

All or Nothing: Labor, Health and the U.S. Social Security Disability Insurance

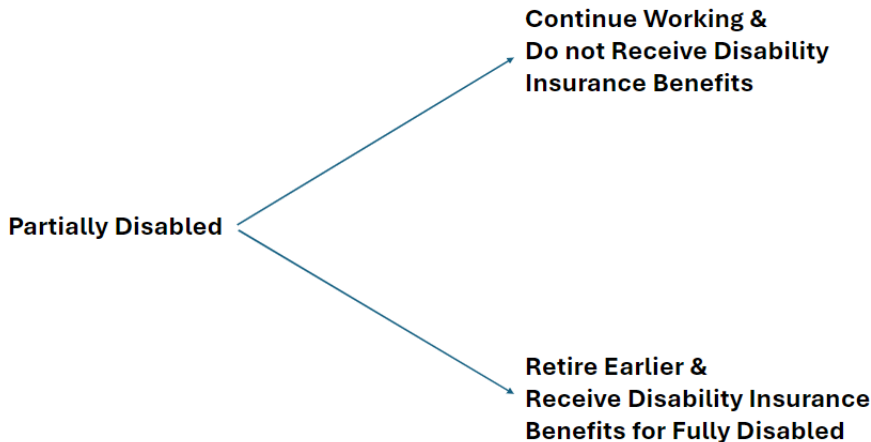
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University of Delaware

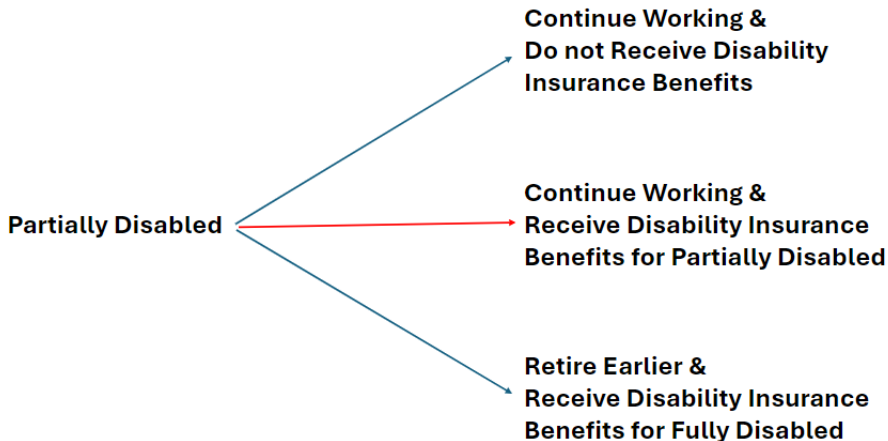
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September 2, 2026

All-or-Nothing Social Security Disability Insurance



Public Disability Insurance Program in Other Countries



Disability Insurance Program for the Partially Disabled

The extension of the SSDI program to the partially disabled will affect health through three main channels:

- Income (additional SSDI benefits)
- Labor supply (reservation wage changes)
- Health insurance coverage (employer-sponsored and early Medicare)

How Did I Get to These Research Questions?

- During the COVID-19 pandemic, the governments have given money to everyone regardless of their health status
- What if there have been transfers based on severe health problems
- Disability insurance (DI) benefits are exactly such a health-related transfer
- No DI benefits for Americans with disabilities who continue working
- Is there a disability insurance reform that can increase longevity?

Preview of the Results

The introduction of partial disability insurance (DI) in the US will

- Increase labor supply of partially disabled individuals
- Decrease the number of disabled Americans by around 1%
- Increase the life span of $\geq 40,000$ people
- Cost of extending the life of one person by one year is \$17K

Literature on Disability Insurance

Empirical approach	Focus on effects of disability insurance on	
	Health	Labor supply
Reduced form models	Borsch-Supan et al. (2017) Black et al. (2021) Gelber et al. (2023)	Gilleskie & Hoffman (2014)
Individual decision-making models that permit the prediction of effects of modifications of SSDI design	This paper	Yin (2015)

Literature on Health Effects of Disability Insurance

According to Gelber et al. (2023), "evidence on the overall impact of DI receipt on mortality — which reflects the combined effects of changes in income, work activity, and health insurance — is limited to a study by Black et al. (2021)"

- Black et al. (2021) show that individuals who are more unhealthy benefit from the DI award, while those who are more healthy experience reductions in health with DI
- Gelber et al. (2023) estimate that an additional \$1,000 in disability insurance payments/person can save 830–1,340 lives annually, i.e., $\sim$ \$10 M/life

Literature on The Welfare Effects of Disability Insurance and Bad Health

- The existing US public disability insurance programs provide valuable but incomplete insurance against health risks (Meyer and Mok, 2019)
- If disability insurance eligibility rules become less strict, or if its generosity increases, welfare increases too (Low and Pistaferri, 2015)
- Assuming savings of all households are zero has little effect on willingness to pay for disability insurance receipt (Autor et al., 2019)
- Major channel how bad health decreases welfare is the shortened life span (De Nardi et al., 2024)

Literature on Retirement

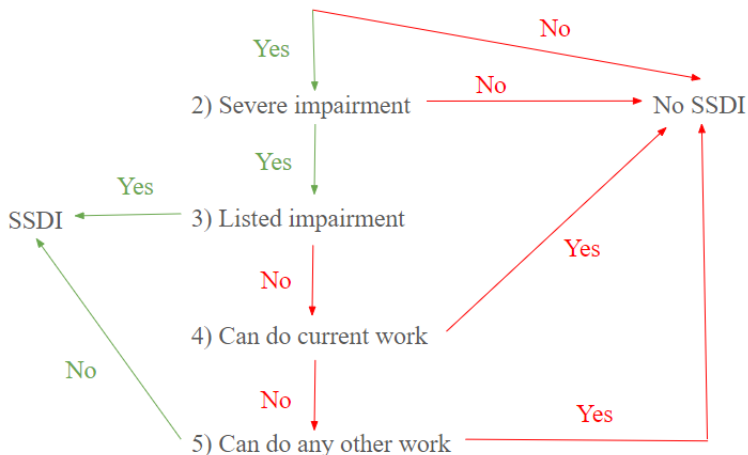
- Under the public disability insurance program for the partially disabled, partially disabled Americans will choose to retire at an older age (see Yin, 2015)
- With 10% higher Social Security benefits, people are 5% more likely to retire and 5% more likely to die in the next five years (see Snyder and Evans, 2006)
- In the month when Americans become eligible for Social Security Old Age, their annual mortality rate increases by 1.5% (see Fitzpatrick and Moore, 2018)
- Men retiring one year earlier live 2.2 months less (Kuhn et al., 2020)

Contribution

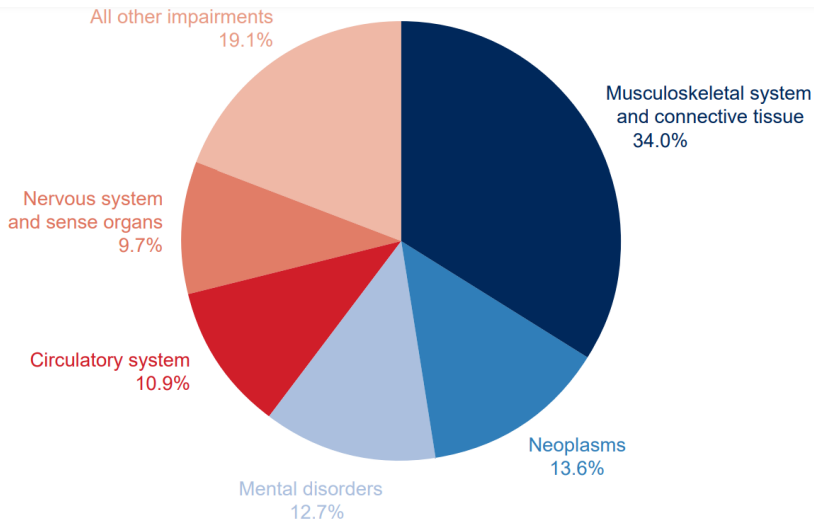
- I reaffirm the existing results on the positive effects of this reform on the labor supply and the possible close-to-zero cost of the reform
- This paper provides the first evidence on the **health** effects of the introduction of disability insurance for the partially disabled in the US
- This paper is the first to show that the reforms to public disability insurance in the US can serve as an effective policy lever for improving public health
- In addition to quantifying the health effects of partial disability insurance reform, the paper identifies the primary mechanism through which disability insurance reform affects health outcomes

