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Allowed and Rejected Disability Insurance Applicants**

Andreas Ravndal Kostøl
Magne Mogstad

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Andreas Ravndal Kostøl

*Statistics Norway,
University of Bergen and IZA*

Magne Mogstad

*University of Chicago,
Statistics Norway, NBER and IZA*

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

Earnings, Disposable Income, and Consumption of Allowed and Rejected Disability Insurance Applicants^{*}

Two key questions in thinking about the size and growth of the disability insurance program are to what extent it discourages work, and how valuable the insurance is to individuals and families. These questions motivate our paper. We begin by describing the earnings, disposable income and consumption of awarded and rejected DI applicants, before and after the disability onset and the allowance decision. Next, we discuss how these descriptive results can be interpreted through the lens of alternative empirical approaches. Our analysis uses a Norwegian population panel data set with detailed information about every individual and household.

JEL Classification: I38, J62, H53

Keywords: disability insurance, labor supply, benefit substitution, disposable income

Corresponding author:

Andreas Ravndal Kostøl
Statistics Norway (SSB)
PB 8191 Dep.
0033 Oslo
Norway
E-mail: kos@ssb.no

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Over the past 50 years, disability insurance (DI) rolls have risen dramatically in many OECD countries. In the U.S., the participation rate has increased from less than 1% to over 5% of the adult population. In many European countries, the increases are even more striking, from 1% to 7% in the U.K and from 2% to almost 10% in Norway.

Two key questions in thinking about the size and growth of the DI program are to what extent it discourages work, and how valuable the insurance is to individuals and families. These questions motivate our paper. We begin by describing the earnings, disposable income and consumption of awarded and rejected DI applicants, before and after the disability onset and the allowance decision. Next, we discuss alternative interpretations of these descriptive results, either through the lens of the approach taken in [Bound \(1989\)](#) or as a difference-in-differences analysis. The key to our study is that we can link a number of data sources from Norway, providing a population panel data set with detailed information about every individual and household.

1 The disability insurance program

The Norwegian disability insurance (DI) program¹ is designed to provide partial earnings replacements to all workers under the full retirement age who are unable to work because of a medically determined physical or mental impairment that has lasted for at least a year. The program also provides benefits to individuals who have a permanent partial disability, allowing them to combine disability benefits and part-time earnings. The level of DI benefits received is determined using a formula based on an individual's earnings history, and the proportion of income replaced is decreasing with past earnings so that low-wage workers replace a larger fraction of their earnings than do high-wage workers.

When an individual submits an application for DI benefits, it is reviewed by disability examiners. These examiners take into account health status, age, education, and work experience as well as the transferability of the applicant's skills. If the examiner concludes that the applicant cannot be expected to engage in any substantial gainful activity, a disability award is made. During the period we consider, a majority of claims were awarded by the disability examiners. If the DI claim is denied, the individual may appeal the decision or reapply at a later time.

2 Data and sample selection

Our analysis uses several data sources, which we can link through unique identifiers for individuals and households. Taken together, they provide a population panel data set with information for

¹We refer to [Kostol and Mogstad \(2014\)](#) for a detailed description of the Norwegian DI program.

every individual and household about their demographic characteristics (including age, gender, and number of children), disability application process (such as disability onset, impairment, allowance and rejection decisions), and socio-economic data (including education, earnings, cash transfers, disposable income, and consumption measures). Details about the data sources and each of the variables are given in the appendix.

We consider individuals who apply for DI benefits during the period 1998-2004. This sample restriction allows us to observe applicants and their families for at least five years before and after the allowance decision. We exclude individuals who were older than 62 years at the allowance decision. The reason for this age restriction is to avoid program substitution between DI and old-age retirement schemes. Following [von Wachter, Song and Manchester \(2011\)](#), our main analysis excludes rejected applicants who reapply within ten years of their denied DI claim. This sample restriction helps in interpreting the changes in earnings over time, as denied applicants who reapply have incentives to stay out of the labor force to signal disability. In the appendix, we show that our main findings are robust to this sample restriction. The appendix also documents the key characteristics of our sample of awarded and rejected applicants.

3 Graphical evidence

Figure 1 provides a descriptive look at the data by plotting economic outcomes of awarded and rejected DI applicants, before and after the allowance decision. In the appendix, we provide figures which compare the economic outcomes before and after disability onset. The trends are broadly similar.

