

Abstract

“Who is Granted Disability Benefit in Sweden? Description of risk factors and the effect of the 2008 law reform”

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Disability benefit is a publicly funded benefit in Sweden that provides financial protection to individuals with permanent working ability impairments due to disability, injury, or illness. The eligibility requirements for disability benefit were tightened June 1, 2008 to require that the working ability impairment be permanent and that no other factors such as age or local labor market conditions can affect eligibility for the benefit. The goal of this paper is to investigate risk factors for the incidence disability benefit and the effects of the 2008 reform. This is the first study to investigate the impact of the 2008 reform on the demographics of those that received disability benefit. A logistic regression model was used to study the effect of the 2008 law change. The regression results show that the 2008 reform did have a statistically significant effect on the demographics of the individuals who were granted disability benefit. After the reform women were less overrepresented, the older age groups were more overrepresented, and people with short educations were more overrepresented. Although the variables for SKL regions together were jointly statistically significant, their coefficients were small and the group of variables had the least amount of explanatory value compared to the variables for age, education, gender and the interaction variables.

Who is Granted Disability Benefit in Sweden?

Description of risk factors and the effect of the 2008 law reform

Glossary

<i>English</i>	<i>Swedish</i>	<i>Description</i>
Activity compensation	Aktivitetsersättning	A benefit for individuals in the age range 19-29 with a long-lasting working ability impairment caused by disability, illness or injury
Disability benefit	Sjukersättning	A benefit for individuals in the age range 30-64 with a permanent working ability impairment caused by disability, illness or injury
Disability pension	Förtidspension	An older term for disability benefit that was used before 2003
Letter of regulation	Regleringsbrev	An annual letter from the government stating the goals and budget for a government agency
Sickness benefit	Sjukpenning	A benefit for those with a temporary working ability impairment caused by illness or injury
Statistics Sweden	Statistiska centralbyrån (SCB)	A government agency that compiles and analyses statistical data
The National Board of Health and Welfare	Socialstyrelsen (SOS)	A government agency that collects and analyses data as well as supervises health and medical services
The Swedish National Institute of Public Health	Statens folkhälsoinstitut (FHI)	A government agency that works to promote health and prevent ill health and injury, especially for population groups most vulnerable to health risks
The Swedish Social Insurance Agency	Försäkringskassan (FK)	A government agency that administers many social insurance benefits including those for working ability impairments
The Swedish Social Insurance Inspectorate	Inspektionen för socialförsäkring (ISF)	A government agency that supervises the efficiency and compliance to legislation of the social insurance system

Introduction

Disability benefit¹ is an important part of Sweden's social security system. It provides financial protection to individuals with permanent working ability impairments due to disability, injury, or illness. The benefit is managed by the Swedish Social Insurance Agency and is granted to individuals between 30 and 64 years old that have permanent working ability impairments. It can be granted full-time or part-time depending on the extent of the working ability impairment. Other social security programs exist for people in other age ranges and for those with temporary illnesses.

After old age pension, disability benefit was Sweden's largest social insurance expenditure in 2010. The payments to about 440,000 individuals cost about 46.5 billion SEK [1]. Disability benefit accounted for roughly 22% of the total expenditures of the Swedish Social Insurance Agency [2] and corresponded to circa 1.4% of Sweden's GDP [3].

The eligibility requirements for disability benefit were tightened June 1, 2008 to require that the working ability impairment be permanent. Prior to this it was possible to receive a temporary benefit for up to three years. The reform required moreover that in contrast to before, no other factors such as age or local labor market conditions can affect eligibility for the benefit.

Most of the individuals who are granted disability benefit continue receiving disability benefit until they turn 65 and receive old-age pension benefits or they pass away [4]. Since disability benefit is expensive and relatively permanent, it is important to understand who is granted the benefit. The goal of this paper is to investigate risk factors for the incidence disability benefit and the effects of the 2008 reform. This is the first study to investigate the impact of the 2008 reform on the demographics of those that received disability benefit.

¹ In this paper, the term "disability benefit" is used to refer to both disability benefit after 2003 (sjukersättning) as well as disability pension before 2003 (förtidspension).

Background

Disability benefit today

Disability benefit is an important part of Sweden's social security system. It provides economic security to individuals who have permanently impaired working ability due to disability, injury, or illness. One can be granted one quarter, half, three quarters, or whole disability benefit depending on the extent of the working ability impairment.

There are several eligibility requirements for disability benefit. First, the individual must be between 30 and 64 years old. The individual must have worked in Sweden in order to be granted the income-based benefit or reside in Sweden in order to receive the guarantee benefit. The working ability must be impaired by at least 25% in relation to all employment opportunities on the labor market. Finally, the working impairment must be permanent and have a medical cause. It must be judged that no further medical interventions or job training could affect the level of working ability. [5]

Guarantee disability benefit is granted to those who have had little or no income. The size of the benefit depends on age and how long the individual has lived in Sweden. The *income-based benefit* is circa 64% of the average of the three highest yearly incomes within a certain time frame up to a maximum amount. [5]

In 2010 about 440,000 people received payments from disability benefit from the Swedish Social Insurance Agency. These payments cost about 46.5 billion SEK which made disability benefit the largest expenditure for the Swedish Social Insurance Agency [1]. Disability benefit accounted for roughly 22% of the Swedish Social Insurance Agency's budget [2] and corresponded to circa 1.4% of Sweden's GDP [3].

Activity compensation is a corresponding benefit for individuals between 19 and 29 years old. In contrast to disability benefit, activity compensation is always time-limited and can be granted for at most three years at a time, but otherwise the eligibility requirements are the same as for disability benefit.

Sickness benefit is a temporary benefit for individuals that a working ability impairment due to injury or illness. Sickness benefit is available to everyone that works in Sweden or receives unemployment benefit. Those that do not work and are not eligible for unemployment benefit are not eligible for sickness benefit. The size of the benefit is generally larger than that for disability benefit. It is circa 80% of one's current income up to a maximum amount. Normal sickness benefit is available for up to one year with extensions available in certain cases. Usually, disability benefit is granted after a long time period with sickness benefit [6].

Possible incomes from social insurance options for a sick individual are summarized in the table below. Private insurance companies can provide additional protection for lost income. In general, individuals with higher than average monthly salaries have more financial incentives to return to work since sickness benefit and disability benefit are proportional to one's yearly salary up to a maximum amount. For an individual with low income or a high risk of being unemployed for over a year, the relatively risk free payments of disability

benefit could be more financially attractive than the risk of searching for employment on the labor market.

Table 1: Comparison of income from three possible sources during illness 2012

	Continue working or searching for work	Temporary sickness benefit	Permanent disability benefit
Employed	The average monthly salary 2010 was 28,400 SEK [7]	The normal level is roughly 80% of yearly income up to a ceiling. If one earns less than 10,600 SEK per year, one does not receive any sickness benefit. One can normally receive sickness benefit for at most one year.	Income related disability benefit is about 64% of one's previous yearly income. Disability benefit is at most about 17,500 SEK per month.
	Normal salary, some risk of becoming unemployed.	At most 22,000 SEK per month, risk to become uninsured and be forced to go back to work.	At most 17,500 SEK per month, low risk of becoming uninsured.
Unemployed	Unemployment compensation is at most 486 SEK per day which is roughly 14,580 SEK per month. One can receive unemployment compensation for at most one year.	At most 486 SEK per day which is roughly 14,580 SEK per month. If one does not receive unemployment compensation, one does not have the right to any sickness benefit. One can normally receive sickness benefit for at most one year.	Disability benefit at the guarantee level is at most 8,800 SEK per month. The amount depends on age and how long one has lived in Sweden.
	At most 14,580 SEK per month, some risk to run out of compensated days before finding work.	At most 14,580 SEK per month, risk to become uninsured and be forced to continue to search for work.	At most 8,800 SEK per month, low risk of becoming uninsured.

Table information is from the Swedish Social Insurance Agency leading documents for disability benefit and website [5], [8].

