FIRST EXITS FROM THE SWEDISH LABOR MARKET DUE TO DISABILITY*

Daniela Andrén
Department of Economics, Göteborg University
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

The number of disability exits has been increasing in recent years, raising questions both about the well being of affected individuals, and about how to finance the related disability pensions. Using a longitudinal database owned by the Swedish National Social Insurance Board, this study analyzes the risk to exit into disability at a certain age, assuming that people remained in the labor force until that age. The estimates show that it was more than 7% higher for each 100 days of sickness, but was lower with each additional sickness spell. It was also higher for increments of 1% in the regional unemployment rate. These results suggest that more resources should be allocated for prevention, improving working conditions and designing the tasks of each job so as avoid overuse of employees working capacity.

Key words: disability pension, sickness spells, long-term sickness, single risk and competing risks models.

JEL Classification: I12, J14, J26, J28.

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1 Introduction

Working people are often exposed to physical, chemical, biological, and psychosocial factors that can cause short-term and/or long-term health problems, many of which could be prevented or controlled. Many of these people may end up with a disability.[1] Disability (and working capacity justifying a disability benefit) may also result from a number of diseases, injuries, or disorders that affect the visual, hearing, locomotor, or mental functions. Disability can affect people of all ages, it diminishes life quality, and it increases the need for care and support from family and community members, as well as from health and social services. "Disability dependence" occurs when, for these reasons or others, employees do not return to work, although they may be capable of doing so. Instead, they become economically dependent on public or private financial support.

In Sweden, although substantial public attention has focused on training and rehabilitation, labor market entry and placement of disabled workers, the problem of employees leaving the labor market early due to disability has received far less recognition. Nowadays, however, with an increasingly aging population *and* a declining working-age population, disability has become a major public policy issue not only in Sweden, but in many other countries as well. In addition to the aging issue, this attention is also explained by the increasing size of the population on disability benefits, and by an implicitly lower level of economic output and foregone tax revenue. Furthermore, exit with disability may not be the best choice for an individual, due to the likelihood that it leads to inactivity, which itself may not be good for health. Therefore it is important to learn more about labor market exits into disability. Given that in Sweden any person aged 16 to 64 is entitled to a disability pension when faced with a reduction of working capacity, it is useful to learn more about *the age of the first exit* from the labor market due to disability and circumstances surrounding exit.

[1] The complexity of the disability phenomenon is in part pictured by the evolution of its definition over time, which is presented in the Appendix.

The goal of this paper is to analyze the individual and labor market characteristics, determining the risk that a person will exit from the labor market at a certain age, conditional that (s)he has remained in the labor market until that age. The analysis uses two longitudinal samples from the *LS database,* which is owned by the Swedish National Social Insurance Board.[2] The exit decision is estimated within a duration framework on the basis of both single risk and competing risks models.

The study is organized as follows: *Section* 2 reviews previous studies, while *Section* 3 discuses the various pathways to early exit from the labor market in Sweden. The theoretical framework is presented in *Section* 4, and the data is described in *Section* 5. *Section* 6 presents the econometric specification, while *Section* 7 presents the results. *Section* 8 summarizes and draws conclusions.

2 Previous studies

The literature on the economics of disability is not very old. Berkowitz and Johnson (1974) is one of the first contributions of economists on analyzing disability. Earlier contributions are to be found in sociology and psychology [e.g., Nagi (1965, 1969a, b) and Haber (1967)]. Since this time there have been many studies concerning the work activities and economic well being of the working-age population with disabilities.

The economic approach to disability can take diverse forms, usually starting from the loss of working capacity, and related productivity loss, and then focusing on various aspects of exit, including economic relations with employers, social insurance officers, program administrators, and household members.

The survey of Haveman and Wolfe (2000) discusses the main lines of economic research, addressing the issues of economic status and behavior of the working-age population with disabilities. Bound and Burkhauser (1999) review the behavioral and redistributive effects of transfer programs targeted on working people with disabilities. They also review the literature on the labor supply behavior of people with disabilities

[2] Actually, all data in this paper are from the Swedish National Social Insurance Board.

and how it is affected by disability program characteristics. They focused primarily on the United States, but also include programs in Sweden, the Netherlands, and Germany.

Economic factors may be important in determining disability. European evidence shows that higher wages or earnings decrease the incentive to withdraw from the labor force (Blau and Riphah, 1999), while US data show contradictory results (Bound and Burkhauser, 1999).

Disability benefits can be imperfectly targeted, and high benefits can be a vehicle availed by employees and in some systems indirectly by employers to subsidize early retirement. Therefore, it is useful to estimate the effects of potential disability benefits on labor force participation, since the magnitude of such effects is not yet clear from previous research. This brings into question the roll of health in modeling exits from the labor force. For example, the "debate" among Parsons (1980a, 1980b, 1984, 1991), Haveman and Wolfe (1984), and Bound (1989, 1991), pointed out a potential heterogeneity bias in the model specification, the estimation method, and the approach for controlling for health. Both the specification of the model and the data available and used in analyzing the effects of potential disability benefits on labor force participation are clearly important for the results.

Another important factor is the type and variety of disability programs available. Burkhauser and Haveman (1982) presented a comprehensive description of American public programs targeted on (largely older) workers with some identifiable health problems.[3] Aarts and De Jong (1992, 1996) have compared the performance of the Dutch social security system, in terms of participants, expenditures, and distributional impacts, with systems in other Western economies (Sweden, Germany, and the United Kingdom in the1996 study, and even more countries in 1992: Denmark, France, the United States, Japan, and more). They found that high disability benefit expenditures even in countries with policies in place to facilitate rehabilitation, provide public-sector jobs, subsidize private employers, and allow partial pensions to encourage employment. They found that incentives mattered, and not just economic incentives faced by workers

[3] They referred to this set of programs as "U.S. disability policy".

with chronic conditions, but also those faced by employers, by disability adjudicators, and by those offering services to workers with disability.

There have been few studies on disability exits from the labor market in Sweden.[4] Summarizing their findings, it seems that, there were three groups of independent variables that influenced the exit into disability: demographic variables (e.g., Berglind, 1977, and Hedström, 1980); labor market variables (e.g., Berglind, 1977; Hedström, 1980; and Wadensjö and Palmer, 1996); and health variables (e.g., Berglind, 1977; Hedström, 1980; and Månsson et al., 1994, 1996). This was not always the case fowever. For example, Wadensjö and Palmer (1996) found that the increasing rate of disability since 1960 is largely a result of changes in other factors than health. These other factors were mainly related to the labor market, but there were also changes in rules (e.g., Wadensjö, 1985, 1996; and Hansson-Brusewitz, 1992), and changes in benefit level and other economic incentives (e.g., Hansson-Brusewitz, 1992; Wadensjö and Palmer, 1996; and Palme and Svensson, 1997).

The present study aims to reexamine the previous findings for Sweden using a new database and examine the data in an attempt to gain information about the factors affecting disability exits, by estimating the risk of exiting into disability at any given age.

3 Exits into disability from the Swedish labor market and related facts

In Sweden, people aged 16 to 64 are eligible for a permanent or temporary disability pension, at full or partial rate (3/4, 2/3, 1/2 or /14)[5] if their working ability is completely or partially lost due to poor health. The disability pension consists of the basic pension and the income-related ATP supplement.[6]

[4] Berglind (1977); Hedström (1980); Wadensjö (1985, 1996); Hansson-Brusewitz (1992); Månsson et al. (1994, 1996); Wadensjö and Palmer (1996); Palme and Svensson (1997).

[5] The rates of 3/4 and 1/4 were introduced in 1993.

[6] ATP (allmän tilläggspension) is the national supplementary pension scheme.

Even though Swedish social policy intends to encourage employers to provide an optimal work environment at all working places, statistics show in both absolute and relative terms, for both men and women, a steady increase in the number of *all* early exits from the labor market since 1960, and not only of the exit into disability. Even though the focus is on exit into disability, for a complete picture of the alternatives faced by individuals Table 1 shows all pathways to early exit from the Swedish labor market during the period covered in this study.[7]

To be entitled to a disability pension, a physician must certify that the individual's capacity to work is reduced by at least 25%. If the individual's working capacity is reduced by at least 25% but not 50%, (s)he is eligible for a 25% disability pension; if reduced by at least 50% but not 75%, (s)he is eligible for a 50% pension; for full pension, working capacity must be completely lost.

Table 1 Pathways to early exit from the Swedish labor market

Pathway	Characteristics
Poor health	People can leave the labor market with a disability pension granted on the basis of a medical diagnosis and a judgment that this reduces work capacity. The sickness cash benefit is higher than the disability pension, so there are economic incentives for individuals to take this pathway and remain in it as long as possible, before a permanent exit.
Occupational injury	A person who leaves the labor market by this route is compensated for up to 100% of earnings loss.
Unemployment	From July 1972, workers 63 and over (lowered to 60 from July 1974) could receive a disability pension *without a medical reason* (called a disability pension "for labor market reasons") if they finished their compensation rights from unemployment, and could not find another job. This pathway was terminated in 1991.
Guarantee pensions	Since 1991 when the disability pension for labor market reasons was terminated, firms can lay off older workers through a guarantee pension (that the firm generally buys from a private insurance company) financed with separate funding.
Early retirement	Since July 1976, when the retirement age was lowered to 65 (from 67), it has been possible to receive a reduced old-age pension from the age of 60. The reduction factor is 0.5% per month.
Part-time pension	There have been different schemes for combining part-time work with a part-time pension: a) half early retirement pension; b) 2/3 or 1/2 disability pension; and c) a partial pension scheme launched in July 1976 for those aged between 60 and 65.

[7] This study analyses mainly the *health* pathway, but some cases in our database resulted from work injuries or long-term unemployment (see Table 1).