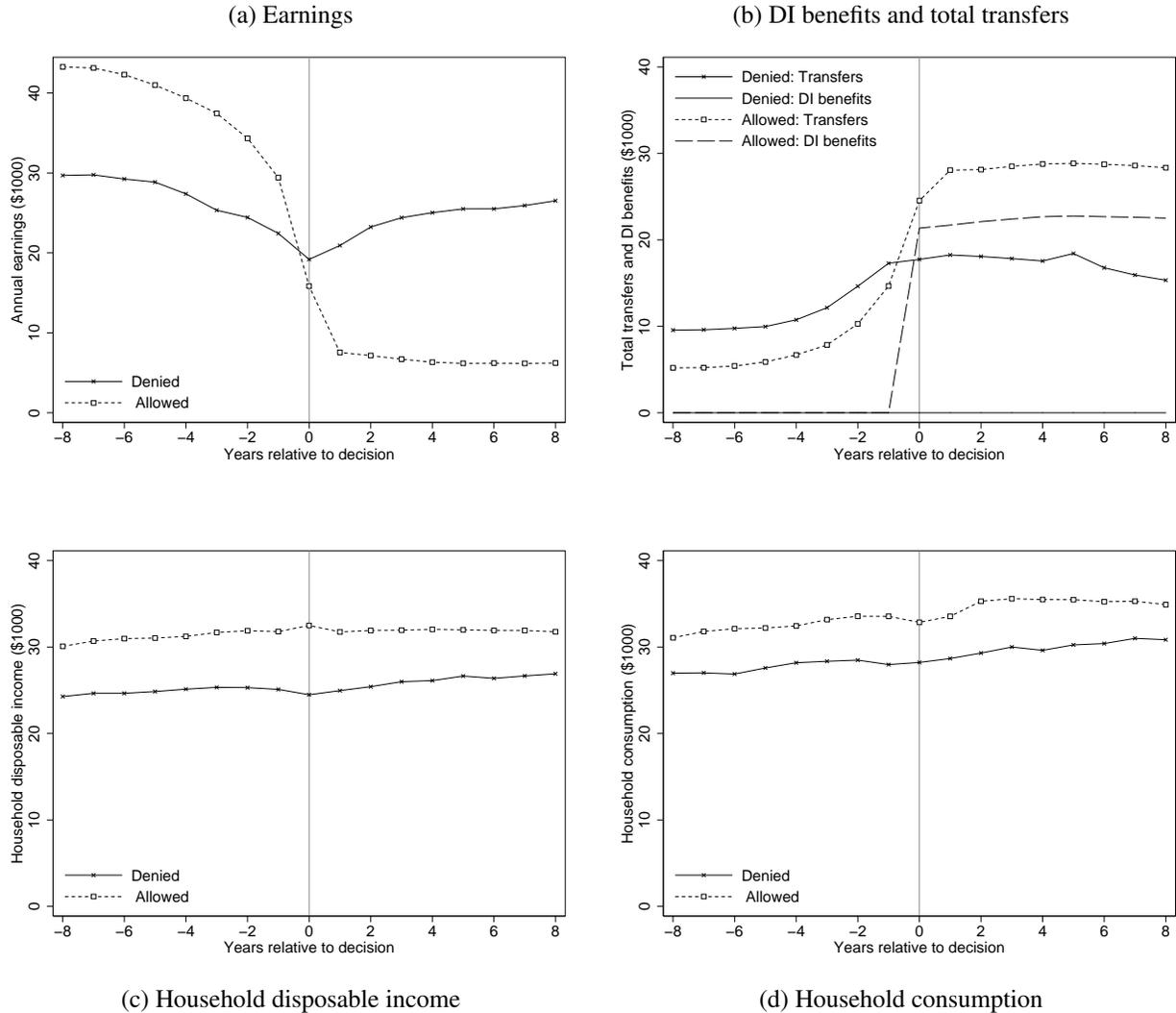
Graph (a) displays annual earnings of awarded and rejected applicants. Prior to the allowance decision, those who are awarded benefits have higher earnings than their denied counterparts. By the year of decision, earnings of awarded and denied individuals are fairly similar. Five years after the decision, average earnings of those allowed is \$6,200 while average earnings of those denied is \$25,500. Differences in earnings between those awarded and those denied emerge rapidly, and are quite stable 3-5 years after the decision.