5 Steps to Receive SSDI

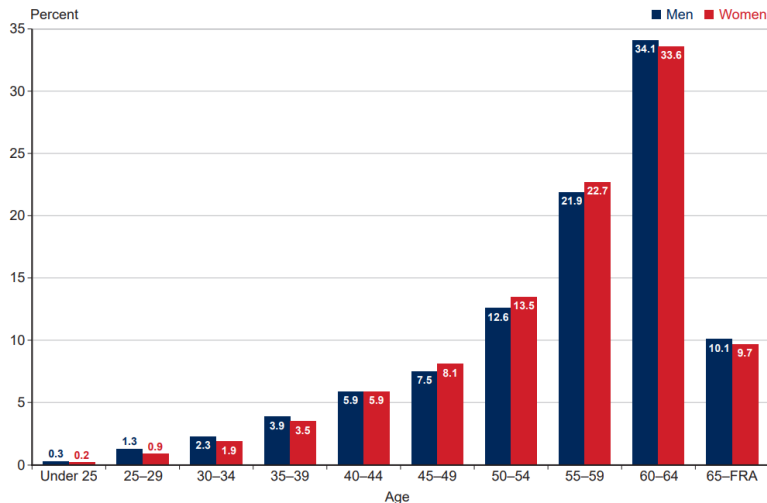
- 1) Earn less than Substantial Gainful Activity (\$1,130/month in 2021)



SSDI Reasons (According to SSA Report on SSDI in 2022)



Age Distribution of SSDI Beneficiaries (According to SSA Report on SSDI in 2022)



Data and Sample Design

Two sources of data:

- ① Health and Retirement Study (HRS) Public Survey Data (1994–2016)
- ② Social Security Administration (SSA) Administrative Data

Estimation sample restrictions:

- ① The age range is from 50 to 90
- ② No missing data on key health-related variables and age
- ③ No missing initial conditions

HRS Questions on Disabilities Preventing Work

HRS has the following questions on disabilities preventing work:

- Do you have any impairment or health problem that limits the kind or amount of paid work you could do?
- Does this limitation keep you from working altogether?

I classify individuals by disability statuses as follows:

- **partially disabled** — those who have limitations that limit their work but do not prevent them from working altogether
- **fully disabled** — those who have limitations keeping them from working altogether

Table: Summary Statistics

	Estimation Sample
Partially Disabled (%)	16.21
Fully Disabled (%)	9.74
Applied for SSDI (%)	1.42
Receive SSDI (%)	6.15
Age	60.03
Number of Person-Years	121,348

Americans with Disabilities

Table: Age Conditional Disability Transition Probabilities

	Not disabled	Partially disabled	Fully disabled	Deceased
Not disabled	0.88	0.09	0.02	0.01
Partially disabled	0.32	0.44	0.22	0.02
Fully disabled	0.07	0.13	0.76	0.04

Notes. The table shows the age-conditional health transition probability of a person whose current period's health is described in the first column and whose next period's health is described in the first row. HRS is biennial, and the period for this table is two years. The table is based on the Health and Retirement Study (HRS) Data

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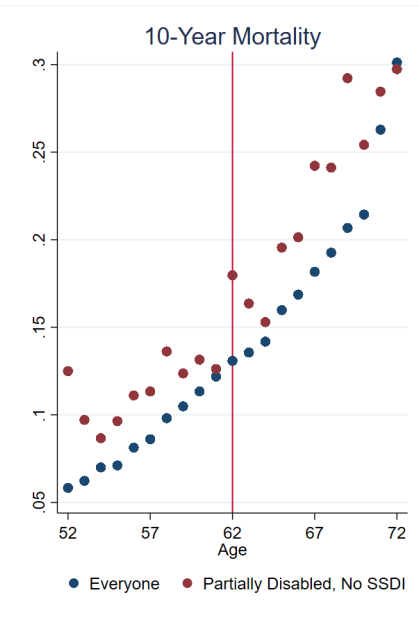
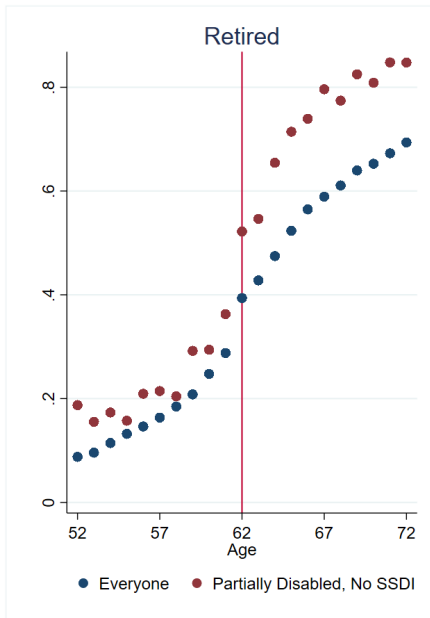


Table: Regression Estimates of Increase in Mortality and Retirement at Age 62

	10-Year Mortality		Retirement	
	Age^2	Age^3	Age^2	Age^3
$1_{62} * 1_{PD}$	.046** (.023)	.046** (.023)	-.0017 (.030)	-.0033 (.030)
1_{PD}	.005 (.003)	.005 (.004)	.136*** (.006)	.138*** (.006)
1_{62}	.005 (.004)	.007 (.004)	.048*** (.006)	.030*** (.007)
Age	-.054*** (.001)	-.080*** (.011)	-.090*** (.005)	-1.97*** (.094)
Age^2	.001*** (.00001)	.001*** (.00001)	.001*** (.00004)	.032*** (.002)
Age^3		-.000002** (.000001)		-.0002*** (.00001)

Self-Reported Disability Status is Unreliable

Questions on disabilities preventing work are unreliable because:

- People report themselves in poor health as a rationalization for what might otherwise be seen as socially unacceptable early retirement (Bound, 1991)
- 20% of HRS respondents who reported receiving SSDI benefits also reported that their disability does not prevent them from working altogether (Benitez-Silva et al., 2004)
 - So, 20% of SSDI beneficiaries admit they are cheating
 - How many respondents decided not to admit their fraud?