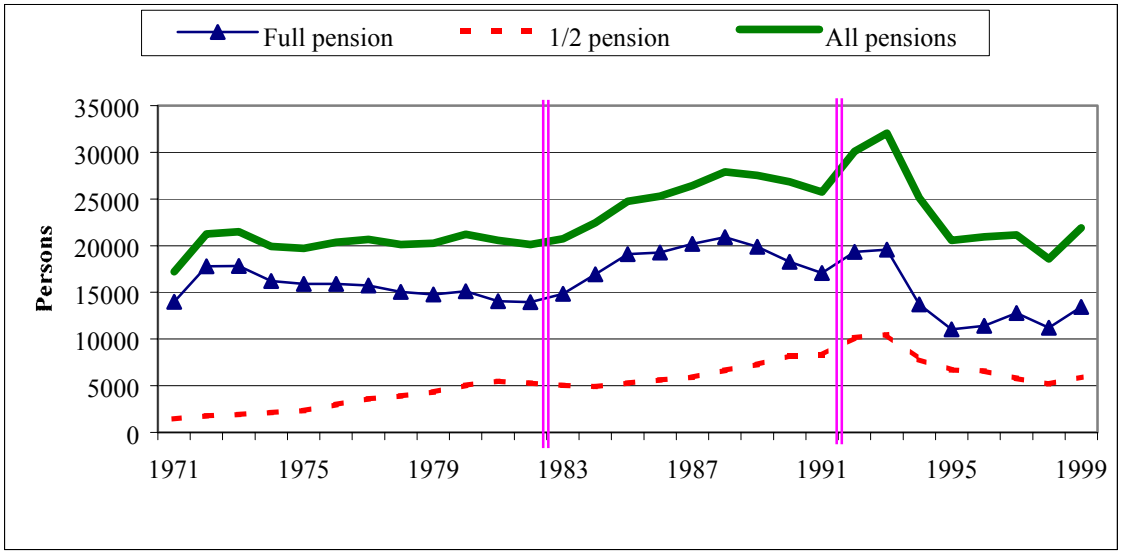
If capacity to work is reduced for a long period but not necessarily permanently, the individual is entitled to a *temporary* disability pension. This is determined with the help of a medical evaluation, and is sometimes difficult to decide. It is therefore not surprising that published statistics in Sweden often do not distinguish between permanent and temporary disability, but they always distinguish if they are full or partial. It is not easy to find an explanation of why the permanent and temporary disability pensions are not distinguished in official statistics, however this way of reporting seems to provide the best way to distinguish exits due to disability from other pathways to early exits from the labor market. Additionally, temporary and permanent disabilities kept together offer information about "lost" working capacity, and not about the "hope" of recovery, which besides could be "biased".

Figures 1 a) and b) show the flows of women (a) and men (b) from the labor market with full or partial disability benefits during the period 1971-1999, where our period of study, 1983-1991, is set off by vertical lines.[8]

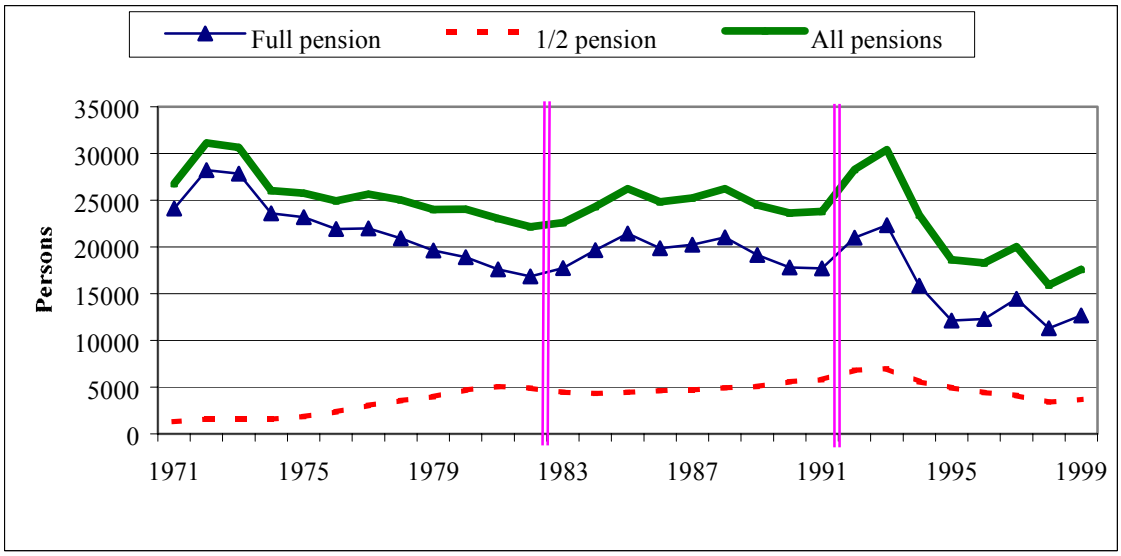
Since 1986, more women than men have exited earlier from the labor market with a disability benefit. This could be the result of increasing rates of women participating in labor force since the end of 1960s. The high number of benefits granted around 1993 is explained by an administrative "drive" to move a large stock of employees on long-term sick leave, and judged not being suitable for rehabilitation, to permanent disability pensions. After the peak year in 1993, the level decreased considerably, due to stricter rules, which led to both a decrease in the number of employees on long-term sick leave, and more restrictive requirements for disability.

When disability exits are compared between women and men, it seems, as we have already noted, that starting with the mid-1980s there were more women than men who exited the labor market due to disability. However, if a more detailed analysis is done (Figures 2 and 3), it is found that this is in general true *only* for partial disability.

[8] The Swedish National Social Insurance Board (RFV) is the *source* of data for entire paper.



a)Women



b)Men

Figure 1 New disability grants, women and men, 1971-1999

Figure 2 shows the difference between women and men by the type of disability pension (full and partial), and for the *all* types of disability pensions, while Figure 3 shows the difference between women and men, for the number of pensions, full-benefit equivalents.

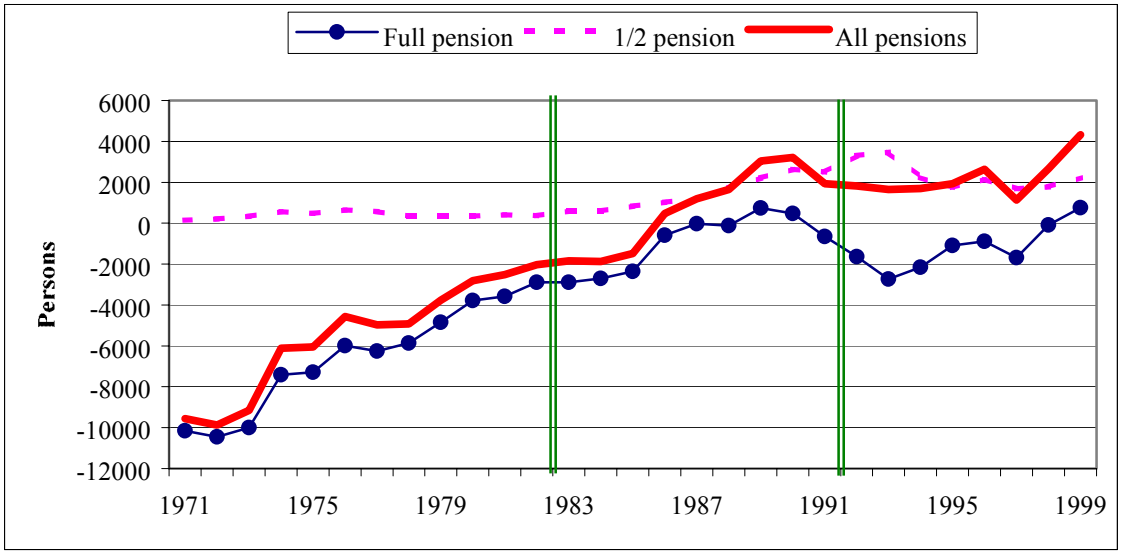


Figure 2 Differences between women and men: new disability pensions, 1971-1999

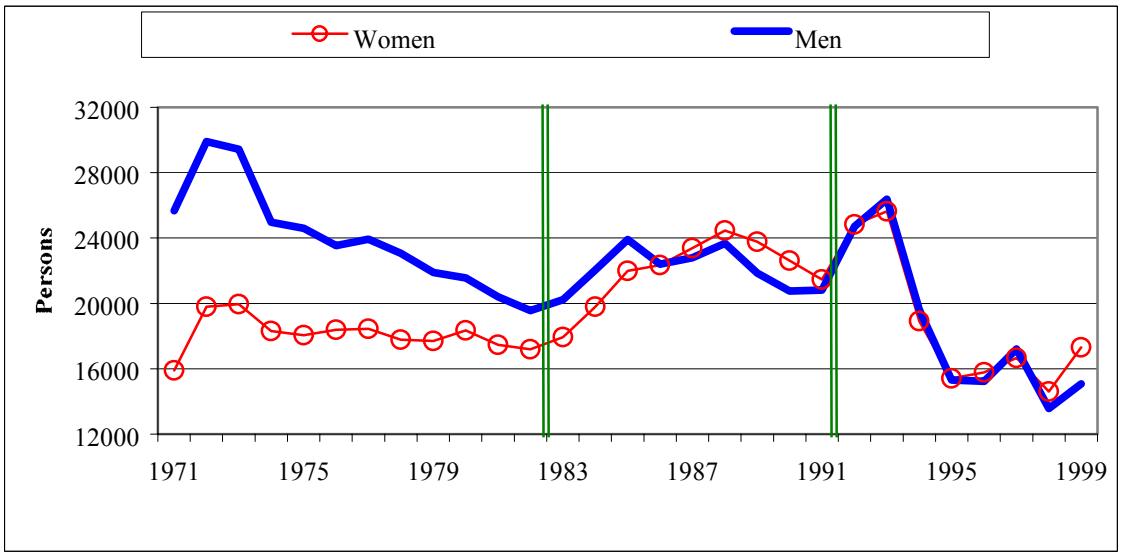


Figure 3 New disability pensions, full-benefit equivalents, women and men, 1971-1999

Can we conclude from the previous figures that women are more or less disability prone than men, wish to work more than men, or that women have better or worse health than men? Definitively not, but we should reconsider this problem more carefully, especially nowadays when the statistics show that women are recorded long-term sick more often than men. First, we should be more careful with these statistics, which show numbers of compensated days regardless if they are "full" or "partial". Then, we should analyze the link between the (new) "detailed" statistics and the exits from the labor market due to disability, and find out how big is the percentage of those

women with partial disability recorded long-term sick.