In graph (b), we show yearly DI benefits and total cash transfers (including DI benefits) of awarded and rejected DI applicants. On average, awarded applicants receive \$22,000 in DI benefits. However, rejected applicants are more likely to apply for and get on other transfer programs, after their DI claim is denied. This program substitution attenuates the loss of DI benefits, giving a difference of \$10,400 in total cash transfers between those allowed and those denied five years after the decision.

Graph (c) and (d) present the evolution of disposable income and consumption of awarded and rejected applicants at the household level (per capita). Our measure of disposable income is net

of taxes and includes earnings, income from self-employment and capital, and cash transfers of all household members. As a result, it incorporates that spouses (or other household members) may respond to the allowance decision, by changing their labor supply or by applying for their own benefits. Our measure of consumption comes from the accounting identity that total expenditure in a period is equal to income and the change in wealth across the period.

Figure 1: Economic outcomes of awarded and rejected applicants, before and after DI decision (\$1,000)



Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate $\$/\text{NOK} = 6$.

The difference in disposable income between those awarded and those denied is about \$6,000, and changes little around the time of the allowance decision. As shown in the appendix, this is in part because rejected applicants increase their earnings after the DI claim is denied, but also program substitution and spousal responses seem to play a role. Both rejected and awarded appli-

cants have relatively low levels of (liquid) assets, and total expenditure follows closely disposable income.

4 Interpreting the evidence

Table 1 presents the regression counterpart of the graphical evidence reported in Figure 1. In both the pre and post periods, we take five-year averages of the outcomes. In the appendix, we show that the regression results change little if we control for a wide range of observable characteristics, such as age, gender, education, marital status, and the type of disorder. We now discuss how the regression results can be interpreted through the lens of two alternative empirical approaches.

Bound approach. We begin by following the approach of [Bound \(1989\)](#). He uses rejected applicants as a control group for awarded applicants, and considers the post-decision labor outcomes of those who are denied as an (upper bound) estimate of the counterfactual labor outcomes of those who are allowed. Recent studies have extended this analysis, in part by analyzing different time periods but also with quasi-experimental variation in the disability determination process to improve the comparability of rejected and awarded recipients.² To date, the existing research focuses on the labor market impact of DI allowance, and little is known about the consequences for disposable income and consumption.³

The first column of Panel A shows that rejected applicants have much higher earnings than allowed applicants in the five years after the decision. In the Bound approach, this difference suggests substantial earnings capacity of allowed applicants. By comparison, the first column of Panel B compares the cash transfers of denied and allowed applicants in the five years after the decision. Interpreting the cash transfers of those who are denied as an estimate of the counterfactual cash transfers of those who are allowed, suggests that total transfer payments increase considerably if an individual is awarded DI. In contrast to earnings, the transfer payments are either nontaxable or taxed at a low rate. The last two panels of Column 1 compare five-year averages of household disposable income and consumption of awarded and rejected applicants. In the Bound approach, these estimates suggest a 26 (19) percent gain in income (consumption) from being allowed DI.

²See e.g. [Chen and van der Klaauw \(2008\)](#), [von Wachter, Song and Manchester \(2011\)](#), [Maestas, Mullen and Strand \(2013\)](#), [French and Song \(2014\)](#), and [Dahl, Kostøl and Mogstad \(2014\)](#).

³Two notable exceptions are [Meyer and Mok \(2013\)](#), who document changes in income and consumption that follow self-reported health changes or disability, and [Low and Pistaferri \(2012\)](#) who provide simulations from a calibrated a life-cycle model to compare the insurance value and incentive costs of DI benefits.

Table 1: Awarded and rejected applicants: Differences and changes in outcomes (\$1,000)

	Difference	Changes in outcomes				Difference-in-differences	
	Post decision	Post decision - pre decision		Post decision - pre onset		Post decision - pre decision	pre onset
Estimation sample:							
Allowed applicant:	✓	✓		✓		✓	✓
Rejected applicant:	✓		✓		✓	✓	✓
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individual:							
A: Earnings	-14.17 (0.16)	-26.91 (0.06)	-2.32 (0.16)	-36.18 (0.07)	-4.63 (0.19)	-24.59 (0.17)	-31.55 (0.20)
B: Transfers	9.83 (0.12)	18.63 (0.04)	4.98 (0.12)	24.10 (0.04)	8.26 (0.14)	13.65 (0.12)	15.85 (0.15)
Household (per capita):							
C: Disposable income	6.56 (0.10)	0.74 (0.02)	0.58 (0.07)	0.36 (0.03)	1.05 (0.09)	0.16 (0.07)	-0.68 (0.09)
D: Consumption	5.41 (0.15)	1.93 (0.04)	1.43 (0.14)	2.43 (0.05)	2.32 (0.15)	0.50 (0.14)	0.11 (0.16)
Observations	141,370	258,839	26,097	242,130	25,253	284,936	267,383

This table shows differences in mean outcomes across the groups of allowed and rejected applicants; within group changes in outcomes before and after decision, and difference-in-difference across groups and time. Standard errors (in parenthesis) are robust to heteroscedasticity and clustered at the individual level. Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.