Health Index Construction

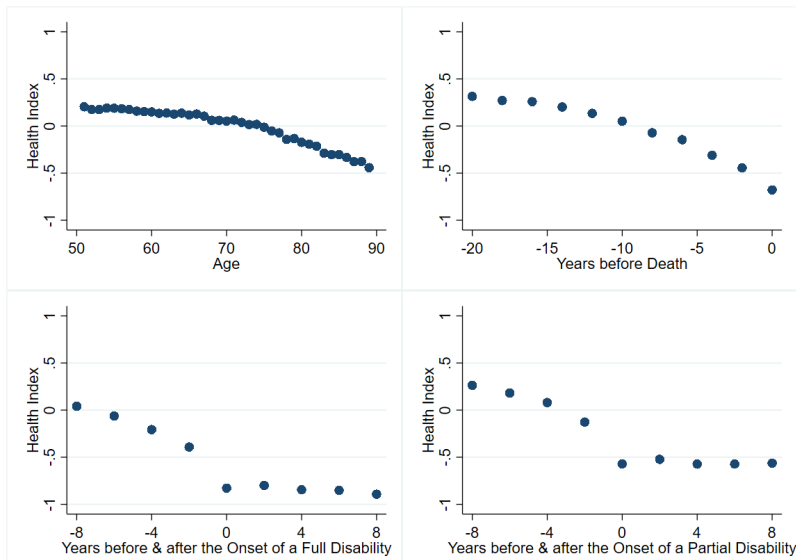
I construct a health index summarizing all available data on the individual health using principal component analysis for the following HRS health-related variables:

- 1 Self-reported health status (excellent/very good/good/fair/poor)
- 2 2 variables related to healthcare utilization
- 3 8 variables related to mental health issues
- 4 8 variables related to doctor-diagnosed health problems
- 5 10 variables related to difficulties with the activities of daily living and instrumental activities of daily living
- 6 Self-reported back pain

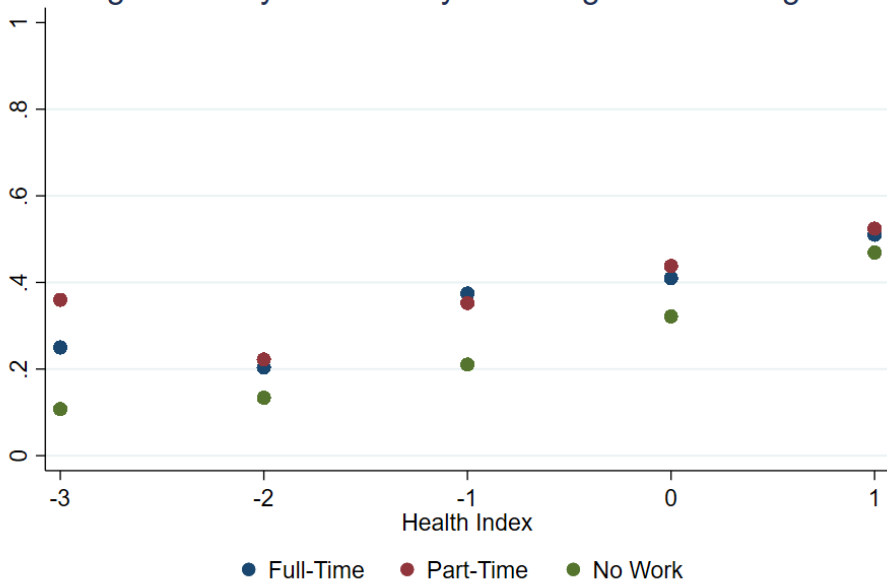
The Percentage of HRS Respondents Who Experienced Health Shocks by 2010 by Health Index Quintile in 1994



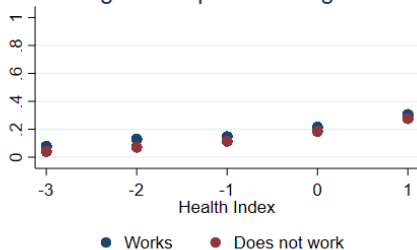
Health Index Dynamics



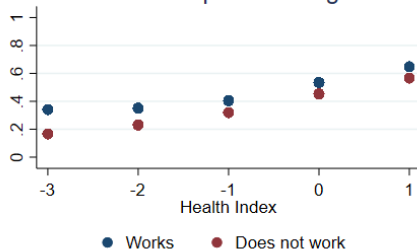
Vigorous Physical Activity Including Work Among PD



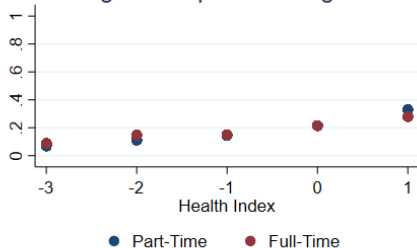
Vigorous Sports Among PD



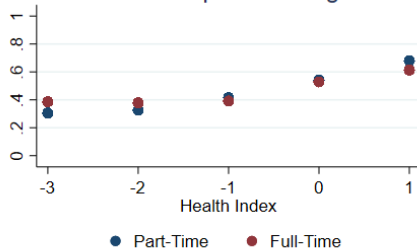
Moderate Sports Among PD



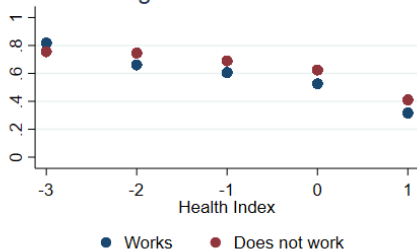
Vigorous Sports Among PD



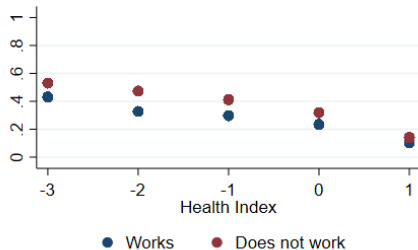
Moderate Sports Among PD



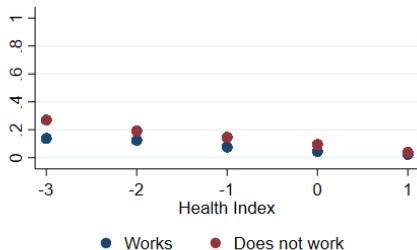
High Blood Pressure



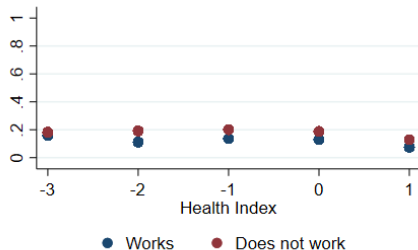
Heart Problems



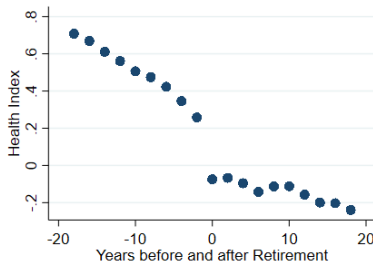
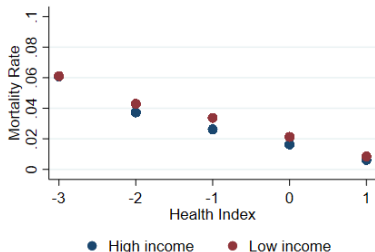
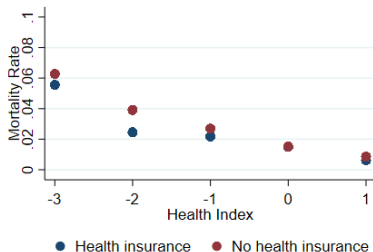
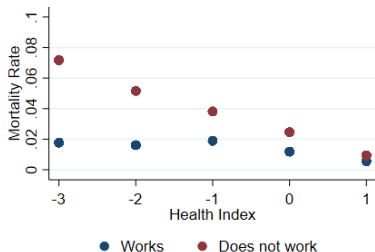
Stroke