4 Theoretical framework

The social insurance system is built in such way that it gives employees whose working capacity is (or may be considered to be) reduced due to sickness or injury a choice between various early-exit pathways from the labor market. The important *point* is that people have a choice. When choosing a *temporary* or *permanent* early exit from the labor market, employees are assumed to maximize their lifetime utility. The choice alternative j for an employee after a long-term sickness can be return-to-work, partial disability or full disability, and full or partial early retirement with the old-age system from age 60. The employee optimization problem is then

$$\textbf{(1)}\ \underset{S,P,F,R}{\text{Max}} \int_{a}^{D} u(C_t, L_t) e^{-d(t-a)} dt$$

subject to

$$\textbf{(2)}\ \int_{W}^{S} Y_t e^{-d(t-a)} dt + \mu_1 \int_{S}^{P} Y_t e^{-d(t-a)} dt + \int_{P}^{F} Y_t^{PD}{}_t e^{-d(t-a)} dt + \mu_2 \int_{F}^{ER} Y_t e^{-d(t-a)} dt + \mu_3 \int_{ER}^{R} Y_t e^{-d(t-a)} dt + \int_{R}^{D} Y_t^{P} e^{-d(t-a)} dt - \int_{W}^{D} C_t e^{-d(t-a)} dt \geq 0$$

where the employee's utility function u depends on employee consumption (C_t), and leisure (L_t); W is the date of beginning to work; S is the beginning of a sickness absence, when the employee gets a sickness benefit that is based on the replacement rate μ_1 and expected annual earnings (Y); P is the beginning of a partial disability period, when the employee gets a partial disability pension PD plus salary for any work done (Y^{PD}); F is the beginning of a full disability period, when the employee gets a full disability benefit (FD) that is based on the replacement rate μ_2 and expected annual earnings (Y, which are the earnings of the previous year); ER is the first day of a full or partially reduced early old-age retirement period, when the employee gets a pension (Y^P) with a reduction (μ_3); R is the first day of the old-age retirement period, when the employee gets a pension (Y^P) that is related to lifetime earnings, work experience and work characteristics; and D is the day when the person dies. The employee's decision

point is age a, d is the discount rate including survival probabilities, and $0 < \mu_i \leq 1$, where i =1, 2 and 3. The model is presented in a "simplified" form, assuming different spells of work and sickness "sum" up under the same integral.

The exit from the labor market due to disability is not completely an individual decision, as it is conditional on a medical evaluation, as well as a work capacity evaluation of a social insurance officer. Additionally, we will assume that financial and psychological dependence may negatively affect employees who become disabled. Thus the decision to exit with a disability pension may be difficult to accept. Employees who suffer from a chronic sickness, for example, may find themselves in a gray area, where they would qualify for a disability pension, but could continue to work. It will be assumed, then, that the individual decision is made on the basis of *actual* utility given the financial resources. Given the financial resources provided by the disability pension, the decision may be *for disability* if the employee values more leisure and/or "psychic gains" that do not relate to the job or work environment, or *for work* (s)he enjoys work and/or can cope with the work environment, derives utility from the social network related at work, and related factors, such as the structure of a fixed schedule.

Conditional on the recuperation of at least part of the (initial) loss of working capacity, losses created by exit into disability may cause great problems for both persons with reduced work capacity (disable employee) and employers. The "disabled" people would not necessarily be better off by deciding to be out of the labor market when they still have working potential. Their inactive life would not necessarily improve their health status. They may become less happy, and, for sure, less wealthy than before exit. The reason why they are out of the labor force is their health status, and they should receive more help with respect to this. "Letting" them exit the labor market does not solve their problem, but offering them the opportunity of working *some* hours in a favorable environment, would increase their present and expected wealth (additional earnings from work), and it would have a positive effect on the employers' side (compensation payments and the expense of hiring and training replacements).

5 The data

The data, which come from the Long-term Sickness (LS) database owned by the Swedish National Social Insurance Board, include longitudinal information for about 4500 people on personal characteristics, earnings, sickness history (from 1983) and rehabilitation history (from 1986), and all exits from the labor market (i.e., including information before the period of observation, which started in January 1986). There are two random samples. One (IP) is representative for the national register of the insured population, aged 20 to 64 during 1986-1991. The second (LSIP) is essentially the same as the first, except that everyone had at least one sickness spell of at least 60 days during the period 1986-1989 (i.e., this sample is representative for the subpopulation of insured who have been recorded as long-term sick at least once). The last sample is larger: The IP sample includes about 1800 persons, while the LSIP sample one includes about 2700 persons. Both samples are analyzed here, allowing us to draw conclusions about slightly different populations: the insured population as a whole and the insured population with long-term sickness history.

It was possible during the period examined to exit with a permanent or temporary disability (granted for up to 3 years at a time). Those who exited received a permanent or temporary (disability) pension at 1/2, 2/3, or full rate. Those who continued to work (1/2 or 1/3) might later also qualify for sickness cash benefit (if sick), or for further disability pension, but only *first exits* are analyzed here. Because only sickness history since 1983 was known, all those who had exited the labor force due to disability before 1983 (50 persons in the IP sample, and 67 in the LSIP sample) were excluded, which of course introduces a potential for selection bias.

Table 2 shows descriptive statistics for the analyzed samples by disability pension status, reported at *exit date*, which is either the actual date of first exit, or the end of the observation period (December 31, 1991) for those who had not exited.

Table 2 Descriptive statistics by individual at "exit" date, IP and LSIP samples

	No exit		**Full disability**		**Partial disability**	
	IP	LSIP	IP	LSIP	IP	LSIP
Variable	1680	1926	74	461	42	239
Gender (1=woman, 0=man)	0.50	0.58	0.46	0.48	0.60	0.54
Marital status (1=married, 0=single)	0.52	0.54	0.51	0.60	0.62	0.58
Married women	0.27	0.34	0.27	0.30	0.31	0.31
Citizenship						
Swedish born	0.88	0.85	0.70	0.83	0.95	0.87
Naturalized Swedes	0.05	0.07	0.16	0.09	0.02	0.07
Foreign born	0.07	0.09	0.14	0.09	0.02	0.07
Educational level						
Low	0.47	0.56	0.85	0.83	0.66	0.74
Medium	0.36	0.34	0.11	0.13	0.24	0.20
High	0.17	0.10	0.04	0.04	0.10	0.06
Age groups						
18-35 *years*	0.33	0.33	0.07	0.07	0.05	0.07
36-45 *years*	0.29	0.29	0.09	0.11	0.10	0.18
46-55 *years*	0.24	0.24	0.31	0.33	0.31	0.30
56-65 *years*	0.14	0.14	0.53	0.49	0.55	0.45
Age	41.99	42.11	53.35	52.33	53.62	51.93
	(10.89)	(10.94)	(9.57)	(8.88)	(8.11)	(9.38)
Earnings[*], 1000 SEK	169.80	164.79	113.60	141.06	96.60	112.04
	(95.08)	(63.34)	(93.10)	(76.40)	(61.32)	(66.34)
Regional unemployment rate (%)	2.37	2.34	2.68	2.50	2.58	2.22
	(1.19)	(1.19)	(1.57)	(1.30)	(1.25)	(1.21)
Sickness spells before exit	9.18	14.15	3.36	4.33	5.17	5.09
	(9.79)	(11.28)	(4.73)	(4.94)	(6.70)	(6.84)
Sickness spells after exit			0.08	0.12	4.79	5.63
			(0.49)	(0.88)	(8.61)	(7.91)
Sickness days before exit	119.27	459.33	537.77	741.74	564.69	654.20
	(237.48)	(418.02)	(422.45)	(416.92)	(495.24)	(478.48)
Rehabilitation type						
Vocational	0.03	0.19	0.12	0.21	0.38	0.30
Medical	0.01	0.08	0.14	0.18	0.19	0.16

Note: Earnings are adjusted to constant values using the 1997 CPI. *Italics* indicate dummy-groups.

The proportions of women and men who did not exit before the end of the observation period were almost the same in the IP sample, whereas in the LSIP sample more women than men did not exit. This difference could be explained by the fact that, on average, women work part time more often than men, and given economic incentives and other factors related to disability, it could be more difficult for them to decide to exit. Being recorded long-term sick, allowed them to accumulate compensation that

qualified them for a better pension latter on. It can also be explained by assuming that part-time work, which is more frequent for women, provides an alternative to leaving the work force with disability when there is a mismatch between job demands or work environment and individual health and/or capacity.