Difference-in-differences. Although the estimates in Column 1 change little if we control for observable characteristics of awarded and rejected applicants, the stark differences in their pre-application earnings profiles raise concerns about selection on unobservables. Columns 2-5 document the changes over time in the outcomes of awarded and denied applicants, using five-year averages in the pre and post periods. Awarded applicants tend to have much higher pre onset earnings than denied applicants. The earnings of awarded applicants decline steadily in the years leading up to the decision, whereas rejected applicants experience a relatively small decline in earnings from disability onset to decision.

One possible way to address the concern for selection on unobservables is to use a difference-in-differences (DiD) approach, comparing the changes in outcomes of awarded and rejected applicants before and after the decision. The last two columns report such DiD estimates. While the results should be interpreted with caution, the common pre-trends in graphs (c) and (d) of Figure 1 indicate that the DiD approach may provide more credible evidence for disposable income and consumption than for earnings and transfers.

In contrast to the results from the Bound approach, the DiD estimates suggest little if any impact on disposable income or consumption from being allowed DI. This conclusion holds true when we use the years prior the decision as the pre-treatment period (column 6), and when we compare the outcomes after the decision to those before disability onset (column 7).

5 Concluding remarks

The stark differences between the Bound approach and the DiD analysis point to the importance of unobservable differences between rejected and allowed applicants. To draw firm conclusions about the impact of being allowed DI on earnings, income and consumption, it would therefore be very useful to exploit quasi-experimental variation in the disability determination process. At the same time, it is necessary to better understand the behavioral responses to program parameters and the role of other insurance mechanisms, such as spouse's labor supply, benefit substitution, and self-insurance through savings. Improving the comparability of rejected and awarded recipients and quantifying the extent to which DI crowds out or adds to other insurance mechanisms are therefore important next steps in assessing the trade-off between costs and insurance aspects of the DI program.

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ONLINE APPENDIX

A.1 Data and sample selection

Our analysis employs several data sources that we can link through unique identifiers for each individual. Information on DI benefits comes from social security registers that contain complete records for all individuals who entered the DI program during the period 1967-2010. The data set includes information on the individual's work history and medical diagnosis, the month when DI was awarded (or denied), and the level of DI benefits received. We merge these data sets with administrative registers provided by Statistics Norway, using a rich longitudinal database that covers every resident from 1967 to 2010. For each year, it contains individual demographic information (such as sex, age, and education).

Since 1993, we have detailed information on virtually all sources of income (such as wages, income from self employment, capital income, cash transfers), most types of assets and durables (such as deposits, securities, liabilities, pension plans, real estate, cars), and asset-specific returns and rates of depreciation at a disaggregate level. We use this information to construct measures of household consumption from the accounting identity that total expenditure in a period is equal to income and the change in wealth across the period. To assess the validity of the method to impute consumption, we have checked our measures of total expenditure against those reported in the Norwegian family expenditure surveys.

Details about the data sources and each of the variables are given in Appendix Table A.1. The coverage and reliability of Norwegian registry data are rated as exceptional in international quality assessments.¹ Importantly, the Norwegian income and asset data has several advantages over those available in most other countries. First, there is no attrition from the original sample because of the need to ask permission from individuals to access their tax records. In Norway, these records are in the public domain. Second, our income data pertains to all individuals, and not only to jobs covered by social security. Third, incomes and assets are recorded without any top or bottom coding.

In Appendix Table A.2, we document the key characteristics of individuals who apply for DI during the period 1998 to 2004. We split the applicants into four groups depending on allowance decision and reapplication: Initially allowed; initially denied, no re-application; initially denied but allowed on re-application; initially denied and denied on re-application.

