



The causal effects of retirement on mental health

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Research Question

What are the effects of retirement on mental health, i.e. depression?

- ▶ 17.4% of the European population are older than 65 years, upward trend
- ▶ Threats to the sustainability of social security systems; constitutionally set retirement ages being increased
- ▶ Costs of depression in Germany: Between EUR 15.5 – 21 billion. Direct costs of EUR 5.2 billion (increase of one third within 6 years)
- ▶ Depression increases the risk of Alzheimer's (2,0-fold), Parkinson's disease (2,0-fold), cardiovascular disease (2,0-fold) und Diabetes (1,4-fold)

Concerns and contribution

Endogeneity problem – Self-selection into retirement

Accounting for heterogeneity in the dependent variable

→ Older literature focuses on mean estimation of overall health, physical health, cognition; few find effects

Rohwedder, S. & Willis, R. J. (2010) – Mental retirement

Coe, N.B. & Zamarro, G. (2011) – Retirement effects on health in Europe.

Survey of Health and Retirement in Europe

Individuals aged 50+ from 19 European countries, 150,000 observations
Micro data on health, socio-economic status

Sample:

Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium

Data from 2004/2005, 2006/2007, 2011/2012

Age-window: 55-69 years

dropped those who never worked

Observations: 29.202; F51% M49%

Key variables

Dependent

EURO-D Index

- ▶ Count of depressive symptoms
- ▶ Depression is clinically indicated at ≥ 4 symptoms

Endogenous

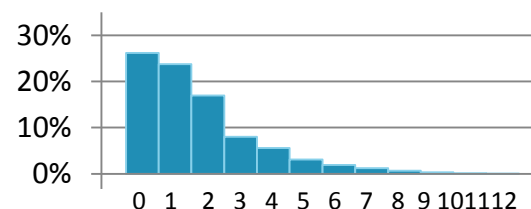
Retired

- ▶ being out of the labor force and staying out permanently
- ▶ 0 when working, i.e. employed or self-employed
- ▶ 1 when retired, unemployed, permanently sick or disabled, homemaker, other and additionally have not done any paid work in the previous month

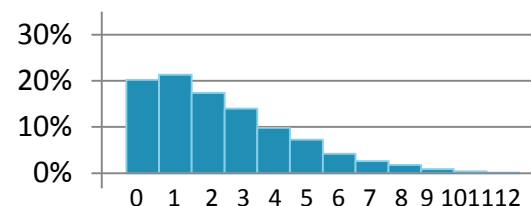
The EURO-D Index (numb. of depressive symptoms)

	ALL	Males	Females
Percentiles:			
1st	0	0	0
5th	0	0	0
10th	0	0	0
25th	0	0	1
50th	1	1	2
75th	3	2	4
90th	5	4	5
95th	6	5	7
99th	9	8	9
Mean	2,045	1,647	2,43001
Standard deviation	2,064	1,848	2,18598
Maximum	12	12	12
Skewness	1,26	1,565	1,02343
Share of ind. with zero depressive symptoms	26,63	32,88	20,59
# of observations	29.202	14.349	14.853

