The Effect of Past Sickness on Current Earnings in Sweden

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Abstract

This paper examines whether sickness history affects annual earnings and/or hourly wages in Sweden, using a unique longitudinal database. If poor health makes people less productive, previous sickness is expected to have a negative effect on hourly wages. If poor health reduces people's working capacity, but not their productivity, it is expected to decrease the hours worked, which implies lower annual earnings and no change in their hourly wage. The results indicate that people who are healthy in the current year but have a longer spell of sickness in previous years have lower earnings than persons who have no record of long-term sickness, and that the effect goes through hours of work rather than the wage rate. In addition, in the current year, sickness has a convex relationship with earnings, going through wages. Persons with lower (higher) wages have more (fewer) days of compensated absenteeism.

Key words: sickness history; reported hours of work; earnings and wage equations.

JEL Classification: I10, I12, J24, J28.

INTRODUCTION

The question addressed in this paper is whether relatively recent and relatively long spells of sickness affect annual earnings and hourly wages in Sweden. If poor health makes people less productive, we expect to find a negative effect of previous health history on current hourly wages, through the wage effect on earnings. If, instead, poor health reduces people's working capacity, but not their productivity, this implies a decrease in hours worked. In this case, health impairment increases the absenteeism rate or reduces hours supplied, or both. By studying both hourly wages and annual earnings, we can discern, first, if there is an effect of poor health on earnings and, second, if there is a significant effect, whether it is because people have lower hourly wages than they would have had without the history of long-term sickness. If an effect on earnings is not reflected in a reduced wage rate, the implication is that it attributable to a change in hours worked.

Individual investments in health, for example, in medical check-ups, diet, and exercise, but also in social activities that enhance well-being help to maintain or improve productivity. However, while personal investments in health may keep working capacity from deteriorating, enabling individuals to maintain a normal level of hours worked (and annual earnings), they do not necessarily increase the hourly wage relative to other workers. They may only be needed to maintain a "normal" level of human capital and prevent some time away from the workplace associated with a spell of poor health.

Employer investments in the individual's work environment, including providing medical check-ups and opportunities to exercise at the expense of the employer, can have the same effect. If the benefits to the employer derived from health-enhancing or health-maintenance work environment measures are greater than the costs of financing them, they are economically justifiable activities to pursue.

In studies of annual earnings and hourly wages, the most common approach is *not* to control for health status. When health status has entered studies, two approaches have been mainly taken. Either health is formulated as a binary exogenous variable, or it is used as a stratification criterion for obtaining samples of “healthy” and “unhealthy” men and women, blacks and whites, etc. In this study, we are able to specify health status using information about days of sickness during five previous years and accompanying diagnoses from administrative registers. This means that the measure of health status used in this study does not rely directly on an individual’s self-evaluation, and therefore may be a more objective measure of health.

In this study, we analyze whether days of absence due to sickness and different diagnoses have an effect on the annual earnings and hourly wages for a sample from the Swedish working age population. We use the only database in Sweden that enables us to combine hours worked, sickness history (days of sickness absence, spells of sickness and their diagnoses), and earnings, all of which are necessary to analyze the effects of previous work absence due to poor health on annual earnings and hourly wages.

Section I places our study within the framework of the relevant literature on health, human capital and labor supply. Section II outlines the theoretical and institutional framework, while Section III presents the data. The empirical results are presented in Section IV, and conclusions are drawn in Section V.

I. SICKNESS, HEALTH AND EARNINGS IN PREVIOUS STUDIES

The "human capital" literature has expanded rapidly since the schooling model was presented in the late 1950s [Mincer (1958, 1962) and Becker (1962)]. However, there is little economic research on the effects of health or health investments on earnings compared to education and training. In the early work on human capital, Becker (1962) mentioned medical care and vitamin consumption as ways of investing in human capital, and referred to investments in mental and physical health that can be made within the firm (medical examinations, lunches, protection against accidents) and outside firms by individuals. In theory, a firm would be willing to compensate employees for individual costs leading to improvements in human capital if it could benefit from a resulting increase in productivity, or an improvement in the "mainframe" of a valued worker, compared with the cost of hiring and training a new worker.

The question is whether employers really think in these terms, and whether instead a health-enhancing investment is usually the result of an individual decision and financed with the individual's own resources. Investments in individual health can take various forms, which can be as diverse as medical check-ups, exercise, and social activities, with the similar result that they prevent absenteeism from work to repair failing health (use of health services, recovery time, etc.). Regardless of whether they are employee or employer financed investments, they are necessary to maintain worker productivity, and from the point of view of the individual to maximize lifetime earnings, health and overall welfare, given individual endowments.

Grossman (1972a, 1972b) constructed the first model of the demand for health capital. The Grossman model of the demand for health identified the complex interrelations between work-time, wages, and health. More recently, Grossman (1999) argues that health capital differs from other forms of human capital. The individual's stock of knowledge affects both his market and non-market productivity, while health status also determines the total amount of working time.

In the economic literature, poor health is usually analyzed in the context of complete exit from the labor market. Following the 1972 studies by Grossman, a number of studies (mainly using US data), focused on work, wages, and health. Currie and Madrian (1999) present an overview of the US literature linking health, health insurance, and labor market outcomes, such as wages, earnings, employment, hours, occupational choice, job turnover, retirement, and the structure of employment. The empirical literature surveyed by them suggests that poor health reduces the capacity to work and has significant effects on wages, labor force participation, and job choice.

