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# "To array a man's will against his sickness is the supreme art of medicine". An analysis of multiple spells of sickness

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## Abstract

This paper analyzes the long-term sickness absences in Sweden using a longitudinal database that contains all compensated sickness spells for 2,789 persons during 1986-1991. Given the political focus on the improved collaboration between the individual, physician, employer, and social insurance officer, the strategy is to analyze the spells of long-term sickness grouping them by all available factors that concern these actors. The estimates of a mixed proportional hazards model suggest that there was more heterogeneity among spells grouped by the factors related to the health status of the individual and the physician's evaluation than among spells grouped by the factors expected to be related to the social insurance praxis or other sorting processes.



**Keywords**: sick leave, long-term sickness, multiple spells, mixed proportional hazards model

**JEL-Codes**: I12; J21; J28

## 1. Introduction

While most of the European Union's member states have a 52-week limit on how long a person may receive sickness benefit, Sweden has no official upper limit. For this reason and due to other institutional settings (e.g., the employer obligation to pay the first two, three or four weeks of sick leave since 1992), the cases of long-term (LT) absenteeism due to sickness (i.e., spells of 60 days of more) fluctuated between 35 and 45% of all ongoing spells at the end of each year until the mid-1980s. Then the percentage increased dramatically, reaching levels around 80% during 1994-2006 (Figure A.1 in the Appendix). Moreover, spells longer than one year increased more than others (Figure A.2 in the Appendix). These facts have attracted a lot of attention from politicians, and several changes concerning social insurance have been made or proposed in order to combat LT sickness. For example, improved collaboration between the individual, physician, employer and social insurance officer has been suggested. However, no one appears to have tried to assess explicitly the effects of this collaboration on the duration of sickness absences, despite emprical evidence [e.g., Arai & Skogman Thoursie (2004); Ichino & Maggi (2000)] of substantial establishment level variation in sickness absences that cannot be explained by the standard worker and establishment characteristics used in the earlier literature.

Having access to a longitudinal database that contains all compensated sickness spells during 1986-1991 for 2,789 persons, this study analyzes the practicality of the political focus on improved actor collaboration between the individual, physician, employer, and social insurance officers. The strategy here is to group the spells of LT sickness by all available factors that concern these actors. The novelty is that this approach offers (for some variables) two types of information: (1) the effect of the analyzed variable on the risk of existing LT sickness (the estimated betas); and (2) the association between sickness spells that have the same characteristic (involving one or more of the mentioned actors in the process of sickness absenteeism) and the hazard to exit from LT sickness. The results show that there was more heterogeneity among spells grouped by the factors related to the health status of the individual and the physician evaluation (health status at the end of the spell and diagnosis) than among spells grouped by the factors expected to be related to the social insurance praxis or other sorting processes.

## 2. Institutional framework and the sick leave decision

In Sweden, sickness insurance is compulsory and publicly administered (by the Swedish Social Insurance Agency), providing compensation for 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%, then the affected individual can qualify for a sickness cash benefit.[1] Depending on the extent of loss of earnings capacity, the compensation can be full (100%) or partial (75%, 50%, or 25%). During the period analyzed here (1986-1991), a medical certificate was required after seven days of absence, and a more detailed certificate from the 29th day. A sickness benefit could be paid out for an unlimited period, was taxable, and counted towards the recipient's pension base. Until March 1991 there was a uniform replacement rate of 90% of the income qualifying for sickness allowance (i.e., the expected yearly earnings from employment).[2] After that only 65% was paid for the first three days, 80% for days 4-90, and 90% thereafter. In addition, most workers also received an extra 10% from negotiated collective agreements on the top of the social insurance compensation.

The entire sick leave process (i.e., the start of a new spell of sickness absen-

[1] 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.