Cancer

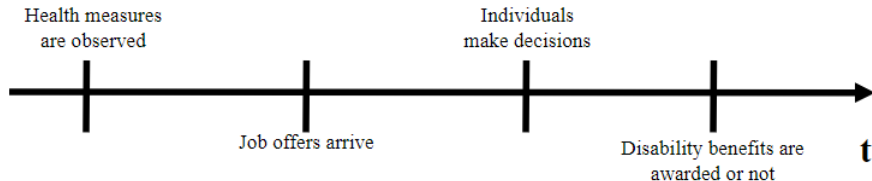


Mortality Rates and Health Index



Model

Timing and Initial Conditions



Individuals make decisions when they are between 51 and 70

The set of initial conditions consists of initial year of observation, t_0 , age, $A_{t_0}^i$, disability, $D_{t_0}^i$, and SSDI reciprocity statuses, $SSDI_{t_0}^i$, and average indexed monthly earnings (AIME), $AIME_{t_0}^i$, at the initial period t_0 for an individual j

After a successful application, SSDI benefits are received starting the next period

Model

Decisions of Agents and Health Measures

- Agents make decisions about:
 - Labor supply: full-time, $w_t^i = 1$, part-time, $w_t^i = 2$, no work, $w_t^i = 0$
 - Disability insurance benefits application, a_t^i :
 - $a_t^i = 1$, if an individual is eligible for full SSDI benefits and claims them
 - $a_t^i = 2$, if an individual is eligible for partial SSDI benefits and claims them
 - $a_t^i = 0$, otherwise
 - Social Security Old-age (SSOA) benefits receipt starting year, s_t^i
 - $s_t^i = 1$, if an individual is eligible for SSOA benefits and starts benefits this year
 - $s_t^i = 0$, otherwise
- Health measures
 - Disability status: fully disabled (FD), $D_t^i = 1$, partially disabled (PD), $D_t^i = 2$, not disabled, $D_t^i = 0$
 - Health index, H_t^i , a continuous measure of health

Model

Utility Function

Utility = $\log(\text{Consumption})$ (Marginal utility of consumption) +

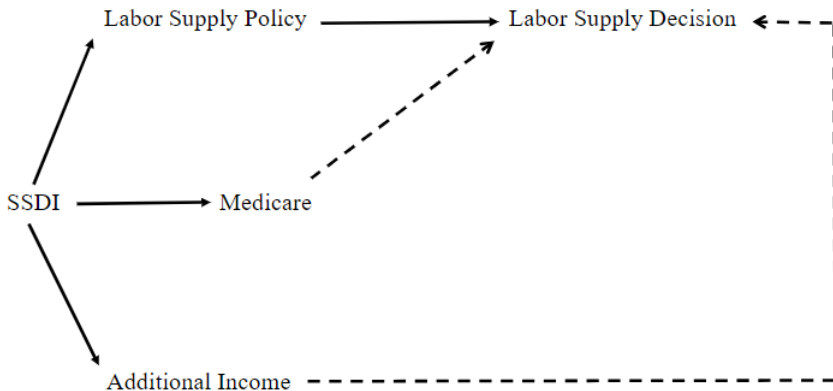
+ Utility of employment transitions +

+ Utility of SSDI application by disability and SSOA statuses,

All utilities are the sum of a constant and a coefficient times the health index

Model

SSDI and Labor Supply Decision



Model

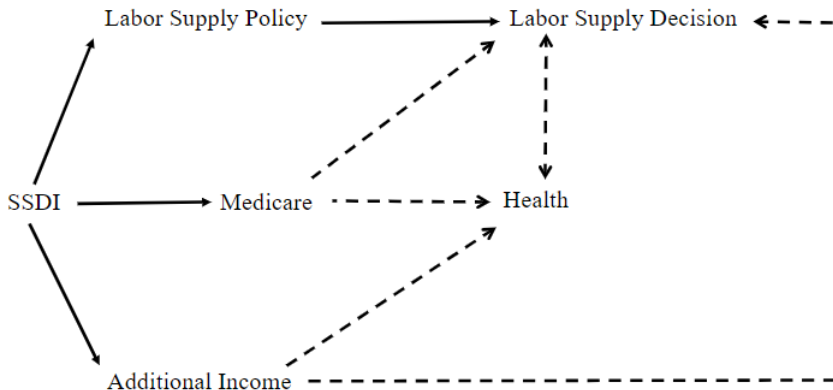
SSDI and Labor Supply Decision

SSDI affects labor supply decisions through

- restrictions on earnings: to be eligible for full SSDI, agents must not work $work_t^i=0$
- additional income: Social Security benefits, $SSB_t^i = SSB(SSDI_t^i, AIME_t^i, t)$, depend on
 - Social Security Administration decision on the application, $SSDI_t^i$
 - Average Indexed Monthly Earnings, $AIME_t^i$
 - Current year, t

Model

Labor Supply Decision and Health



Model

Health measures

Mortality rate, $M_{t+1}^i(\cdot)$, disability status, $D_{t+1}^i(\cdot)$, health index, $H_{t+1}^i(\cdot)$, are functions of previous

- labor supply decisions, w_t^i , by disability status, D_t^i , and education, E_t^i
- health insurance: I_t^i , by disability status, D_t^i , and education, E_t^i
- consumption: C_t^i , by disability status, D_t^i , and education, E_t^i
- disability status: D_t^i
- health index: H_t^i
- age: A_t^i
- college education: E_t^i

Model

Health measures

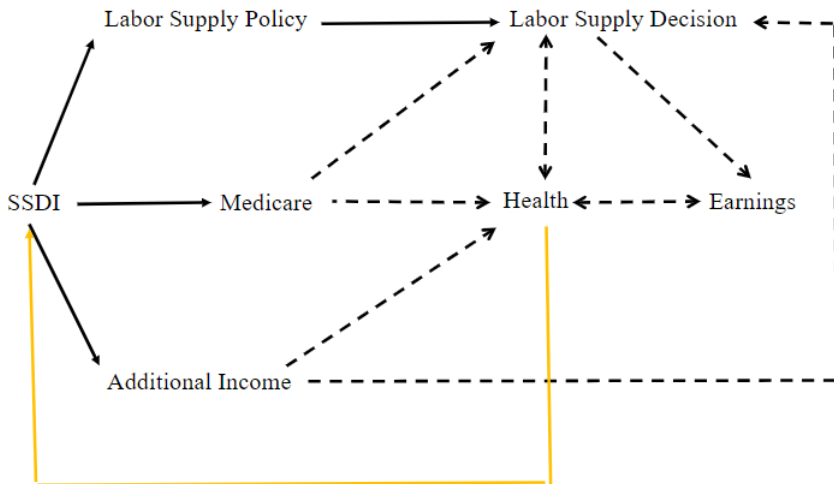
The effects of labor supply (w_t^i) on mortality rate, $M_{t+1}^i(\cdot)$, disability status, $D_{t+1}^i(\cdot)$, and health index, $H_t^i(\cdot)$, are β_t^{wli} , where $l \in \{M, D, H\}$

These effects are heterogeneous for the partially disabled:

$$\beta_t^{wli} = \gamma^{wl} + \epsilon_t^{wli},$$

where γ^{wl} is a constant and ϵ_t^{wli} is i.i.d. normal shock

Model



Model

The probability of SSDI award, $\pi_t^{ai}(D_t^i, H_t^i, A_t^i, E_t^i)$, is determined based on a logistic function of

- disability status: D_t^i
- health index: H_t^i
- age: A_t^i
- college education: E_t^i

The probability of health insurance enrollment, $I_{t+1}^i(w_t^i, C_t^i, D_t^i, H_t^i, A_t^i, E_t^i)$, depends on the same variables as health outcomes

The earnings, $W_t^i(w_t^i, D_t^i, H_t^i, A_t^i, E_t^i, \epsilon_t^{Wi})$, are simulated as a linear combination of the same inputs as health outcomes, excluding consumption and health insurance, but including an i.i.d. normal shock, ϵ_t^{Wi}