Compared to the no-exit group of the IP sample, the LSIP sample's no-exit group also has more naturalized Swedes and foreign-born people, more days and spells of sickness, and they participated more often in a rehabilitation program. There are also more married people, and more married women. People with medium and higher education are presented in higher proportions for the no exit group of IP than LSIP. In both samples the proportions of people with low education who exit into full (83-85%) or partial disability (66-74%) were much higher compared to the other educational levels. The average age of the first exit was higher in the IP sample than in the LSIP sample for all types of exit, which can be explained by the better health status of people in the IP sample.

As expected, the averages of both sickness spells before exit and compensated days of sickness, were much higher for the LSIP sample (working-age insured people with LT sickness) than for the IP sample (all working-age insured people): "No-exits" in the LSIP sample averaged about 51 compensated days of sickness per year (over the period 1983-1991), whereas those in the IP sample averaged about 13 days.

Except for the "no-exit", the average annual earnings of exit people of each pension category in the LSIP sample were higher than in the IP sample. This might happen because the IP sample contains people who did not work at all, whereas everyone in the LSIP sample must have worked in order to qualify for a sickness benefit.

The exits into full and partial disability differ between them, and in general, they are different for the two samples. For those who exited with a full benefit, the proportions of naturalized Swedes, of foreign-born people, and of those aged 56-65 were higher for IP sample than for LSIP. Otherwise, the proportions (i.e., the mean values for age-groups dummies) were higher for LSIP than IP.

For exits with partial disability, the proportions of married, of Swedish born, and of those aged 50-65 were higher for IP than for LSIP. The same was the relationship for those who participated into vocational, or medical rehabilitation.

6 The econometric specification

We assume people make rational choices under uncertainty in a given risky environment and these choices both determine the hazard of exit, and the change in it over time. According to Lancaster (1990), if we could observe the hazard function of a number of people living in the same risky environment and using the same decision making policy, or operating in environments and using policies which differ in *known* ways, we could confirm or refute the theory of their behavior and determine parameters that could be interpreted according to economic theory.

Our aim is to estimate the hazard of exit, which is the risk that a person will exit at a certain age due to disability, assuming that (s)he has remained in the labor force until that age. The model outlined above and the data allow for various types of early withdrawal from the labor force. Therefore, the exit decision will be estimated within a duration framework using both *single risk* and *competing risks models*, where the latter describes duration models in which an individual spell may terminate via more than one outcome.

Competing risks must be mutually exclusive and collectively exhaustive[9] for the models to be transition specific. So, considering the event of exiting from the labor force, and possible explanations for doing so: One may exit partially or totally at any age (i.e., 16-65 in Sweden) because of reduced working capacity (exits analyzed by this study), and from age 60 also exit without reduced work capacity. Therefore the models used here analyze the time until a transition-specific event, treating alternative transitions as censored, and so there is a different analysis for each transition specific risk or event.

Survival curves are useful for preliminary examination of the data, for computing the probabilities of survival, and for evaluating the fit of the regression models. Since the survivor function gives a complete account of the survival experience of different

[9] The risks must be completely different from one another in that either one or the other can happen, but not both, at the same time.

groups, we test the null hypothesis that the survivor functions are the same for two [H_0: $S_1(t) = S_2(t)$ for all t] or more groups.

Given public concerns about increasing disability rates it could be helpful to learn more about the factors that lead to health problems, considering all possible sources: genetics, the working environment, the characteristics of an individual's job task, the individual's social integration, the impact of family circumstances, culture, technical change, etc. Unfortunately, this kind of information has not been available for this study, but relatively good instruments were available for the mentioned factors (i.e., dummies for citizenship - accounting for cultural impact, social integration, and even working conditions; the number of sickness spells and rehabilitation dummies - accounting for work environment and working conditions). Therefore, the impact of those factors on exit due to disability is estimated next semiparametrically using the Cox proportional hazard model (Cox, 1972). This model evaluates treatment, diagnostic, or predictive factors to determine the magnitude and significance of their effects on population survival or failure time. It is assumed that the hazard function can be factored into a function of time and a function of variables related to the sickness spell and the individual, and so it is set up a model for the conditional probability of exiting due to disability:

(3) $h(t; x_i) = h_0(t)\exp(\beta x_i)$,

where β represents the coefficients to be estimated, and $h_0(t)$ is an unknown function of time. The expression $h_0(t)$ gives the hazard function for the standard set of conditions, $x = 0$.

The advantage of the semiparametric approach is that it does not make any assumption about the underlying distribution of "waiting times", and it leaves $h_0(t)$ parametrically unspecified. The model asserts that the effect of the explanatory factors on the hazard rate (the risk of the occurrence of an event, such as exit from the labor market, at any point in time) is multiplicative and does not change over time. So, if the hazards of exiting were proportional, the corresponding proportion between the cumulative integrated hazards would be the same, and plots of the logarithm of the cumulative hazards corresponding to values differing by the same measure should be parallel. This allows examining the proportionality assumption graphically by using the survival estimates.

The extension of the standard single risk model to two or more independent exit destinations, i.e. the independent competing risks model (Lancaster, 1990), implies that the log-likelihood can be split into the sum of its risk-specific hazards. In such a model, observations that exit differently (i.e., 1/2 or 2/3 disability pension) from the analyzed exit (i.e., full disability pension) are treated as censored. Therefore, maximizing the likelihood for a total competing risks model is equivalent to separately maximizing the likelihood for each exit type (j), as in

$$\textbf{(4)}\quad \ln L_j = \sum_{i=1}^{N_j} \ln h_j(t_i) - \sum_{i=1}^{N} \int_0^{t_i} h_j(u)du\,,$$

where N_j is the number of uncensored observations, i.e. exits to state j, and N denotes the total number of observations, i.e., exits to *all* states, plus non exits.

As it was already mentioned, not all the information needed was available for this study; therefore some instruments were used instead. Additionally, an unobserved heterogeneity term should be considered, but this requires strong assumptions especially when more than one exit destination is considered.[10] In the next step, first exits from the labor market due to disability were studied using a *frailty model*, were the frailty represents the total effect on survival of the covariates not measured when collecting information on individual subjects. The model used is the so-called shared frailty model, an extension of the proportional hazard regression model, which assumes that the hazard rate for the j^{th} subject in the i^{th} group, given frailty (w_i), is of the form

$$\textbf{(5)}\quad h_{ij}(t) = h_0(t)\exp(\sigma w_i + \beta' x_{ij})\,,$$

where $h_0(t)$ is an arbitrary baseline and σ is the coefficient for the frailty term (w_i). When σ is zero, this model reduces to the basic proportional hazard model (3).

[10] Two approaches have typically been adopted in the empirical literature. The first involves introducing a random disturbance term in each of the cause-specific hazards (Katz and Meyer, 1990), requiring the assumption of independence across terms. The second approach assumes a disturbance term common to all cause-specific hazards, or terms proportional to each other (Flinn and Heckman, 1982; Pickles and Davis, 1985). Narendranathan and Stewart (1993) argue that introducing possible misspecifications through the unobserved heterogeneity term could bias the results of interest. In particular, they argue that there is no reason for any resulting distortions to be less serious than those caused by ignoring unobserved heterogeneity.

7 Estimation results and discussion

The economic model specified above takes into account several forms of exit with benefits. In this study we focus only on exits due to disability. "Waiting time" until the first exit from the labor market due to disability was "measured" in years of age, because both the a) age when people started to work, and b) their working history were not in the data. Nevertheless, even if these data were available, we will still prefer the years of age because: 1) the employees' productivity may fall bellow what (s)he is paid, creating an incentive for the employer to "push" them on the direction of exit, and perhaps to lose interest in helping them; 2) the employees working capacity may decline due to a number of factors (i.e., the work environment/tasks are no longer as suitable; the employees' physical capacity may deteriorate due to a long absence of sufficient physical activity; health can become poorer; skills may become outdated, and the willingness or capacity to accommodate to change lower; they may desire more leisure, etc.). Therefore, exit alternatives may look more attractive at different ages, regardless of when people started to work. On the other hand, a long working career itself may be a factor of increasing importance with increasing age. At any given age, the hazard of exiting for those who did not exit earlier was estimated both nonparametrically and semiparametrically.

7.1 Nonparametric results

Figures 4 a) and b) show the survival and hazard functions for first exit from the labor market for women and men from age 30 for the IP sample. Figures 5 a) and b) show the same functions for the LSIP sample.[11]

For the IP sample, the survival rate for both men and women decreased slowly until about age 55, when there was a marked increase in the rate of exit from the labor force; for the LSIP sample, this increase started several years earlier (i.e., about age 49).

[11] There were few exits before age 30.

After age 55, women in the LSIP sample had a higher hazard of exit than men; this was not the case for the IP sample. The difference seems clearly to be attributable to the different health status of the samples: Previous long-term sickness seems often to be a precursor of earlier exit. The clear decrease in survival for both samples around age 60 is probably related to the "standard" economic (behavioral) explanation: A natural decrease of the employees' productivity by age, an increasing probability that the employee's working capacity declines with age, perhaps poor adaptation to technical change, and a higher preference for leisure are some of the factors that explain best the increasing hazard around 60.

Figures 6 a) and b) show the plots of survival and hazard functions by marital status for the IP sample, while Figure 7 a) and b) show them for the LSIP sample. In the LSIP sample, married people generally "survived" longer than did singles, and this was also true in the IP sample until age 59, after which singles "survived" longer. This suggests that being single is a risk factor for younger people and for those with a history of long-tem sickness. It can also be the case that people with poorer health, social status and education, have a greater risk of not finding (keeping) a partner. Economic incentives could also play a role: For example, for some married people (mainly men), even if they have reduced working capacity, the fact that their work is the main source of family income may make a disability pension an undesirable choice. On the other hand, some single people are widowed, and those born before 1945 had the possibility to combine a disability pension with a survivor pension, thus increasing their economic incentive for exit.[12] Other factors, such as injuries, but also psychological disorders, are an important cause of early exit of young people, who are often singles.