There are only a few studies that focus on our question, the extent to which there is *some* rather than complete reduction in labor supplied. Among these are Chirikos and Nestel (1985), who examined the effect of health histories over the preceding ten-year period on current economic welfare, using US data and a two-equation model. First, health history effects on wage rates adjusted for sample selectivity bias were estimated, and then the influence of health history and wages on annual hours of work were estimated using Tobit regressions. Analyzing people grouped by gender, race, and health status, they found that health problems in the past (up to 10 years) adversely affected current earnings.

Another study in this genre is Haveman *et al*. (1994). They specified a 3-equation model, designed to capture interrelationships among work-time, wages, and health, which is estimated using the generalized method of moments' technique. An implicit demand for health function accounts for the interrelationships among health, work time, and wages. Simpler models were then estimated with more restrictive assumptions, and substantial differences were found between these estimates and those from the simultaneous model. A positive relationship was found between work time and health, but this disappeared when the relevant simultaneities were considered.

The Swedish literature on the effects of absenteeism on individual wages has focused mainly on time out of the labor force, accompanying childbirth and childcare, and the results are contradictory. Gustafsson (1981) used an OLS cross-sectional regression, and estimated the effect of absenteeism on monthly salaries in 1974 for women aged 30-44 years (from a random sample of white-collar workers), and found a negative effect of time spent out of work on monthly salaries. Edin and Nynabb (1992) used a sample of persons employed during the interview week in 1984, with no internal missing values, and re-interviewed in 1986. They found a positive effect on (log) hourly earnings of time out for women and no significant effect for men. Stafford and Sundström (1996) used OLS cross-sectional regressions and found negative effects (significant at the 10 % level only for men) of time spent out of work on wages. Albrecht *et al*. (1998) examined the effects of career interruption (parental leave, household time, other time out, diverse leave, unemployment and military service) *not* including sickness absenteeism on subsequent wages. Time out had a significant negative effect on both women's and men's wages. Parental leave had no effect on women's wages, but had a significant negative effect on men's wages.

The effect on earnings and hourly wages of time spent away from the workplace associated with childbirth and childcare is, thus, a recurring theme in the literature on absenteeism in Sweden. The interest in this area has to do with Sweden's very liberal legislation regarding the right to be away from the work place in conjunction with childbirth, and the fact that earnings of increasingly longer periods of absenteeism for childbirth have been financed publicly.

As opposed to these earlier studies, the present study focuses on the effects on earnings and wages of sickness history within the five preceding years (measured by total compensated days, long spells of absence and specific diagnoses), which per se is almost unique in the literature.

The empirical literature in this area is based largely on US data and institutions. By comparison, our analysis of the relationship of past health to present earnings is set in a typical European environment, with universal social insurance and highly organized collective bargaining. In Sweden, as in many other European countries workers cannot be laid off solely due to poor health, although they can change jobs on their own initiative. Regardless of whether the worker with a poor health history continues with the same employer or changes jobs, our analysis will capture the overall effect of health on earnings, and will indicate whether, and to what extent, the effect runs through a reduced wage rate, a reduction in hours worked or both.

Consequently, this study provides additional findings to the literature on the effects of poor health on earnings and wages, as well as an additional insight into the general question of whether absenteeism affects the wage rate.

II. THE THEORETICAL AND INSTITUTIONAL FRAMEWORK

The human capital model that assumes that an individual can, by forgoing earnings, spend time on education or training and thereby, augment the quality and the value of his/her labor services. Schultz's (1960) focus on education as a key to raising productivity, and his work paved the way for Becker's analysis of human skills as a source of productivity growth, which relates hourly earnings to the effects of schooling, on-the-job training, and work experience. This model, which is the point of departure in many studies of earnings formation and differences in earnings between various groups, is our point of departure too.

Health is similar to education and training in the sense that it is a “stock” that can be enhanced and/or maintained with investment (good nutrition, exercise, etc.) through life, although the normal process of aging can increase the likelihood of some specific diseases. Health is an investment for which people do not necessarily need skills in order to maintain or increase human capital, but it requires at least their access to information. We consider the investment in health to be the same as the investment in education and/or training, and view prevention of work absence due to poor health as a maintenance investment, as we have discussed above.

De Leire and Manning (2004) discuss how to measure the labor market costs of illness, and suggest that an increase in the health impairment rate is equivalent to an increase in the effective wage rate. At the margin, this leaves the price-taking employer with two alternatives, since the marginal worker is too expensive. The first is to replace him with a less expensive worker from the pool of available labor, and at the exogenously determined market wage. Another alternative is to negotiate the correct market wage, given impairment, or to hold back on future wage increases for the health-impaired worker, or both. In addition, if the impairment goes over, this provides an opportunity for once again increasing the individual’s wage up to the level consistent with a non-health-impaired worker.

The individual is assumed to maximize his or her utility from consumption, C, and leisure, l, for a given health status, h, i.e. $U(c, l; h)$, where health impairment is reflected in a change in the health status parameter. The consumer maximizes utility given that his or her effort is restrained by the number of hours in the day, and given preferences for consumption of goods and services and leisure.

There are different outcomes for the individual. The first is to attempt to maintain an unchanged wage, in spite of the increase in impairment. If demand for labor is elastic and if there is an unimpaired worker willing to work at the exogenously determined wage rate, then the optimum policy for the employer is to replace the health-impaired worker with a healthy worker. The *optimum* for the worker, without full income replacement from insurance for time away from the workplace, is to reduce his or her reservation wage. This strategy could enable the "marginal worker" to remain employed. On the other hand, if earnings are replaced up to the amount that is consistent with the individual's marginal value to the employer, the individual may be indifferent between leisure or work at a reduced wage. The decision on time spent at work can depend on where in the career profile the individual finds him or herself, the degree of health impairment, and individual preferences for leisure. The first two can be quantified, which is the aim of our analysis.

