Disability and Multi-State Labour Force Choices with State Dependence

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Disability and Multi-State Labour Force Choices with State Dependence

Long term health conditions/disability that limits amount or type of work you can do. [Work Limitation]

Disability and Multi-State Labour Force Choices with State Dependence

$$y_{i,t} = f(y_{i,t-1} | X_{i,t}, D_{i,t}, \alpha_i)$$

Long term health conditions/disability that limits amount or type of work you can do. [Work Limitation]

Full time Part time Unemployed Not in the Labour Force

Disability and Multi-State Labour Force Choices with State Dependence

$$y_{i,t} = f(y_{i,t-1}|X_{i,t}, D_{i,t}, \alpha_i)$$

Long term health conditions/disability that limits amount or type of work you can do.

A Few Questions

- How does disability impact transitions within the labour force?
- Does State Dependence depend on (labour force) state?
  - What is the role of disability?
  - Is part time work a stepping stone?
- Is there a long run impact of a temporary disability?
  - Do skills matter?

Literature

- Static Binary Choice
  - Stern 1989, Bound 1990, Campolieti 2002, Cai 2009
- Static Multinomial Choice
  - Raphahn 1999, Lindeboom *et al* 2006
- Dynamic Binary Choice
  - Gannon 2005, Kapteyn *et al* 2008, Oguzoglu 2010,2011

Contribution

- Dynamic multinomial choice model
  - Dynamic mixed multinomial logit with random effects
- Dynamic Interaction Model
- Model Simulations
  - Intertemporal Effect of Disability on Employment
- A Robustness Check
  - Fixed Effects Models with endogenous disability using GMM.

Data

- Household, Income and Labour Dynamics in Australia (HILDA), 2001-2007
- In 2001, 13,969 persons from 7,865 households are interviewed.
- Labour force, income, wealth, Socio-demographics, life events, Health, fertility, expectations...

Work Limitation Measure

- HILDA disability question:

"…do you have any long-term health condition, impairment or disability that restricts you in your everyday activities, and has lasted or is likely to last, for 6 months or more?"

- HILDA work disability question:

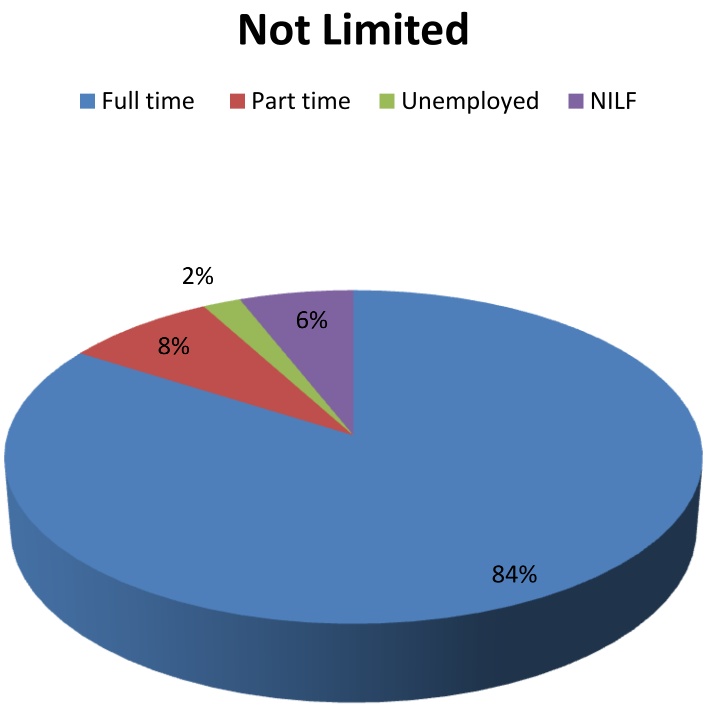
"Does your condition limit the type of work or the amount of work you can do?"

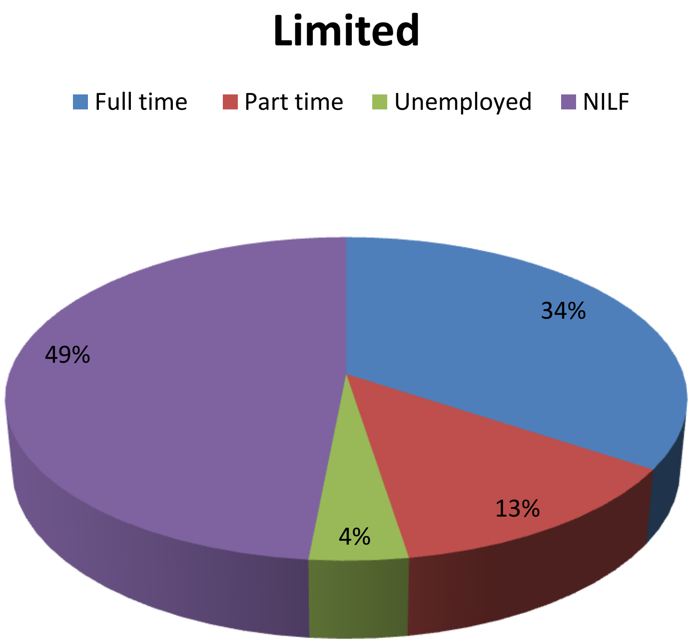
Sample

- Unbalanced sample of 1787 men and 1925 women
- Observed at least 3 consecutive waves in HILDA. (max 7 waves)
- Not in full-time education and Not eligible for Old Age Pension.
- 24-64 year old men
- 24-60 year old women