[2] The cash benefit had both a upper and a lower limit. The upper limit is 7.5 times the base amount (an amount of money, fixed one year at a time and appreciated in line with price changes measured by the Retail Price Index), which was SEK 241,500 in 1991 (i.e., about USD 40,000 in December 1991, or the end of the period analyzed here).

teeism and its duration) encompasses both the individual's choice, the medical evaluation, the decision of the insurance adjudicator and the possiblity of employers to offer acceptable working conditions and job tasks. More exactly, the individual decision is 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 sickness absenteeism is the outcome of a decision to transition to another state (rehabilitation, return to work, disability pension, unemployment, etc.) in the optimal moment.

Considering this design of the sick leave process and all the agents involved, the question is what economic model is suitable to explain the people's absenteeism due to sickness. 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 contracts were terminated, either at their own initiative or at that of their employers.[3] However, in Sweden employees are protected against contract termination in the case of sickness, but they themselves may choose to terminate or change their contracts.

Even though "being on sick leave" is viewed as not being a choice, choice may

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

still be possible at the margin. Given their health status and a reasonable wage, these employees would choose any work reasonable alternative the employer can offer. In other cases, people may be able to return to their previous jobs, doing the same task as before, needing only some changes in the working conditions (e.g., an ergonomic desk, a better chair, etc). If employees expect that these changes will not take place, then the duration of their sickness spells is expected to be even longer. This suggests that the medical evaluations should be done more often in order to help persons on sick leave to choose the best alternative given their health status. Moreover, different diagnoses imply different treatments, and cause different behavior across individuals, as for example people with the same diagnosis and the same observable characteristics have different durations of the sickness absences.

Even though the social insurance rules are universal across regions, there is great flexibility in how they are applied. In fact, the degree of flexibility can last at the level of the officer at the local social insurance office who handles the case. However, the region data might bring even more information about the interaction of the regional flexibility with other regional characteristics (such as concentration of different industries or other sectors of activities, share of the private sector, etc.).

In trying to learn more about factors affecting long-term sickness spells, the focus is on groups of spells, i.e., "families" of spells grouped by all observables. This strategy is in close proximity to Chadwick-Jones *et al.* (1982), who suggest that different groups and organizations have different beliefs and practices regarding absence behavior.[4] Each group or organization is therefore associated with an "absence culture", which implies a set of shared understandings about absence legitimacy and an established "custom and practice" of employee absence behavior and of its control. Therefore, the extent of absence behavior that is acceptable varies from group to group, and the individual variations operate within the limits set by the group. However, in the case of absence due to sickness, the norms are operative in terms of the institutional settings that may allow people to be absent from their workplace when their work capacity is diminished. These settings might even permit people to claim that they have lost their work capacity even when they have not, altgough the rules can also be (or become) quite harsh and force people to work even though they cannot. However, our analysis does not focus on identifying such extremes.

[4] For example, using a stratified partial-likelihood model that allows for nonparametric school-specific baseline hazards, Lindeboom & Kerkhofs (2000) find strong effects of both observed personal characteristics and school characteristics on the sickness absenteeism of Dutch teachers.

## 3. Sickness duration and the caveats of the proportional hazards model

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. Based on these results, 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 hazard rate expresses the instantaneous risk of ending sickness at time $t$, given that this event did not occur before time $t$. 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. For the analysis of long-term sickness, this model implies that a sick person has the same probability of ending the sickness absence (or becoming healthy) every day, and therefore the sequence of conditional probabilities would be a constant. Given that the sickness absences are very different from each other, it might be (more) appropriate to assume that the conditional probability of becoming healthy decreases with the length of the spell.