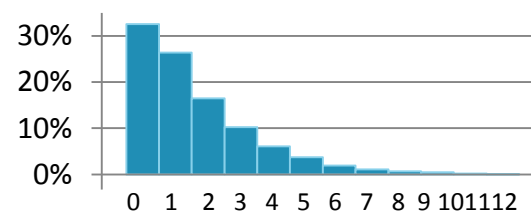
All – 21% depressed



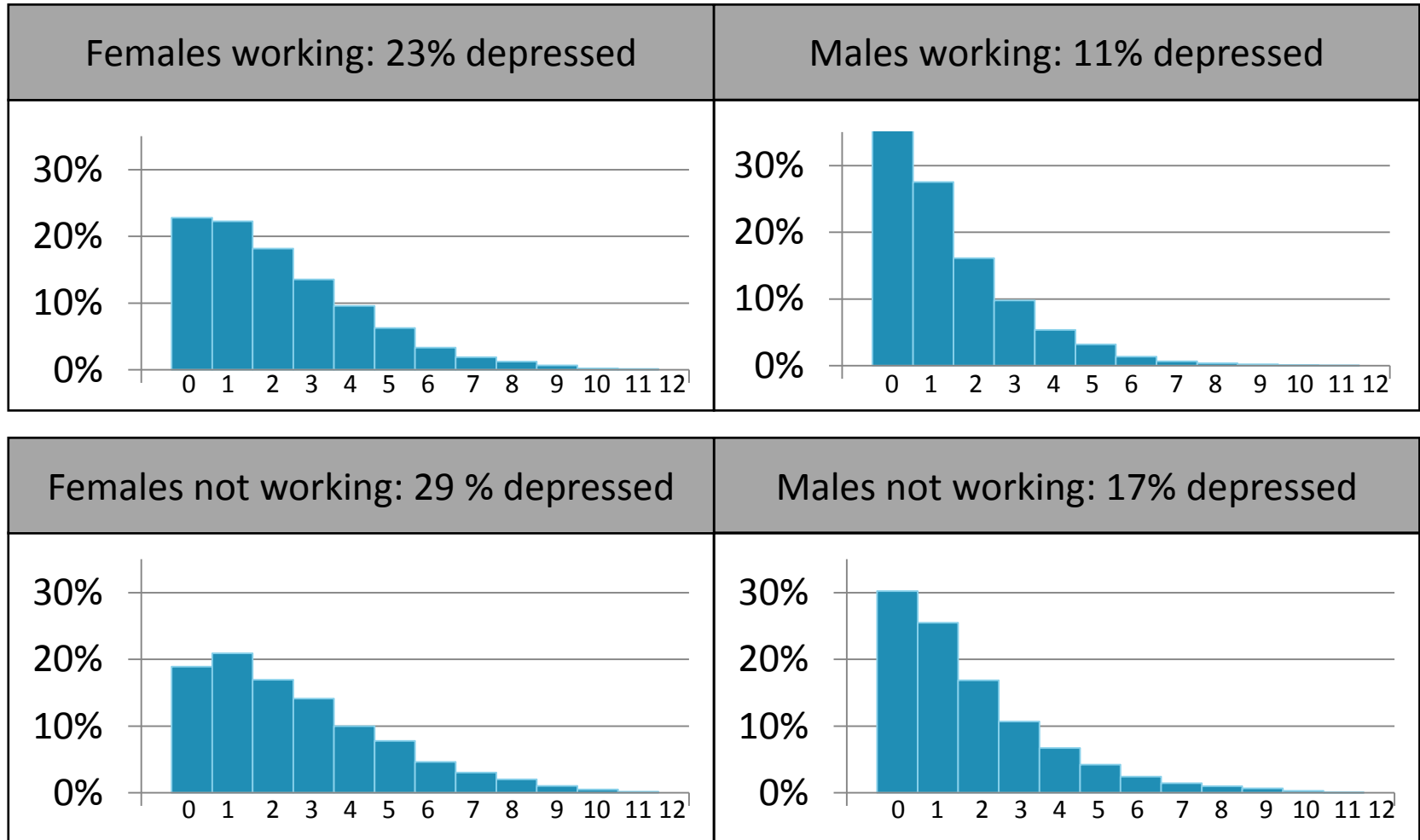
females: 27% depressed



males: 14% depressed



Number of depressive symptoms conditional on working



Method – censored quantile IV regression

$$M_i^r = X_i \beta^\tau + \hat{r}_i \delta^\tau + \varepsilon_i$$

M = mental health
 X = controls
 r = retirement dummy
 i = index individual i
 τ = quantile

- quantile: effects could differ from the estimated mean effect
- skewness: 79% have less than 4 depressive symptoms
- censoring: 26% of individuals without symptoms
 Type I Tobit model of Amemiya
 less sensitive to outliers
- endogeneity: $\text{corr}(r, \varepsilon) \neq 0$
 negative feedback effect: underestimation

Estimator of Chernozhukov und Kowalski (2012)

Instruments: eligibility ages to receive pension benefits

$$z_1 = 1 \text{ if } \text{age}_{it} \geq \text{early}_{tc}$$

$$z_2 = 1 \text{ if } \text{age}_{it} \geq \text{full}_{tc}$$

early_{tc} = earliest age to receive retirement benefits in country c at time t

full_{tc} = eligibility age to receive full retirement benefits in country c at time t