Disability benefit's history

Disability benefit has a long history in Sweden. The first national pension program was implemented in 1914. This program also protected individuals with permanently impaired working ability. The income-based supplementary pension program (ATP) was implemented in 1960 [9]. Until the 1990's the eligibility criterion for disability benefit became increasingly lenient allowing for labor market reasons as well as illness to be taken into account. In 1991 the possibility for being granted disability benefit for purely labor market reasons was removed. However, at this time, workers over the age of 60 could receive disability benefit when their unemployment benefit expired. This opportunity was, however, removed in 1997. [10]

In 2003 disability benefit was moved from the pension system to the social security system. At this point the name of the benefit and the calculation of the payments were changed but the eligibility criterion remained the same [10]. Also in 2003, the Swedish Social Insurance Agency received a letter of regulation from the government that laid a goal for reducing the number of people receiving benefits for impaired working ability. The goal was to half the number of individuals that receive the temporary sickness benefit and to also reduce the amount of individuals that are granted sickness and activity compensation by the year 2008 [11]. Since disability benefit is usually granted after a long period with the temporary sickness benefit, this goal led to a dramatic reduction in the number of newly granted disability benefit cases during this time period. In 2006 the local social insurance offices were combined to create one central social insurance agency. One of the reasons for this consolidation was to decrease the amount of regional differences in the use of sickness benefit and disability benefit that could not be explained with demographic differences by creating a more unified system [12].

In 2008 the eligibility requirements for disability benefit were tightened further. Now the working ability impairment is required to be permanently impaired with regards to the entire labor market [5]. The reform's goal was to make sickness insurance more foreseeable and to give better motivations for a return to the labor force [13]. The reform meant that the possibility for time-limited disability benefit was removed and that it was no longer possible to receive disability benefit while waiting for an adapted employment opportunity [5]. The last individuals with the time-limited benefit were removed from the system on December 31st, 2012.

Previous studies

The underlying conditions for being granted disability benefit are complex and individual. Even though the decision is to be based solely on the impaired working ability that has a medical cause, there are other factors that can affect the situation since there are no completely objective measurements for working ability.

Many studies have discussed risk factors that are correlated with the rate of newly granted cases of disability benefit. For many of these risk factors, however, it is difficult to come to a conclusion about the direction of causality. For example, the unemployment rate has been shown to be correlated positively with incidence of disability benefit [6]. Reasons for this could be that sick individuals are more likely to become unemployed or that unemployment itself could be detrimental to one's health [14]. Even if the direction of causality cannot be directly discovered with statistical methods, risk factors can still be useful for predicting the utilization of disability benefit.

Several studies have examined the effect of certain rule changes for disability benefit [6] [15] [16]. These studies have concluded that the larger restrictions during the 1990's have reduced the number of individuals that receives disability benefit in the age range targeted by the law change. However, it is unclear whether the law changes have led to an increase in employment since many individuals transitioned to other social security programs when disability benefit was limited.

Health status is an important factor when it comes to the granting of disability benefit. However, since the decision for disability benefit is based on the degree of working ability impairment and not the degree of illness, it can be difficult to apply medical studies to the topic of disability benefit. Mortality rates are commonly reported measures, but it is not clear that the disorders that cause permanent working ability impairment are the same as those that cause death and vice versa. The National Board of Health and Welfare and the Swedish National Institute of Public Health have discussed several trends within the state of public health in Sweden in their joint yearly report. Life expectancy has been increasing since 1990. Overall, mortality has decreased for the two most common causes of death, cardiovascular disease and cancer. The incidence of heart attack and stroke has decreased overall but much of the decrease is due to individuals over 65 years of age. The incidence of cancer has been increasing since 1990 but the cancer mortality rate has been decreasing. This means that there are more people living with a cancer diagnoses because of earlier diagnoses and improved health care. [17]

Another measure of population health is rates of inpatient care. Since healthcare is universally available to all residents of Sweden, social factors such as income, education and background should not theoretically affect this measure. Rates of inpatient care are however sensitive to the number of beds available at the hospitals and treatment strategies as well as the actual rates of the illnesses. It is also not clear that the disorders that cause permanent working ability impairment are the same as those that require inpatient care. Although cancer and heart disease are common causes of death, the most common diagnosis groups for newly granted disability benefit 2003-2011 were musculoskeletal (31.49%) and psychological (29.62%) disorders with the most common diagnoses being

depressive episode (7.78%) and back pain (6.96%) [18]. During the time period 2003-2010 the number of inpatients in the age range 25-64 has increased somewhat for both musculoskeletal as well as psychological disorders [19].

Although self-reported health status is highly subjective, it has the advantage of counting individuals that may not be counted in more objective measures such as mortality rates and inpatient care rates. In Sweden, there are two national surveys that investigate the health status of the residents. One is administered by Statistics Sweden (SCB:s ULF-undersökning) and the other by the Swedish National Institute of Public Health. Statistics Sweden's Survey on Living Conditions underwent a method change in 2006-2008 which means that it is difficult to compare results before and after the change even though the wording of the question did not change during this time [20]. Both surveys showed an increase in the proportion of respondents reporting a good or very good health status and a small decrease in the amount of individuals reporting bad or very bad health status over the years 2004-2011 [21] [22]. Jönsson et al. [16] found no correlation between mortality rates and the incidence of disability benefit during the period 1950-2009, but they did find a correlation between self-reported health (SCB:s ULF-undersökning) and the rates of disability benefit during the period 1975-2005, especially among the younger age groups.

The National Board of Health and Welfare and the Swedish National Institute of Public Health have also reported differences in mortality rates between individuals with different levels of education. In the age group 35-64 all of the major causes of death are most common among individuals with short educations and least common among those with long educations. The mortality rate is higher for men in all age groups including 25-44 and 45-64. The difference is mainly accounted for by an increased mortality for accidents, suicide and alcohol-related causes for the younger age group and an increased mortality for cardiovascular disease and alcohol-related causes for the older age group. [17] In the Swedish National Institute of Public Health's survey on public health during the time period 2004-2011, however, men consistently reported a better health status than women. Individuals with a short education reported the worst health status while individuals with a long education reported the best health status. [22]

Regional differences in social insurance have been a topic of discussion for a long time. Provinces in the north of Sweden have historically used more sickness benefit and disability benefit than average (1970-2001). This is correlated with the higher unemployment rates of these sparsely populated provinces [23]. The regional differences in rates of sickness benefit and disability benefit that are not explained by demographic differences have been interpreted as possible unfair implementations of the law. The local social insurance offices were unified in 2006 in order to reduce the amount of regional differences [12]. The Swedish Social Insurance Inspectorate has found evidence for some unexplained regional differences in the use of disability benefit even in recent years. Although the absolute differences have decreased due to the decrease in the total number of granted cases of disability benefit, the relative regional differences were larger in 2003 and 2008-2010. The observed regional differences during the studied time period have a changing regional pattern and a weak correlation to the unemployment rates. The differences are interpreted as a sign of uncertainty after rule changes rather than local trends. [24]

Some of these unexplained regional differences could be due to local variations in norms and attitudes regarding sickness benefit and disability benefit. Lindbeck et al [25] found evidence for the presence of regional differences in the utilization of sickness benefit between different neighborhoods in Sweden. After controlling for many observable factors, regional differences were found by observing the behavior of immigrants who had moved to certain neighborhoods and adopted the local rates for the utilization of sickness benefit. The Swedish Social Insurance Agency has investigated attitudes regarding social insurance with a national survey in 2005. The results of this survey were able to explain some of the regional variation in the use of sickness benefit and disability benefit that was not able to be explained with demographic differences alone. In the Swedish Social Insurance Agency's regression model that included factors about age, education, local labor market, percentage of immigrants, and the results of three of the survey questions, the three attitude measurements had the second most explanatory power after the average age of the municipality [26].