Lancaster & Nickell (1980) argue that in the proportional hazards model the effects of time dependency (true duration dependency) and unobserved heterogeneity (spurious duration dependency) cannot be distinguished, while Elbers & Ridder (1982) show that this is not the case if the model allows for observed explanatory variables in the hazard. Furthermore, mixed proportional hazards models (with proportional unobserved heterogeneity of unknown distribution) are identified if auxiliary assumptions on either the first moment of the mixing distribution or the tail of the mixing distribution are maintained [Elbers & Ridder (1982) and Heckman & Singer (1984), henceforth ER-HS]. It might be reasonable to assume that the hazard is the same for all spells for the same person. However, each person may have spells that are related but not exactly of the same type (i.e., the first spell could be a work injury, the second a musculoskeletal diagnosis, and the third could be related to postnatal complications). Therefore, when having multiple spells it might be desirable to specify different hazards for different spells, but the model might have lagged duration dependence (i.e., the lagged duration is endogenous), and therefore the ER-HS results will not apply (i.e., the mixed proportional hazards model cannot be identified). However, Honore (1993) proves that the ER-HS results can be generalized to multi-spell models with lagged duration dependence. He also proves that without lagged duration dependence, the identification result does not depend on moment conditions or tail conditions on the mixing distribution.

Nonetheless, there are unobserved characteristics (such as genetic constitution, physical robustness, etc.) that can result in an individual health status that is not observable. In this context, we can define a factor (called frailty) that represents the combined effects of genetic, environmental, and lifestyle characteristics of the individual upon his/her risk of ending sickness absence. Moreover, although social and biological factors jointly determine the health of an individual and the duration of his/her sickness absence, the only way to analyze their complex interaction is to design reasonable assumptions about their differences. The mechanism of selective survival that leads to decreasing differences between two groups in exiting sickness absence only works if frailty is distributed independent from the grouping status. At least some determinants of the hazard of ending sickness must be independent of the grouping criterion.

## 4. A mixed proportional hazards model of sickness absenteeism

Based on the various groups of spells, let $T_{i1}, \ldots . T_{iJ}$ denote the $J$ "waiting times" (or durations) before exit from LT sickness in group $i$. 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. The (notion of) frailty provides a convenient way to introduce random effects, association, and unobserved heterogeneity into models for survival data. The variability in sick leave durations (or the time to the end of a sickness spell) can be produced by two factors: (1) randomness (described by a hazard function) and (2) random effect (which is either an individual variable or a variable common to several individuals). In the univariate case (i.e., sick leave time of independent individuals), the frailty describes heterogeneity, that is, the influence of unobserved risk factors in a proportional hazards model. In the multivariate case (where the frailty is common to a group of individuals), the frailty generates dependence among the individuals in the group (frailty meaning unobservable explanatory variables that may be correlated across groups of sickness spells). Conditional on frailty, event times within groups are mutually independent with the conditional hazard function

$$h(t_{ij}|w_i) = h_0(t_{ij}) \exp(x'_{ij}\beta) w_i \tag{4.1}$$

where $\beta$ is a vector of fixed and time-varying effects, and $h_0(t_{ij})$ denotes the baseline hazard. The group-level random effect (i.e., the unobserved heterogeneity, or frailty term), $w_i$, acts multiplicatively on the group $i$ risk of exit from LT sickness so that the risks of all spells to end in a particular group are multiplied by this common factor. We consider the impact of unobserved group-level heterogeneity on sickness duration by assuming that spells in the same group share a common set of time-invariant, generalized, unmeasured characteristics (that can be captured by $w_i$). Given otherwise similar characteristics, spells in one group might be longer than spells in another, mainly because of the individuals' different health conditions, but also because of work motivation, 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 the unmeasured group-level component (or random effect) that contributes to the risk of exit from LT sickness.