Employment by Work Limitation

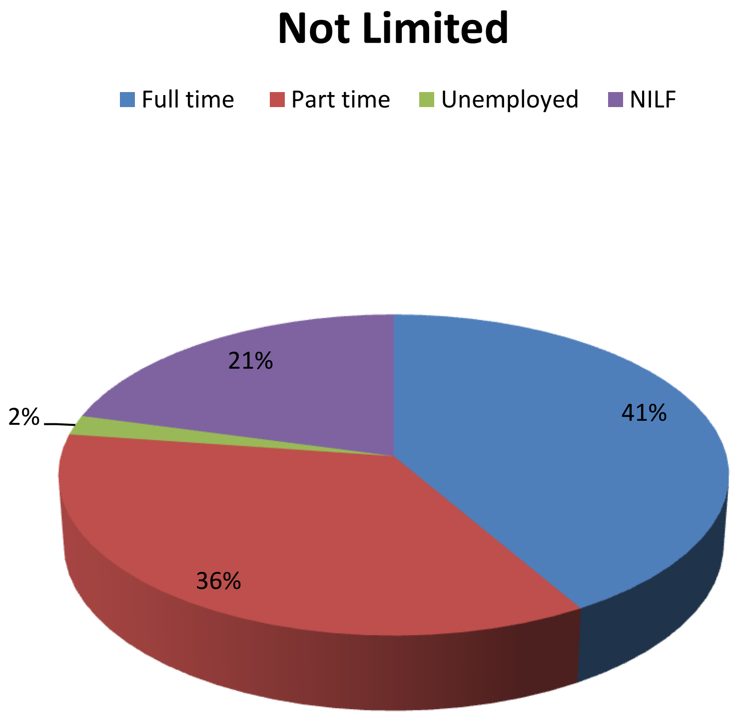
MEN

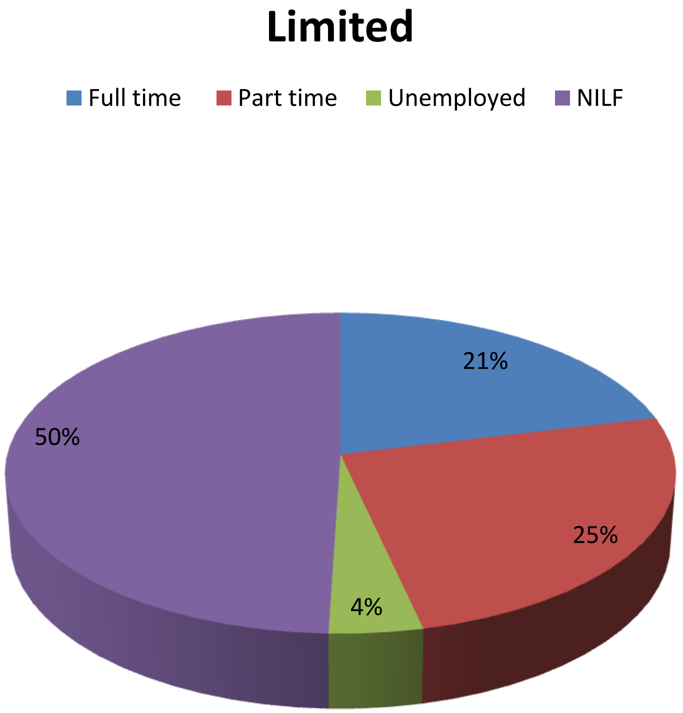




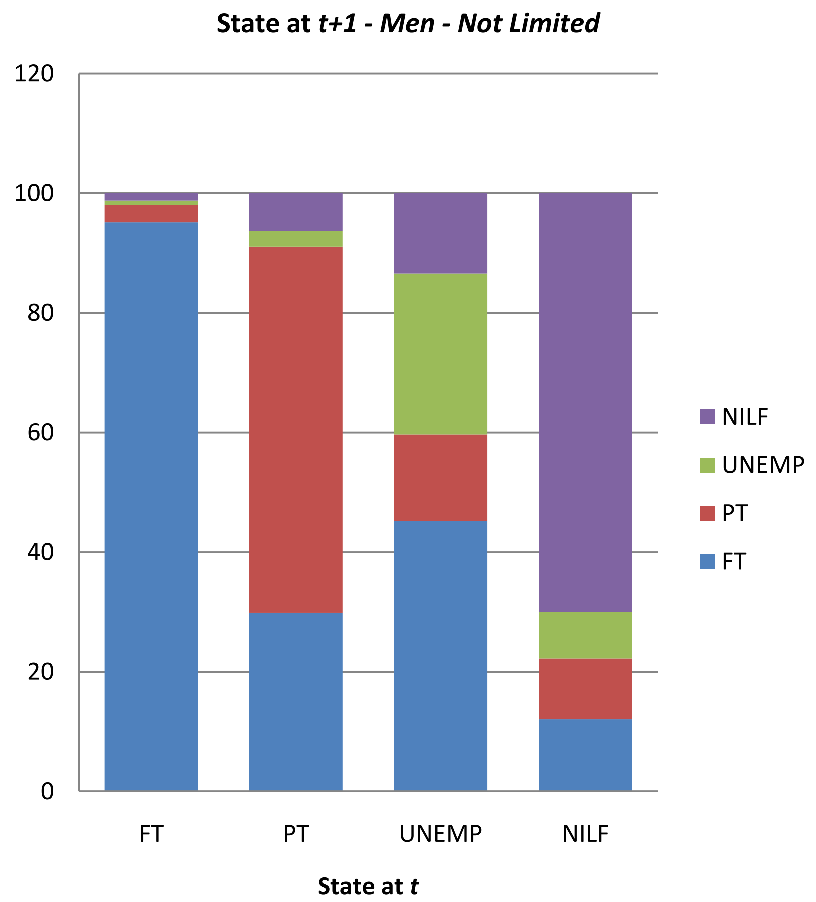
Employment by Work Limitation

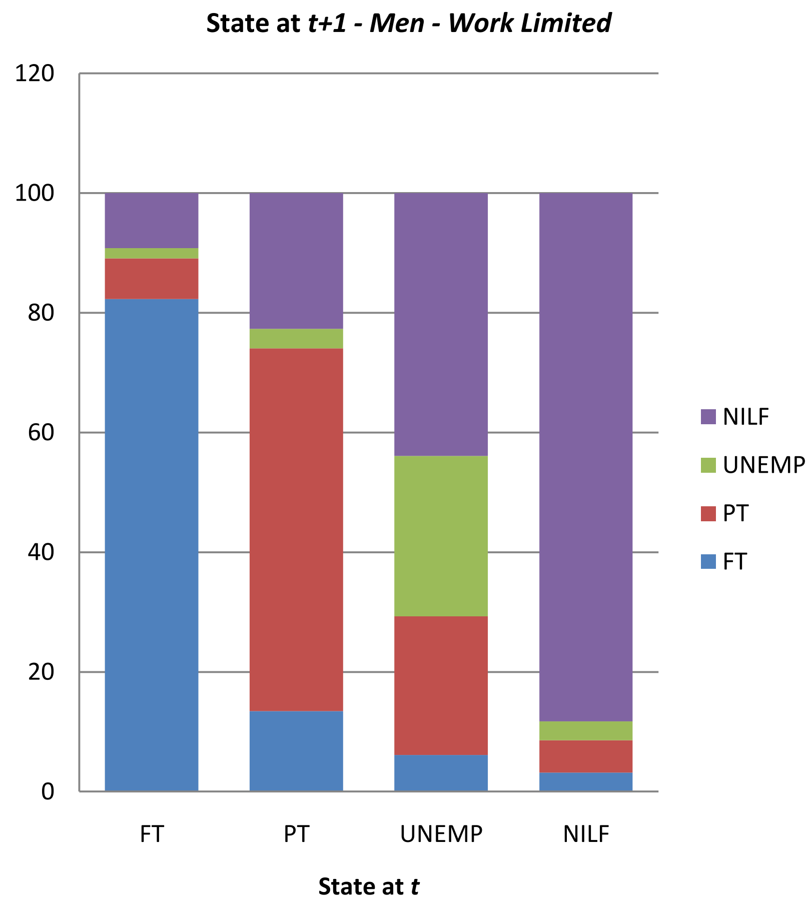
WOMEN



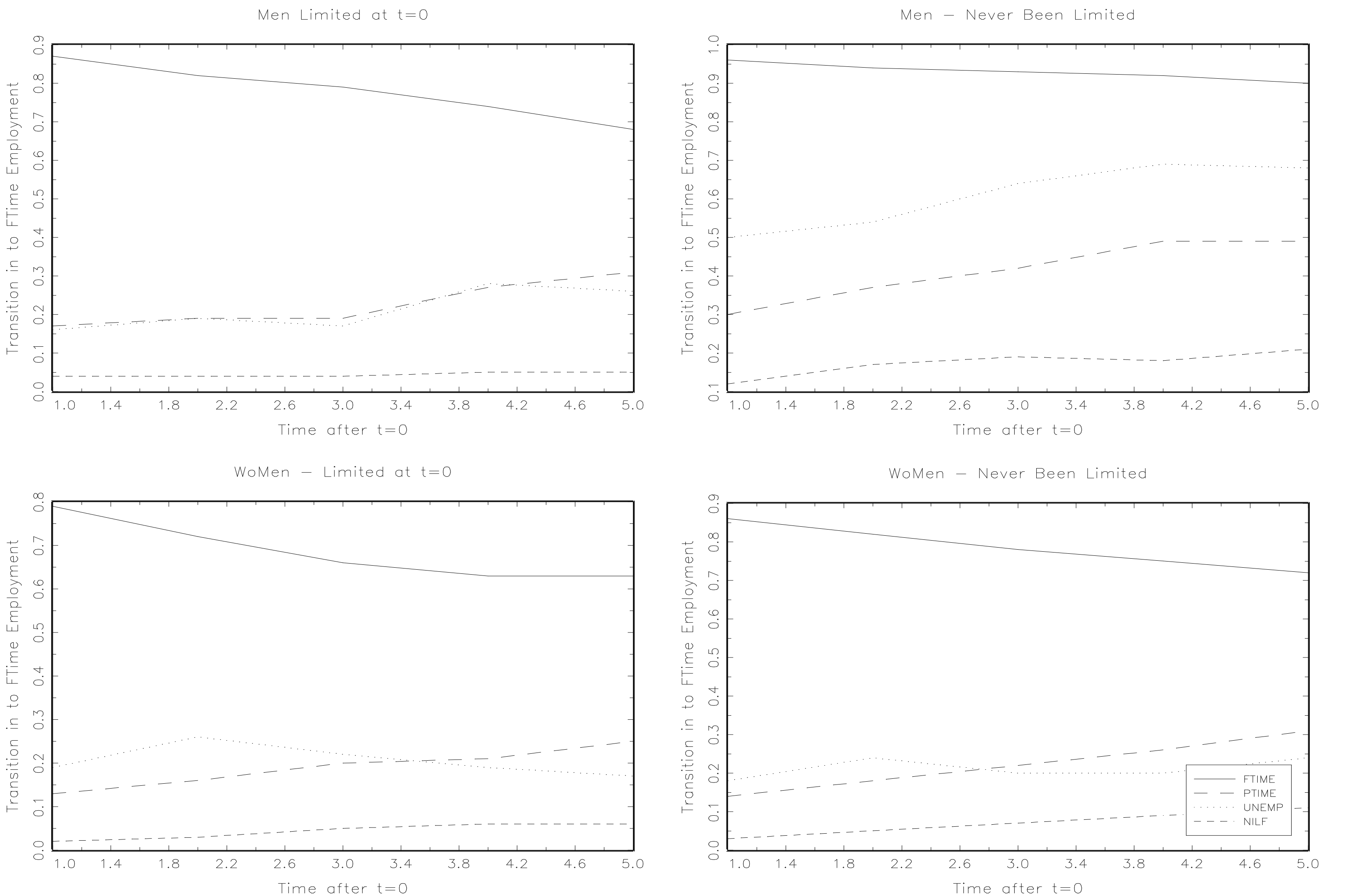


Transition across Employment States