Several studies have investigated the connection between financial incentives and rates of disability benefit [27] [28] [29]. Individuals in some situations may have a choice of income security programs that they may be eligible for. Although disability benefit tends to give the lowest payoff, it has the lowest risk of becoming uninsured (see table 1). Less than one percent of the population with disability benefit or activity compensation returned to the labor force each year between 1995 and 2005 [4].

Data

Data for the whole population of Sweden is from Statistics Sweden's (SCB) education and research database. Population information for individuals aged 30-64 was used from the years 2003 – 2011. The residents of Sweden were treated as a new individual each year. (total 38,371,085 individuals)

The Swedish Association of Local Authorities and Regions' (SKL) municipality grouping was used to group Sweden's 290 municipalities into ten groups based on the type of local labor market. The definitions from 2011 was used because they are based on data from 2008 [30] and it is more descriptive than the previous grouping. The names of the municipality groups were translated as follows:

Table 2: SKL regions

English	Swedish
SKL01 Metropolitan municipalities (3 municipalities)	SKL01 storstäder (3 kommuner)
SKL02 Suburban municipalities (38 municipalities)	SKL02 förortskommuner till storstäder (38 kommuner)
SKL03 Large cities (31 municipalities)	SKL03 större städer (31 kommuner)
SKL04 Suburban municipalities to large cities (22 municipalities)	SKL04 förortskommuner till större städer (22 kommuner)
SKL05 Commuter municipalities (51 municipalities)	SKL05 pendlingskommuner (51 kommuner)
SKL06 Tourism and travel industry municipalities (20 municipalities)	SKL06 turism- och besöksnäringkommuner (20 kommuner)
SKL07 Manufacturing municipalities (54 municipalities)	SKL07 varuproducerande kommuner (54 kommuner)
SKL08 Sparsely populated municipalities (20 municipalities)	SKL08 glesbygdskommuner (20 kommuner)
SKL09 Municipalities in densely populated regions (35 municipalities)	SKL09 kommuner i tätbefolkad region (35 kommuner)
SKL10 Municipalities in sparsely populated regions (16 municipalities)	SKL10 kommuner i glesbefolkad region (16 kommuner)

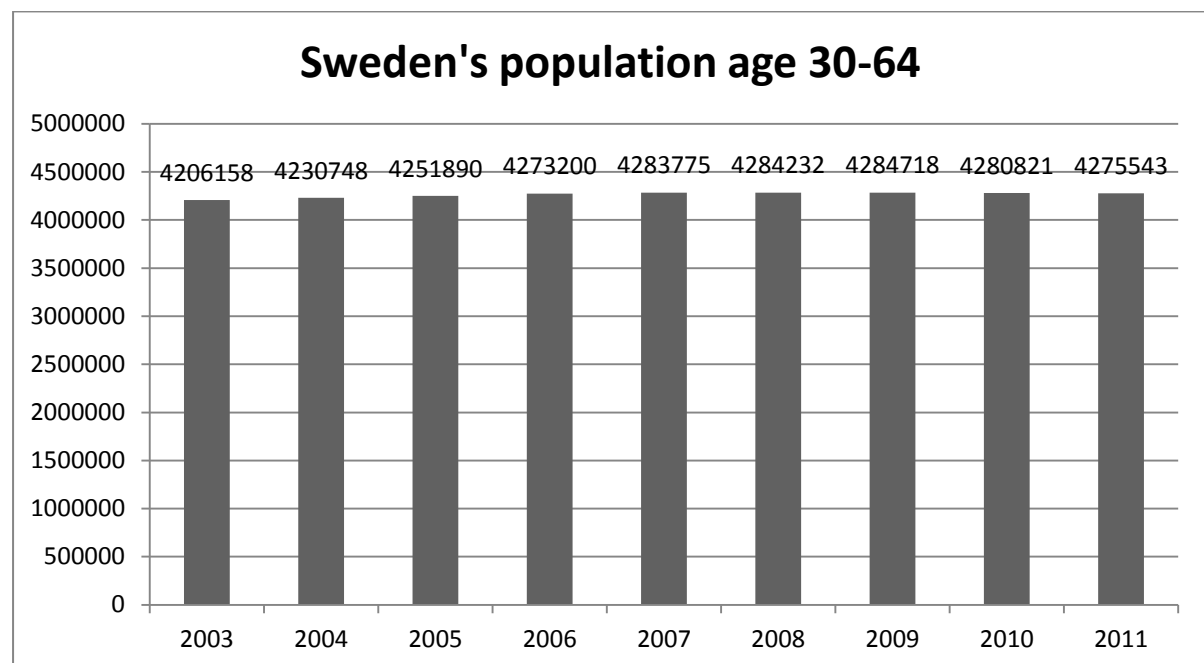
Information about those that were granted disability benefit is from the Swedish Social Insurance Agency's database STORE. This paper focuses on the incidence of disability benefit. The data studied here describes the newly granted cases of disability benefit during the time period. Newly granted cases of disability benefit do not include individuals that transferred from activity compensation to disability benefit when they reached the 30 year age limit or individuals that transferred to a new period with disability benefit after a period with time-limited disability benefit. The list of newly granted cases of disability benefit does, however, include individuals that had had disability benefit or activity compensation in the past but had entered the labor market for any period of time before being granted disability benefit again.

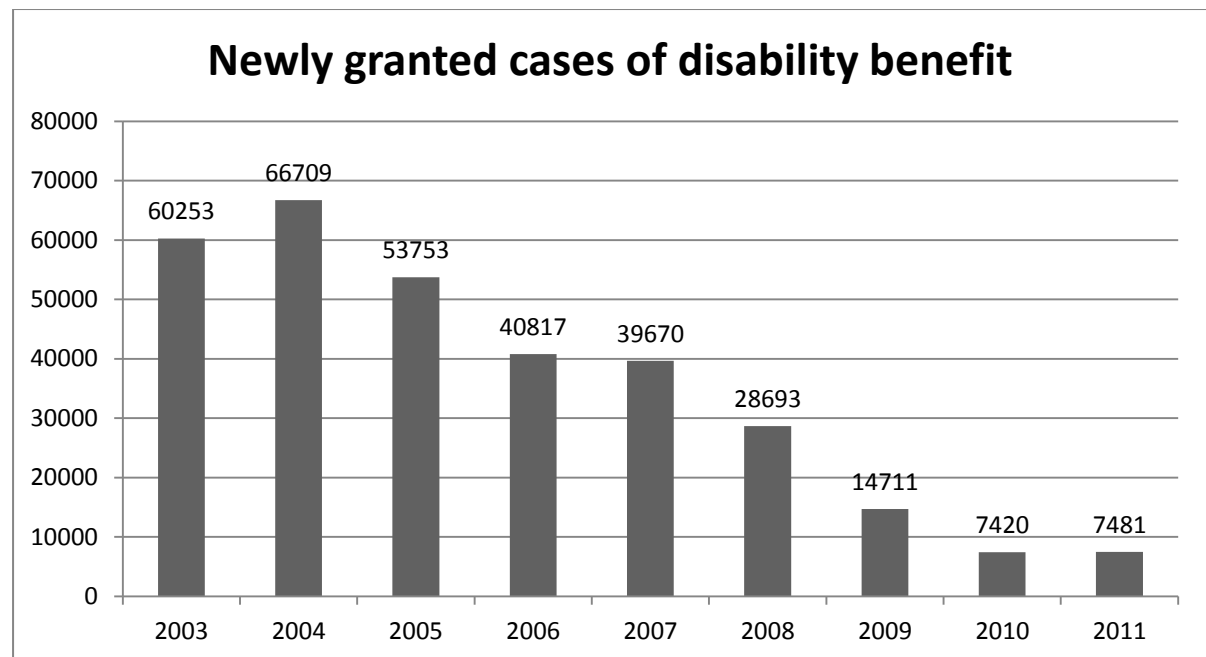
Individuals outside the age range 30-64 were removed from this data set (2700 individuals) as well as individuals that were living outside of Sweden or were missing information for municipality (2942 and 6919 individuals respectively). After this process, 319,507 individuals remain in the list of individuals receiving disability benefit during the time period. An individual can appear several times in this list, but each decision is treated as a different individual in the analysis.