We assume that the frailty term follows a gamma distribution with a 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 $\sigma$. The estimate of $\sigma$ can be interpreted in terms of the relative risk of exit from a hypothetical spell of LT sickness. When $\sigma = 0$ the observations are mutually independent and the equation reduces to the standard proportional hazards model for individual-spell data. To fit this model, we use the EM algorithm proposed by Dempster *et al.* (1977), and named it EM to describe the Expectation and Maximization steps in each iteration.[5]

## 5. Data

This paper analyses the Long-term Sick Insured Population (LSIP) sample from the Long-term Sickness (LS) database.[6] This sample contains 2,789 persons who

[5]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 $\Pr(t|X;\beta)$over the hidden variables, given the visible variables ($X$) and the current value of the parameters ($\beta$). 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. The EM algorithm finds a frailty estimate for each group. The frailty distribution parameter, $\alpha$, 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 $\alpha$ is negligible.

[6]See Andren (2001) for a detailed description of the LS database.

represent all residents in Sweden born 1926-1966, and who had at least one sickness spell of at least 60 days during 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 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 from the data, resulting in a sample of 2,666 persons, who together had 4,430 spells of LT sickness.[7] The average person in the sample was sick 582 days during the analyzed period, with 1.7 spells of LT sickness and 8.9 spells of short-term sickness (Table A.2 in the Appendix). Almost half of the sample (1,088 persons, or about 41%) had more than one spell of LT sickness, 16% had at least three spells and about 6% had at least four spells (Table A.3 in the Appendix). Even though we follow the same persons over time, the percentage of the spells that were longer than one year is about 19-26% (Table Table A.4 in the Appendix).

[7]For more descriptive statistics, see Tables A.1 and A.2 in the Appendix. Table A.1 presents the descriptive statistics at the beginning of analyzed spells of LT sickness by spell (spells 1-3), and Table A.2 shows descriptive statistics of sickness variables (days and spells) by individual. Table A.3 presents descriptive statistics regarding the duration of the LT sickness by spell. Table A.4 presents descriptive statistics regarding the duration of the LT sickness by spell and "one year upper limit" of sickness spells.

## 6. Results

The results, reported in Table 6.1, show that during 1986-1991 the hazard of ending LT sickness was higher for women than men, and it was lower for older people compared to groups of younger people; for foreign-born holding a Swedish citizenship compared to Swedish born; and for higher educated compared to lower educated.

However, if there was unobserved heterogeneity (i.e., the frailty effect, or the grouping factor's effect, was statistically significant), then the magnitude of the estimated effects of the other explanatory variables were higher.

