagnoses, and almost no association among regions.

Women had a higher hazard to exit from LT sickness than men, much of which might be explained by the fact that women exited into disability more often than men. The older people were, the lower was the hazard of exit from LT sickness, which indicates that little is done to help older workers back to the work place. This suggests that policy initiative to improve health status, speed up the recovery and encourage work should also be targeted towards those in older age groups. On the other hand, to prevent or slow down the increasing trend of LT sickness, besides helping these people, special policies should be oriented to prevent deterioration of the heath status of younger employees. These policies should relate both to working conditions and to health problems related to work. One such policy would be greater flexibility in working time. In this context the consequence of overtime work and the burden of both paid careers and house work (usually) for women needs to be analyzed in a long-term perspective as well, since over use work capacity today might cause health problems in the future.

The hazard of exit from LT sickness was lower for naturalized Swedes than the Swedish born. There was labor migration to Sweden during 1960s and early 1970s, often to jobs requiring hard physical effort and/or with a less amenable working environment (there was less competition from Swedes for these jobs).

The quarter when a LT sickness spell started also had an impact on the hazard of exiting the spell: Starting during the summer implied the lowest hazard of exiting compared to winter. These findings may suggest an effect of weather. During the colder and darker months, persons with rheumatic or psychological problems may be affected more.

Loss of earnings due to sickness decreased the length of the spell. On the other hand, the presence of high unemployment increased the length of the spells, perhaps, due to the uncertainty about the outcome if people return to work.

The medical examination is clearly a very important element in this whole process, but even more so regarding the future of employed individuals. Having a well-done evaluation, and flexible programs connected to it, can help the individual's health and wealth, and the society too. Nevertheless, being active in a "well-balanced" way is considered to have a positive impact on health, especially in the long run.

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Appendix

Table A1 Descriptive statistics, at the beginning of analyzed LT sickness spell, by gender and spell, 1986-1991

Variables	First spell			Second spell			Third spell		
	All	Men	Women	All	Men	Women	All	Men	Women
Gender (1=Female)	0.56			0.58			0.61		
Age	43.70	44.72	42.88	44.53	45.38	43.92	44.38	43.98	44.63
	(11.81)	(11.71)	(11.84)	(11.61)	(11.57)	(11.60)	(10.97)	(11.49)	(10.65)
Age-groups									
35 and under	0.29	0.26	0.32	0.26	0.24	0.28	0.25	0.29	0.23
36-45 years	0.24	0.24	0.24	0.26	0.25	0.27	0.29	0.26	0.31
46-55 years	0.25	0.25	0.24	0.25	0.26	0.24	0.26	0.26	0.27
56-65 years	0.22	0.25	0.19	0.23	0.25	0.22	0.20	0.19	0.20
Citizenship									
Swedish born	0.85	0.84	0.85	0.82	0.82	0.82	0.78	0.81	0.77
Foreign born	0.08	0.09	0.07	0.09	0.10	0.09	0.12	0.13	0.12
Nationalized Swede	0.07	0.07	0.07	0.09	0.08	0.09	0.10	0.07	0.12
Educational level									
Low	0.63	0.69	0.59	0.65	0.71	0.61	0.67	0.69	0.65
Medium	0.28	0.27	0.30	0.29	0.26	0.31	0.28	0.29	0.27
High	0.08	0.05	0.11	0.06	0.03	0.08	0.06	0.02	0.08
Marital status									
Unmarried	0.27	0.31	0.23	0.25	0.31	0.21	0.24	0.31	0.19
Married	0.55	0.52	0.57	0.53	0.51	0.54	0.49	0.44	0.52
Divorced	0.16	0.16	0.17	0.19	0.16	0.21	0.24	0.22	0.25
Widowed	0.02	0.01	0.03	0.03	0.02	0.04	0.04	0.03	0.04
Spell duration (in days)	306.4	327.8	289.1	271.0	285.0	261.1	282.0	289.5	277.2
	(371.9)	(384.2)	(360.8)	(282.7)	(300.5)	(269.1)	(261.8)	(271.2)	(256.1)
No. of spells before spell *i*	5.31	4.66	5.84	10.34	9.41	10.99	13.23	12.45	13.72
	(5.96)	(5.69)	(6.13)	(8.79)	(8.74)	(8.77)	(9.45)	(9.88)	(9.15)
Short-term spells before spell *i*	2.98	2.42	3.43	5.13	4.31	5.70	5.88	5.02	6.42
	(4.86)	(4.38)	(5.18)	(6.58)	(6.06)	(6.86)	(6.63)	(6.17)	(6.86)
Diagnosis									
Musculoskeletal	0.39	0.38	0.39	0.44	0.41	0.47	0.47	0.43	0.49
Cardiovascular	0.07	0.10	0.04	0.06	0.09	0.04	0.03	0.04	0.03
Mental	0.12	0.12	0.12	0.13	0.17	0.11	0.19	0.26	0.14
Respiratory	0.03	0.03	0.02	0.03	0.03	0.03	0.01	0.03	0.00
General Symptoms	0.04	0.03	0.05	0.05	0.05	0.06	0.06	0.03	0.07
Injuries and poisoning	0.13	0.18	0.09	0.07	0.11	0.04	0.06	0.08	0.05
Other	0.23	0.16	0.29	0.21	0.15	0.26	0.19	0.13	0.22
Annual earnings (1000 SEK)*	160.2	184.8	140.6	162.9	184.6	147.3	162.5	186.7	147.3
	(76.3)	(83.4)	(63.7)	(61.7)	(66.5)	(52.9)	(61.7)	(69.1)	(51.1)
Regional unemployment rate**	2.30	2.40	2.21	1.96	1.96	1.96	1.86	1.77	1.91
	(1.29)	(1.38)	(1.21)	(1.09)	(1.02)	(1.13)	(1.02)	(0.91)	(1.08)
Number of observations	2666	1187	1479	1089	452	637	415	160	255