In our main analysis, we focus on the first two groups of applicants, excluding individuals who reapply within ten years of their denied DI claim. We also exclude individuals who were older

¹See e.g. Atkinson, Rainwater, and Smeeding (1995): "Income Distributions in OECD countries: evidence from the Luxembourg Income Study", OECD Publications and Information Center.

than 62 years at the allowance decision (to avoid program substitution between DI and old-age retirement schemes). Appendix Table A.3 displays summary statistics of the economic outcomes for the main estimation sample. Note that in the graphical analysis of the outcomes of allowed and rejected applicants over time, we exclude observations for years in which an individual is dead, has emigrated, is younger than 18 or older than 67 (and thus ineligible for DI).

Table A.1: Data and variable description

Application data	<i>Source: FD-trygd</i>
Decision/application	Year and month of decision/application
Disability/sickness onset	Year and month of disability/sickness onset
DI benefits	Basic and supplemental benefit levels
Disorder	Disorder classification is based on ICD-10 codes.
Individual outcomes	<i>Source: Tax registers</i>
Annual earnings	Wages and income from self-employment
Annual total transfers	Taxable and nontaxable cash transfers from federal and local government
Annual individual income	Sum of earnings and taxable and nontaxable cash transfers.
Individual characteristics	<i>Source: National Education Database and Central Population Register</i>
Age	Age of applicant
Foreign born	Indicator variable for applicant being foreign born
Children	Number of children (aged less than 18) of applicant
Married	Indicator variable for marital status of applicant
Household size	Number of household members (spouse, cohabitant, children) of applicant
Education level	Years of schooling of applicant
Household outcomes	<i>Source: Eika (2014, mimeo)</i>
Disposable income	All sources of recorded income less taxes
Consumption	Total expenditure in a period = Disp. income + change in wealth across the period

Sources: More information about data sources can be found at "[Data collections](http://www.ssb.no/a/english/mikrodata_en/)" (www.ssb.no/a/english/mikrodata_en/).

Table A.2: Descriptive statistic of different types of applicants

	Initial application		Final application	
	No reapplication		Reapplication	
Allowed applicant:	✓		✓	
Rejected applicant:		✓		✓
Age (at the time of decision)	50.42	43.44	48.74	44.20
	[10.47]	[10.41]	[9.46]	[9.48]
Female	0.55	0.60	0.60	0.58
	[0.50]	[0.49]	[0.49]	[0.49]
Married	0.58	0.50	0.53	0.47
	[0.49]	[0.50]	[0.50]	[0.50]
Foreign born	0.06	0.18	0.11	0.26
	[0.25]	[0.38]	[0.31]	[0.44]
Years of Schooling	10.92	10.23	10.36	9.30
	[3.21]	[4.19]	[3.49]	[4.59]
Children below age 18	0.41	0.98	0.60	1.02
	[0.85]	[1.22]	[1.03]	[1.30]
Musculoskeletal disorders	0.36	0.42	0.40	0.42
	[0.48]	[0.49]	[0.49]	[0.49]
Mental disorders	0.26	0.29	0.31	0.29
	[0.44]	[0.45]	[0.46]	[0.45]
Number of observations	127,050	12,802	20,445	2,514

Standard deviations [in square brackets]

Notes: This table displays means for applicants and re-applicants. The applicant sample consists of all claims made during the period 1998-2004 by individuals who are at most 62 years of age. The sample of re-applicants (see section A.1) is a subgroup of the initially denied applicant sample. Unless otherwise stated, all characteristics are measured the year before application. Nominal values are deflated to 2005 and represented in US dollars using the average exchange rate \$/NOK = 6.

Table A.3: Summary statistics of economic outcomes for estimation sample

Period:	0-5 years		5-1 years		5-1 year	
	After Decision		Before Onset		Before Decision	
Allowed applicant:	✓		✓		✓	
Rejected applicant:		✓		✓		✓
A: Individual earnings	8.47 [11.31]	22.64 [17.76]	42.85 [23.15]	28.12 [23.57]	35.38 [23.35]	24.97 [21.63]
B: Individual transfers	27.81 [10.85]	17.98 [13.63]	4.49 [7.69]	9.77 [11.08]	9.19 [10.33]	13.00 [11.43]
C: Household income	32.07 [10.55]	25.50 [11.23]	31.57 [12.21]	24.72 [11.46]	31.32 [11.93]	24.92 [11.43]
D: Household consumption	34.71 [15.40]	29.30 [16.03]	32.67 [15.99]	27.20 [15.18]	32.78 [14.96]	27.87 [15.06]
Number of observations	128,386	12,984	116,115	12,450	130,453	13,113

Note: This table shows mean outcomes for the groups of allowed and rejected applicant for three periods: 'After decision' is the average 0-5 years after decision; 'before onset' is the average 1-5 years before disability onset; 'before decision' is the average 1-5 years prior to decision. The sample consists of all applicants during the period 1998-2004 who did not re-apply and were at most 62 years at the time of the decision. Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.