Descriptive Statistics

Number of cases of disability benefit

During the nine year period studied, the population of Sweden has remained rather stable with a small increase between 2003 and 2009. The number of newly granted disability benefit cases has decreased drastically since 2004. The decrease in the number of newly granted cases of disability benefit during the time period may have several explanations including the letter of regulation in 2003, the reorganization of the Social Insurance Agency in 2006 as well as the rule change in 2008.

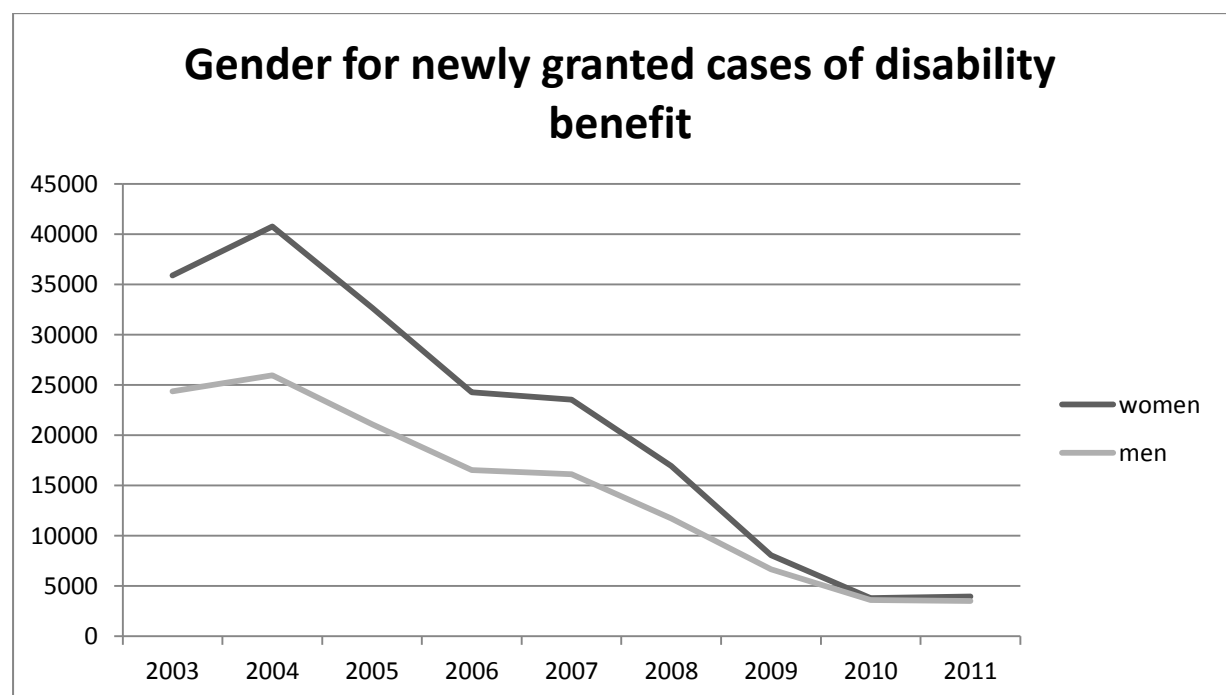




Gender

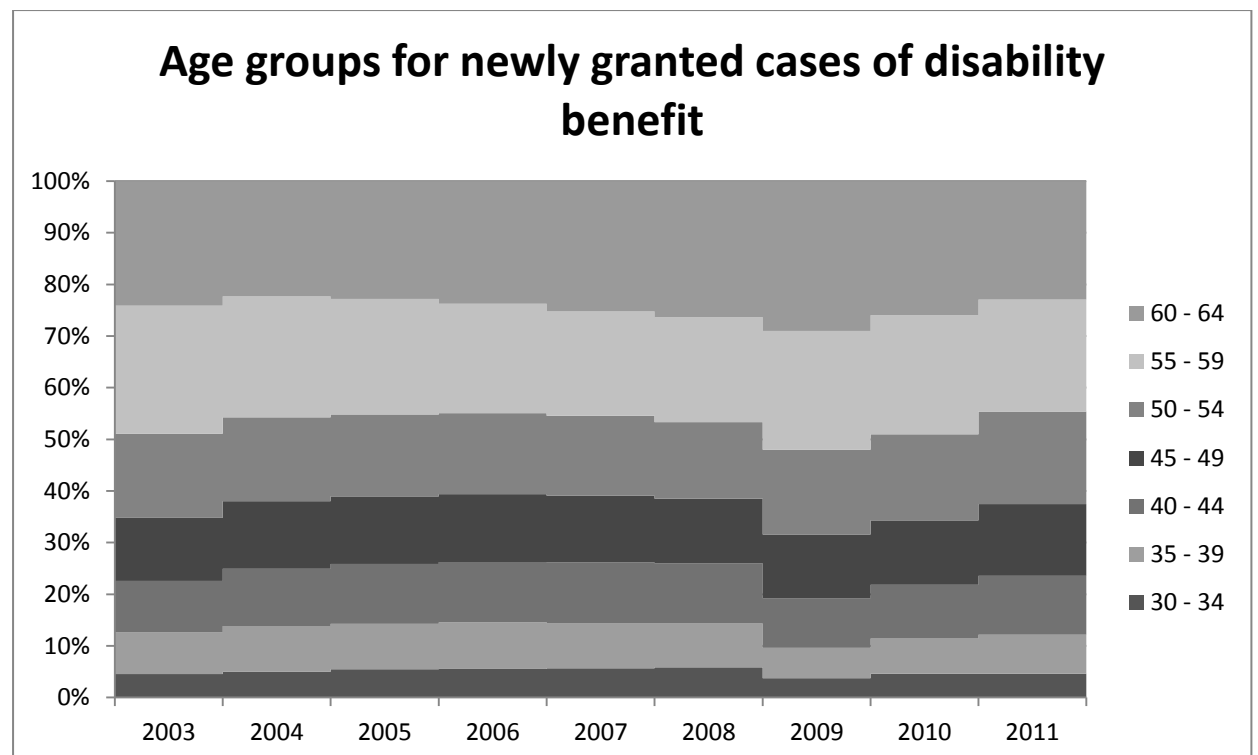
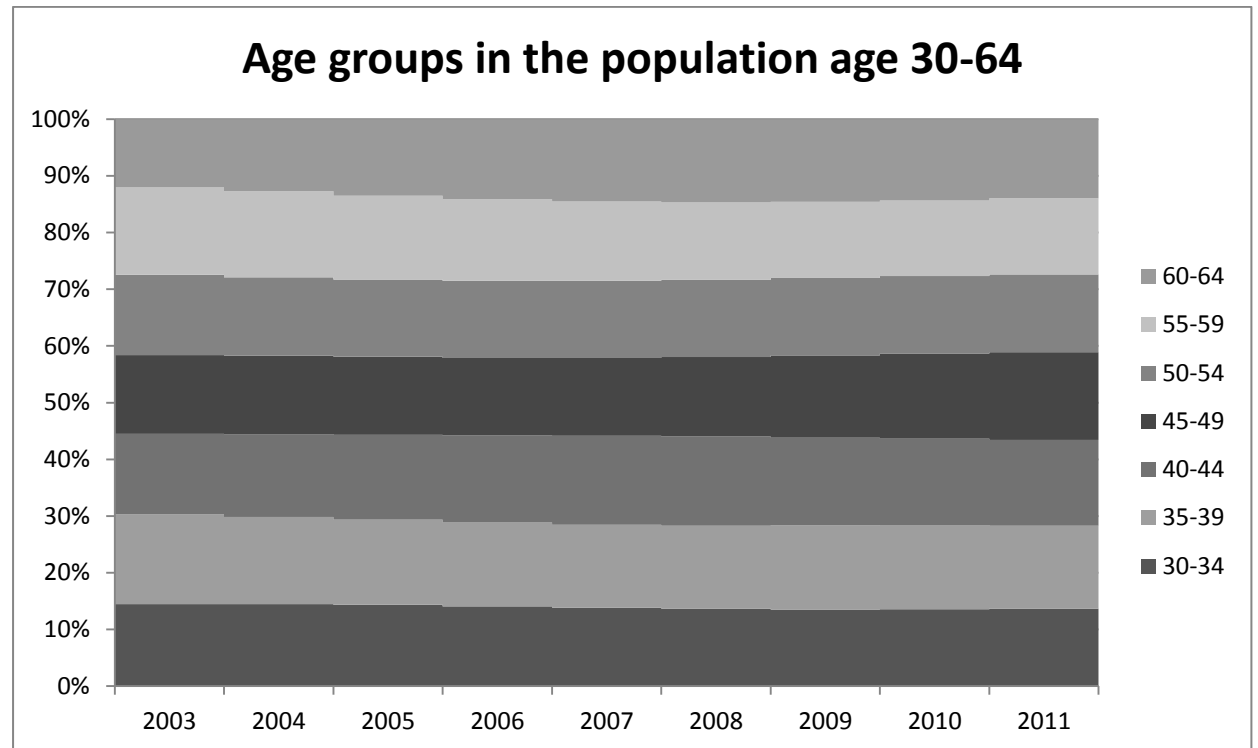
The percentage of men in the population aged 30-64 is relatively stable during the time period. Men made up 50.7% of the population 2003-2007 and 50.6% of the population 2008-2011.