We expand the standard model of earnings and wages with variables related to personal characteristics (*X*), history of health and work absenteeism due to sickness (*Z*) to estimate the effect of the health status on hourly wages and annual earnings ($\ln y$):

$$\ln y = \beta_0 + \beta_1 SD + \beta_2 age + \beta_3 age^2 + \delta X + \sigma Z + \varepsilon \,,$$

where (SD) are schooling dummies. In the Swedish setting, persons with higher education would be those with generally more flexible contracts, and the likelihood that their wages might be affected by past sickness is greater. Empirically, the schooling dummies would be expected to pick up this effect.

The typically observed concave profile for lifetime earnings is captured by the experience and quadratic experience variables, measured by years of work, or approximated by age, with positive and negative expected values of β_2 and β_3, respectively.

In Sweden, during the period studied, as well as later, there were centrally negotiated contracts covering all groups of employed persons. However, individual wage drift above the negotiated percentage increase was the rule, rather than the exception. In addition, for white-collar workers, the negotiated percentage increases were frequently viewed as an aggregate restriction for a specific employer, and the employer had the freedom to set individual wages. Only the aggregate constraint was binding. Nevertheless, the fact that close to 90% of the labor force were covered by central contracts at the time would mean that an effect of sickness history on the individual's wage would have to come through a job or task change or through a gradual process associated with not getting pay raises. In the Swedish context, it is highly improbable that individual wages would be decreased, other than relatively, through non-pay-rise "erosion" and the process of erosion might take much more time than we have been able to examine with the database at our disposal.

During the period studied, and later, given a ceiling level, around 100% of lost earnings during periods of sickness absence from the workplace are/were replaced by a combination of social insurance (90%) and widespread collective agreements (10%). Blue-collar workers were not compensated for earnings over the ceiling, but there were practically no blue-collar workers with earnings at this level. Privately and publicly employed white-collar workers were compensated for earnings above the ceiling, but compensation was tapered off at higher levels.

Given that the immediate opportunity cost of being away from work is so low, the work-related incentive for maintaining one's health and returning to work as quickly as possible is to maintain a good standing and influence future wages. This incentive effect can be expected to be lower for older workers and with generally failing health, and to some extent must explain the decline in age-earnings profiles of older workers. The latter can also be a work effort effect: reduced willingness to work long and/or inconvenient hours that can give higher remuneration. Nonetheless, it is important to recall that an additional reason why earnings can fall for older workers is that they eventually begin to place a higher value on leisure rather than work-time.

Finally, the immediate opportunity cost of sickness absenteeism close to zero where earnings replacement rates are close to or are full, which has typified both Sweden, but also other European countries with national insurance systems offering high earnings replacement. Given this circumstance, the correlation between compensated days of sickness and earnings could be positive, negative or zero. It would be positive if persons with higher earnings (either higher wages or more hours worked, or both) tend to have more compensated days of sickness in any given year, and negative if the opposite were to be the case.

The behavioral connection between compensated days of sickness in the current year and earnings may be more complicated, however. Assume that the there is greater intrinsic value, or other indirect opportunity costs for absenteeism for employees with higher wages. Then, *ceteris paribus*, if the opportunity cost of being away from work were low for persons with lower earnings and high for persons with high earnings, there would be a convex relationship between compensated days and earnings during the *current* year. This is a hypothesis we will test empirically in this study. A ceiling on replaced earnings would imply a maximum value around the level of the ceiling.

III. THE DATA

The data for our analysis are from the Swedish National Social Insurance Board's LS Database. We analyze a sample of 1688 relatively healthy individuals from the database's larger random sample drawn from persons 16 to 64 years old in 1986-1991, but the minimum and maximum ages for the sample are 22 and 62 in 1988. The sources of the database are register and personal interviews covering the period January 1, 1983 to December 31, 1991. The goal of paper, to estimate the effects of past sickness on present earnings, requires a sample of relatively healthy individuals in the analyzed year (1988). Therefore, we left out all persons who had part-time disability pension or were classified as long-term sick during 1988 (i.e., 187 persons). This gives us a sample of 1688 persons, or about 90% of the initial sample. Individuals in analyzed samples were insured and resided in the country in 1988, alive at the end of the year and were not incarcerated, long-term sick or had not disability pension during the year. This is a broader definition than the labor force, which by definition only includes people who have or are seeking employment. This means that there are persons with zero earnings and zero hours worked in our samples.

The database is unique in Sweden because it contains information on days (spells) of absence due to sickness and the associated diagnoses (during 1983-1991), hours worked (in 1988), together with annual earnings (available for 1980, 1985-1990). The year 1988 is the only year in Sweden for which there is a database (the National Social Insurance Board's LS-database) combining all these information.

Hours of work are available for 1988 following a change in the law in 1987 requiring everyone to specify hours (and changes in hours) worked in 1988. In 1988, people were required to report hours worked to maintain an insurance status. For this reason, non-compliance was very low at the start, and the information reported for 1988 is highly accurate. Hours worked were also updated as a part of the claim process. We know from other sources (Palmer, 1990) that at the time of our analysis about two-thirds of the covered population claimed sickness compensation in the course of a year. Consequently, updating was frequent, but not complete, and therefore there is a risk that the quality of data on hours worked worsened with time from the initial required reporting date (December 1987). This suggests that non-compliance would be a source of missing data, and, in fact, data on hours worked are lacking for around 7% of the sample, however, almost this percent did not report taxable earnings in 1988. This suggests that the fact that they reported zero hours was instead a result of not working that year. Even these people are included in the analysis, however, since it is important to ignore persons with previous work histories who are not working (but not due to an early retirement) during the period of analysis. The requirement to report hours worked was revoked after a couple of years because it proved to be difficult to get people not claiming benefits to report changes in hours worked.