A.2 Additional figures and tables

This appendix provides additional tables and figures.

Figure A.1 shows the trends in individual income for rejected and awarded DI applicants. Annual individual income is the sum of total transfers and earnings (adjusted by household size to be comparable to household disposable income in graph (c) of Figure 1 in the paper). By comparing this figure to graph (c) in Figure 1, we can see the role of the spouse in the changes in disposable income.

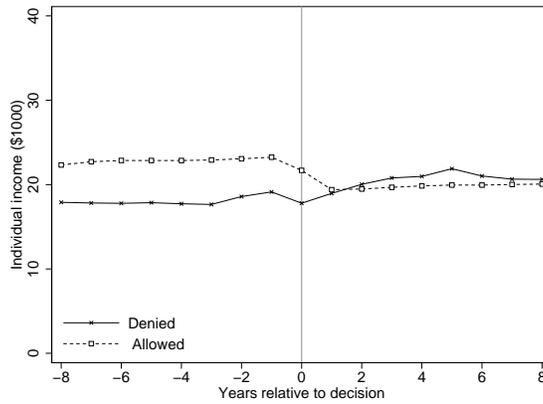
Table A.4 adds controls to the regressions reported in Table 1 of the paper.

Figure A.2 plots economic outcomes of awarded and rejected DI applicants, before disability onset (year -8 to 1) and after the allowance decision (year 1 to 8). In year 0, we report the mean outcome over the period from disability onset to allowance decision.

In Figure A.3, we redo Figure 1 in the paper, except that we now look at the sample of applicants who are initially denied, reapply and are either awarded or rejected upon reapplication. In this figure, year 0 refers to the time of the decision on the reapplication.

In Table A.5, we redo Table 1 in the paper, except that we now look at the sample of applicants who are initially denied, reapply and are either awarded or rejected upon reapplication. In this table, decision refers to the outcome of the reapplication.

Figure A.1: Individual income of awarded and rejected applicants, before and after DI decision (\$1,000)



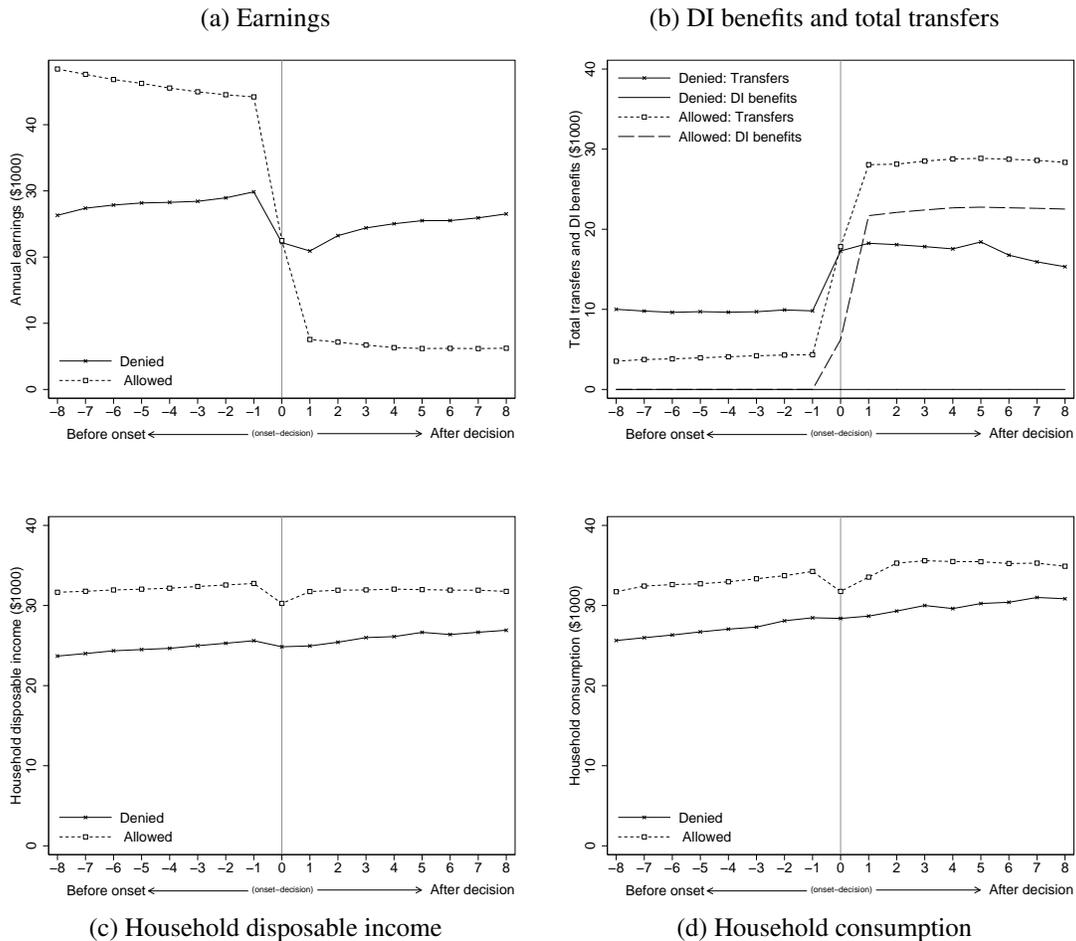
Note: Individual income (earnings and total transfers) are adjusted for household size. Nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.