Note: * *Annual Earnings* of the year when the first LT sickness spell began were inflated to "present" values using the 1997 CPI; ** *Unemployment rate* is reported by quarter, gender and administrative region, and is shown here for the quarter when LT-sickness spell began.

Table A2 Descriptive statistics by individual during 1986-1991 (*n* = 2666)

Variable	Min	Max	Mean	Mean	Std Dev
Days of Long-Term Sickness	60	3153	483.38		447.25
Days of Short-Term Sickness	0	1106	99.39		110.95
Total Days of Sickness	60	3346	582.78		466.78
Number of Long-Term Sickness Spells	1	10	1.66		1.02
Number of Short-Term Sickness Spells	0	101	8.89		10.41

Table A3 Test of equality over strata

Test	Chi-Square	DF
Log-Rank	**12.05**	2
Wilcoxon	**24.70**	2
-2Log(LR)	4.69	2

Note: **Bold =**significant at less than 1%, while the other value is significant at the 10% level.

Table A4 Hazard ratios estimated for all spells and by spells

Variable	All spells -1-	All spells (lag duration) -2-	Spell 1 -3-	Spell 2 -4-	Spell 3 -5-
Lag (Duration)		1.000			
Female (CG[a]: Male)	1.183 ***	1.181 ***	1.153 ***	1.478 ***	1.503 ***
Age (CG: < 36 years)					
36-45 years	0.779 ***	0.781 ***	0.758 ***	0.802 **	0.819
46-55 years	0.701 ***	0.703 ***	0.674 ***	0.631 ***	0.878
56-65 years	0.627 ***	0.629 ***	0.623 ***	0.525 ***	0.549 ***
Citizenship (CG: Swedish Born)					
Naturalized Swede	0.901 *	0.902 *	0.886	0.91	0.991
Foreign born	0.987	0.987	0.925	1.152	0.91
Marital status (CG: Married)					
Unmarried	0.875 ***	0.877 ***	0.848 ***	0.952	1.25
Divorced	0.977	0.978	0.948	1.023	0.957
Widowed	1.065	1.063	1.003	1.366	0.898
Educational level (CG: low)					
Medium	1.013	1.013	1.052	0.923	0.781 *
High	0.957	0.958	1.014	0.693 **	0.575 **
Quarter (CG: Winter)					
Spring	1.15 ***	1.148 ***	1.148 **	1.182 *	0.904
Summer	1.08	1.08	1.083	1.135	1.288
Autumn	0.907 **	0.909 **	0.961	0.887	0.734 *
Year (CG: ≤ 1986)					
1987	1.178 ***	1.186 ***	1.275 ***	0.943	1.1
1988	1.012	1.019	1.034	0.793	1.503
1989	1.007	1.016	1.047	0.858	0.952
1990	0.941	0.962	1.169	0.735 **	1.008
1991	0.519 ***	0.529 ***	0.361 *	0.477 ***	0.46 *
Diagnosis (CG: respiratory)					
Musculoskeletal	0.954	0.952	0.971	0.998	0.592
Cardiovascular	0.929	0.923	0.865	1.205	0.46
Mental	1.021	1.018	0.997	1.052	0.852
General symptoms	1.139	1.137	1.415 **	0.846	0.698
Injuries & poisoning	1.377 ***	1.366 ***	1.335 **	1.562 *	0.78
Other	1.257 **	1.251 **	1.281 *	1.297	0.661
Previous cases [b]	1.001	1.001	1.001	1.006	1.002
Daily loss [c] (100 SEK)	1.013 ***	1.012 ***	1.011 ***	1.028 ***	1.028 ***
Unemployment rate	0.946 **	0.945 **	0.935 **	1.002	1.04
Region (CG: Göteborg)					
Stockholm	1.075	1.072	1.037	1.464 **	1.251
Kronoberg	1.290 *	1.281 *	1.161	2.313 ***	0.677
Bohuslän	0.698 ***	0.698 ***	0.707 **	0.696	1.403
Varmland	1.362 ***	1.373 ***	1.513 ***	1.266	1.302
Västernordbotten	0.729 ***	0.730 ***	0.690 **	1.199	0.745
Norrbotten	1.117	1.116	1.250 *	0.941	0.806
n	4430	4430	2666	1087	412
% censored spells	8.60	8.60	3.26	12.05	20.15