Women are overrepresented with regards to newly granted cases of disability benefit. There is, however, a small decrease in the proportion of women receiving disability benefit after 2008.



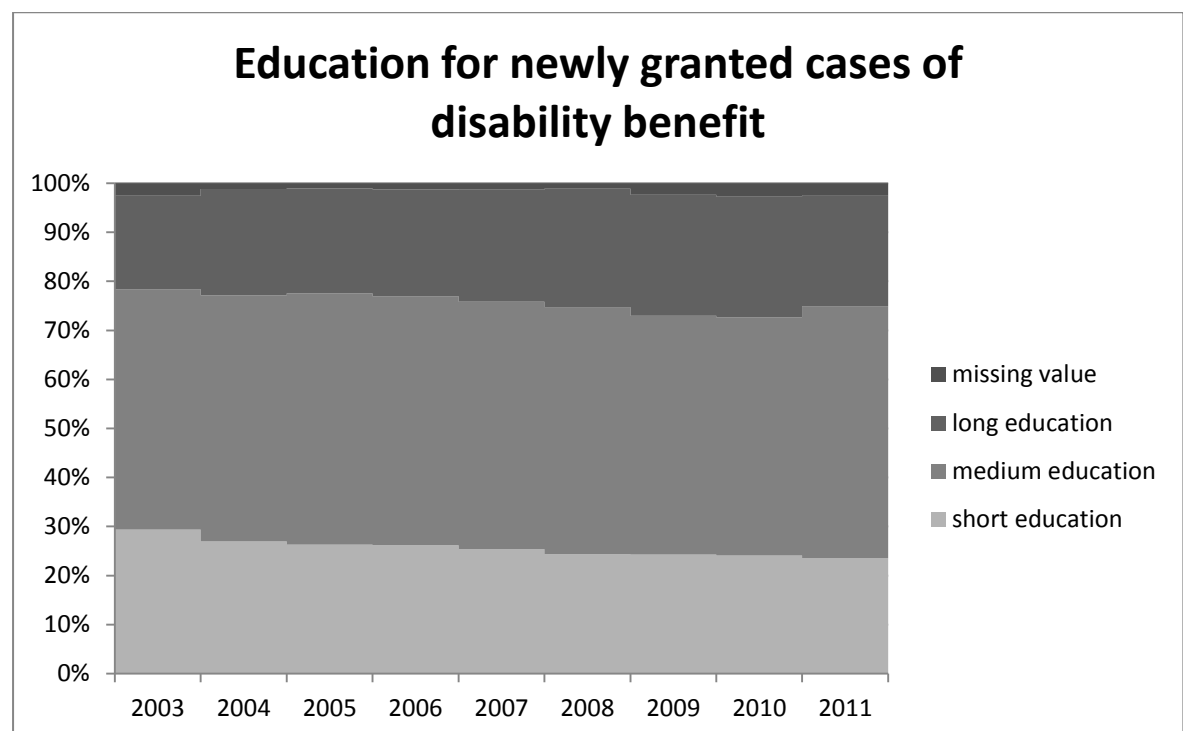
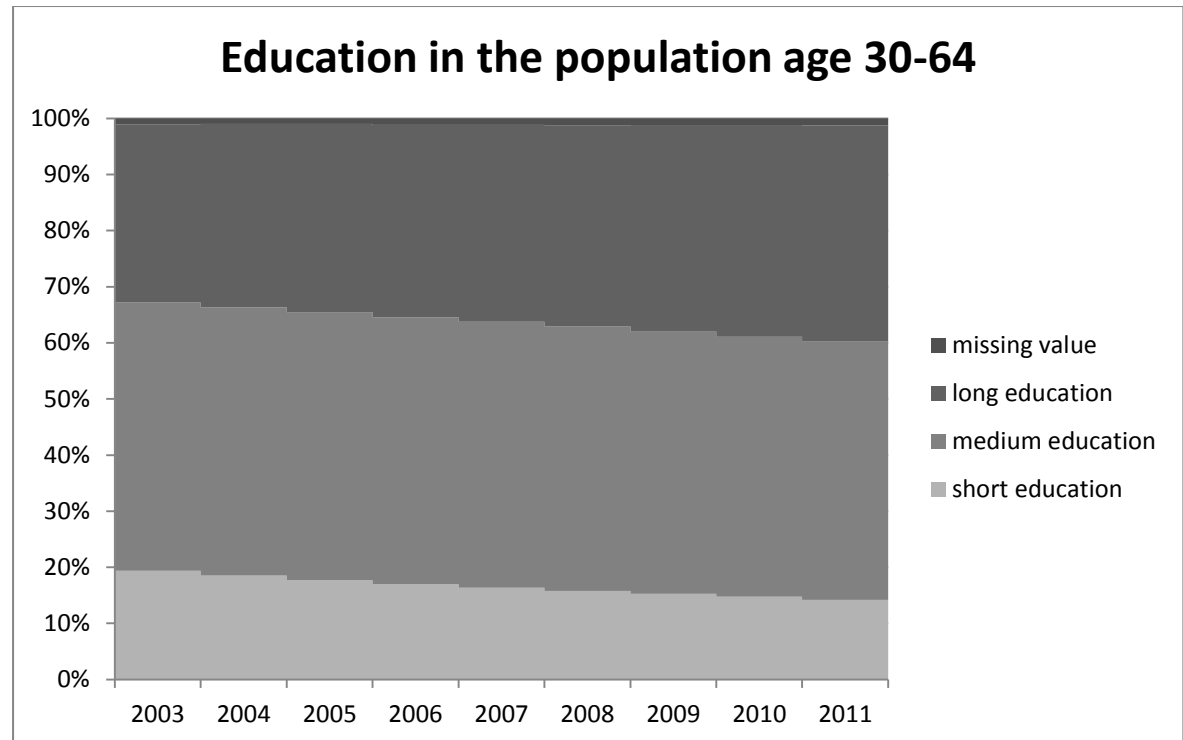
Age group

The age structure of the population is very stable during the time period. The older age groups are overrepresented in the incidence of disability benefit while the younger age groups are underrepresented.