Controlling for country-specific age-effects and including country dummies.

assumption:

- ▶ No effect on the mental health status of the individual
- ▶ uncorrelated with unobserved determinants of mental health
- ▶ Estimator for the probability of being retired

(Exogenous, valid, relevant)

Instruments: eligibility ages to receive pension benefits

	early						normal							
	'04 May	'05 Jan	'06 Jul	'10 Jan	'11 Jul	'12 Jul	'04 May	'05 Jul	'06 Jan	'10 Jan	'11 Jan	'11 Jul	'12 Jan	'12 Jul
Austria	61.5 (56.5)	61.9 (56.9)	·	62.3 (57.3)	62.9 (57.9)	·	65 (60)	·	·	·	·	·	·	·
Belgium	60	·	·	·	·	·	65 (63)	·	·	(64)	·	(65)	·	·
Switzerland	64 (62)	·	·	(63)	·	·	65 (63)	·	(64)	·	·	·	·	·
Denmark	60	·	·	·	·	·	65/67	·	·	65	·	·	·	·
Spain	60	·	·	·	·	·	65	·	·	·	·	·	·	·
France	60	·	·	·	·	·	60	·	·	·	·	60-62	·	·
Germany	60	·	·	·	·	·	65	·	·	·	·	·	65.1	·
Greece	60 (55)	·	·	·	·	(56)	65 (60)	·	·	·	·	(61)	·	·
Italy	57	·	·	·	·	62	65 (60)	·	·	·	·	·	·	66 (62-66)
Netherlands	60	·	·	·	·	·	65	·	·	·	·	·	·	·
Sweden	61	·	·	·	·	·	65	·	·	·	·	·	·	·

sources: European Commission (2012), Government of the Netherlands (2012), OECD (2005, 2007, 2009, 2011)

note: Eligibility ages applicable at the respective years for those who have reached the eligibility ages, i.e. those that could retire in the respective year. The eligibility ages chosen are those with the greatest incentives to retire. Varying incentives are indicated.

First Stage OLS

	Male		Female	
early	0,079***	(0,015)	0,089***	(0,016)
full	0,139***	(0,020)	0,120***	(0,020)
<i>N</i>	14349		14853	
adj. R^2	0,4269		0,3651	

Standard errors in parentheses

note: coefficients of other control variables not shown

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Weak instruments:

Staiger-Stock rule of thumb rejects the null of weak instruments.

Validity:

Overidentifying restriction is met (no rejection of the null: Hansen's / Sargan Test)

Descriptives

	All	Male	Female		All	Male	Female
eurod	2,04	1,65	2,43	hhincQ1	0,10	0,10	0,10
depressed	0,21	0,14	0,27	hhincQ2	0,23	0,22	0,24
retired	0,65	0,59	0,70	hhincQ3	0,31	0,31	0,31
early	0,29	0,31	0,27	hhincQ4	0,36	0,37	0,35
full	0,32	0,26	0,37	married	0,78	0,83	0,72
age	61,54	61,56	61,51	gali	0,36	0,33	0,39
underweight	0,01	0,01	0,02	iadl2	0,09	0,07	0,12
normalweight	0,38	0,31	0,44	adl2	0,06	0,06	0,06
overweight	0,43	0,50	0,36	mobility	1,05	0,78	1,30
obese	0,19	0,18	0,19	phactiv	0,06	0,06	0,06
social	1,29	1,23	1,34	city	0,20	0,20	0,21
nchild	2,10	2,10	2,10	town	0,27	0,28	0,26
edlow	0,23	0,22	0,25	rural	0,19	0,20	0,18
edmed	0,50	0,50	0,51				
edhigh	0,26	0,28	0,24				

note: Not reported are seasonal and country dummies. Equivalent household income is measured in rank quartiles.