The 1988 data on annual earnings, sickness absence and hours worked have been used to compute hourly wage rates in 1988. Two sources of annual earnings are available: reported earnings for sickness insurance, from the social insurance register, and taxable earnings from the tax register. These two sources are used to determine annual earnings from work. If there was a discrepancy, we used taxed earnings.

Just important for our purposes, the LS-database contains longitudinal data on sickness absenteeism spells and their diagnoses from 1983, enabling us to put together and analyze a fairly sophisticated picture of sickness absenteeism, earnings and wages. As recently as 2004 Sweden still had no register data on sickness diagnoses, which means the database used in this study provides the only possibility of combining information on hourly wages, earnings, spells of sickness and diagnoses.

Tables A1 and A2 in the Appendix present basic descriptive statistics for variables used in this study.

IV. RESULTS

We estimate equations for annual earnings and hourly wages for 1988. Both equations are estimated with the same explanatory variables, but the method of estimation differs. Because the range of the dependent variable is limited by the occurrence of zero earnings for some people, we use a Tobit model to estimate the annual earnings equation. Because the dependent variable is limited by the occurrence of missing hourly wages for some persons, Heckman's selection model is used to estimate the hourly wage equation. Table 1 presents Tobit estimated coefficients of the annual earnings equation for all individuals together, and for different groups: men, women, people with no long-term sickness spell during 1983-1988, and those with at least one spell of long-term sickness during 1983-1987.[1] Table 2 presents coefficient estimates for the wage equation, and Table A3 in the Appendix presents the coefficient estimates for the selection equation.

[1] Since about 7% of observations had zero annual earnings, it is not surprising that the Tobit estimates are almost the same in size, sign, and significance as the OLS estimates reported by Andrén and Palmer (2001).

Table 1 Estimated parameters of the earnings equation in 1988

	All, Not LT-sick in 1988		Men		Women		Not long-term Sick 1983-1988		Long-term Sick 1983-1987	
	PE	SE	PE	SE	PE	SE	PE	SE	PE	SE
Female	-0.613***	0.142					-0.628***	0.143	-0.375	0.592
Age	0.412***	0.050	0.425***	0.071	0.411***	0.068	0.436***	0.051	0.128	0.206
Age-Squared/100	-0.518***	0.058	-0.532***	0.083	-0.520***	0.081	-0.550***	0.060	-0.178	0.235
Citizenship (CG: Swedish born)										
Foreign	-2.003***	0.273	-2.320***	0.415	-1.834***	0.352	-2.058***	0.271	-0.722	1.490
Nationalized	-0.596*	0.332	-0.864*	0.442	-0.464	0.499	-0.845**	0.344	1.550	1.166
Education (CG: low)										
Medium	0.864***	0.167	0.881***	0.231	0.820***	0.233	0.817***	0.167	0.968	0.734
High	0.991***	0.207	0.635**	0.311	1.214***	0.270	0.936***	0.205	2.095*	1.075
Married	-0.038	0.172	0.269	0.257	-0.326	0.226	-0.008	0.174	-0.167	0.693
Sickness Cohorts										
Year 1983	-1.969***	0.658	-2.509**	1.008	-0.881	0.868			-1.177	1.396
Year 1984	-1.113**	0.505	-1.371*	0.703	-0.982	0.730			-0.742	1.074
Year 1985	-0.132	0.500	0.651	0.755	-0.178	0.663			-0.237	1.071
Year 1986	0.019	0.596	1.548	0.978	-0.824	0.750			0.221	1.101
Year 1987	-0.451	0.622	-1.607*	0.971	0.765	0.831				
Sickness Days (86-88) by diagnosis										
Musculoskeletal	0.002*	0.001	0.005**	0.002	-0.001	0.001	0.003	0.003	0.003	0.002
Cardiovascular	0.001	0.001	0.003	0.003	-0.001	0.001	0.003	0.003	0.001	0.002
Respiratory	0.001	0.002	0.001	0.002	0.002	0.006	0.006	0.006	-0.001	0.003
Mental	-0.001	0.002	0.002	0.002	-0.008**	0.003	-0.004	0.009	-0.001	0.002
Gen. Symptoms	-0.001	0.004	-0.024**	0.010	0.003	0.004	0.006	0.011	-0.004	0.005
Injuries	-0.004*	0.002	0.000	0.002	-0.012***	0.004	0.002	0.003	-0.008**	0.004
Other	-0.001	0.002	0.003	0.004	-0.004	0.003	0.001	0.004	-0.001	0.004
Compensated days of sickness by year										
1983	0.019***	0.005	0.006	0.008	0.018**	0.007	0.011	0.007	0.013	0.011
1984	-0.005**	0.003	0.006	0.004	-0.011***	0.003	0.003	0.006	-0.009**	0.004
1985	-0.007***	0.002	-0.012***	0.003	-0.003	0.003	0.001	0.006	-0.008***	0.003
1986	-0.004	0.003	-0.019***	0.005	0.006*	0.003	0.000	0.005	-0.004	0.005
1987	0.003	0.003	0.013**	0.006	0.002	0.003	0.003	0.006	0.000	0.004
1988	0.172***	0.016	0.161***	0.024	0.169***	0.022	0.136***	0.018	0.315***	0.059
1988-squared/100	-0.282***	0.035	-0.260***	0.052	-0.274***	0.047	-0.231***	0.038	-0.506***	0.116
Intercept	2.512**	1.004	2.250	1.441	2.079	1.368	2.140**	1.025	6.764	4.398
Ancillary parameter	2.845***	0.052	2.842***	0.074	2.734***	0.071	2.712***	0.052	3.643***	0.215
Left-censored obs.	117		59		58		91		26	
Uncensored obs.	1571		790		781		1412		159	
LR chi-squared[a]	440.39		246.11		257.96		329.97		91.83	
Log-likelihood	-4097		-2054		-2004		-3589.2		-471.8	
Pseudo-R^2	0.044		0.051		0.053		0.039		0.072	