Table A.4: Awarded and rejected applicants: Differences and changes in economic outcomes, with controls (\$1,000)

	Difference	Changes in outcomes				Difference-in-differences	
	Post decision	Post decision - pre decision		Post decision - pre onset		Post decision - pre decision	pre onset
Estimation sample:							
Allowed applicant:	✓	✓		✓		✓	✓
Rejected applicant:	✓		✓		✓	✓	✓
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individual:							
A: Earnings	-14.55 (0.16)	-26.84 (0.06)	-2.31 (0.16)	-35.58 (0.07)	-4.60 (0.19)	-24.54 (0.17)	-31.00 (0.20)
B: Transfers	10.23 (0.12)	18.63 (0.04)	4.98 (0.12)	24.00 (0.04)	8.22 (0.14)	13.64 (0.12)	15.70 (0.15)
Household (per capita):							
C: Disposable income	2.43 (0.09)	0.77 (0.02)	0.61 (0.07)	0.91 (0.03)	1.13 (0.09)	0.17 (0.07)	-0.23 (0.09)
D: Consumption	1.22 (0.14)	1.96 (0.04)	1.46 (0.14)	2.95 (0.05)	2.41 (0.15)	0.50 (0.14)	0.53 (0.16)
Observations	141,370	258,839	26,097	242,130	25,253	284,936	267,383

Note: In this table, we add controls to the regression results reported in Table 1 of the paper. We control for all background characteristics, listed in Table A.2. We allow for a flexible functional form by including a large set of dummies for different values of the covariates. Standard errors (in parenthesis) are robust to heteroscedasticity and clustered at the individual level. Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.