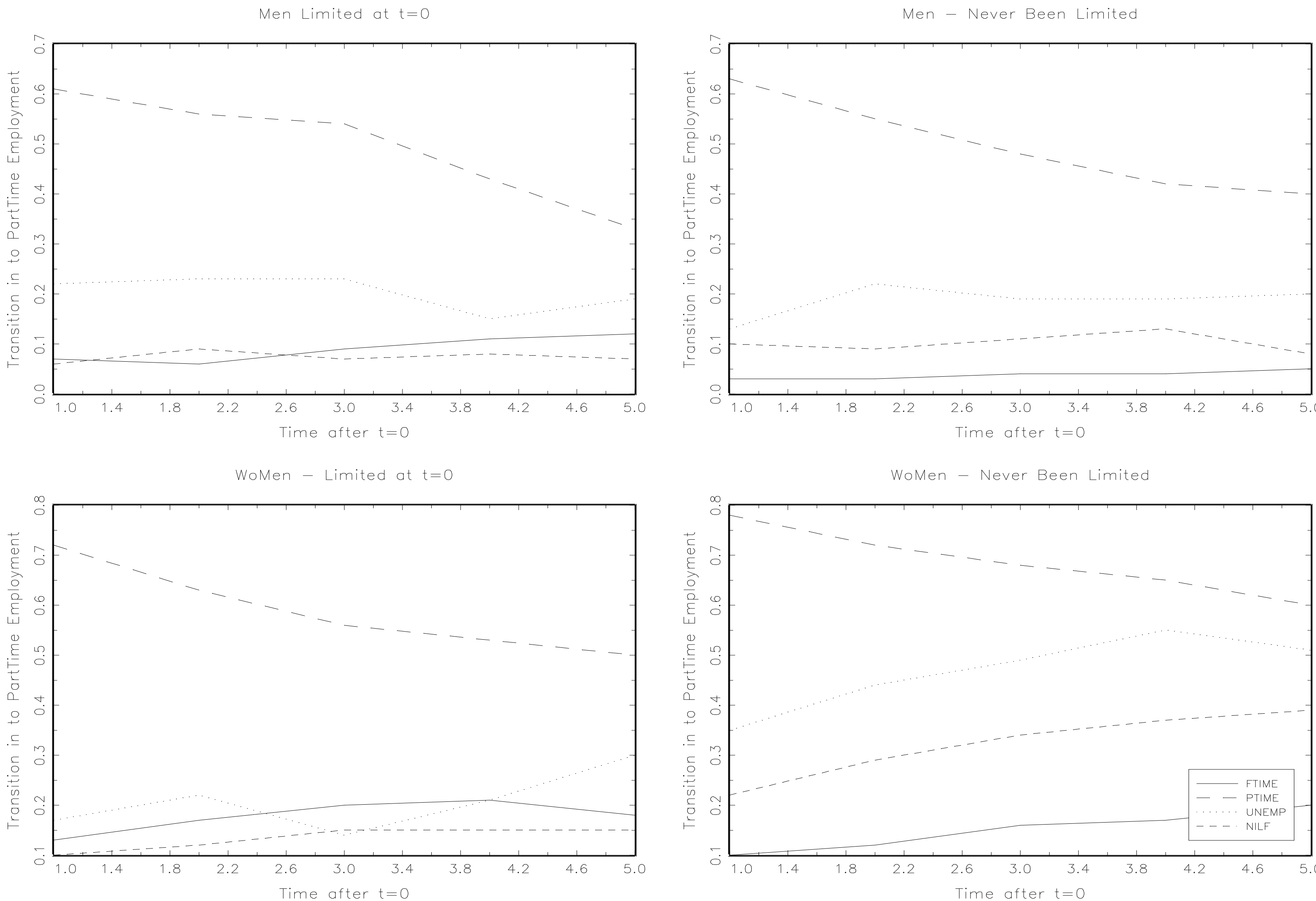




Probability of Switching to Full time Employment Conditional on Initial Employment State and Disability



Probability of Switching to Part time Employment Conditional on Initial Employment State and Disability



Dynamic Model

- Individual's Labour Supply Problem for individual *i* at time *t:*

$$Max_j U_j(\alpha_{i,j}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,j,t})$$

Dynamic Model

- Individual's Labour Supply Problem for individual *i* at time *t:*

$$Max_j U_j(\alpha_{i,j}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,j,t})$$