Notes: [a]Prob >chi-squared = 0.000 for all samples. PE indicates the parameter estimate in the semi-log annual earnings equation and SE indicates its standard error; ***, **, and * indicate significance at less than 1%-, 5%- and 10%-level; *Italics* indicate dummy variables. CG is the comparison group. These notes also apply to Tables 2 and A3.

Table 2 Estimated parameters of the wage equation in 1988

	All, Not LT-sick in 1988		Men		Women		Not long-term Sick 1983-1988		Long-term Sick 1983-1987	
	PE	SE	PE	SE	PE	SE	PE	SE	PE	SE
Female	-0.218***	0.017					-0.226***	0.019	-0.162***	0.052
Age	0.039***	0.006	0.047***	0.010	0.034***	0.008	0.041***	0.007	0.031*	0.018
Age-Squared/100	-0.041***	0.008	-0.051***	0.011	-0.037***	0.010	-0.043***	0.008	-0.036*	0.021
Citizenship (CG: Swedish born)										
Foreign	-0.108***	0.036	-0.076	0.059	-0.130***	0.042	-0.085**	0.037	-0.256**	0.127
Nationalized	0.017	0.041	0.033	0.060	-0.006	0.057	0.046	0.046	-0.169*	0.100
Education (CG: low)										
Medium	0.112***	0.020	0.196***	0.030	0.020	0.026	0.123***	0.021	0.002	0.061
High	0.246***	0.025	0.337***	0.041	0.164***	0.031	0.262***	0.026	0.083	0.090
Married	0.022	0.021	0.072**	0.033	-0.012	0.025	0.019	0.022	0.019	0.058
Sickness Cohorts										
Year 1983	0.077	0.085	0.061	0.154	0.031	0.099				
Year 1984	0.058	0.069	0.043	0.106	0.100	0.092				
Year 1985	-0.086	0.062	-0.048	0.103	-0.083	0.077				
Year 1986	0.185**	0.072	0.169	0.129	0.179**	0.084				
Year 1987	-0.025	0.077	-0.047	0.126	-0.006	0.096				
Sickness Days (86-88) by diagnosis										
Musculoskeletal	-0.0002	0.0001	-0.0003	0.0003	-0.0001	0.0002	-0.0004	0.0004	-0.0002	0.0002
Cardiovascular	-0.0001	0.0002	0.0002	0.0003	-0.0001	0.0002	0.0002	0.0004	-0.0001	0.0002
Respiratory	0.0003	0.0002	0.0003	0.0003	0.0005	0.0006	0.0000	0.0008	0.0003	0.0002
Mental	-0.0001	0.0002	0.0000	0.0003	0.0000	0.0005	-0.0012	0.0012	0.0000	0.0002
Gen. Symptoms	0.0007	0.0005	0.0013	0.0024	0.0007*	0.0004	0.0026*	0.0014	0.0008*	0.0005
Injuries	0.0000	0.0003	0.0002	0.0004	-0.0002	0.0006	0.0000	0.0004	-0.0001	0.0005
Other	-0.0003	0.0003	-0.0010*	0.0005	0.0001	0.0003	-0.0004	0.0005	-0.0003	0.0003
Compensated days of sickness by year										
1983	-0.0006	0.0007	-0.0017	0.0011	-0.0001	0.0008	-0.0003	0.0009	-0.0005	0.0007
1984	-0.0002	0.0004	-0.0005	0.0006	0.0001	0.0005	-0.0003	0.0008	0.0001	0.0004
1985	-0.0003	0.0003	0.0001	0.0007	-0.0004	0.0003	-0.0005	0.0008	-0.0003	0.0003
1986	-0.0004	0.0003	-0.0003	0.0007	-0.0004	0.0004	-0.0007	0.0006	-0.0001	0.0004
1987	-0.0002	0.0004	-0.0002	0.0008	-0.0005	0.0004	0.0005	0.0008	-0.0005	0.0004
1988	0.0116***	0.0020	0.0152***	0.0032	0.0075***	0.0026	0.0109***	0.0023	0.0092*	0.0053
1988-squared/100	-0.0239***	0.0043	-0.0338***	0.0067	-0.0137**	0.0054	-0.0234***	0.0049	-0.0187*	0.0102
Intercept	3.260***	0.129	3.003***	0.197	3.254***	0.163	3.208***	0.138	3.580***	0.376
rho	-0.280***	0.115	-0.108	0.161	-0.531***	0.126	-0.377***	0.097	-0.681***	0.175
sigma	0.338***	0.006	0.360***	0.009	0.303***	0.008	0.342***	0.007	0.301***	0.018
lambda	-0.095***	0.039	-0.039	0.058	-0.161***	0.040	-0.129***	0.034	-0.205***	0.058
Censored obs.	117		59		58		91		26	
Uncensored obs.	1571		790		781		1412		159	
Wald chi^2	370.86		174.66		104.49		327.22		50.22	
Log likelihood	-782.34		-438.75		-271.66		-683.01		-67.01	

Generally, our results are similar to those found in earlier labor supply studies (at least with respect the sign and statistical significance of the estimated parameters), but add to the picture information about the effect of the health variables (history of sickness absenteeism and diagnoses) on both annual earnings and the hourly wage. The age effect is significantly positive and the effect of the quadratic of age is significantly negative in both the earnings and wage equations, with a much stronger effect in the earnings equation than in the wage equation. The relative strength of the effect of the age variable in the earnings equation suggests an age-related decrease in work-time. This can be driven either by a positive choice for more leisure at higher ages, or a negative effect on work-time through generally poorer health, or both.