Model Solution

The model is solved numerically by backward recursion:

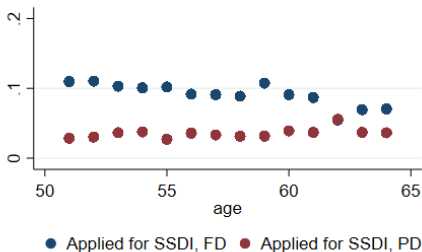
- At age $t_{max} - 1$, an individual makes optimal work and SS application decisions to maximize $V_{t_{max}-1}$
- The expected value of $V_{t_{max}-1}$, $EV_{t_{max}-1}$, is approximated by Monte Carlo integration, i.e., by taking draws from the shock vector distribution and averaging. 10 Monte Carlo draws for health and earnings shocks are used
- The calculations are done at a set of all possible deterministic state points (health index and AIME values are discretized into 4 values)
- This procedure is repeated at age $t_{max} - 2$

The approximations of EV_t are the solution to the optimization problem

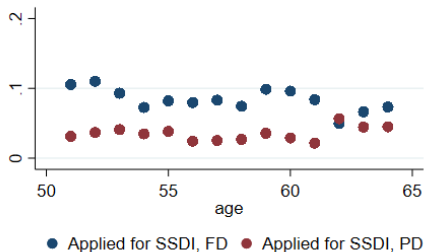
Parameter Estimation

- The parameters are estimated based on the method of simulated moments
- 160 model parameters are estimated using 287 moments related to:
 - Full-time/part-time employment levels by disability status at each age
 - SSDI application rates by disability status at each age
 - SSDI reciprocity rates by age, disability status, and education
 - Shares of partially or fully disabled respondents, their mortality, wage, and health insurance enrollment by age, employment, disability, and education statuses

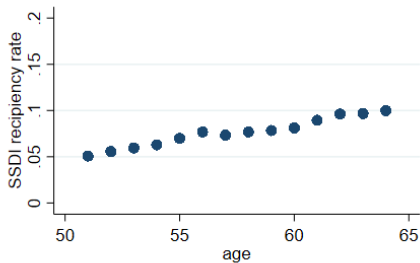
Data



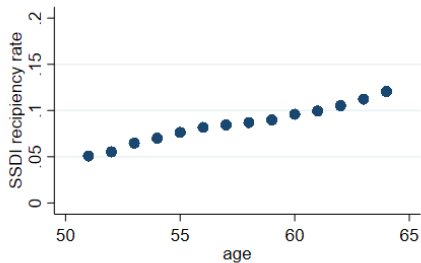
Simulations



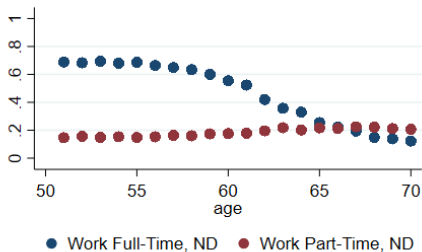
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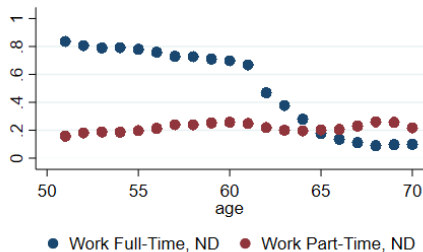
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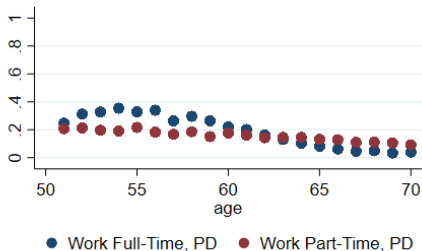
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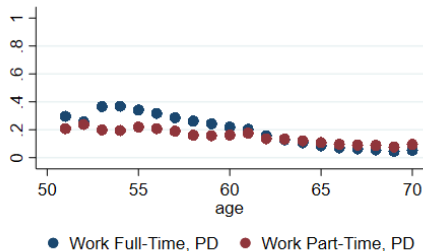
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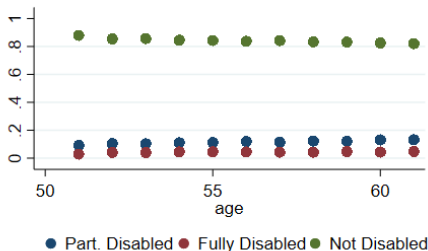
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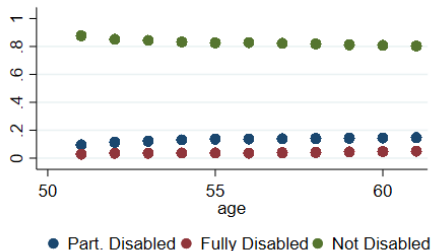
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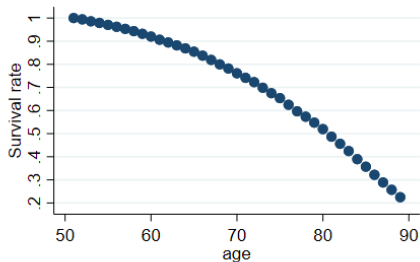
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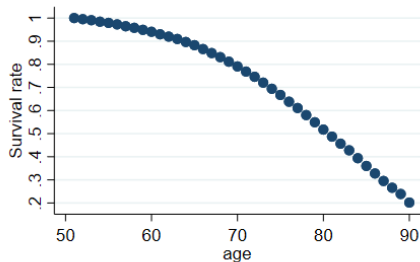
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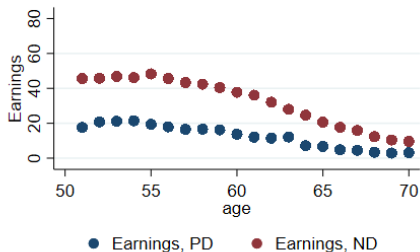
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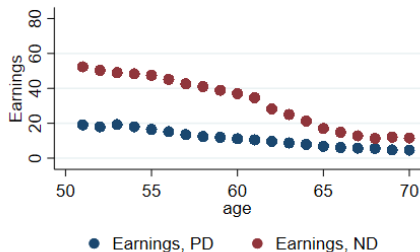
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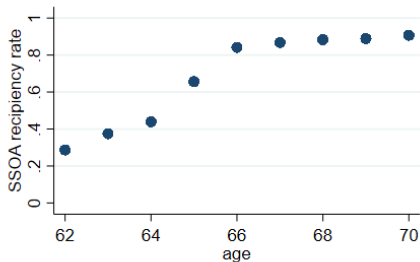
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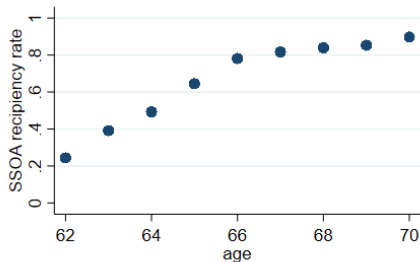
Simulations



Data



Simulations



Mortality probability (M)		
	AME of $\gamma^{MJ}, \%$	AAME of $\epsilon_{it}^{MJ}, \%$
Full-time work for PD	-2.41	.27
Part-time work for PD	-1.47	.29
Consumption for PD	-.01	
Health insurance for PD	-.0001	
	AME, %	
Partial disability	2.79	
Full disability	2.126	
(Standardized) Health index	-.16	
Age	.06	

Notes: Health effects of full-time (FT) and part-time (PT) work are heterogeneous for partially disabled (PD):

$$\beta_{it}^{MJ} = \gamma^{MJ} + \epsilon_{it}^{MJ}, \quad \epsilon_{it}^{MJ} \stackrel{iid}{\sim} N(0, \sigma_{MJ}^2), \quad J \in \{FT, PT\},$$

AAME — average absolute marginal effect, AME — average marginal effect, consumption is in tens of thousands of 2018 US dollars.