Observed characteristics
Age, Age^2, Marriage, Kids, Nonlabour income, education, partner LF status, city, occupation

Health History up to t

Employment History

j = Not in Labour Force, Unemployed, Part time, Full time

Dynamic Model

- Linear Approximation of utility of choosing employment state *j.*

$$y_{i,j,t} = 1 \begin{cases} 1 \text{ if } U_j(\alpha_{i,j}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,j,t}) > U_k(\alpha_{i,k}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,k,t}) \\ 0 \text{ otherwise} \end{cases}$$

$$y_{i,j,t} = \gamma_j y_{i,j,t-1} + \delta_{1,j} D_{i,t} + \delta_{2,j} D_{i,t-1} + \beta_1 x_{i,t} + \alpha_{i,j} + \epsilon_{i,j,t}$$

Dynamic Interaction Model

- Linear Approximation of utility of choosing employment state *j.*

$$y_{i,j,t} = 1 \begin{cases} 1 \text{ if } U_j(\alpha_{i,j}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,j,t}) > U_k(\alpha_{i,k}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,k,t}) \\ 0 \text{ otherwise} \end{cases}$$

$$y_{i,j,t} = \gamma_j y_{i,j,t-1} + \delta^*_{1,j}(y_{i,j,t-1} \times D_{i,t}) + \delta_{2,j} D_{i,t-1} + \beta_1 x_{i,t} + \alpha_{i,j} + \epsilon_{i,j,t}$$

Dynamic MMNL Model

- Linear Approximation of utility of choosing employment state *j*.

$$y_{i,j,t} = 1 \begin{cases} 1 \text{ if } U_j(\alpha_{i,j}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,j,t}) > U_k(\alpha_{i,k}, X_{i,t}, D_{i,t}, \Omega_{i,t-1}, \epsilon_{i,k,t}) \\ 0 \text{ otherwise} \end{cases}$$

Type I Extreme Value

$$y_{i,j,t} = \gamma_j y_{i,j,t-1} + \delta_{1,j} D_{i,t} + \delta_{2,j} D_{i,t-1} + \beta_1 x_{i,t} + \alpha_{i,j} + \epsilon_{i,j,t}$$

(Alternative specific) Individual Unobserved Heterogeneity

$$\alpha_i \sim I_3(0, \Sigma)$$

Few Issues

- Random effects are too random
  - Mundlak (1978), Chamberlain (1986)
- Initial Conditions Problem
  - Heckman (1981), Gong et al (2004)

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$t = 0$

Data Starts

$$y_t = f(y_{t-1}, \alpha_i) \\ = f(y_0, \alpha_i)$$

Few Issues: Likelihood Function

$$\theta_i = C\alpha_i = B\eta_i;\ \eta_i \sim N(0, I_3)$$

$$L_i(\eta) = \prod_{j=1}^{J} P(j|x_{i,1}, \theta_{ij}) \prod_{t=2}^{T} \prod_{j=1}^{J} P(j|x_{i,t}, D_{i,t}, D_{i,t-1} y_{i,j,t-1}, \alpha_{i,j})$$

$$L = \prod_{i=1}^{N} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} L_i(\eta_i) f(\eta_i) d(\eta_{i2}) d(\eta_{i3}) d(\eta_{i4})$$

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The model is infeasible to estimate, unless we use...

Simulated Maximum Likelihood

- Steps:
  - Generate random draws
  - Convert to trivariate normal
  - Plug them into the likelihood function
  - Repeat...
    - Simulated Likelihood Function

$$L_i^R = \frac{1}{R}\sum_{r=1}^{R} L_i(\eta_i^r)$$

MMNL Results at a glance

- Dynamic Models
  - Highly significant own and cross state dependence
  - Highly significant current disability effect
  - REs significant except for unemployment
  - Unobserved factors are similar (but not the same) across states.
- Dynamic Interaction Models
  - Disability effect depends on past employment
    - except unemployment

Average Partial Effects

	MEN				WOMEN			
	State at t				*State at t*			
	NILF	UNEMP	PT	FT	NILF	UNEMP	PT	FT
Dynamic Model								
LFT	-37.67	-3.83	-8.98	50.49	-50.55	-1.34	-13.21	65.10
LPT	-34.12	-2.77	28.47	8.42	-47.38	-1.58	41.62	7.35
LUNE	-27.55	4.76	0.20	22.59	-33.85	3.62	9.76	20.48
LWORKLIM	0.90	-0.80	0.55	-0.66	3.54	-0.37	-2.54	-0.63
WORKLIM	8.26	1.07	2.17	-11.50	9.03	1.03	-1.67	-8.39