Being a woman has a negative effect on annual earnings, but note that in the earnings equation, neither the age nor the gender effects are significant for people with long-term sickness records. This indicates that there may be little age/gender differentiation between the persons with histories of long spells. *The results suggest, then, that persons with histories of poor health differ as a group from those without sickness history* (Tables A1 and A2 in the Appendix).

Being foreign-born has a significant negative effect on both the wage rates and earnings. However, the effect is not significant for the earnings equation of people with long-term sickness records. Men born outside Sweden who have become Swedish (nationalized) citizens have lower earnings than native-born Swedes, at the 10 percent significance level. As with age and gender, there is no citizenship effect for the earnings of persons with a long-term sickness history. Being (non-nationalized) foreign born, has a significant negative effect on the wages of women and of people with long-term sickness history, but not men. There is no significant effect of being a nationalized

Swede on wages, however. Since the earnings of nationalized Swedes are affected rather than the hourly wage, this indicates fewer hours worked. This could reflect individual choices or “immigrant effects” on human capital such as language difficulties and employer discrimination favoring native-born workers.

Higher levels of education have a positive effect on both wages and earnings, although the effect is greater for earnings, suggesting that persons with relatively low education tend to work fewer hours. There is also a significant effect on earnings, but not wages, through the education variable in the sample with a long-term sickness history, suggesting that those with a long-term sickness history are more likely to be persons with higher education whose relatively high earnings are a function of more hours worked.

We examine three measures of work absence due to poor health: the number of compensated days per year, the “year-cohort” (that is the year of the first spell of 60 days or longer), and the number of compensated days by diagnosis groups during 1986-1988.

In the earnings equation, the cohort effects are generally negative, and are significant in 1983 and 1984, with men seemingly driving the significant results. With one exception, women in 1986 (with the wrong sign), there are no significant effects going through the wage rate.

The effects of the days of sickness by diagnosis groups are weak and sporadically significant across the samples in the earnings equations: for women, injuries and mental diagnoses yield a significant negative effect, while for men, musculoskeletal diagnoses have a very small positive, and general symptoms yield a significant negative effect. For the whole sample, compensated days with a musculoskeletal diagnosis have a significant positive effect, while compensated days with a general symptom have a significant negative effect. For the sample of people with a long-term sickness history, compensated days with injury or poisoning have a significant negative effect.

For the wage equation, the effects of the days of sickness by diagnosis are significant only for two groups of diagnoses: general symptoms (for women, not long-term sick, and long-term sick), and “other” (for men). The first has a counter-intuitive positive correlation with earnings, which may be reflect a dominance of absenteeism due to maternity complications, the second has the expected negative effect.

For longer sickness spells, mental diagnoses, dominated by depression, constitute the second largest group in Sweden after musculoskeletal diagnoses. According to the wage equation, these diagnoses do not have a significant effect on wages, and a significant negative effect in the earnings equation indicates that women with mental (depression) symptoms and injuries, associated with a previous spell of 60 days or more, work less in following years. This is also the case for men with general symptoms. According to the same line of reasoning, men with previous musculoskeletal problems work on average more hours.

Continuing with the earnings equation, the lagged variable for compensated days of sickness for the more distant years (1984 and 1985) have a significant negative effect on the 1988 earnings of the whole sample. The effect for 1986 is also negative, but insignificant, and then the coefficient changes signs, and even becomes positive and significant in 1988. The significant negative effect indicates that persons with longer (and perhaps more comprehensive) histories are more likely to experience a negative earnings effect of past sickness absence.

The combined effects of compensated days per person and compensated days squared for the current year (1988) confirms our hypothesis that the *current* correlation between sickness and earnings is positive for low earnings and changes sign (earnings squared) and is negative for persons with higher earnings. A similar effect arises in the wage equation, suggesting that the effect is positive for persons with low wages and negative for persons with high wages. This confirms the hypothesis that there can be intrinsic values associated with work that lead to more compensated days of sickness of persons with low earnings (wages) and fewer for persons with high earnings (wages). This is one of the most important results of this study.

Aside from the "current-year effect" (1988) just discussed, the wage equation provides no evidence that previous sickness history and related work absences have a significant negative effect on the wage rate in Sweden. Instead, the effects go through earnings, and, implicitly, then, through hours worked. Compensated days of sickness during the preceding six years have no significant effect on the wage rates of men and women.

V. SUMMARY AND CONCLUSIONS

The estimated earnings equations confirm the usual paradigm of a concave profile, first increasing, then tapering off, and eventually declining with age. Age-wage profiles are much flatter than earnings profiles, which is typical for the Swedish labor market. Nevertheless, there is a premium for education: higher education enhances both earnings and the hourly wage rate, suggesting that the effect on earnings goes mainly through the age-career component of the wage rate. In addition, there is a strong negative effect on the wage rate associated with being a woman, but also an even stronger negative effect on earnings, which probably reflects the tendency of women to work part-time more often than men.