Partial disability probability (P)		
	AME of $\gamma^{PJ}, \%$	AAME of $\epsilon_{it}^{PJ}, \%$
Full-time work for PD	-7.13	.54
Part-time work for PD	.58	4.62
Consumption for PD	-.01	
Health insurance for PD	-4.51	
	AME, %	
Partial disability	24.96	
Full disability	.001	
(Standardized) Health index	-104.11	
Age	.18	

Notes: Health effects of full-time (FT) and part-time (PT) work are heterogeneous for partially disabled (PD):

$$\beta_{it}^{MJ} = \gamma^{MJ} + \epsilon_{it}^{MJ}, \quad \epsilon_{it}^{MJ} \stackrel{iid}{\sim} N(0, \sigma_{MJ}^2), \quad J \in \{FT, PT\},$$

AAME — average absolute marginal effect, AME — average marginal effect, consumption is in tens of thousands of 2018 US dollars.

Full disability probability (F)		
	AME of $\gamma^{FJ}, \%$	AAME of $\epsilon_{it}^{FJ}, \%$
Full-time work for PD	-12.41	.39
Part-time work for PD	.26	4.88
Consumption for PD	-.0001	
Health insurance for PD	-2.87	
	AME, %	
Partial disability	.001	
Full disability	16.39	
(Standardized) Health index	-17.59	
Age	.04	

Notes: Health effects of full-time (FT) and part-time (PT) work are heterogeneous for partially disabled (PD):

$$\beta_{it}^{MJ} = \gamma^{MJ} + \epsilon_{it}^{MJ}, \quad \epsilon_{it}^{MJ} \stackrel{iid}{\sim} N(0, \sigma_{MJ}^2), \quad J \in \{FT, PT\},$$

AAME — average absolute marginal effect, AME — average marginal effect, consumption is in tens of thousands of 2018 US dollars.

Private health insurance logistic regression

Parameter	Estimate
Full-time work for non-disabled AME	42.58%
Full-time work for partially disabled AME	22.16%
Part-time work for non-disabled AME	21.58%
Part-time work for partially disabled AME	2.25%

Earnings (in 2018 \$K) regression

Parameter	Estimate
Full-time work for non-disabled	48.756
Full-time work for partially disabled	27.881
Part-time work for non-disabled	10.544
Part-time work for partially disabled	10.204

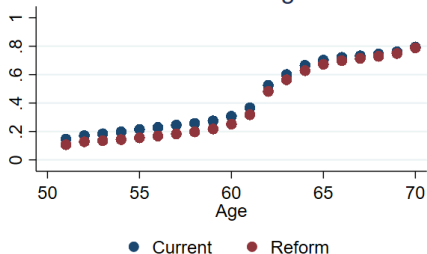
Counterfactual Partial Disability Insurance Reform

- As before, partially or fully disabled individuals can apply for full disability insurance benefits
- Partially disabled can now apply for partial disability insurance benefits
- Partially disabled individuals applying for partial disability insurance benefits endure the same disutility as the fully disabled applying for fully disabled
- Partially disabled individuals applying for partial disability insurance (DI) benefits, on average, have the same probability of receiving partial DI benefits as the fully disabled applicants receiving full DI benefits

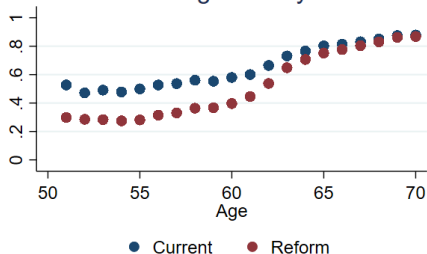
Counterfactual Partial Disability Insurance Reform

- Those who apply for and those who receive partial DI must continue working (either part-time or full-time)
- If earnings of a partially disabled person are above SGA amount (Substantial Gainful Activity amount, \$1,130/month in 2018), then their benefits are decreased by \$1 for each extra \$1
- Partial DI beneficiaries are not awarded Medicare
- If the partial disability insurance recipients claim they developed full disability and applied for full SSDI benefits, they are granted full SSDI benefits for the period of application

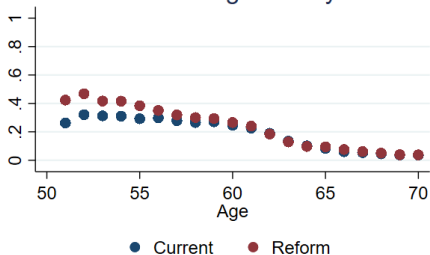
Non - Working All



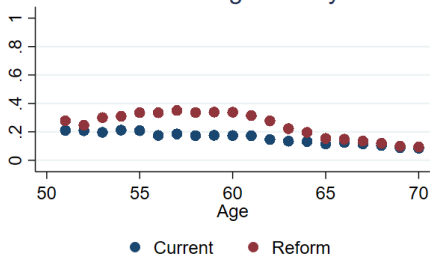
Non - Working Partially Disabled



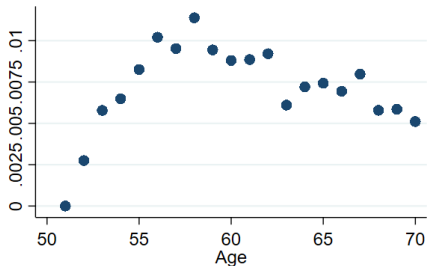
Full - Time Working Partially Disabled



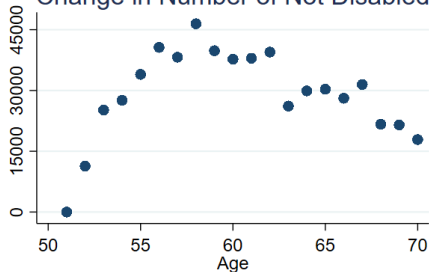
Part - Time Working Partially Disabled



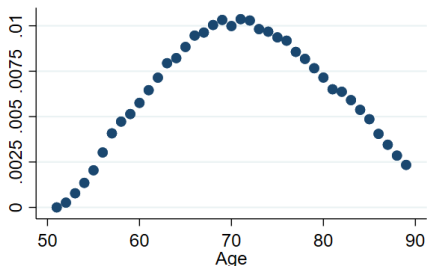
Increase in Share of Not Disabled



Change in Number of Not Disabled



Increase in Survival rate



Lives Saved



Alternative Versions of Partial Disability Insurance Reform

Alternative reforms with different parameters directly related to the channels of health effects of disability insurance (income, health insurance, and labor supply):

- Partial DI benefits are taxes that partially disabled workers pay
- Partial DI recipients are eligible for early access to Medicare after a two-year waiting period
- Work is not required for benefits

Alternative Versions of Partial Disability Insurance Reform

Alternative reforms with differences in the partial DI application process:

- Receiving partial disability insurance benefits is as difficult as receiving full disability insurance benefits for the partially disabled
- No utility cost of applying for partial disability insurance benefits

Changes in Decisions under 6 Alternatives

Partial disability insurance beneficiaries:

- switchers from full to partial disability insurance programs
- partially disabled who did not apply for full disability insurance benefits but chose to apply for partial disability insurance benefits (induced entry)