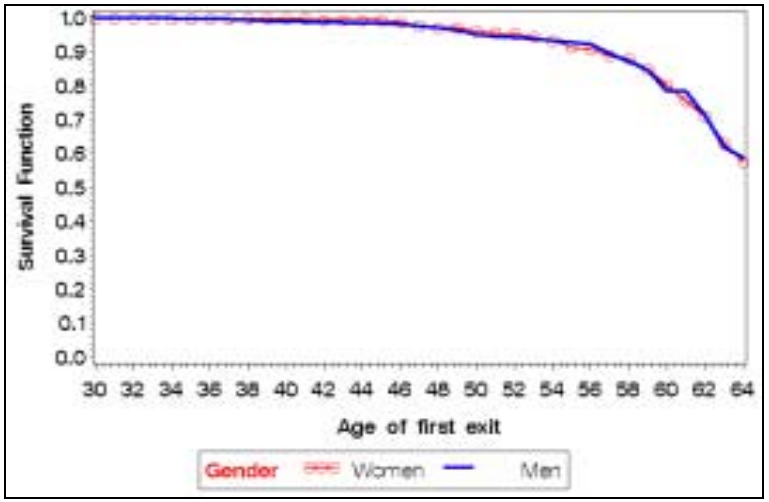
Figures 8 a) and b) show the survival and hazard functions by citizenship for the IP sample, while Figures 9 a) and b) show them for the LSIP sample. For both samples, Swedish born people "survived" longest, followed by naturalized Swedes and then

[12] Survivor's pension comprises adjustment pension, special survivor's pension, widow's pension and child pension. Adjustment pension is payable to women/men under age of 65 whose husband/wife died after December 31st 1989. This pension is payable the first year after the spouse's death, and can be extended if there are children under the age of twelve in the family.

foreign-born persons. For the IP sample these differences become clear for persons in their late forties (about 47 years), and about ten years earlier (about 37 years) for the LSIP sample. This result may have been caused by a difference in working conditions and work characteristics, but it could also be caused by other unobserved factors, such as health capital, as well as cultural and social aspects.

Figure 10 shows log-log survivor functions for the two samples by pension rate. Since the log-log survival functions are almost parallel, we can conclude that the hazards of exit with different disability pensions are proportional, which means that *if* the hazard of exit with a full pension changes with time, the hazard of exit with one-half or two-thirds pension changed proportionately.

Figure 11 shows the corresponding smoothed hazard functions. Again, we can see that the hazard of *early* exit was higher for the LSIP sample than for the IP sample. In the IP sample, the hazard of exit with a full pension increased dramatically at about age 50, and shortly thereafter for partial pensions, while in the LSIP sample, there were no such clear "break-points". Instead there was a steady increase starting much earlier. The difference seems clearly explained by the different health status of the samples. In other words, previous long-term sickness seems often to be a "precursor" to earlier exit.

a) 

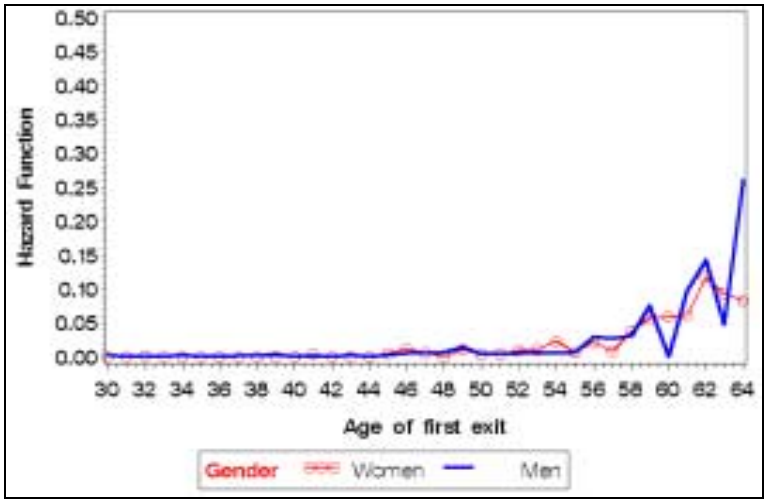
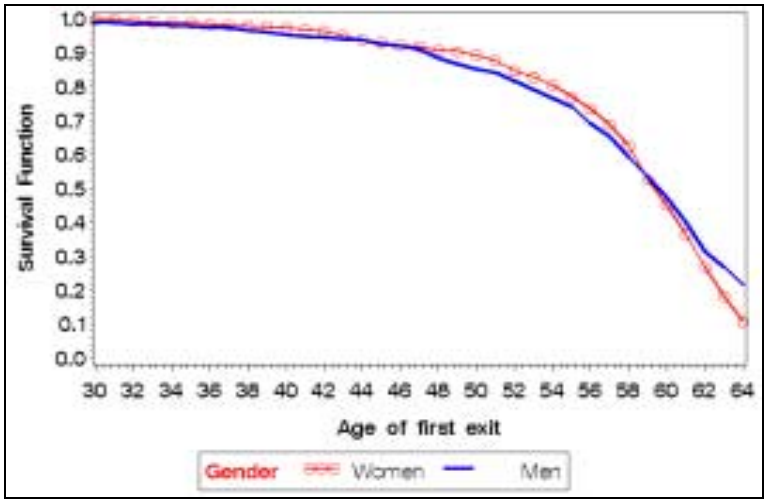
b) 

Figure 4 Plots of survival (a) and hazard (b) functions by gender; IP sample.

a) 

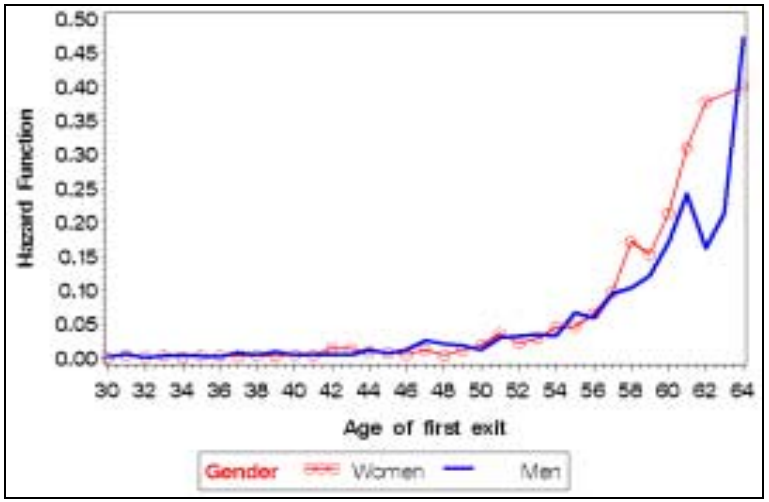
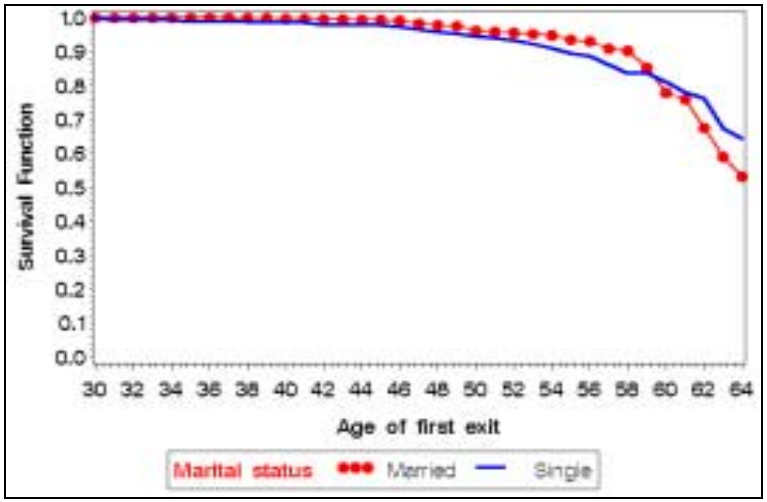
b) 

Figure 5 Plots of survival (a) and hazard (b) functions by gender; LSIP sample.

a) 

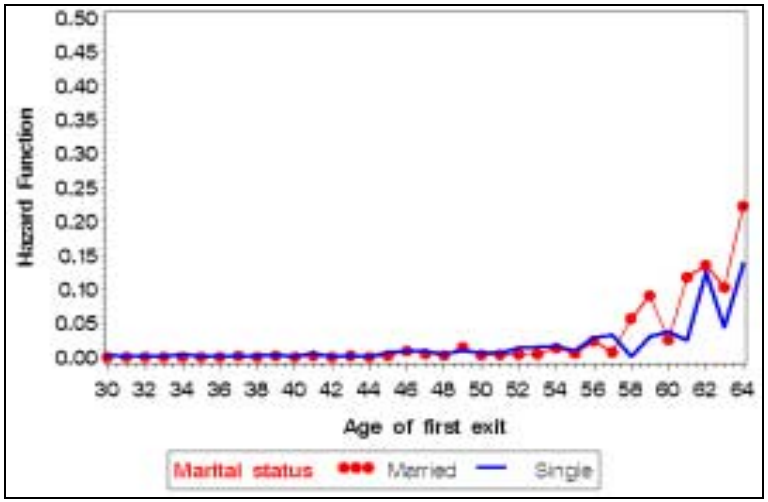
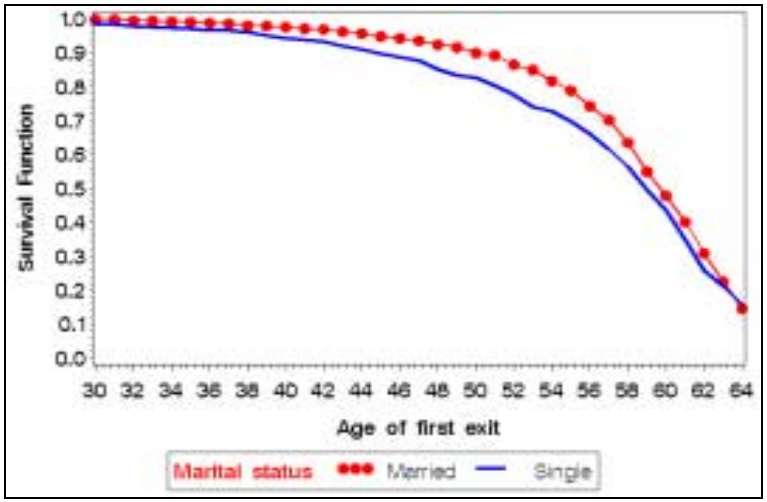
b) 