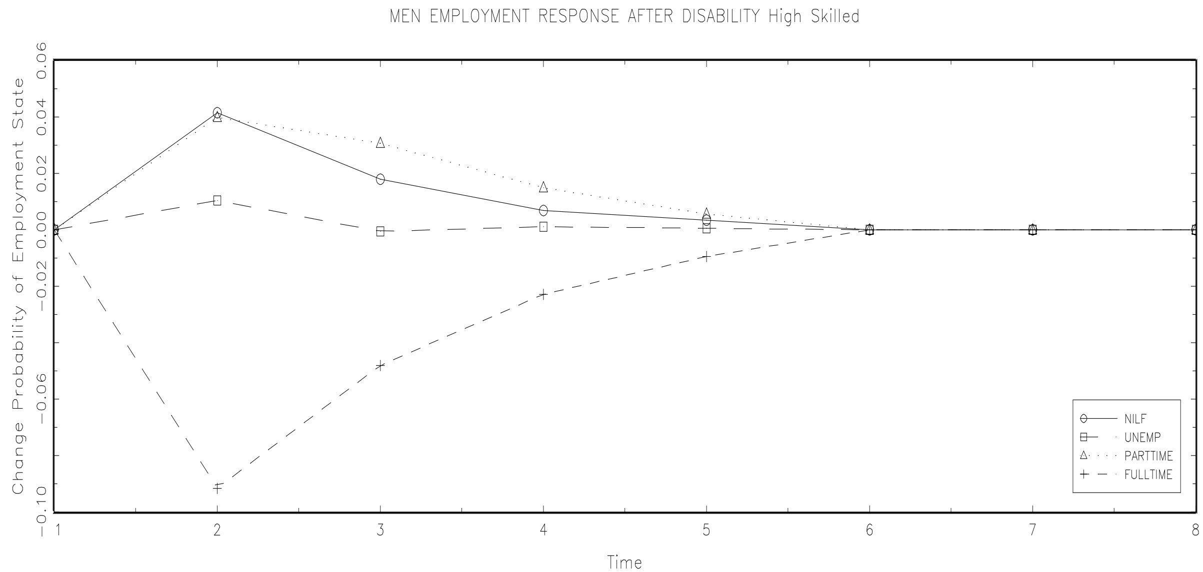
Average Partial Effects- Interaction Model

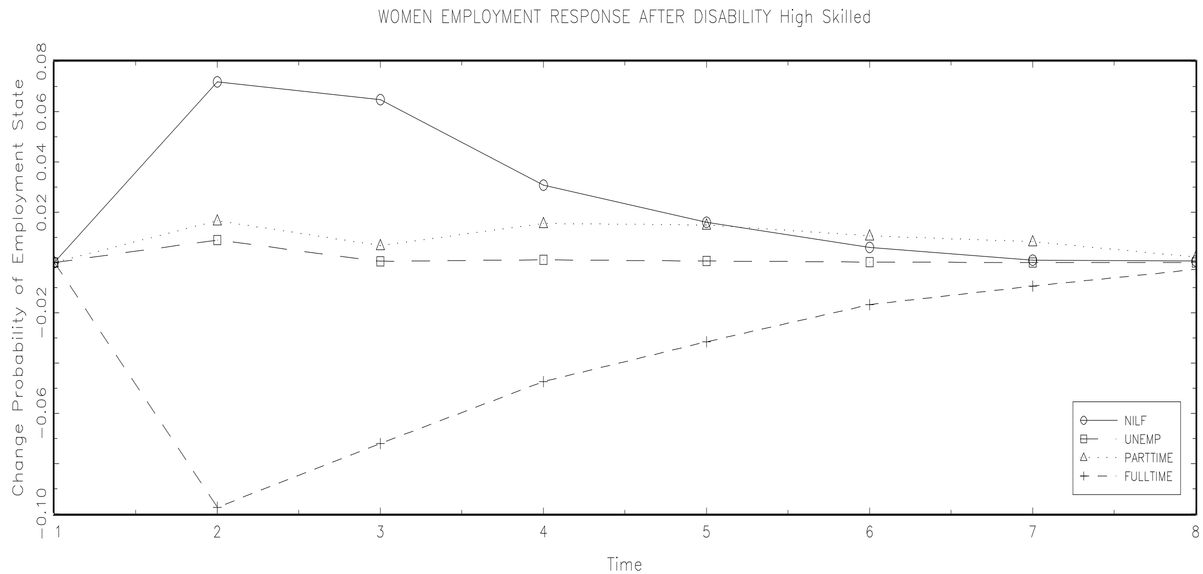
	MEN				WOMEN			
	State at t				*State at t*			
	NILF	UNEMP	PT	FT	NILF	UNEMP	PT	FT
Dynamic Interaction Model								
LFT	-42.52	-4.48	-10.28	57.28	-54.12	-51.18	-37.06	2.72
LPT	-38.38	-3.52	30.57	11.33	-1.48	-1.49	3.41	-0.33
LUNE	-33.55	3.82	-0.78	30.50	-12.88	43.13	9.37	-1.94
LWORKLIM	0.81	-0.81	0.50	-0.49	68.48	9.54	24.28	-0.44
WORKLIM								
x LFT	9.03	1.19	2.88	-13.10	5.54	2.35	4.79	-12.68
x LPT	12.63	2.38	3.74	-18.75	9.27	0.84	-2.49	-7.62
x LUNE	21.28	6.99	7.47	-35.75	10.25	3.38	3.09	-16.72
x LNILF	10.10	1.74	2.00	-13.84	15.35	3.56	-6.67	-12.23