Estimation results for men using quantile regression

Male

CQIV	retired	q1	q2	q3	q4	q5	q6	q7	q8	q9
Censored Quantile	_b	0.00	0.00	0.07	0.06	0.06	0.08	0.09	0.21	0.28
	mean	0.01	0.02	0.08	0.06	0.06	0.08	0.11	0.19	0.29
	lower	-0.01	0.00	0.00	0.00	0.01	0.03	0.02	0.03	0.11
	upper	0.04	0.12	0.18	0.15	0.12	0.15	0.21	0.32	0.45
Censored Quantile IV	_b	0.00	0.00	1.00	0.50	0.53	0.21	0.83	-0.34	0.29
	mean	0.14	0.11	0.77	0.59	0.65	0.57	1.06	0.27	0.81
	lower	-0.12	-0.90	-0.33	-0.92	-0.50	-0.38	-0.50	-2.18	-2.09
	upper	1.33	1.70	2.65	2.28	2.09	1.69	2.48	3.17	3.89

	(1)	(2)	(3)	(4)	(5)	(6)
Mean Estimates	OLS	IV	OLS	IV	TOBIT	TOBIT IV
retired	0,026*** (0,007)	0,117 (0,124)	0,166*** (0,038)	0,272 (0,633)	0,202*** (0,053)	0,405 (0,908)
Observations	14349	14349	14349	14349	14349	14349

Note: Lower and upper bounds of 95% confidence interval from 200 bootstrap replications in CQIV. Dependent variable in (1) and (2) is clinically indicated depression with four or more symptoms. Dependent Variable in (3) (4) (5) and (6) is the Euro-D scale counting the number of depressive symptoms and running from 0 to 12. Standard errors in parentheses for mean estimates; * p<0.1, ** p<0.05, *** p<0.01; Tests on endogeneity with Ho: variables are exogenous

















Estimation results for women using quantile regression

Female		retired	q1	q2	q3	q4	q5	q6	q7	q8	q9
Censored Quantile	CQIV										
	_b	0.14	0.04	0.07	0.08	0.04	0.06	0.08	0.21	0.22	
	mean	0.06	0.06	0.08	0.08	0.05	0.07	0.09	0.20	0.21	
	lower	-0.06	-0.03	0.00	-0.03	-0.05	-0.06	-0.06	0.01	0.02	
upper	0.24	0.17	0.16	0.17	0.15	0.21	0.25	0.34	0.41		
Censored Quantile IV	_b	-0.28	0.33	0.47	0.77	0.84	0.90	0.75	-0.76	-2.24	
	mean	0.42	0.15	0.62	1.29	1.09	1.25	0.80	-0.72	-1.59	
	lower	-1.72	-1.77	-1.13	-1.11	-1.03	-1.45	-1.76	-4.06	-5.13	
	upper	3.47	2.32	2.26	3.81	2.66	3.18	3.31	1.86	1.86	

	(1)	(2)	(3)	(4)	(5)	(6)
Mean Estimates	OLS	IV	OLS	IV	TOBIT	TOBIT IV
retired	0,016*	0,164	0,093**	0,282	0,115**	0,066
	(0,009)	(0,163)	(0,044)	(0,772)	(0,054)	(1,0605)
Observations	14853	14853	14853	14853	14853	14853

Note: Lower and upper bounds of 95% confidence interval from 200 bootstrap replications in CQIV. Dependent variable in (1) and (2) is clinically indicated depression with four or more symptoms. Dependent Variable in (3) (4) (5) and (6) is the Euro-D scale counting the number of depressive symptoms and running from 0 to 12. Standard errors in parentheses for mean estimates; * p<0.1, ** p<0.05, *** p<0.01; Tests on endogeneity with Ho: variables are exogenous

Effects on distinct symptoms of depression

Dependent Variable	Males		Females	
	OLS	2SLS	OLS	2SLS
  depression	0,016*	0,151	0,022**	0,239
 suicidality	0,016***	-0,095	0,006	-0,001
 guilt	0,011**	-0,000	0,002	0,096
  sleep	0,018**	-0,001	0,024**	-0,001
 tearfulness	0,018**	0,051	0,014	0,307
 irritability	0,005	0,068	-0,005	-0,101
 appetite	0,012***	0,046	0,001	-0,071
 fatigue	-0,002	-0,092	-0,008	-0,035
  pessimism	0,025***	0,169	0,017***	0,056
 interest	0,020***	-0,085	0,000	0,018
 concentration	0,016**	0,096	0,007	-0,007
  enjoyment	0,015**	0,024	0,011*	-0,237*
Observations	14357	14357	14851	14851