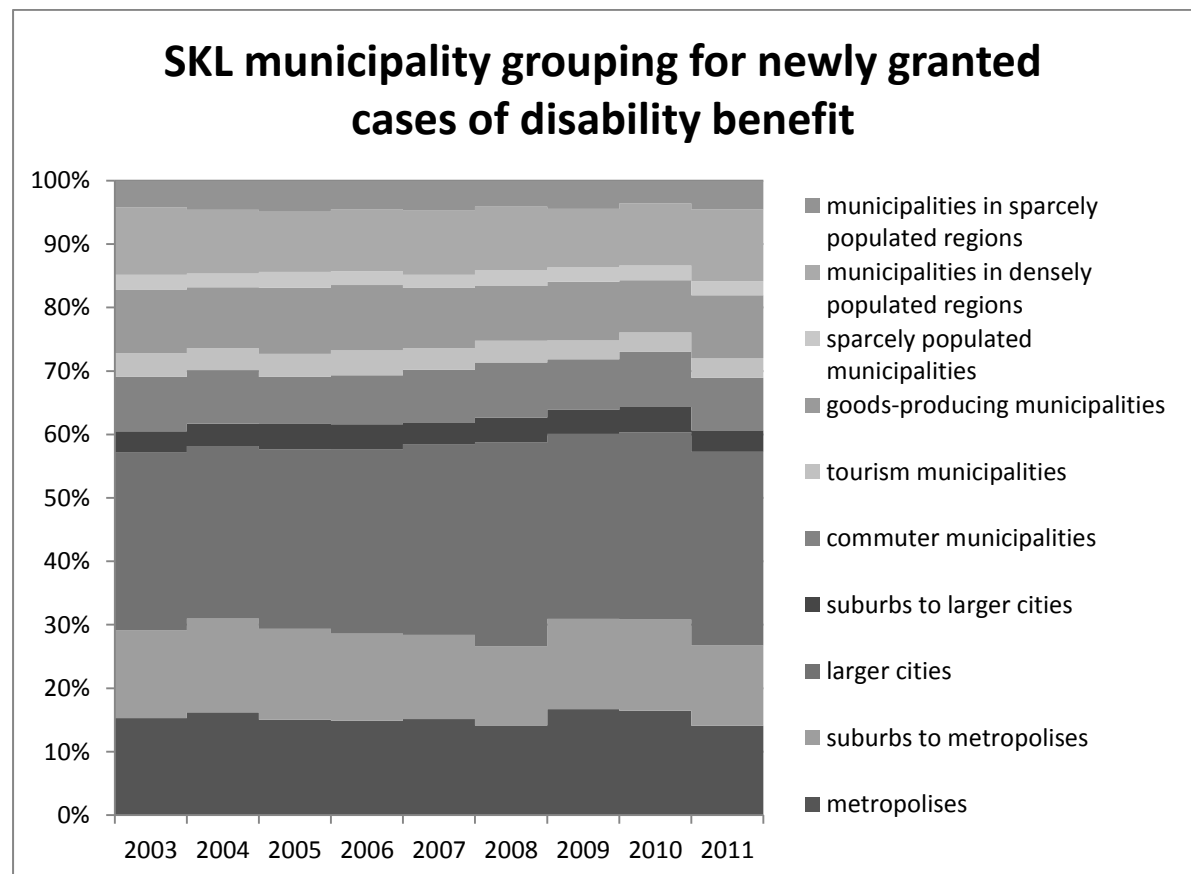
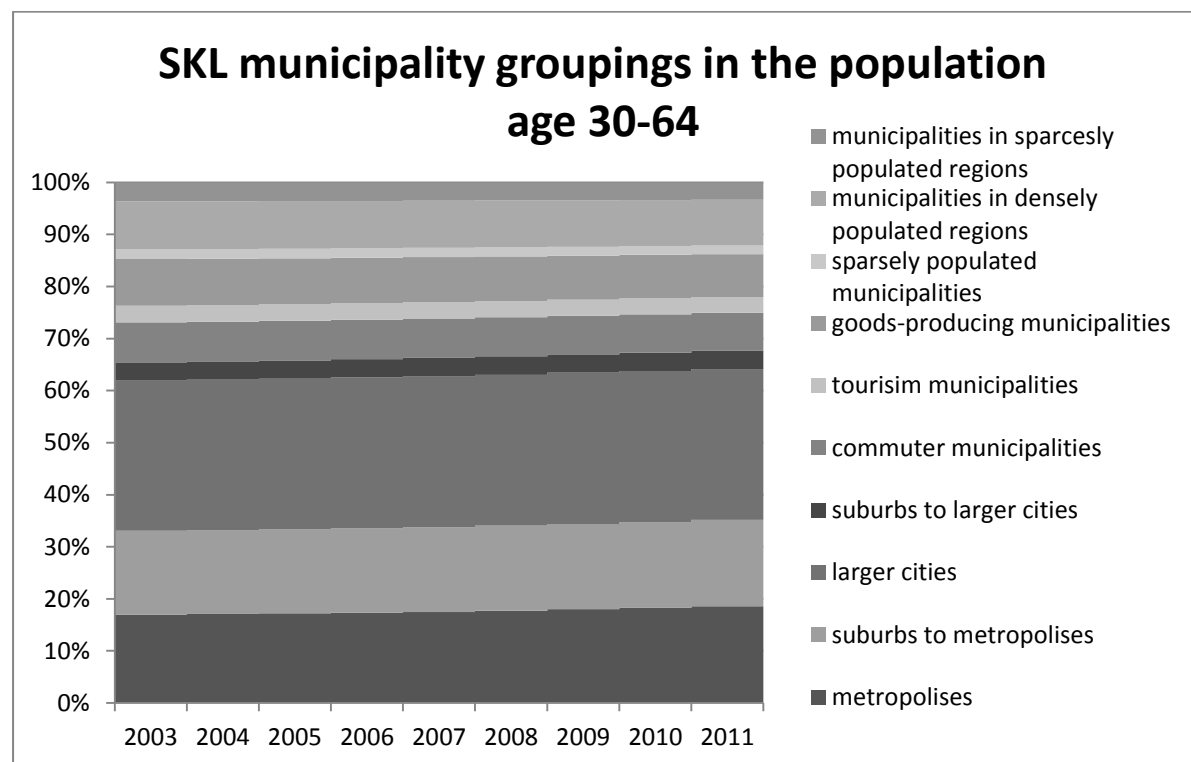
Education

During the time period studied, the proportion of people with longer educations has increased while the proportion of people with shorter educations has decreased. Individuals with short educations are overrepresented while people with long educations are underrepresented in the incidence of disability benefit.



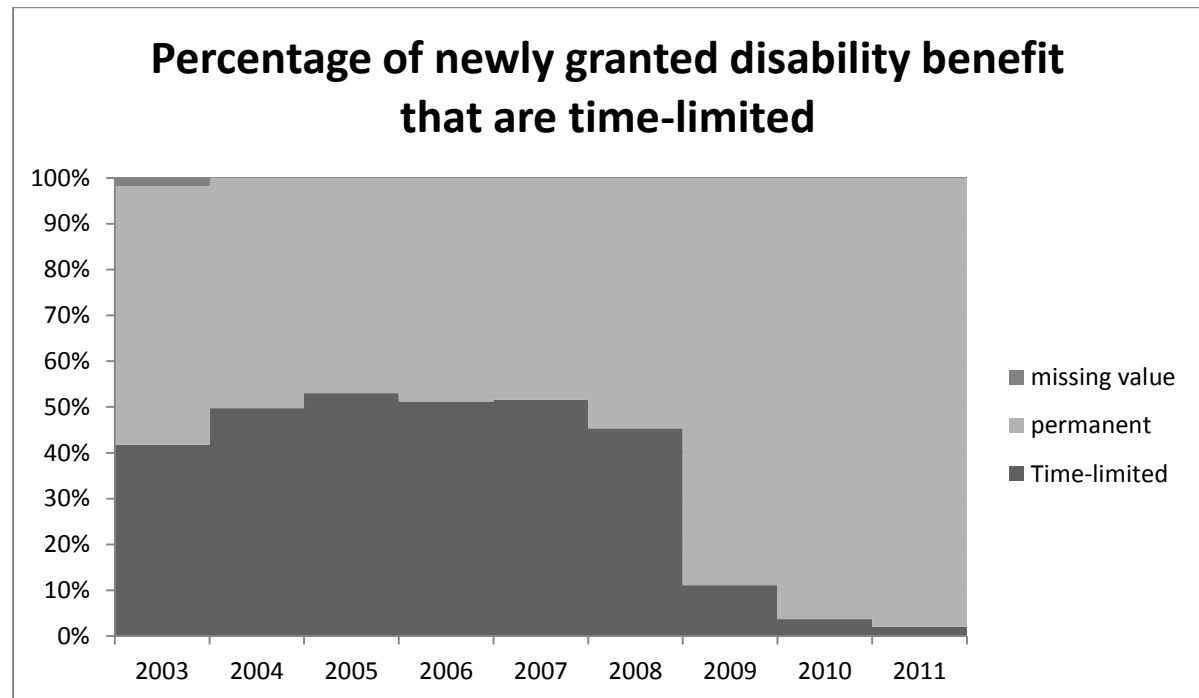
SKL region

The populations of the municipality groups have been relatively stable during the studied time period.