Model Simulations : The Design

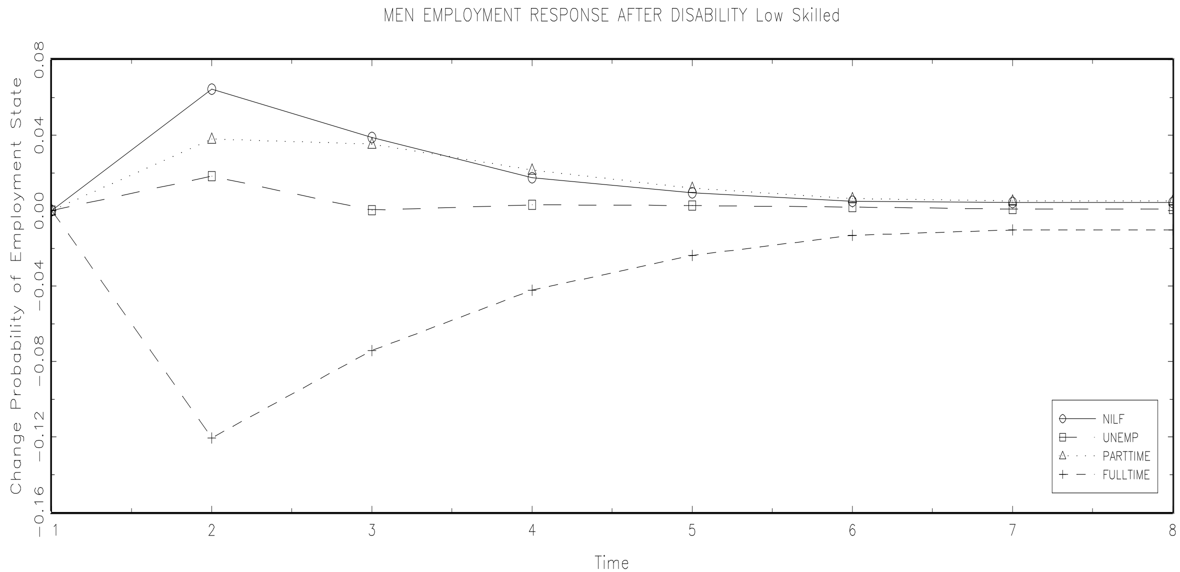
- Simulating intertemporal effect of disability on average person’s choice probabilities
  - High skilled (BA+ , white collar)
  - Low skilled (not BA+, blue collar)
  - Disability shock at $t = 2$
    - not disabled at $t = 1$ & $t \geq 3$

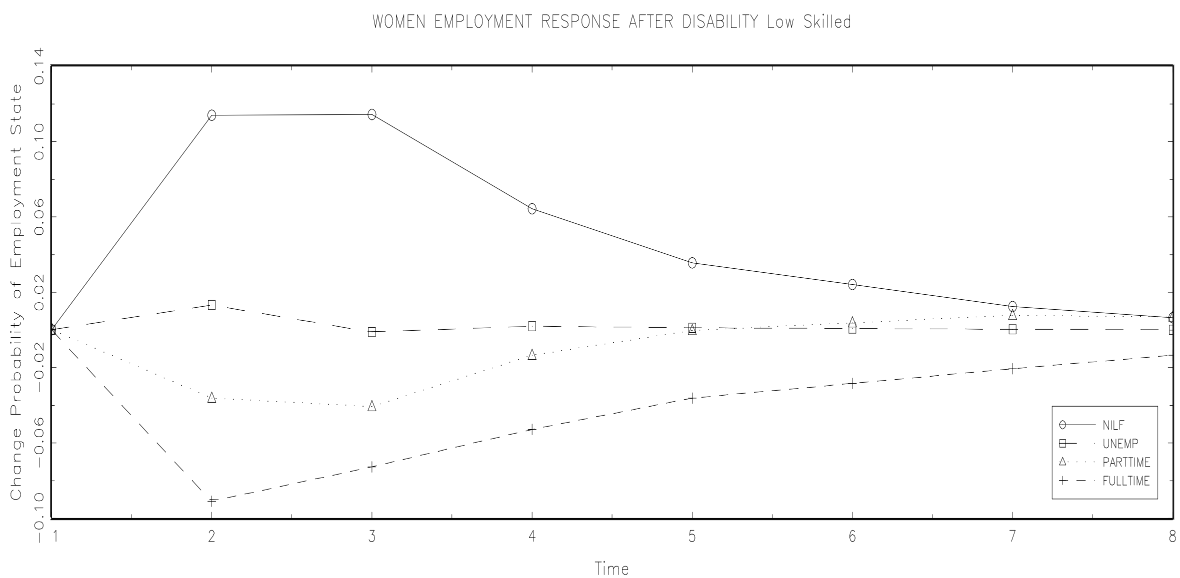
Employment Response after Disability - High Skilled Persons





Employment Response after Disability - Low Skilled Persons





Conclusion

- Strong own and cross state dependence in labour force behaviour
- Large effect of disability on FT
- Small effect on UEMP and PT is due to opposite flows from other employment states
- Magnitude of effect depends on employment history
- Due to feedback effect temporary shock may have long lasting impacts
  - Different effect across gender and skill.

Endogeneity of Work Disability

- Justification bias + Measurement Error
- LPM with Fixed Effects estimated by GMM

$$y_{i,t}^{FT} = \gamma_1 y_{i,t-1}^{FT} + \beta_1 Z_{it} + \beta_2 D_{it} + \beta_3 D_{i,t-1} + \eta_i^{FT} + \epsilon_{it}^{FT}$$

$$y_{i,t}^{PT} = \gamma_2 y_{i,t-1}^{PT} + \beta_4 Z_{it} + \beta_5 D_{it} + \beta_6 D_{i,t-1} + \eta_i^{PT} + \epsilon_{it}^{PT}$$

$$y_{i,t}^{UE} = \gamma_3 y_{i,t-1}^{UE} + \beta_7 Z_{it} + \beta_8 D_{it} + \beta_9 D_{i,t-1} + \eta_i^{UE} + \epsilon_{it}^{UE}$$

  – can accommodate $E[\eta_i, X_{it}] \neq 0 \text{ and } E[D_{it}, \epsilon_{it}] \neq 0$