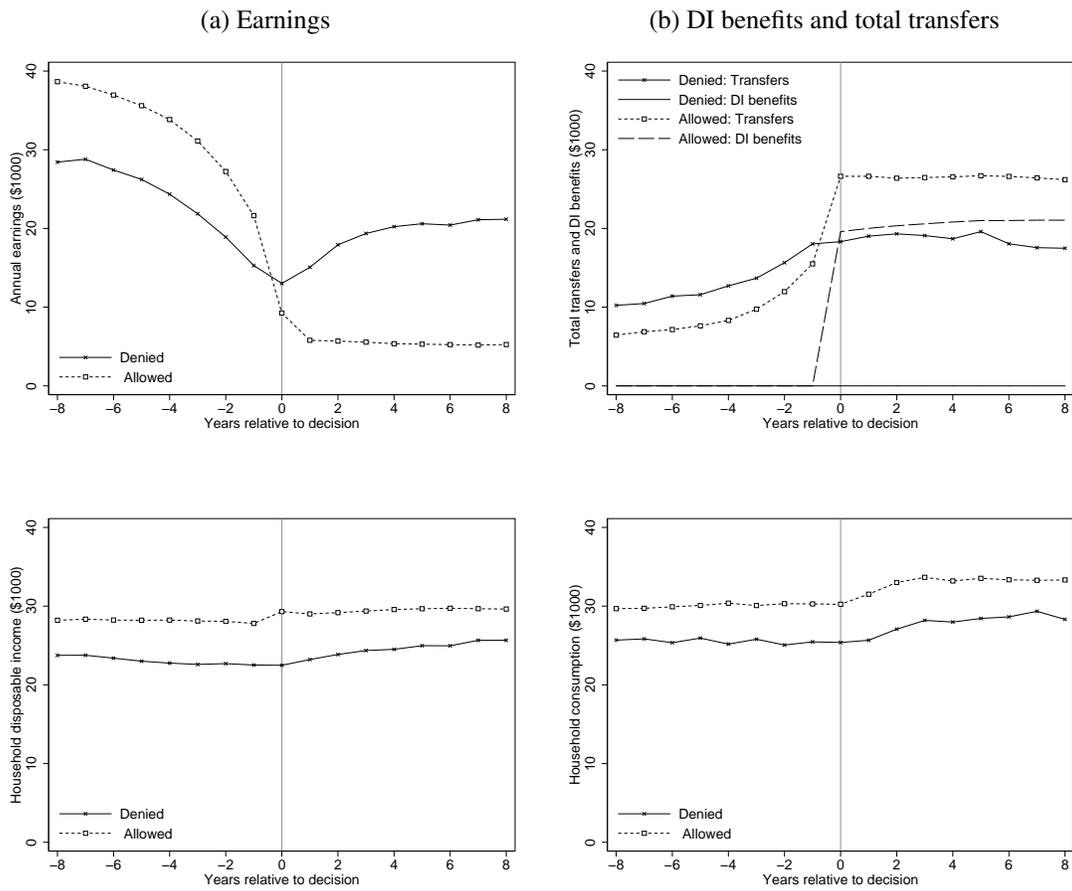
Figure A.2: Economic outcomes of awarded and rejected applicants, before disability onset and after DI decision (\$1,000)



(c) Household disposable income (d) Household consumption

Note: The years -8 to -1 are relative to the year of disability onset. In year 0, we report the mean outcome over the period from disability onset to allowance decision. The years from 1 to 8 are relative to decision. Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.

Figure A.3: Economic outcomes of awarded and rejected re-applicants, before and after DI decision (\$1,000)



(c) Household disposable income

(d) Household consumption

Notes: The sample consist of applicants who are initially denied, reapply and are either awarded or rejected upon reapplication during the period 1998-2004 who were at most 62 years at the time of the decision. Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.

Table A.5: Awarded and rejected re-applicants: Differences and changes in economic outcomes (\$1,000)

	Difference	Changes in outcomes				Difference-in-differences	
	Post decision	Post decision - pre decision		Post decision - pre onset		Post decision - pre decision	pre onset
Estimation sample:							
Allowed re-applicant:	✓	✓		✓		✓	✓
Rejected re-applicant:	✓		✓		✓	✓	✓
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Individual:							
A: Earnings	-11.05 (0.34)	-20.98 (0.15)	-1.97 (0.40)	-27.16 (0.18)	1.47 (0.39)	-19.01 (0.43)	-28.63 (0.43)
B: Transfers	7.68 (0.27)	14.99 (0.10)	4.08 (0.30)	18.63 (0.10)	3.20 (0.28)	10.91 (0.32)	15.43 (0.30)
Household (per capita):							
C: Disposable income	5.61 (0.22)	1.86 (0.06)	1.48 (0.18)	1.40 (0.08)	1.70 (0.17)	0.38 (0.19)	-0.29 (0.19)
D: Consumption	5.52 (0.31)	2.91 (0.12)	1.88 (0.34)	3.08 (0.14)	2.41 (0.29)	1.03 (0.36)	0.68 (0.32)
Observations	23,205	39,944	4,975	37,571	5,097	44,919	42,668

Note: This table shows differences in mean outcomes across the groups of allowed and rejected re-applicants; within group changes in outcomes before and after decision, and difference-in-difference across groups and time. The sample consist of applicants who are initially denied, reapply and are either awarded or rejected upon reapplication during the period 1998-2004. We restrict the sample to applicants who were at most 62 years at the time of the decision on the reapplication. Standard errors (in parenthesis) are robust to heteroscedasticity and clustered at the individual level. Household variables are per capita, and nominal values are deflated to 2005, represented in US dollars using the average exchange rate \$/NOK = 6.