**Table 6.1** Estimation results for all spells (n=4430), grouped by factors

| | Individual | Diagnosis | Status at the end | Age | Gender | Region | Quarter | All spells |
|---|---|---|---|---|---|---|---|---|
| Estimation method [#] | MPH | MPH | MPH | MPH | MPH | MPH | MPH | SPH |
| Frailty | 1.359*** | 1.375*** | 1.950 | 1.026*** | 1.006 | 1.012** | 1.007 | |
| Female (CG[a]: Male) | 1.459*** | 1.232*** | 1.141*** | 1.199*** | | 1.175*** | 1.181*** | 1.183*** |
| Age (CG: < 36 years) | | | | | | | | |
| 36-45 years | 0.774*** | 0.810*** | 0.900** | | 0.779*** | 0.776*** | 0.778*** | 0.779*** |
| 46-55 years | 0.655*** | 0.744*** | 0.914* | | 0.700*** | 0.704*** | 0.701*** | 0.701*** |
| 56-65 years | 0.554*** | 0.638*** | 1.000 | | 0.625*** | 0.628*** | 0.626*** | 0.627*** |
| Citizenship (CG: Sw. born) | | | | | | | | |
| Naturalized Swede | 0.888 | 0.883** | 0.946 | 0.907 | 0.901* | 0.904* | 0.900* | 0.901* |
| Foreign born | 1.036 | 1.042 | 1.068 | 1.004 | 0.986 | 0.983 | 0.986 | 0.987 |
| Marital status (CG: Married) | | | | | | | | |
| Unmarried | 0.914 | 0.937 | 0.932 | 0.934 | 0.873*** | 0.873*** | 0.877*** | 0.875*** |
| Divorced | 0.939 | 0.960 | 0.961 | 0.962 | 0.977 | 0.980 | 0.977 | 0.977 |
| Widowed | 1.067 | 1.097 | 1.096 | 1.031 | 1.069 | 1.079 | 1.068 | 1.065 |
| Educational level (CG: low) | | | | | | | | |
| Medium | 0.979 | 0.967 | 0.992 | 1.045 | 1.013 | 1.013 | 1.013 | 1.013 |
| High | 0.772** | 0.844** | 0.905 | 0.964 | 0.961 | 0.959* | 0.956 | 0.957 |
| Quarter (CG: Winter) | | | | | | | | |
| Spring | 0.941 | 0.960 | 0.995 | 0.960 | 0.938 | 0.940 | | 1.150*** |
| Summer | 0.743*** | 0.785*** | 0.843*** | 0.908 | 0.789*** | 0.792* | | 1.080 |
| Autumn | 0.856*** | 0.861*** | 0.935 | 1.043 | 0.870*** | 0.871*** | | 0.907** |
| Year (CG:1986 or before) | | | | | | | | |
| 1987 | 1.128** | 1.145*** | 1.157*** | 1.142 | 1.178*** | 1.180*** | 1.182*** | 1.178*** |
| 1988 | 0.945 | 0.968 | 1.059 | 1.402*** | 1.012 | 1.020 | 1.016 | 1.012 |
| 1989 | 0.880 | 0.928 | 1.125* | 1.286** | 1.006 | 1.017 | 1.013 | 1.007 |
| 1990 | 0.800* | 0.873 | 1.271*** | 0.931 | 0.940 | 0.948 | 0.946 | 0.941 |
| 1991 | 0.418*** | 0.474*** | 1.476*** | 0.784*** | 0.519*** | 0.524*** | 0.524*** | 0.519*** |
| Diagnosis (CG: respiratory) | | | | | | | | |
| Musculoskeletal | 0.884 | | 0.880 | 0.869*** | 0.957 | 0.964 | 0.952 | 0.954 |
| Cardiovascular | 0.851 | | 0.859 | 1.167*** | 0.928 | 0.941 | 0.927 | 0.929 |
| Mental | 1.002 | | 0.999 | 1.006 | 1.022 | 1.027 | 1.020 | 1.021 |
| General symptoms | 1.187 | | 1.030 | 0.981 | 1.143 | 1.141 | 1.137 | 1.139 |
| Injuries & poisoning | 1.484*** | | 1.191 | 0.917 | 1.375*** | 1.383*** | 1.375*** | 1.377*** |
| Other | 1.272* | | 1.218* | 0.497*** | 1.262** | 1.269*** | 1.257** | 1.257** |
| *Previous cases* [b] | -0.288 | 0.095 | 1.003 | 1.002 | 1.001 | 0.156 | 1.001 | 1.001 |
| *Daily loss* [c] *(100 SEK)* | 3.161*** | 2.205*** | 1.009*** | 1.013*** | 1.013*** | 1.220*** | 1.013*** | 1.013*** |
| *Unemployment rate* | -6.681* | -5.953*** | 0.944** | 0.947** | 0.945** | -4.719* | 0.947** | 0.946** |
| Region (CG: Göteborg) | | | | | | | | |
| Kronoberg | 1.432* | 1.287* | 1.207 | 1.295* | 1.287* | | 1.292* | 1.290* |
| Varmland | 1.414** | 1.314** | 1.269** | 1.373*** | 1.361*** | | 1.366*** | 1.362*** |
| Bohuslän | 0.740** | 0.747** | 0.797** | 0.701*** | 0.698*** | | 0.701*** | 0.698*** |
| Västernordbotten | 0.834 | 0.891 | 0.780** | 0.758** | 0.728*** | | 0.730*** | 0.729*** |
| Kendall's TAU | 0.1330 | 0.1373 | 0.2503 | 0.0125 | 0.0032 | 0.0061 | 0.0034 | |
| *j* (number of groups) | 2666 | 346 | 4 | 48 | 2 | 25 | 4 | |
| -2 Log Likelihood [d] | | | | | | | | |
| No frailty | 48550 | 48628 | 48550 | 48630 | 48574 | 48621 | 48581 | |
| Frailty | 48323 | 48340 | 47070 | 48598 | 48557 | 48603 | 48562 | |