Figure 6 Plots of survival (a) and hazard (b) functions by marital status; IP sample.

a) 

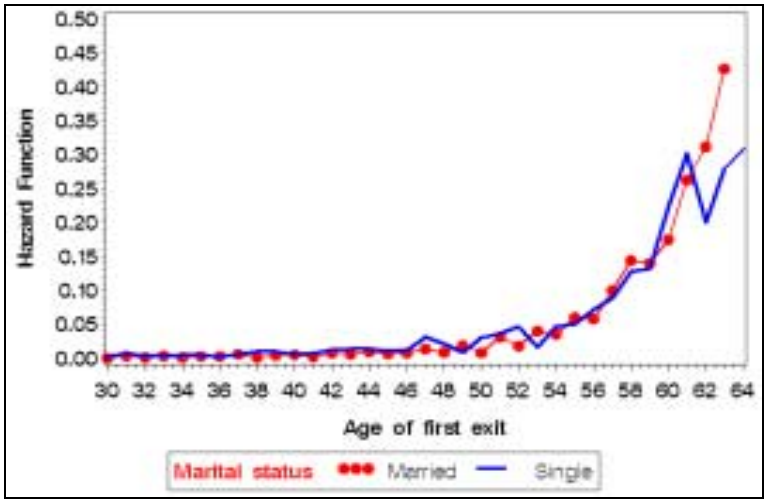
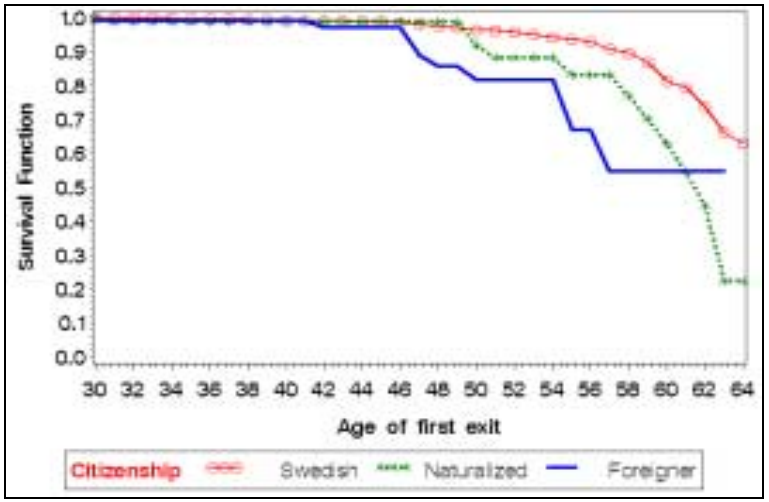
b) 

Figure 7 Plots of survival (a) and hazard (b) functions by marital status; LSIP sample.

a) 

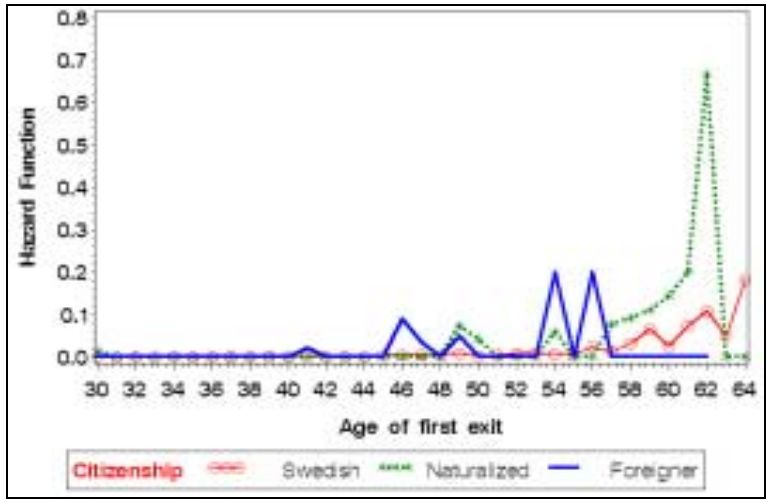
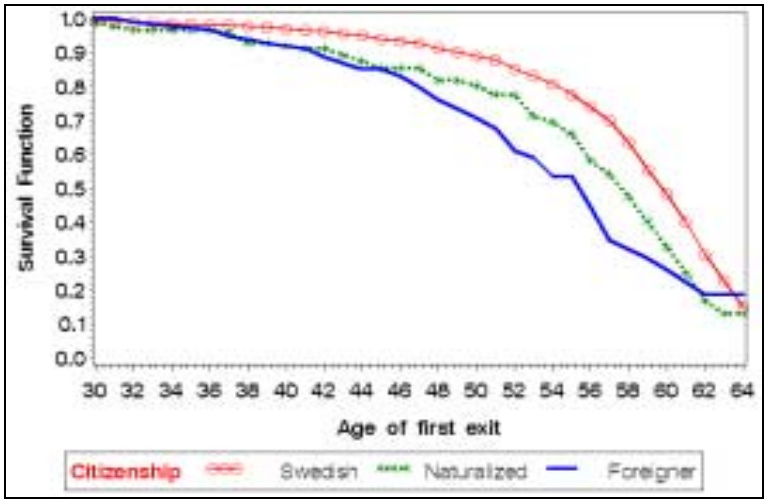
b) 

Figure 8 Plots of survival (a) and hazard (b) functions by citizenship; IP sample.

a) 

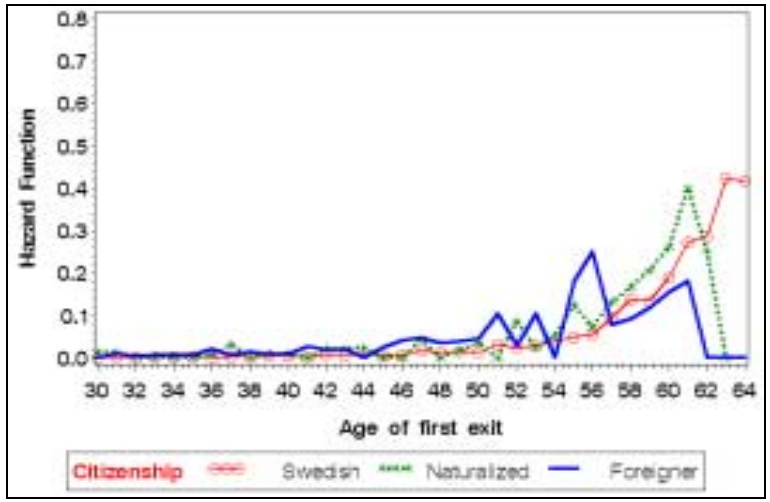
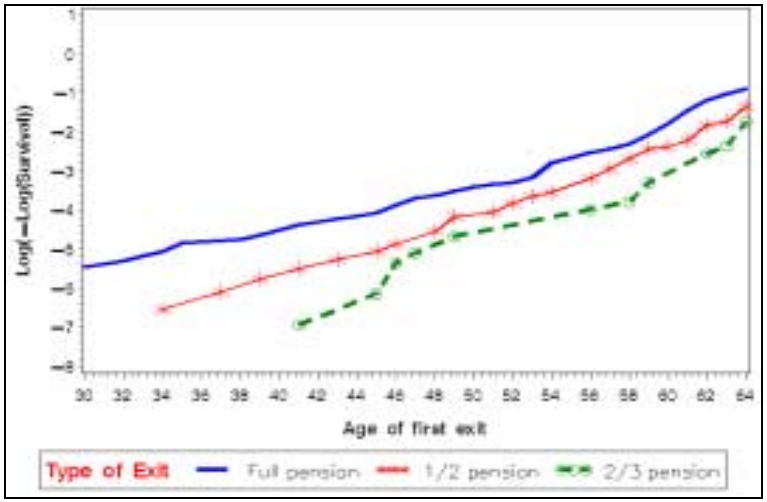
b) 

Figure 9 Plots of survival (a) and hazard (b) functions by citizenship; LSIP sample.

a) 