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

 Male
 Female

Social network and retirement

Effects of retirement on EURO-D, individuals with and without social activities

	Males				Females			
	OLS		2SLS		OLS		2SLS	
	No Soc. Act	Soc. Act	No Soc. Act	Soc. Act	No Soc. Act	Soc. Act	No Soc. Act	Soc. Act
retired	0,264*** (0,064)	0,102** (0,047)	0,928 (1,150)	-0,211 (0,739)	0,213*** (0,079)	0,033 (0,053)	-0,711 (1,183)	1,042 (1,030)
Observations	5535	8814	5535	8814	5185	9668	5185	9668
Adjusted R ²	0,262	0,155	0,247	0,15	0,257	0,176	0,237	0,144

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Effects of retirement on distinct social activities:

Dependent Variable	Males	Females
	OLS	OLS
any social act.	0,031***	0,053***
(1) charitywork	0,027***	0,059***
(2) educctraining	-0,042***	-0,060***
(3) sportclub	0,032***	0,024***
(4) religious	0,007	0,007
(5) politics	-0,015***	-0,006
Observations	14306	14828

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A less demanding environment leads to an increase in psychological problems

Retirement is associated with developing (more) depressive symptoms.

Retirement does not seem to severely increase mental health problems...

...effects differ from mean estimation for a substantial part of the distribution...

...but also does not improve mental health.



Thank you for your attention.



Additional slides

<p>Question 1: SAD OR DEPRESSED LAST MONTH ‘In the last month, have you been sad or depressed?’ 0 No 1 Yes</p>	<p>Question 7: IRRITABILITY ‘Have you been irritable recently?’ 0 No 1 Yes</p>
<p>Question 2: HOPES FOR THE FUTURE ‘What are your hopes for the future?’ 0 Any hopes mentioned 1 No hopes mentioned</p>	<p>Question 8: APPETITE ‘What has your appetite been like?’ 0 No diminution in desire for food, non-specific or uncodeable response 1 Diminution in desire for food</p>
<p>Question 3: FELT WOULD RATHER BE DEAD ‘In the last month, have you felt that you would rather be dead?’ 0 No such feelings 1 Any mention of suicidal feelings or wishing to be dead</p>	<p>Question 9: FATIGUE ‘In the last month, have you had too little energy to do the things you wanted to do?’ 0 No 1 Yes</p>
<p>Question 4: FEELS GUILTY ‘Do you tend to blame yourself or feel guilty about anything?’ 0 No such feelings 1 Obvious excessive guilt or self-blame, mentions guilt or self-blame, but it is unclear if these constitute obvious, or excessive guilt or self-blame</p>	<p>Question 10: CONCENTRATION ‘How is your concentration?’ (Difficulty in concentrating on entertainment or reading) 1 Difficulty in concentrating on entertainment 2 No such difficulty mentioned</p>
<p>Question 5: TROUBLE SLEEPING ‘Have you had trouble sleeping recently?’ 0 No trouble sleeping 1 Trouble with sleep or recent change in pattern</p>	<p>Question 11: ENJOYMENT ‘What have you enjoyed doing recently?’ 0 Mentions any enjoyment from activity 1 Fails to mention any enjoyable activity</p>
<p>Question 6: LESS OR SAME INTEREST IN THINGS ‘In the last month, what is your interest in things?’ 0 No mention of loss of interest, non-specific or uncodeable response 1 Less interest than usual mentioned</p>	<p>Question 12: TEARFULNESS ‘In the last month, have you cried at all?’ 0 No 1 Yes</p>

Censoring

Three step procedure:

1. Estimate the probability of censoring based on X (Probits) and selection of the estimates with the higher probability to be censored
2. Quantile regression with this sample J_0 and selection of the observations above censoring point
3. Estimate the quantile regression with this extended sample

$$\hat{\beta}^0(u) = \arg \min_{\beta \in \mathbb{R}^{\dim(x)}} \sum_{i \in J_0} \rho_u(Y_i - \hat{X}_i' \beta)$$

With

$\rho_u = (\tau - 1(u \leq 0))u$ „check function“,
weights positive and negative terms asymmetrically