Note: The estimate is significant at the 10% level (*), at the 5% level (**), and at the 1% level (***). *Italics* indicate that the hazard ratio (*hr*) had been recomputed as *phr* = 100*(*hr*-1) for these (continuous) variables; [a] CG is the comparison group; [b] Previous cases of sickness before the analyzed spell, and starting with January 1983, regardless of duration; [c] Daily earnings loss due to sickness; [d] In all cases, "No Frailty" is rejected at the 1% level. [#] *MPH* stands for mixed proportional hazards model, and *SPH* stands for the standard proportional hazards model for individual-spell data.

Women's hazard rate was 18-46% higher than men's, which means that women's spells on average were shorter than men's. 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 younger than 36, while for those aged 46 to 55 the hazard was about 66-74%, and for those aged 56 to 64, 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 was lower (about 77-84%) for those with higher education than for people with lower education. This result can be explained by differences in several characteristics of the two groups, such as income, work environment and working conditions, and health capital. It is possible that people's care for their own health is an important factor driving this difference. People with higher education may be more careful with their health and more receptive to health-related information than less educated people.

People whose spells started in the 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 an autumn quarter it was about 86-87%. This might be explained by the seasonality of different occupations, but also by some helath problems that are getting worse during seasons with cold weather. Moreover, the hazard of exiting from LT sickness was higher (13-18%) for spells that started in 1987 compared to those that started in 1986 or before (i.e., 1983-1986), while for those that 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 social insurance reforms that occurred under two very different business cycles: the relatively good period in the late 1980s and the beginning of the recession period in the early 1990s. This can be an explanation for the different sign of the estimated coefficients for 1987 and 1991.

The hazard of exit from LT sickness was 38-48% higher for those with injuries or poisoning diagnosis, and 27% higher for those with "other diagnosis" compared to those with a respiratory diagnosis. 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, which might be explained by the concentration of different industries or other sectors of activities and the share of the private sector in these regions, and even by the flexibility in how the universal rules of the social insurance are applied across regions.

Judging from Kendall's tau, the intra-group correlation was 0.25 for spells grouped by the health status at the end of spells, 0.13 for spells grouped by individual and 0.14 for the spells grouped by diagnosis. The intra-group correlation was less than 0.01 for spells grouped by region, gender, and quarter. Therefore, it is not surprising that the estimated values of the betas for the spells grouped by region, quarter, and gender are almost identical to those estimated by a proportional hazards model of all spells (the last column in Table 6.1), but they are different from the betas estimated for all spells grouped by individual, diagnosis and status at the end of spells. This implies that controlling for unobserved heterogeneity does matters.[8]

In sum, the approach in this paper offers both information about the effect of the analyzed variable on the risk of exiting long-term sickness (the estimated betas) and information about the association between spells of sickness having

[8]Table A.5 presents the test of equality over strata (by spells). Table A.6 presents the hazard ratios of all spells pooled together without controlling for multiple observations for the same individual, and by spell (only the first, second and third spells).

the same characteristic (a factor linked to one or more actors involved in the whole process of sickness absenteeism) and the hazard to exit from LT sickness. The first type of information shows that gender, age, daily loss of income, regional unemployment rate, and three regional dummies had a statistical significant effect on all model specifications (supporting the findings in the previous literature). The second type of information shows that the health status at the end of the sickness spell had the highest association, and there was a relatively low association in the risk of exit from sickness among individuals and diagnoses, and almost no association among regions, gender, and quarters (supporting previous hypotheses about the duration of work absences due to sickness).