Reform	Switchers	Induced Entry
Primary Version	72%	115%
Tax Credits	13%	37%
Early Medicare	72%	115%
Work is not Required	87%	196%
Low Award Probability	69%	38%
No Application Disutility	75%	666%

Costs and Benefits of 6 Alternatives

Reform	Years	Cost
Primary Version	753,594	\$17K
Tax Credits	186,197	-
Early Medicare	791,644	\$59K
Work is not Required	562,647	\$61K
Low Award Probability	626,671	-
No Application Disutility	781,756	\$72K

The value of a life-year is:

- > \$100K for people below 90 (Murphy and Topel, 2006)
- \$120K (Miller et al., 1990)
- \$175K (Moore and Viscusi, 1988)

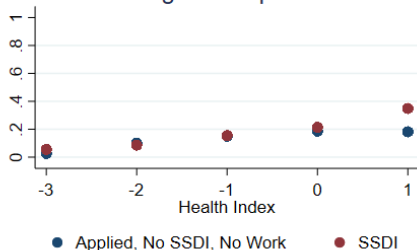
Partial Disability Insurance Reform Benefits

- The partially disabled increase their labor supply and postpone retirement
- Share of individuals who are not disabled decreases:
for 63-year-olds, this share decreases by ~ 1.2 p.p.
- Survival rate rises: for 70-year-olds, the survival rate increases by ~ 0.9 p.p.
- If the decrease in the share of disabled individuals and the survival rate is multiplied by the number of Americans of a given age in 2022, we can see that the introduction of partial disability insurance
 - Saves $\sim 40,000$ lives of 70-year-old Americans
 - Decreases the number of disabled 63-year-old Americans by $\sim 45,000$

Partial Disability Insurance Reform Drawbacks

- The number of disability insurance applications increases by 20%.
- After accounting for the increase in income taxes, the total cost of benefits increased by 8%.
- Social Security Administration will have to distinguish between fully disabled and partially disabled individuals
- Partially disabled individuals are more likely to fully recover in comparison with fully disabled ones

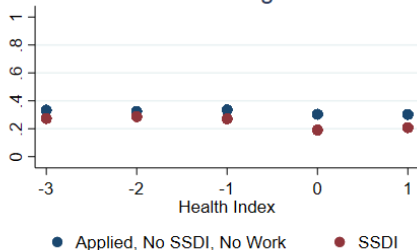
Vigorous Sports



Moderate Sports



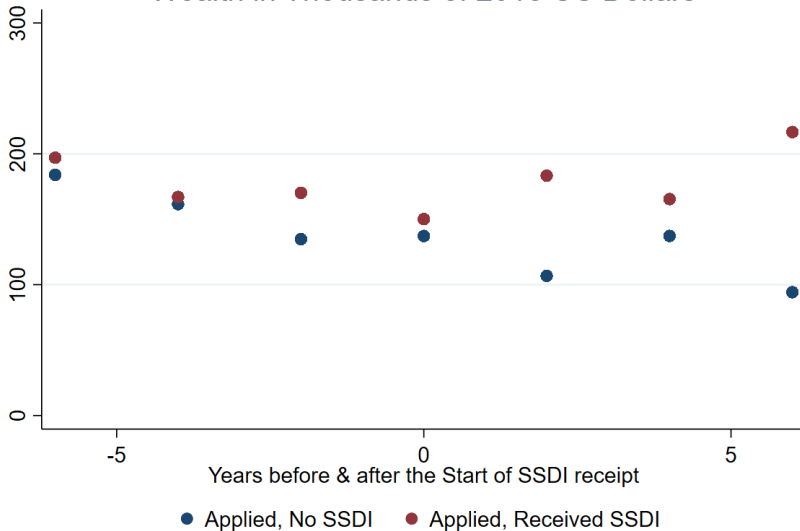
Smoking



Binge Drinking



Wealth in Thousands of 2018 US Dollars



Partial Disability Insurance Reform Conclusion

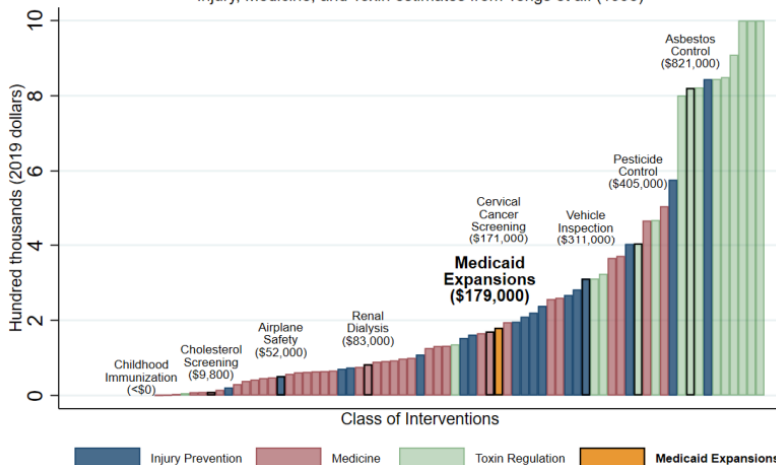
The introduction of partial disability insurance (DI) in the US will

- Increase labor supply of partially disabled individuals:
- Decrease the number of disabled Americans by around 1%
- Increase the life span of $\geq 40,000$ people
- Cost of extending the life of one person by one year is \$17K

Wyse and Meyer (2023)

Cost-Effectiveness of Medicaid Expansions and Other Life-Saving Interventions: Average Cost Per Life-Year Saved

Injury, Medicine, and Toxin estimates from Tengs et al. (1995)



Comparison with Reduced-Form Evidence

Fitzpatrick and Moore (2018) imply that 1–2 out of 100 Americans retiring earlier have shorter lifespans:

- ~1M retiring at 62 translates into 10K additional deaths for 62-year-olds
- ~1.2M retiring at 62 or 63 leads to 22K additional deaths for 62–63-year-olds

My results imply a similar magnitude of health effects of changes in retirement behavior. Under the reform:

- Approximately 3M person-years of increased labor supply
- $\geq 40K$ people have longer lives

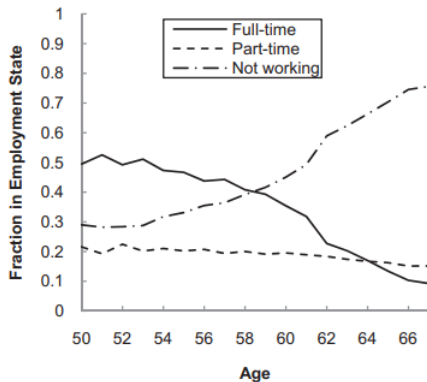
Possible Extensions

The following papers can expand the research on disability insurance:

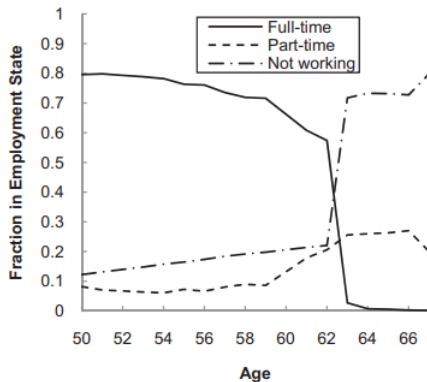
- Disability Insurance for the Partially Disabled Would Come Handy During the COVID-19 Pandemic and Recessions
- Early Medicare Saves Lives
- How do the Effects of Disability Insurance on Health Vary with Gender, Race, and Education?
- How The Value of Private Disability Insurance Varies With Occupation and Industry?