The question addressed in this study is: “What is the effect of sickness on earnings?”. The estimated earnings equations suggest that long spells of sickness (of 60 days or more) have a negative effect on earnings for the overall sample. Largely, days of sickness associated with specific diagnoses do not play a significant role in determining wage rates. There are some significant relationships between annual earnings and compensated days of sickness by diagnosis groups: musculoskeletal, mental disorder, and injuries. The combined regression results from the earnings and wage equations indicate that for women, the occurrence of more days with a mental disorder or injury, and for men a general symptoms diagnosis leads to reduced work-time (given an insignificant wage effect), and consequently reduced earnings.

The combined effects of compensated days per person and compensated days squared for the present year (1988) confirms our hypothesis that the current correlation between sickness and earnings is positive for low earnings and changes sign (earnings squared) and is negative for persons with higher earnings. A similar effect arises in the wage equation. This confirms our hypothesis that for relatively healthy people, negative intrinsic values associated with work lead to more compensated days of sickness for persons with low earnings and positive intrinsic values lead to fewer compensated days for persons with higher earnings.

In sum, the effects of *past* sickness on *actual* earnings and wages are different: previous days of sickness have an effect on the annual earnings of both men and women, but there is no significant effect on hourly wages. Of course, it would be interesting to examine a large number of years to see whether the results obtained here are resilient, or perhaps even amplified by a even longer history of health problems. A final conclusion of this paper is that both annual earnings and the hourly wage need to be analyzed in order to explain the effect of (past) sickness on earnings.

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APPENDIX

Table A1 Descriptive statistics (individual characteristics) of men and women, by sickness status 1983-88

	Not LT sick in 1988				Not LT sick during 1983-88				LT sick during 1983-87 & Not LT sick in 1988			
	Men (N=849)		Women (N=839)		Men (N=766)		Women (N=737)		Men (N=83)		Women (N=102)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Age	41.09	11.24	40.80	11.28	40.62	11.08	40.45	11.09	45.43	11.86	43.34	12.38
Age-groups												
22-30 years	0.22	0.42	0.22	0.42	0.23	0.42	0.23	0.42	0.13	0.34	0.19	0.39
31-45 years	0.42	0.49	0.42	0.49	0.43	0.50	0.43	0.50	0.37	0.49	0.35	0.48
46-50 years	0.11	0.31	0.12	0.32	0.11	0.32	0.12	0.32	0.08	0.28	0.10	0.30
51-55 years	0.10	0.30	0.11	0.31	0.10	0.30	0.11	0.31	0.11	0.31	0.14	0.35
56-62 years	0.14	0.35	0.13	0.34	0.12	0.33	0.12	0.32	0.30	0.46	0.23	0.42
Citizenship												
Swedish born	0.88	0.32	0.88	0.33	0.89	0.32	0.87	0.34	0.84	0.37	0.94	0.24
Foreign born	0.06	0.24	0.09	0.28	0.06	0.25	0.09	0.29	0.05	0.22	0.03	0.17
Nationalized	0.05	0.23	0.04	0.20	0.05	0.22	0.04	0.20	0.11	0.31	0.03	0.17
Education												
Low	0.51	0.50	0.47	0.50	0.49	0.50	0.45	0.50	0.69	0.47	0.62	0.49
Medium	0.35	0.48	0.34	0.47	0.36	0.48	0.35	0.48	0.27	0.44	0.26	0.44
High	0.14	0.34	0.20	0.40	0.15	0.35	0.21	0.40	0.05	0.22	0.13	0.34
Marital status												
Unmarried	0.41	0.49	0.34	0.47	0.42	0.49	0.34	0.48	0.33	0.47	0.30	0.46
Married	0.54	0.50	0.55	0.50	0.54	0.50	0.55	0.50	0.58	0.50	0.58	0.50
Divorced	0.04	0.20	0.10	0.29	0.04	0.19	0.10	0.30	0.10	0.30	0.09	0.29
Widower	0.01	0.08	0.01	0.12	0.01	0.09	0.01	0.11	0.00	0.00	0.03	0.17
Zero earnings	0.07	0.25	0.07	0.25	0.06	0.24	0.06	0.24	0.17	0.38	0.12	0.32
Annual hours work	1591	837	1287	849	1628	812	1324	838	1247	977	1025	870
Hourly wage-SEK	68	36	54	25	70	36	55	25	55	39	51	28
Earnings*	142	80	94	51	145	78	96	51	118	88	83	48

Note: *Italics indicates dummy variables. **Earnings have been adjusted to 1997 values using the CPI, and are expressed in thousand Swedish krona (SEK) per year.