Nonetheless, one of the most important findings of this paper is that from all observed factors, the status at the end of a sickness spell had the highest association with the risk of exit from LT sickness. This supports the political focus on the importance of improved collaboration between the individual, physician, employer, and social insurance officer, since all these actors can be linked to this factor (the individual and his/her health status obviously, the physician through medical evaluation, the officers at the social insurance office applying the rules regarding exits into disability and return to work, and the employer through the possibility to adapt working conditions and job tasks to the employee's working capacity).

## 7. Summary and policy implications

Only very few studies have modeled and analyzed the duration of multiple spells of sickness in Sweden [e.g, Andren (2001), Andren (2005) and Johansson & Palme (2005)]. Using longitudinal data from a representative subset of the insured population, the present paper presented a new strategy for analyzing sickness spells and, implicitly, new results on the determinants of the duration of LT sickness for employed individuals in Sweden from the mid-1980s through the beginning of the 1990s. The strategy was to analyze the spells of long-term sickness by grouping them by all available factors that concern actors involved in the whole process of a person's sick leave. The novelty is that this approach offers, for some variable, information about both the effect of the analyzed variable on the risk of exiting long-term sickness (the estimated betas) and the association between spells of sickness having the same characteristic (a factor linked to one on more actors involved in the sick leave process) and the hazard to exit from LT sickness. For example, the results for gender show that women had a higher hazard to exit from LT sickness than men (the first type of information), but the association between the spells grouped by gender and the risk of exit from sickness spell was almost zero (the second type of information). Moreover, the hazard was (much) higher in all specifications when the unobserved heterogeneity at the group level had a statistically significant effect on the duration of the sickness spell. This might be explained by the fact that unobserved heterogeneity might include factors related to the active help to return to work received by people on sick leave, but also to the individual's motivation, family situation, etc. The estimates for age showed almost the same pattern: when unobserved heterogeneity had a significant effect, the older the people, the lower their hazard of exit from LT sickness. This might indicate that little is done to help older workers come back to work, and therefore it might suggest a need for a policy initiative targed to improve health status of older age groups, speed up the recovery, and encourage work should also be targeted towards those in older age groups. In addition, special policies should be focused on preventing the deterioration of the heath status of younger employees in order to prevent or slow down the increasing trend of long-term sickness. These policies should relate both to working conditions and to health problems related to work. One such policy could be greater flexibility in working time. In this context the consequences of overtime work and the burden of combining paid careers and housework (usually) for women needs to be analyzed in a long-term perspective as well, since over-used work capacity today might cause health problems in the future.

Even though this database is relatively old, it contains enough information to test the practicality of the political focus on the improved collaboration between the individual, physician, employer, and social insurance officer. The results show that from all observed factors, the status at the end of the sickness spell had the highest association with the risk of exit from a LT sickness. Given that all the individual, the physician, the employer, and the social insurance officer influence or use the information related to the individual health status, the results support the practicality of the political focus on the improved collaboration between these actors. Moreover, given that most of the results suggest that the focus should be on factors related to the health of the individual, the medical examination seems to be a very important element in the whole process of sickness absenteeism, but even more so regarding the future of employed individuals. A thorough medical evaluation and flexible programs designed accordingly, can help an individual's health and wealth, and society too. Nevertheless, being active in a "well-balanced" way is expected to have a positive impact on health, especially in the long run.