Note: Parameters are significant at the 10% (***), 5% (**) or 1% (***) level.

Table A5 Estimates for region dummies (Comparison region: Göteborg)

Region	Individuals (J =2666)			Diagnoses (J =346)		
	Estimate	Std. Error	Hazard ratio	Estimate	Std. Error	Hazard ratio
Blekinge	-0.01	0.18	0.99	-0.01	0.14	0.99
Bohuslän	-0.30	0.15	0.74	-0.29	0.11	0.75
Gotland	0.21	0.25	1.24	0.18	0.19	1.20
Gävleborg	-0.12	0.14	0.89	-0.14	0.11	0.87
Halland	0.02	0.17	1.02	-0.05	0.13	0.95
Jämtland	0.04	0.17	1.04	-0.01	0.14	0.99
Jönköping	-0.03	0.15	0.97	-0.06	0.12	0.94
Kalmar	0.05	0.15	1.05	0.01	0.12	1.01
Kopparberg	-0.03	0.15	0.97	-0.04	0.11	0.96
Kristianstad	0.13	0.14	1.14	0.15	0.11	1.16
Kronoberg	0.36	0.19	1.43	0.25	0.15	1.29
Malmöhus	0.07	0.13	1.08	0.01	0.10	1.01
Norrbotten	0.13	0.14	1.14	0.07	0.11	1.07
Skaraborg	0.29	0.17	1.34	0.19	0.13	1.21
Stockholm	0.05	0.12	1.05	0.00	0.09	1.00
Södermanland	-0.11	0.16	0.90	-0.14	0.12	0.87
Uppsala	-0.06	0.15	0.94	-0.10	0.12	0.91
Värmland	0.35	0.14	1.41	0.27	0.11	1.31
Västerbotten	-0.05	0.15	0.95	-0.05	0.12	0.95
Västernorrland	-0.18	0.15	0.83	-0.12	0.12	0.89
Västmanland	-0.17	0.14	0.84	-0.16	0.11	0.86
Älvsborg	0.06	0.14	1.06	0.05	0.11	1.05
Örebro	0.03	0.15	1.03	0.00	0.12	1.00
Östergötland	-0.08	0.14	0.92	-0.09	0.11	0.91