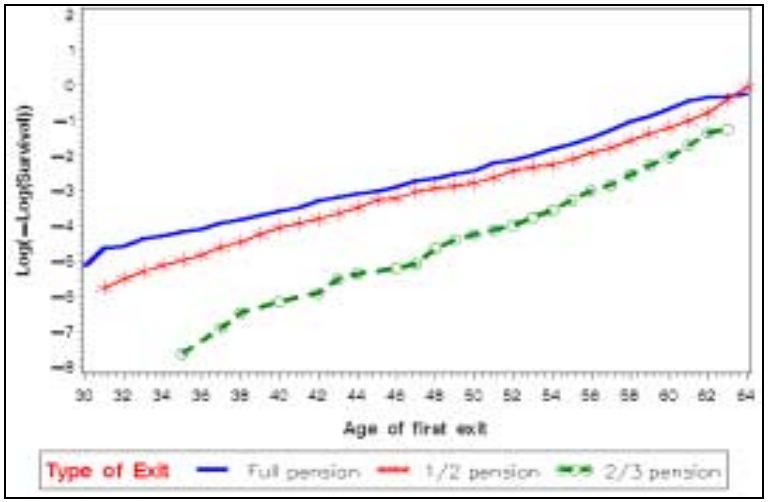
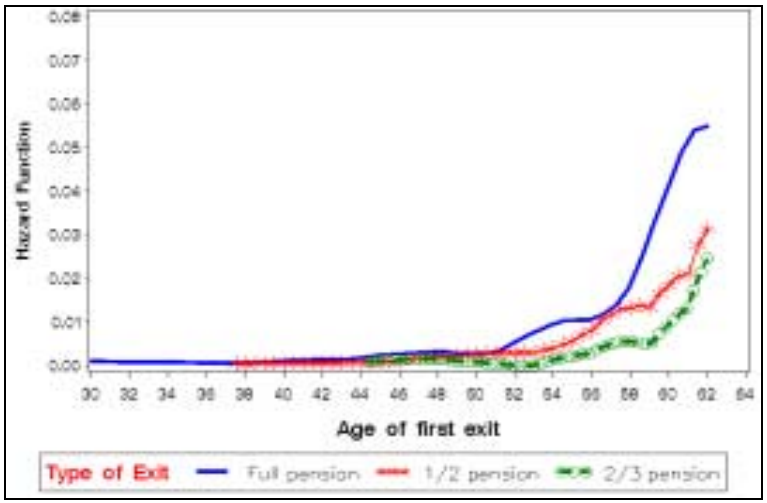
b) 

Figure 10 Log-Log survival plots- Exits with full or partial disability pension, IP (a) and LSIP (b) samples

a) 

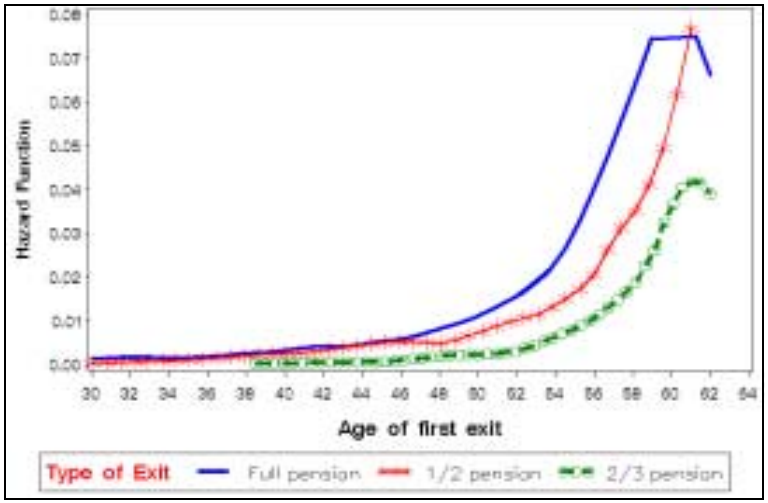
b) 

Figure 11 Smoothed hazard functions- Exits with full or partial disability pension

7.2 Semiparametric results

We will now look at whether the effects of covariates were the same or different across exit types, when analyzed with a Cox model for all types of exit, and separately for each type. Table 3 shows the estimates for the (general) IP sample, and for the (previous long-term sickness) LSIP sample. These are discussed separately.

For *the IP sample*, considering all exits together, except gender, marital status and educational level dummies, all other variables are statistically significant by conventional criteria. Naturalized Swedes were three times as likely as Swedish born people to leave the labor force earlier due to disability at any given age, while foreigners were about 5.13 times as likely at any age. citizenship may be a proxy for culture and attitudes toward work, as well as, human and perhaps health capital when starting working. Many of those who are not Swedish born immigrated to Sweden before 1973, during a period characterized mainly by an economically motivated migration. Given the health and human capital at that time (which not necessarily were the same as for Swedish born people), if they had jobs that required mainly (heavy) physical effort, the results here would not be unexpected.

Previous history of sickness in other spells mattered: For each one hundred days of previous sickness there was about a 25% increase in the risk of exit, but for each additional spell of sickness there was a decrease of 7.9% in the risk of disability exit.

Regional unemployment was also a significant push factor for exit: Each one percent increase in the regional unemployment rate was associated with about a 30% increase in the risk of exit due to disability.

Table 3 Semiparametric estimates for single-risk and competing-risks models of first exit due to disability, IP and LSIP samples

Variable	All exits			Full Pension			Partial Pension		
	β	Std Err	HR	β	Std Err	HR	β	Std Err	HR
IP-sample									
Women (CG: men)[a]	0.04	0.21	1.04	-0.07	0.26	0.93	0.29	0.35	1.34
Married (CG: unmarried)	-0.06	0.22	0.94	-0.28	0.28	0.76	0.49	0.38	1.63
Education level (CG: low)									
Medium	-0.01	0.27	0.99	-0.59	0.40	0.56	**0.75**	0.41	2.13
High	-0.25	0.42	0.78	**-1.10**	0.62	0.33	**0.92**	0.57	2.52
Citizenship (CG Sw born)									
Naturalized Swede	**1.12**	0.30	3.06	**1.71**	0.34	5.53	-0.55	1.02	0.58
Foreigner born	**1.63**	0.35	5.13	**2.25**	0.39	9.52	0.02	1.03	1.02
Rehabilitation type									
Vocational	**0.74**	0.30	2.09	-0.36	0.44	0.70	**2.06**	0.44	7.85
Medical	**1.13**	0.31	3.11	**0.93**	0.40	2.53	**1.69**	0.49	5.44
Sickness days before exit[b]	**0.23**	0.02	*25.60*	**0.29**	0.03	*33.00*	**0.14**	0.04	*15.00*
Sickness spells before exit	**-0.08**	0.02	*-7.90*	**-0.13**	0.03	*-12.50*	-0.03	0.03	*-3.40*
Earnings (1000 SEK)	**0.00**	0.00	*-0.30*	0.00	0.00	*0.00*	**-0.01**	0.00	*-0.90*
Regional unemployment	**0.27**	0.08	*30.50*	**0.36**	0.10	*42.60*	0.13	0.13	*14.20*
Testing H_0: BETA=0[*]									
Likelihood ratio	225.45			165.56			97.61		
Score	394.64			247.84			226.97		
Wald	251.07			154.31			115.23		
-2 Log-likelihood[c]	1289.9	1064.5		819.8	654.2		472.4	374.8	
Events| censored cases	116	1680		74	1722		42	1754	
LSIP-sample									
Women (CG: men)	-0.01	0.08	0.99	0.05	0.10	1.05	-0.08	0.14	0.93
Married (CG: unmarried)	**-0.20**	0.08	0.82	**-0.23**	0.10	0.79	-0.16	0.14	0.85
Education level (CG: low)									
Medium	-0.08	0.11	0.92	**-0.27**	0.14	0.76	0.23	0.17	1.26
High	**-0.41**	0.18	0.66	**-0.74**	0.24	0.48	0.20	0.28	1.22
Citizenship (CG: Sw born)									
Naturalized Swede	**0.52**	0.14	1.68	**0.66**	0.17	1.94	0.18	0.26	1.19
Foreigner born	**0.90**	0.15	2.46	**1.02**	0.18	2.77	**0.55**	0.27	1.73
Rehabilitation type									
Vocational	**0.59**	0.10	1.80	**0.27**	0.13	1.31	**1.12**	0.17	3.07
Medical	**0.64**	0.10	1.90	**0.67**	0.13	1.95	**0.55**	0.18	1.73
Sickness days before exit	**0.11**	0.01	*11.90*	**0.13**	0.01	*14.00*	**0.07**	0.02	*7.4*
Sickness spells before exit	**-0.09**	0.01	*-8.20*	**-0.10**	0.01	*-9.50*	**-0.06**	0.01	*-5.4*
Earnings (1000 SEK)	**0.00**	0.00	*-0.30*	0.00	0.00	*-0.10*	**-0.01**	0.00	*-0.8*
Regional unemployment	**0.06**	0.03	*6.10*	**0.13**	0.04	*14.10*	**-0.11**	0.06	*-10.5*
Testing H_0: BETA=0[*]									
Likelihood ratio	580.55			430.68			213.48		
Score	633.91			470.87			235.20		
Wald	598.76			438.53			221.36		
-2 Log-likelihood	8941.7	8361.1		5934.3	5503.6		3031.5	2818.0	
Events| censored cases	700	1926		461	2165		239	2387	

Note: The estimates in **bolds** are significant at the 10%-level. [*]For all models, the degrees of freedom (DF), is 12, and the chi-square statistic is significant beyond 0.001 level; [a] CG is the comparison group; [b] in hundred; [c] the first value for the case without covariates, and the second value for the case with covariates. *Italics* for hazard ratio (HR) indicate that for the continuous variables it had been recomputed as *phr* = 100*(*HR*-1).

When a distinction was made among different kinds of exit (i.e., full or part-time) in the IP sample, it was found that compared to people with lower education, higher education decreased the hazard of exit with a *full* disability pension, but increased hazard of exit with partial disability benefit. The first result can be attributed to investment in health, but also by different work environments and working conditions for persons with low and high education. The second result may indicate that it is easier for persons with higher education to remain in the workforce (at least partially).

Foreign-born people were about 9.5 times as likely as Swedish born to exit with a full disability pension, while naturalized Swedes were about 5.5 times as likely. This can be the result of different cultural background, and/or different health and human capital, but also it can be related to occupation, work environment and working conditions.

Being in a rehabilitation program (both vocational and medical) increased the probability of exit with a part-time benefit, but being in a vocational rehabilitation had no significant impact on exit with full disability. This may mean that participation in a rehabilitation program could be considered somewhat successful, in that some people can combine part-time work with partial benefit.