Endogeneity of Work Disability

- Justification bias + Measurement Error
- LPM with Fixed Effects estimated by GMM

$$y_{i,t}^{FT} = \gamma_1 y_{i,t-1}^{FT} + \beta_1 Z_{it} + \beta_2 D_{it} + \beta_3 D_{i,t-1} + \eta_i^{FT} + \epsilon_{it}^{FT}$$
$$y_{i,t}^{PT} = \gamma_2 y_{i,t-1}^{PT} + \beta_4 Z_{it} + \beta_5 D_{it} + \beta_6 D_{i,t-1} + \eta_i^{PT} + \epsilon_{it}^{PT}$$
$$y_{i,t}^{UE} = \gamma_3 y_{i,t-1}^{UE} + \beta_7 Z_{it} + \beta_8 D_{it} + \beta_9 D_{i,t-1} + \eta_i^{UE} + \epsilon_{it}^{UE}$$

  – Should watch out for Sargan and AR(2) tests

RE vs FE

MMNL	LPM
Own state dependence	✓
Cross state dependence	✓ ✗ (PT, UNEMP)
Work Disability at t	✓ ✗ (PT, UNEMP)

EXTRAS

Joint Estimation

- Two-Equation Model

$$y_{it} = \gamma y_{i,t-1} + X'_{it}\beta_1 + \delta_1 D_{it} + \delta_2 D_{i,t-1} + \alpha_i + \varepsilon_{it}$$

$$D_{it} = \gamma_1 D_{i,t-1} + X'_{it}\beta_2 + \eta_i + \nu_{it}$$

$$(\alpha_i, \eta_i) \sim BVN(\sigma_1, \sigma_2, \rho)$$

Logit Probabilities

- Probability of Choosing State *j*

$$P(j|X_{it},\alpha_i) = \frac{exp(y_{i,t-1,j}\gamma_j + X_{it}\beta_j + \delta_{1j}D_{i,t} + \delta_{2j}D_{i,t-1} + \alpha_{ij})}{\sum_{k=1}^{J} exp(y_{i,t-1,k}\gamma_k + X_{it}\beta_k + \delta_1 D_{i,t} + \delta_{2k}D_{i,t-1} + \alpha_{ik})}$$

Employment by Work Limitation

	MEN		WOMEN	
	Work Limited	Not Work Limited	Work Limited	Not Work Limited
FT	36.65	85.00	19.96	38.54
PT	13.03	8.10	27.21	38.04
UNEMP	4.21	2.00	4.29	2.08
NILF	46.11	4.90	48.55	21.34

Transition across Employment States, Not Disabled

MEN								
State at t	*State at t +1*				*State at t+2*			
	FT	PT	UNE	NILF	FT	PT	UNE	NILF
FT	95.12	2.90	0.76	1.21	93.52	3.68	0.73	2.07
PT	29.90	61.18	2.61	6.31	36.40	52.34	2.95	8.32
UNEMP	45.16	14.52	26.88	13.44	47.59	19.88	18.07	14.46
NILF	12.06	10.17	7.80	69.98	19.25	11.80	6.83	62.11

WOMEN								
State t	*State t +1*				*State t+2*			
	FT	PT	UNE	NILF	FT	PT	UNE	NILF
FT	85.03	10.82	0.59	3.55	80.46	13.67	0.56	5.31
PT	14.58	76.45	1.15	7.83	19.08	70.29	1.24	9.40
UNEMP	19.16	32.24	19.16	29.44	24.46	40.22	11.96	23.37
NILF	3.21	19.40	4.05	73.34	5.54	26.04	4.11	64.31

Transition across Employment States, Disabled

MEN

State at t	State at t +1				State at t+2			
	FT	PT	UNE	NILF	FT	PT	UNE	NILF
FT	82.29	6.83	1.67	9.21	76.53	7.36	2.30	13.80
PT	13.43	60.65	3.24	22.69	19.58	54.50	5.82	20.11
UNEMP	6.10	23.17	26.83	43.90	12.50	21.88	14.06	51.56
NILF	3.16	5.40	3.16	88.27	2.99	8.82	2.68	85.51

WOMEN

State at t	State at t +1				State at t+2			
	FT	PT	UNE	NILF	FT	PT	UNE	NILF
FT	73.32	16.44	2.70	7.55	69.88	17.08	3.73	9.32
PT	9.83	71.18	2.40	16.59	11.32	63.68	2.12	22.88
UNEMP	11.11	15.28	31.94	41.67	10.17	22.03	22.03	45.76
NILF	1.83	9.05	4.03	85.09	2.77	11.08	4.08	82.07

Disability Transition

	MEN		
	Percentage Disabled		
State at t	*t+1*	*t+2*	*t+3*
Not Limited	5.72	6.97	7.71
Limited	74.60	74.51	72.63
	WOMEN		
State at t	*t+1*	*t+2*	*t+3*
Not Limited	5.38	6.73	7.65
Limited	71.00	69.53	68.65

Model Predictions

	MEN				WOMEN			
Wave 2								
	NILF	UNEMP	PT	FT	NILF	UNEMP	PT	FT
Actual	9.68	3.25	8.39	78.68	26.55	2.91	35.69	34.86
Static	6.72	0.00	0.17	93.12	11.12	0.00	66.70	22.18
Dynamic	9.96	0.34	4.25	85.45	28.21	0.16	35.79	35.84
Dynamic Int.	10.18	0.22	4.76	84.83	28.21	0.16	35.84	35.79

Motivation

- Disability → work, hours of work, wages ↓
- Health ~ Work Relationship is complex
  - Both outcome vary overtime
  - Unobserved heterogeneity
  - State dependence mask true effect of health
  - Long run effect of temporary shocks
  - *Endogeneity of self assessed health*