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# A. Appendix

**Table A.1** Mean values at the beginning of the LT sickness spell

| 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 A.2** Descriptive statistics by individual, 1986-1991 (n = 2666)

| 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 |

Notes: * 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 A.3** Descriptive statistics for the duration (in days) by spell

| 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 |

Notes: * 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 A.4** Descriptive statistics by one year upper limit

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

**Table A.5** Test of equality over strata

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

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

**Table A.6** 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 | 0.910 | 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 or before) | | | | | |
| 1987 | 1.178 *** | 1.186 *** | 1.275 *** | 0.943 | 1.100 |
| 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 | 0.460 |
| 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 * | 0.780 |
| Other | 1.257 ** | 1.251 ** | 1.281 * | 1.297 | 0.661 |
| Previous cases | 1.001 | 1.001 | 1.001 | 1.006 | 1.002 |
| Daily loss (100 SEK) | 1.013 *** | 1.012 *** | 1.011 *** | 1.028 *** | 1.028 *** |
| Unemployment rate | 0.946 ** | 0.945 ** | 0.935 ** | 1.002 | 1.040 |
| 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 |
| -2 Log L without covariates | 60621 | 60621 | 35930 | 11680 | 3420 |
| -2 Log L without covariates | 59704 | 59702 | 35321 | 11361 | 3281 |
| n | 4430 | 4430 | 2666 | 1088 | 413 |
| % censored spells | 8.60 | 8.60 | 3.26 | 12.04 | 20.10 |

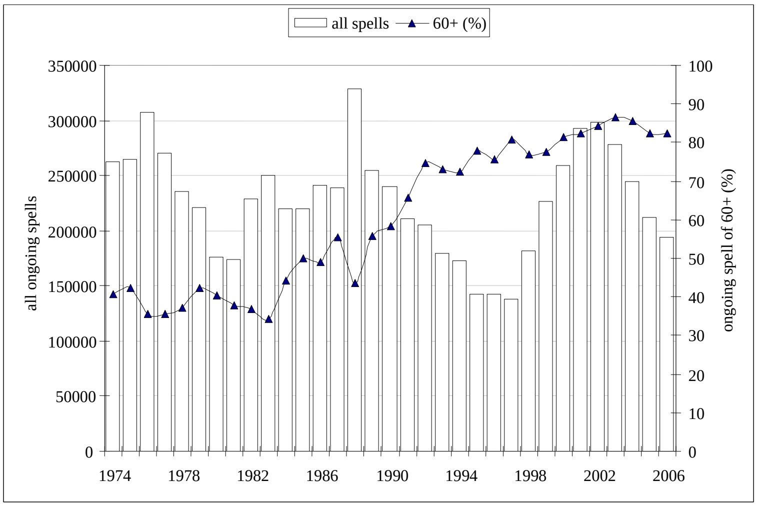


**Figure A.1** Ongoing spells at the end of the year by duration, and the percentage of the LT sickness spells

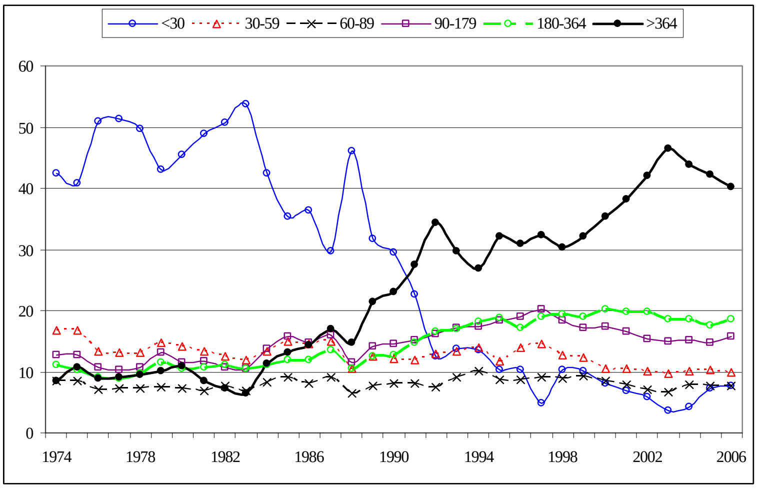


**Figure A.2** Ongoing spells at the end of the year by duration (in percent)