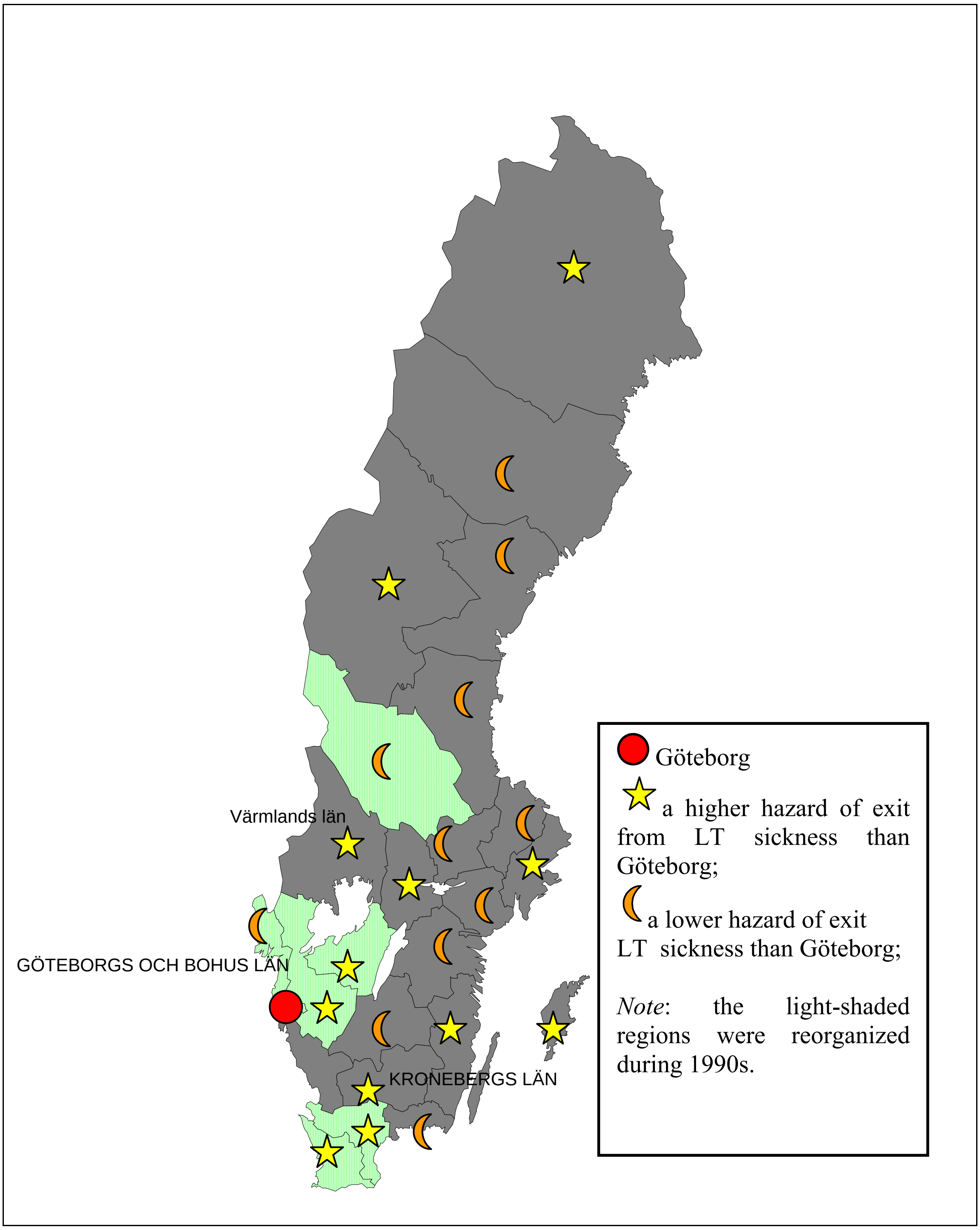

Figure A1 The hazard of ending sickness of Sweden's administrative regions, compared to Göteborg, 1986-1991.

Notes

[1] Winkler (1980); Chelius (1981) and Youngblood (1984).

[2] Dunn and Youngblood (1986); Chaudhury and Ng (1992, 1994); Dalton and Mesch (1992), Drago and Wooden (1992); Barmby et al. (1994); Johansson and Palme (1996, 2002); Johansson and Brännäs (1998); Gilleskie (1998); and Brown (1999).

[3] Baum and Youngblood (1975); Scott et al. (1985).

[4] Fenn (1981); Butler and Worrall (1985); and Johnson and Ondrich (1990).

[5] Some Swedish studies that analyzed the relationship between unemployment and (long-term) absenteeism due to sickness [e.g., Selander et al. (1996), and Marklund and Lidwall (1997), Lidwall and Skogman Thoursie (2000)] found that people who were or are unemployed face a higher risk of being sick than people without unemployment history.

[6] The compulsory sickness cash benefit system insurance, implemented in 1955, stipulated a limit of two years replacement for long-term sickness. Except for old-age pensioners, this limit was abolished in 1963.

[7] This is an amount of Swedish crowns, fixed one year at a time, and appreciated in line with price changes, measured by the Retail Price Index.

[8] Job search models have been very popular as explanatory theoretical frameworks for reduced-form econometric duration analysis (see Devine and Kiefer, 1991).

[9] “Being sick” is viewed in a very general way here as not being a choice, but at the margin, choice may still be possible. We will assume that medical evaluations are very well done, showing the true health status of employees. We will also assume that, given a reasonable wage, employees prefer to work, and would choose any work reasonable alternative their health status allows.

[10] The hazard rate (also called hazard function, risk function, intensity rate, failure rate, transition rate, or mortality rate), expresses the instantaneous risk of ending sickness at time t, given that this event did not occur before time t. It is not a probability, because $h(t)$ is a positive number that can be greater than 1.

[11] Van den Berg (2001) examines various types of relations between duration variables, as motivated by economic theory, and how they can be incorporated into multivariate extensions of the mixed proportional hazards model.

[12] When $\sigma = 0$, the observations are mutually independent and the equation reduces to the standard proportional hazards model for individual-spell data.