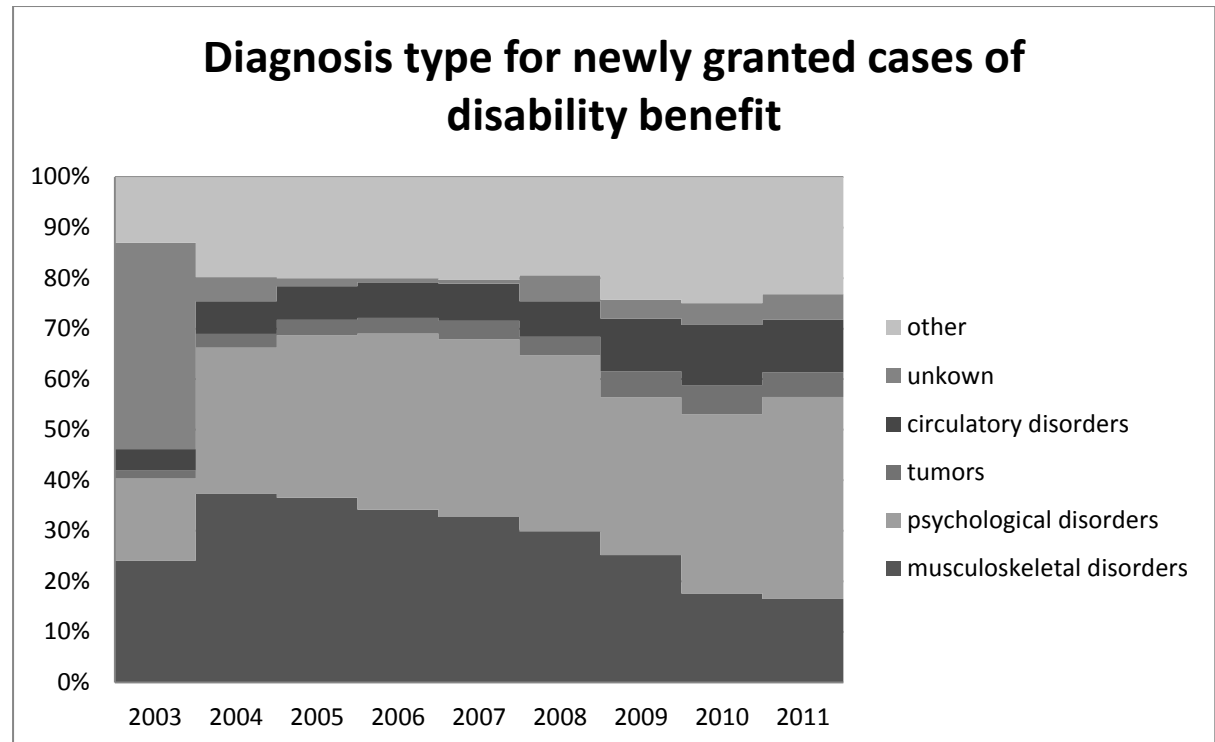
Time-limited disability benefit

Before the law change in 2008, 40 to 50 percent of newly granted cases of disability benefit were time limited. After the rule change only a few time limited cases were granted using special rules for the transitional period. Individuals that went over to permanent disability benefit after a period with time limited disability benefit are not included in these statistics since they are not regarded as having a newly granted case of disability benefit.



Diagnosis

The graph below describes the main diagnosis for the newly granted cases of disability benefit. The percentage of newly granted cases of disability benefit due to a psychological disorder increased during the studied time period while the percentage of cases related to musculoskeletal disorders decreased.



Method

A logistic regression model was used in order to study the effects of the independent variables on the binary dependent variable. The independent variables were a series of dummy variables that described the individuals' gender, region, age group, education, as well as a dummy variable for the individual appearing after the rule change. There was also a variable that described which year during the period the data belonged to. The dependent variable was a binary variable taking the values 1 for receiving disability benefit and 0 for not receiving disability benefit during the year in question. Interaction variables were also included for the interaction between the dummy variable for after the rule change with each of the demographic variables.

Table 3: Explanatory variables

Description	Variable name
	Intercept
Year (1 variable) This variable takes the values in the range 0 - 8	Year
Dummy variable for sex (1 variable) Woman = 1, Man = 0	genderDummy
Dummy variables for SKL region (9 variables) See table 2 for description.	SKL02Dummy
	SKL03Dummy
	SKL04Dummy
	SKL05Dummy
	SKL06Dummy
	SKL07Dummy
	SKL08Dummy
	SKL09Dummy
Dummy variables for age group (6 variables)	SKL10Dummy
	30Dummy
	35Dummy
	40Dummy
	45Dummy
	50Dummy
Dummy variables for education level (3 variables)	55Dummy
	shortEduDummy
	medEduDummy
Dummy variable for after rule change (1 variable) = 1 for 2009, 2010, and 2011 = 0 otherwise	longEduDummy
	afterDummy

Interaction variables with afterDummy for all variables (20 variables)	shortEduDummy*afterDummy
	medEduDummy*afterDummy
	longEduDummy*afterDummy
	30Dummy*afterDummy
	35Dummy*afterDummy
	40Dummy*afterDummy
	45Dummy*afterDummy
	50Dummy*afterDummy
	55Dummy*afterDummy
	SKL02Dummy*afterDummy
	SKL03Dummy*afterDummy
	SKL04Dummy*afterDummy
	SKL05Dummy*afterDummy
	SKL06Dummy*afterDummy
	SKL07Dummy*afterDummy
	SKL08Dummy*afterDummy
	SKL09Dummy*afterDummy
	SKL10Dummy*afterDummy
	genderDummy*afterDummy
	year*afterDummy

Results

BIC tests confirm that the full model should be used.

The *Bayesian information criterion* (BIC) criterion is a method for selecting a model from a set of possible models. In this case the BIC criterion was used to investigate whether all the groups of parameters contributed in a meaningful way to the regression model. The model with the lowest BIC value is considered to have the best trade-off of extra parameters versus explanatory power.

BIC value = $-2\log(L) + k \cdot \log(n)$, where:

L = the maximized value of the likelihood function for the estimated model

n = the number of observations (individuals)

k = the number of parameters

The number of observations was 38,371,085 so $\log(n) = 17.46$

Table 4: BIC criterion for possible models

Model	- 2logL	BIC value = -2log(L)+k*log(n)
full	3,459,357.2	3,460,090.6
no SKL	3,460,454.5	3,460,873.6
no interactions	3,461,128.5	3,461,512.7
no gender	3,474,984.7	3,475,683.2
no education	3,478,717.8	3,479,346.5
no age	3,519,576.8	3,520,100.7

The 2008 reform did have an effect on the demographics of the newly granted cases of disability benefit.

To investigate whether the 2008 reform affected which groups were more likely to be granted disability benefit, I tested if the vector of 19 interaction variables was jointly equal to zero using a likelihood ratio (LR) test.

A LR-test compares the fit of two models. Here, the restricted model with all interaction variables equal to zero is compared to the full model.