Model Fit in Yin (2015)

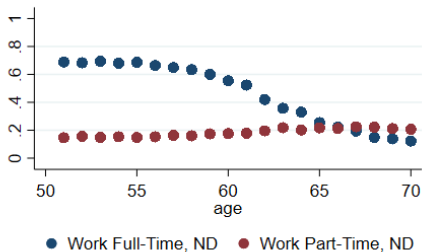
a. Actual Employment Status in HRS



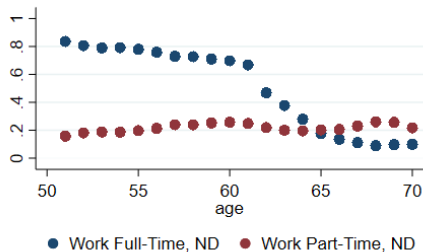
b. Simulated Employment Status



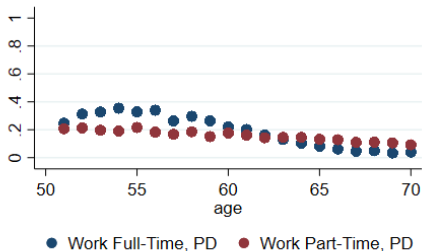
Data



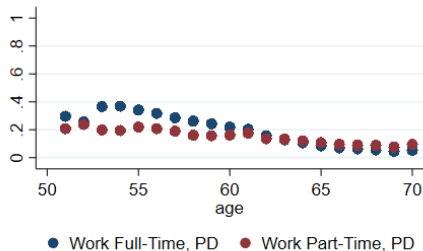
Simulations



Data



Simulations



Model

Utility Function

$$\begin{aligned} \text{Utility} = & \log(\text{Consumption}) \left(1 + \right. \\ & + \text{Utility of full-time leisure} + \text{Utility of part-time leisure} + \\ & + \text{Utility of working full-time while partially disabled} + \\ & + \text{Utility of working part-time while partially disabled} + \\ & + \text{Utility of SSOA application by disability status} \left. \right) + \\ & + \text{Utility of returning to part-time work} + \\ & + \text{Utility of returning to full-time work} + \\ & + \text{Utility of SSDI application by disability and SSOA statuses,} \\ & \text{All utilities are the sums of a constant and a coefficient times the health index} \end{aligned}$$

Utility Function

$$\begin{aligned}
 u_t^i(S_t^i) = & \ln(C_t^i) \left(1 + \sum_{j \in \{P, N\}} (\alpha_L^j 1_{work_t^i=j} + \alpha_L^{jH} 1_{work_t^i=j} \tilde{H}_t^i) + \right. \\
 & + \sum_{j \in \{F, P\}} (\alpha_W^j 1_{work_t^i=j} 1_{D_t^i=P} + \alpha_W^{jH} 1_{work_t^i=j} 1_{D_t^i=P} \hat{H}_t^i) + \\
 & + \sum_{j \in \{F, P, N\}} (\alpha_O^j start_t^i 1_{D_t^i=j} + \alpha_O^{jH} start_t^i 1_{D_t^i=j} \tilde{H}_t^i) \Big) + \\
 & + \sum_{j \in \{F, P\}} (\alpha_R^j 1_{work_t^i=j} 1_{work_{t-1}^i=N} + \alpha_R^{jH} 1_{work_t^i=j} 1_{work_{t-1}^i=N} \hat{H}_t^i) + \\
 & + \sum_{j \in \{P, N\}} (\alpha_{PF}^j 1_{work_t^i=F} 1_{work_{t-1}^i=P} + \alpha_{FP}^j 1_{work_t^i=P} 1_{work_{t-1}^i=F}) 1_{D_t^i=j} + \\
 & + \sum_{k \in \{NA, t, t-1, t-2\}, j \in \{P, F\}} (\alpha_k^j + \alpha_k^{jH} 1_{D_t^i=j} \tilde{H}_t^i) 1_{apply_t^i=F} 1_{SSOA_t^i=k}
 \end{aligned}$$

The maximization problem

$$V_t^i(\Omega_t^i; Z_t^i; \tilde{\epsilon}_t^i) = \max_{Z_t^i} (u^i(S_t^i) + \beta E(V_{t+1}^i(\Omega_{t+1}^i; Z_{t+1}^i; \tilde{\epsilon}_{t+1}^i)))$$

s.t.

$$C_t^i = W_t^i + SSB_t^i,$$

- Ω_t^i — state variables (SS reciprocity, disability, education, previous labor force statuses, health index, AIME, age, and year)
- Z_t^i — decisions (labor supply and SS applications)
- $\tilde{\epsilon}_t^i$ — shocks to health and earnings
- $u_t^i(\cdot)$ — utility function depends on labor force, disability, and SS statuses, consumption, and health index
- C_t^i — consumption
- W_t^i — earnings
- SSB_t^i — Social Security benefits

Health Index Calculation

$$\begin{aligned}
 H_{t+1}^i = & \beta^{HC} + \beta_t^{HPFTi} 1_{D_t^i=P} \cdot 1_{work_t^i=FT} + \beta_t^{HPPTi} 1_{D_t^i=P} \cdot 1_{work_t^i=PT} + \\
 & + \beta_t^{HI} I_t^i + \beta_t^{HC} C_t^i + \beta^{HP} 1_{D_t^i=P} + \beta^{HF} 1_{D_t^i=F} + \beta^{HH} H_t^i + \\
 & + \beta^{HNFT} 1_{D_t^i=N} \cdot 1_{work_t^i=FT} + \beta^{HNPT} 1_{D_t^i=N} \cdot 1_{work_t^i=PT} + \beta^{HA} a_{t+1}^i + \\
 & + \beta^{HE} e^i + \beta^{HFE} 1_{work_t^i=FT} \cdot e^i + \beta^{HPE} 1_{work_t^i=PT} \cdot e^i + \epsilon_{t+1}^{Hi},
 \end{aligned}$$

Health Index Transformations

- The health index is transformed in such a way that everyone receives utility benefits from leisure and utility costs from applications and working while disabled.
- Those who have a higher health index receive higher utility benefits from leisure, higher utility costs from the application, and lower utility costs from working while disabled.

- $\tilde{H}_t^i = \max(|H_t^i|) + H_t^i$

- $\hat{H}_t^i = |\min(H_t^i)| - H_t^i$

(Standardized) Health index (H)		
	γ^{HJ}	σ_{HJ}
Full-time work for PD	-.0509	.0105
Part-time work for PD	-.03899	.036
Consumption for PD	.000005	.000005
Health insurance for PD	.00005	.00002
	β^{HK}	
Partial disability	-.4	
Full disability	-.71	
Health index	.77	
Age	-.00107	

Notes: Health effects of full-time (FT) and part-time (PT) work, consumption (C), and health insurance (I) are heterogeneous for partially disabled (PD): $\beta_{it}^{HJ} = \gamma^{HJ} + \epsilon_{it}^{HJ}$, $\epsilon_{it}^{HJ} \stackrel{iid}{\sim} N(0, \sigma_{HJ}^2)$, $J \in \{FT, PT, C, I\}$, consumption is in tens of thousands of 2018 US dollars, $K \in \{P, F, H, A, E\}$.

Parameter	Estimate
Earnings (in 2018 \$K) regression	
Full-time work for non-disabled	48.756
Full-time work for partially disabled	27.881
Part-time work for non-disabled	10.544
Part-time work for partially disabled	10.204
Private health insurance logistic regression	
Full-time work for non-disabled AME	42.58%
Full-time work for partially disabled AME	22.16%
Part-time work for non-disabled AME	21.58%
Part-time work for partially disabled AME	2.25%
SSDI reciprocity logistic regression	
Full disability AME	0.17%
(Standardized) Health index AME	-15.42%