Table A2 Descriptive statistics: women and men, by sickness status 1983-1988

	Not LT sick during 1983-1988				LT sick during 1983-1987 & not LT sick in 1988			
	Men (N=766)		Women (N=737)		Men (N=83)		Women (N=102)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Compensated days of sickness per year								
1983	5.13	10.49	6.75	11.73	20.65	32.87	23.96	39.58
1984	5.26	11.91	6.75	13.29	40.75	72.60	51.45	93.01
1985	5.85	12.08	7.69	14.16	68.48	135.7	47.54	97.23
1986	5.80	10.92	8.58	21.53	69.72	102.5	84.45	106.2
1987	6.40	13.01	8.71	16.23	42.11	67.52	68.11	93.96
1988	6.71	10.83	8.80	12.30	13.77	17.34	13.77	15.43
Sickness cohorts								
Year 1983*					0.17	0.38	0.23	0.42
Year 1984					0.31	0.47	0.22	0.41
Year 1985					0.23	0.42	0.23	0.42
Year 1986					0.13	0.34	0.20	0.40
Year 1987					0.16	0.37	0.14	0.35
Sickness spells by diagnosis, 1986-88								
Musculoskeletal	0.42	1.13	0.46	1.16	0.92	1.68	1.03	1.77
Cardiovascular	0.03	0.21	0.06	0.31	0.06	0.36	0.07	0.29
Respiratory	1.57	2.34	2.17	2.79	1.75	2.69	2.31	3.25
Mental	0.04	0.35	0.06	0.35	0.23	0.80	0.19	0.71
Gen. symptoms	0.33	0.88	0.57	1.17	0.61	1.05	0.68	1.48
Injuries etc.	0.23	0.68	0.16	0.45	0.58	0.95	0.36	0.73
Other	0.64	1.38	1.20	1.94	1.11	1.77	1.75	2.41
Compensated days of sickness by diagnosis, 1986-88								
Musculoskeletal	5.46	30.32	5.39	19.94	77.48	212.1	101.0	257.9
Cardiovascular	1.69	35.85	0.61	4.12	9.51	62.34	37.7	230.2
Respiratory	7.44	12.92	10.07	15.32	27.24	151.1	14.7	40.33
Mental	0.74	6.64	1.30	9.28	41.63	201.4	21.4	96.52
Gen. symptoms	1.67	5.50	2.74	7.58	6.10	33.32	13.7	69.61
Injuries	3.92	34.22	1.88	8.82	28.53	93.72	18.8	81.72
Other	4.13	12.85	8.74	27.62	26.52	85.08	40.6	79.88
LT sickness by diagnosis, 1986-87								
Musculoskeletal*					0.169	0.377	0.225	0.420
Cardiovascular					0.024	0.154	0.010	0.099
Respiratory					0.072	0.261	0.059	0.236
Mental					0.012	0.110	0.049	0.217
Gen. symptoms					0.145	0.354	0.069	0.254
Injuries etc.					0.096	0.297	0.206	0.406
Other					0.096	0.297	0.206	0.406

Note: **Italics* indicates dummy variables.

Table A3 Estimated parameters of the selection equation

	All, Not LT-sick in 1988		Men		Women		Not long-term Sick 1983-1988		Long-term Sick 1983-1987	
	PE	SE	PE	SE	PE	SE	PE	SE	PE	SE
Female	-0.093	0.123					-0.199	0.149	0.135	0.358
Age	0.210***	0.055	0.248***	0.085	0.239***	0.085	0.218***	0.050	0.069	0.149
Age-Squared/100	-0.274***	0.071	-0.321***	0.110	-0.331***	0.106	-0.289***	0.056	-0.102	0.161
Citizenship										
(CG: Swedish born)										
Foreign	-0.910***	0.179	-1.107***	0.269	-1.001***	0.281	-0.813***	0.206	0.089	0.867
Nationalized	-0.221	0.262	-0.663**	0.336	-0.430	0.501	-0.412	0.316	0.565	0.775
Education (CG: low)										
Medium	0.666***	0.171	0.778***	0.271	0.633**	0.262	0.794***	0.205	0.745	0.627
High	0.679***	0.204	0.292	0.265	1.212***	0.394	0.660***	0.232		
Married	0.212	0.205	0.548*	0.303	0.195	0.344	0.377	0.330	0.278	0.535
Sickness Cohorts										
Year 1983	-0.858*	0.512	-1.382**	0.661	3.711**	1.706				
Year 1984	-0.989***	0.377	-1.063*	0.543	-0.222	0.812				
Year 1985	0.090	0.535	2.028	1.317	1.354	1.107				
Year 1986	-0.304	0.553			-1.470	0.958				
Year 1987	0.286	0.611	-9.385***	3.152	2.400*	1.224				
Sickness Days (86-88)										
by diagnosis										
Musculoskeletal	0.002*	0.001	0.002	0.004	-0.007***	0.002	0.002	0.008	0.001	0.001
Cardiovascular	0.002	0.002			-0.004***	0.001			0.001	0.002
Respiratory	0.055***	0.013	0.064***	0.022	0.071***	0.022	0.016	0.017	0.083**	0.039
Mental	0.000	0.001	0.005	0.018	-0.013**	0.006	0.016	0.029	0.000	0.001
Gen. Symptoms	-0.002	0.002	0.024*	0.012	0.113*	0.059	0.077	0.049	-0.007	0.007
Injuries	-0.003***	0.001	0.011***	0.004	-0.018***	0.004	0.042	0.026	-0.006**	0.003
Other	0.002	0.002	0.023**	0.009	-0.007**	0.003	0.052	0.035	0.000	0.002
Compensated days										
of sickness by year										
1983	0.013**	0.005	-0.002	0.008	0.059***	0.022	0.028*	0.016	0.000	0.006
1984	-0.002	0.002	0.015***	0.005	-0.013***	0.005	0.004	0.013	-0.004***	0.001
1985	-0.001	0.001	-0.004**	0.002	-0.004	0.003	0.006	0.010	-0.002*	0.001
1986	-0.002	0.002	-0.033***	0.010	0.019***	0.007	-0.015	0.011	-0.002	0.003
1987	-0.002	0.002	0.145***	0.041	-0.002	0.003	0.001	0.017	0.002	0.003
1988	0.101***	0.018			0.157***	0.041			0.056**	0.025
"*50 plus*"	-0.006	0.306	-0.145	0.458	0.342	0.443				