The test statistic for the LR-test is:

$$D = -2\log(L)(\text{restricted model}) - (-2\log(L)(\text{full model}))$$

Where L = the maximized value of the likelihood function for the estimated model.

The test statistic D has approximately a chi-squared distribution with degrees of freedom = (number of parameters in the full model) – (number of parameters in the restricted model)

$$-2\log(L) (\text{full model}) = 3459357.2$$

$$-2\log(L) (\text{restricted model no interactions}) = 3461128.5$$

$$-2\log(L) (\text{restricted}) - (-2\log(L)(\text{full})) = 1771.3 > 50.80 = \text{p-value of chi squared}(19 \text{ df}) \text{ for significance } .0001$$

So the null hypothesis that the 2008 reform had no effect on the demographics of the individuals that are granted disability benefit is rejected.

Interpretation of parameter estimates

Since a logistic regression model was used, the estimated parameters have an effect on the odds ratio for receiving disability benefit. The regression model is:

$$\text{logit}(p) = \log(p/(1-p)) = \beta_0 + \beta_1 * \mathbf{x1} + \dots + \beta_k * \mathbf{xk}$$

$$\text{odds ratio} = (p/(1-p)) = \exp(\beta_0 + \beta_1 * \mathbf{x1} + \dots + \beta_k * \mathbf{xk})$$

where $\beta_0 \dots \beta_k$ are the coefficients for the variables $\mathbf{x1} \dots \mathbf{xk}$

Therefore the exponential effect of each parameter $\text{Exp}(\beta_i)$ is multiplied to the odds ratio $(p/(1-p))$.

However, since the probability of being granted disability benefit is small, the odds ratio is approximately the same as the probability. For example, $\text{Exp}(\text{Estimate})$ for the genderDummy variable is 1.599 means that the risk to be granted disability benefit is roughly 59.9% higher for a woman than for a man with all the other parameters the same.

Year

Parameter	Exp(Estimate)	p-value for coeff. = 0
year	0.855901	<.0001
year*afterDummy	0.809936	<.0001
afterDummy	3.353149	<.0001

The probability of being granted disability benefit decreased during the time period.

The chart below describes the exponent of the combined effect of the three year parameters by year.

2003	2004	2005	2006	2007	2008	2009	2010	2011
1	0.85591	0.73257	0.62701	0.53666	0.45934	0.37214	0.25793	0.17884

Gender

Parameter	Exp(Estimate)	p-value for coeff. = 0
genderDummy	1.59887459	<.0001
genderDummy*afterDummy	0.76383766	<.0001

Women were more likely to receive disability benefit compared to men during the time period. After the reform, women were still more likely to receive disability benefit than men, but the difference between the sexes decreased.

SKL Region

Parameter	Exp(Estimate)	p-value for coeff. = 0
SKL02Dummy	0.89735835	<.0001
SKL03Dummy	1.00974720	0.1029
SKL04Dummy	0.99885066	0.9167
SKL05Dummy	1.01399705	0.0888
SKL06Dummy	1.04143545	0.0002
SKL07Dummy	1.02091573	0.0073
SKL08Dummy	1.13292185	<.0001
SKL09Dummy	1.02788162	0.0003
SKL10Dummy	1.18317322	<.0001
SKL02Dummy*afterDummy	1.00036607	0.9870
SKL03Dummy*afterDummy	1.03179500	0.1013
SKL04Dummy*afterDummy	1.02788162	0.4363
SKL05Dummy*afterDummy	1.01928357	0.4698
SKL06Dummy*afterDummy	0.85598708	<.0001
SKL07Dummy*afterDummy	0.95284789	0.0587
SKL08Dummy*afterDummy	1.03066065	0.4862
SKL09Dummy*afterDummy	0.99859099	0.9548
SKL10Dummy*afterDummy	0.96666817	0.3116

The covariates for the various SKL regions are generally small which means that there was little effect of what type of area one lived in. The three types of areas that had the most influence on the probability of being granted disability benefit are suburban municipalities that had a lower frequency as well as sparsely populated municipalities and municipalities in sparsely populated regions which had a higher frequency of disability benefit compared to the rates in the metropolitan municipalities.

Region is a statistically significant factor for newly granted cases of disability benefit.

To investigate whether where one lives in the country is significant when it comes to the probability of being granted disability benefit, I test whether the SKL variables are jointly equal to zero using a LR test

$$-2\log(L) \text{ (full model)} = 3459357.2$$

$$-2\log(L) \text{ (restricted model no SKL regions)} = 3460454.5$$

$$-2\log(L) \text{ (restricted)} - (-2\log(L) \text{ (full)}) = 1097.3 > 50.80 = \text{p-value of chi squared(19 df) for significance .0001}$$

So the null hypothesis that region does not have a statistically significant effect on disability benefit is rejected. This result, however, does not imply that municipality had an important effect on disability benefit since the parameter estimates are small.

Age

Parameter	Exp(Estimate)	p-value for coeff. = 0
30Dummy	0.23119356	<.0001
35Dummy	0.35148087	<.0001
40Dummy	0.45339118	<.0001
45Dummy	0.55421643	<.0001
50Dummy	0.68004249	<.0001
55Dummy	0.88161485	<.0001
30Dummy*afterDummy	0.77763346	<.0001
35Dummy*afterDummy	0.74475498	<.0001
40Dummy*afterDummy	0.86260362	<.0001
45Dummy*afterDummy	0.88629981	<.0001
50Dummy*afterDummy	1.01958940	0.3122
55Dummy*afterDummy	1.06353684	0.0004

The probability of being granted disability benefit increases with age during the time period. This pattern was strengthened after the 2008 reform.

Education

Parameter	Exp(Estimate)	p-value for coeff. = 0
shortEduDummy	0.81131410	<.0001
medEduDummy	0.66684343	<.0001
longEduDummy	0.41528095	<.0001
shortEduDummy*afterDummy	0.66884696	<.0001
medEduDummy*afterDummy	0.62575272	<.0001
longEduDummy*afterDummy	0.65711253	<.0001

The probability of being granted disability benefit decreases with longer education, but is highest in the group who is missing education information in the database. This pattern remained after the 2008 reform but with an increased overrepresentation of individuals with a short education and an increased underrepresentation of individuals with a long education.

Discussion

During the studied time period there was a drastic decrease in the number of individuals that were granted disability benefit. This decrease can have many different factors involved. The underlying conditions for being granted disability benefit are complex and individual and there are no objective means for measuring an individual's working ability.

The regression results show that the 2008 reform did have a statistically significant effect on the demographics of the individuals who were granted disability benefit. After the reform women were less overrepresented, the older age groups were more overrepresented, and people with short educations were more overrepresented. Although the variables for SKL regions together were statistically significant, their coefficients were rather small and the group of variables had the least amount of explanatory value compared to the variables for age, education, gender and the interaction variables.

Many other factors can influence the rates of individuals being granted disability benefit. An important aspect is the health status of the applicant. The most common diagnosis groups for individuals being granted disability benefit during the time period were musculoskeletal and psychological disorders. These diagnoses are difficult to objectively measure in the population. The two surveys about self-reported health from Statistics Sweden and the Swedish National Institute of Public Health both reported a small decrease in the number of people reporting bad health during the time period, but no trends as strong as the decrease in the number of individuals granted disability benefit.

There are no reliable statistics over the individuals that had applied for, but were denied disability benefit during the studied time period. Therefore, the changes in the demographics of the individuals that were granted disability benefit could be a reflection of a difference in the demand for the benefit. Financial incentives as well as public attitudes towards social insurance can also influence an individual's decision to apply for a certain benefit.

Disability benefit is the Swedish Social Insurance Agency's most expensive benefit and it permanently removes individuals from the labor market. Although there are many factors involved with an individual's decision to apply for the benefit and it is a subjective judgment from the Social Insurance Agency that decides if the benefit will be granted, it is important to continue to study the impacts of changes to the laws and their implementations.

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