Endogeneity: Instrumental Variable Estimation

Relationship of interest:

$$m=f(r)$$

m=mental health; r=retirement

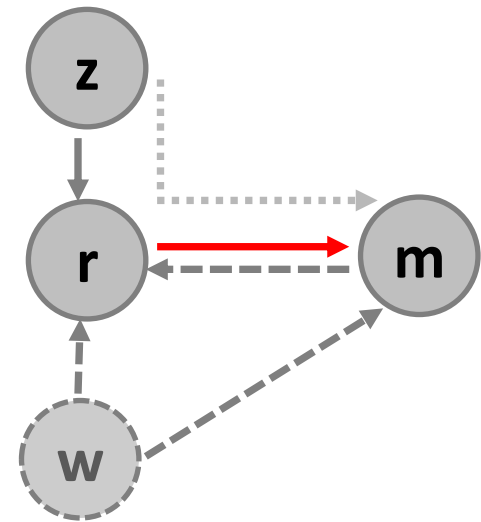
Problems:

omitted variable bias

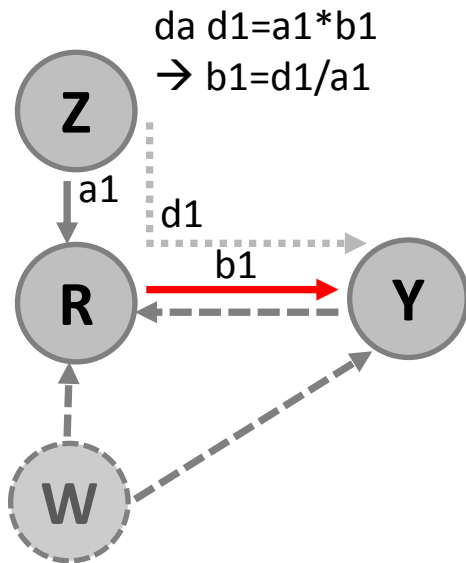
Simultaneous causation – Assuming that bad (good) health leads to an increase (decrease) of the probability to retire → negative feedback effect results in underestimation of the true effect.

Solution:

Instrument z, so $r=g(z)$



Endogeneity: Instrumental Variable Estimation

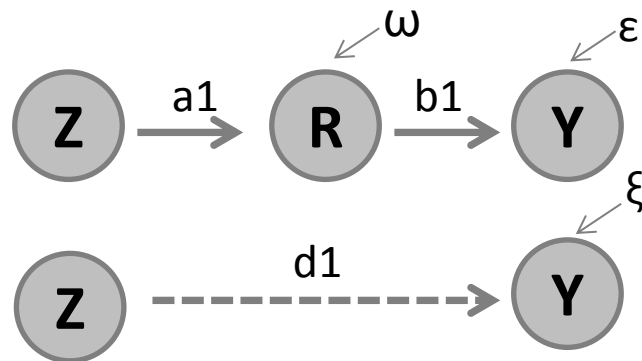


First Stage: $X = a_0 + a_1 Z + \omega$

Structural Model: $Y = b_0 + b_1 X + \epsilon$

Reduced Form: $Y = d_0 + d_1 Z + \xi$

$da \quad d1 = a1 * b1 \rightarrow b1 = d1 / a1$



Social network and retirement

Distribution of the EURO-D Scale by participation in social activities and gender

EUROD			0	1	2	3	4	5	6	7	8	9	10	11	12
m	0 social	#	1766	1371	872	559	346	247	142	94	61	47	22	5	3
	activities	%	31.9	24.8	15.8	10.1	6.3	4.5	2.6	1.7	1.1	0.9	0.4	0.1	0.1
	>0 social	#	2952	2403	1480	900	501	304	134	65	43	19	11	2	0
	activities	%	33.5	27.3	16.8	10.2	5.7	3.5	1.5	0.7	0.5	0.2	0.1	0	0
f	0 social	#	1010	1070	862	653	522	383	274	175	119	62	35	17	3
	activities	%	19.5	20.6	16.6	12.6	10.1	7.4	5.3	3.4	2.3	1.2	0.7	0.3	0.1
	>0 social	#	2050	2100	1740	1390	917	692	358	203	128	65	25	8	0
	activities	%	21.2	21.7	18.0	14.4	9.5	7.2	3.7	2.1	1.3	0.7	0.3	0.1	0