For *the LSIP sample*, when no distinction was made among different kinds of exits (i.e., considering all exits together), except dummies for gender and medium level of education, all other variables were statistically significant at the 10% level. The hazard of exit for married people was about 80% of the hazard of singles. The hazard of exit for higher educated people was about 66% of the hazard of lower educated people, and even lower (about 48%) for exits a with full benefit.

Naturalized Swedes were about 1.7 times as likely to exit due to disability as Swedish born people, while the foreign born were 2.5 times as likely as the Swedish born. These proportions were even higher for full benefits, and lower for part-time benefits.

Being in a rehabilitation program (both vocational and medical) increased the probability of exit: Those who participated in a vocational rehabilitation program were about 1.3 times as likely to exit with full benefit as those who had not, and about 3.07 times as likely to exit with a part-time benefit. Those who participated in a medical rehabilitation program were about 1.9 times as likely to exit with full benefit as those

who had not, and about 1.7 times as likely to exit with a part-time benefit. It seems that vocational rehabilitation had a higher impact on the decision of part-time pensions, while medical rehabilitation had a higher impact on exits with full pension. This may be associated with likelihood for persons with more severe medical problems to require medical rehabilitation, whereas vocational rehabilitation provides a means to remain active at least part-time.

Previous history of sickness had significant effects on the hazard of exit: For each one hundred days of previous sickness there was about an 11.9% percent increase in the risk of exit, and even higher (about 14%) for full pensions, but lower (about 7.4%) for part-time benefits. On the other hand, each additional *spell* of previous sickness was associated with about a 8.2% decrease in the risk of exit. As we have seen in the descriptive statistics of the samples, persons with a previous history of long-term sickness often have a history of many spells. One possible explanation of this is that previous sickness spells give people the opportunity to recuperate, thus delaying or avoiding exit due to disability. This is a result that supports the belief that preventing and controlling the deterioration of the health capital of people would decrease the number of exits from the labor market due to disability.

Unemployment was again a significant push factor: Each one percent increase in the regional unemployment rate was associated with about 6.1% increase in the risk of exit, and even higher (14.1%) for full pension; and it was associated with about 10.5% decrease in the risk of exit with part-time benefit, which can be related to the fear of getting unemployed.

The likelihood-ratio chi-square statistic for the null hypothesis that the explanatory variables have *identical coefficients across destination types* is significant at well beyond the .01 level for both IP and LSIP samples, and therefore we reject the hypothesis.[13] These results suggested that the analysis must be done by exit type. In the

[13] The test was constructed by summing log-likelihood values for the model *with covariates* (multiplied by –2) for full and partial pensions and then subtracting this from the log-likelihood value for the model with covariates (multiplied by –2) for all types combined. There were 12 degrees of freedom, corresponding to the difference between the number of coefficients when models for the three types were estimated separate, and the number of coefficients when the model for all types together was estimated.

next step the frailty model was estimated by grouping the individuals by type of exit.

7.3 Estimation results for the frailty model

The gamma frailty model was fitted to the "single-risk" data (i.e., exit due to disability regardless of the pension type), which was grouped by the type of pension, and the coefficients were estimated by applying the Expectation Maximization (EM) algorithm. For the IP sample the EM algorithm could not find a higher value for the likelihood function than the one that corresponds to the model without frailty. Table 4 presents these results only for the LSIP sample. The unobserved heterogeneity variable is not significant by conventional criteria, but the gender variable is significant now (while in the model without unobserved heterogeneity it was not): Women were about 1.3 times as likely as men to exit due to disability. Nevertheless, even though unobserved heterogeneity was included in the model, marital status, citizenship, vocational and medical rehabilitation, sickness days before exit and regional unemployment rate still were highly significant estimates (not very different in size from the estimates of the model without unobserved heterogeneity). The educational dummies (considered as being good proxies for occupation, job characteristics and working conditions) were not significant by conventional criteria. Of course, if it had been available additional information, for example about occupation, job characteristics and working conditions, etc. would have been useful in analyzing labor market exits due to disability.

Table 4 Estimates of the frailty model. LSIP sample

Variables	Parameter Estimate	Standard Error	Hazard Ratio
Frailty	**4.80**	3.90	112.73
Women (CG: men)[a]	**0.23**	0.08	1.26
Married (CG: unmarried)	**-0.22**	0.08	0.80
Educational level (CG: lower)			
Medium	0.04	0.11	1.04
Higher	0.09	0.18	1.10
Citizenship (CG: Swedish born)			
Naturalized Swede	**0.32**	0.14	1.37
Foreigner born	**0.74**	0.15	2.10
Rehabilitation type			
Vocational	**0.52**	0.10	1.68
Medical	**0.59**	0.10	1.81
Sickness days before exit (100)	**0.07**	0.01	7.60
Sickness spells before exit	-0.01	0.01	-0.94
Earnings (1000 Swedish kronor)	**-0.00**	0.00	-0.12
Regional unemployment rate (%)	**0.08**	0.03	7.92
Kendall's tau	**0.70**		
-2 Log-Likelihood (without| with covariates)	5397.96	4671.72	

Note: The **bold** estimates are significant at the 1%- level; [a] CG is the comparison group; *Italics* for hazard ratio (hr) indicate that for the continuous variables it had been recomputed as phr = 100*(hr-1).

The results from this section show that there are differences between different types of exit into disability, and that the unobserved heterogeneity must be used when not enough information is available.

8 Summary and conclusions

The risk of exit due to disability at a certain age, conditional on having remained in the labor force until that age, was analyzed. After age 55, women in the LSIP sample had a higher hazard of exit than did men, but this was not the case for the IP sample. This difference indicates that more research should be done using different groups of people. From our duration analysis, we learned that if women were long-term sick, we would expect that they would exit into disability much faster than men. Therefore, one obvious proposal for policy would be that more resources should be allocated for preventing long-term sickness in general, but especially focus on the work environment for women.

It was also found that the hazard of early exit was lower for married people than for singles, while naturalized Swedes and the foreign born were more likely to exit earlier than Swedish born people. Participation in a vocational rehabilitation program increased the risk of exit with a partial disability, which could imply that rehabilitation was in a way efficient (in the sense that people are kept in the labor market). Those who were long-term sick and participated in a medical rehabilitation program were about 1.9 times as likely to exit with full benefit as those who had not, and about 1.7 times as likely to exit with part-time benefit, while those who participated in a vocational rehabilitation program were about 1.3 times as likely to exit with full benefit as those who had not, and about 3 times as likely to exit with a part-time benefit. For persons with more severe medical problems, this may be associated with likelihood to require medical rehabilitation, whereas vocational rehabilitation may provide a mean to remain active at least part-time.

Reducing the incidence and severity of disability in a population involves changes in the social and physical environment at work, changing attitudes towards what is required of especially older workers and what individuals should require of themselves in society, as well as changing individual performance (by improving physical capacity, learning new skills, being flexible enough to change tasks/jobs, etc.). Therefore, the health and educational systems should be developed in such a way to make it easier for individuals to achieve human and health capital that would allow them to reach a higher level of welfare. The development of strategies to reduce “disability dependence” thus

requires detailed understanding of the underlying systems for rehabilitation and financial support, including the structure of the support and service system, the routes by which one enters it, and those by which one can exit, as well as the characteristics of the worker who becomes disabled.

More effort should be made to design flexible programs that can be adapted to individual needs. Making the alternative of returning to work more attractive, would reduce the economic burdens on society, and it would improve the quality of life and self-esteem of many employees who otherwise might have become disabled as well.

The decision to exit the labor market is an extreme alternative, and is not always the best alternative for the individual. On the other hand, even supposing that it is accepted that working some hours has a positive impact on individuals with health problems, it is difficult to match individuals with available jobs on the market. In such conditions, the process of integrating these people in the labor market becomes very complex, and it requires resources allocated on both sides: training and/or vocational rehabilitation of those individuals, and the improvement of the working conditions and rethinking the job tasks in general. Even with these improvements, disability will always be a very complex phenomenon that requires dynamic and flexible policies aimed to a better well being of the individuals themselves, and the welfare of society in general.

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Appendix The definition of disability

The World Health Organization made an attempt in 1980 to find a way out from the dilemma of a right term for disability by issuing the International Classification of Impairments, Disabilities, and Handicaps (ICIDH). "Disability" was defined as "any restriction or inability (resulting from an impairment) to perform an activity in the manner or within the range considered normal for a human being". ICIDH was criticized as model of consequence of disease in the following years, and a new version, ICIDH-2, is currently being drafted. It differs substantially from the original one,[14] being *a classification of human health and disability*, systematically arranged according to somatic, psychological and social levels. Both a "medical model" and a "social model" have been proposed for understanding and explaining disability and health.[15] The medical model views disability as "a personal problem, directly caused by disease, trauma or other health condition, which requires medical care provided in the form of individual treatment by professionals". The social model, on the other hand, views the disability mainly as "a socially created problem, and principally as a matter of the full integration of individuals into society".

Under the medical approach, the management of the disability is aimed at cure or the individual's adjustment and behavior change, while under the social approach, it is the collective responsibility of society at large to make the environmental modifications necessary for the full participation of people with disabilities in all areas of social life.

Medical care is viewed as the main issue, and at the political level the principal response is that of modifying or reforming healthcare policy, while environmental changes is viewed as an attitudinal issue, which at political level becomes a question of human rights.

[14] ICIHD has moved away from its old focus on the impacts of diseases or other health conditions (the 1980's "consequence of disease" classification) to a new focus on what constitutes health (today's "components of health" classification).

[15] The term "model" here means an explanatory style or paradigm.