We are not all equal: impact of socioeconomic status on old age dependence

LAGV Conference - July 2025

Laure Heymans[1], Mathieu Lefebvre[2], Jérôme Schoenmaeckers[3]

[1]UCLouvain Saint-Louis and HEC-Liege, [2]University of Strasbourg, [3]HEC-Liege

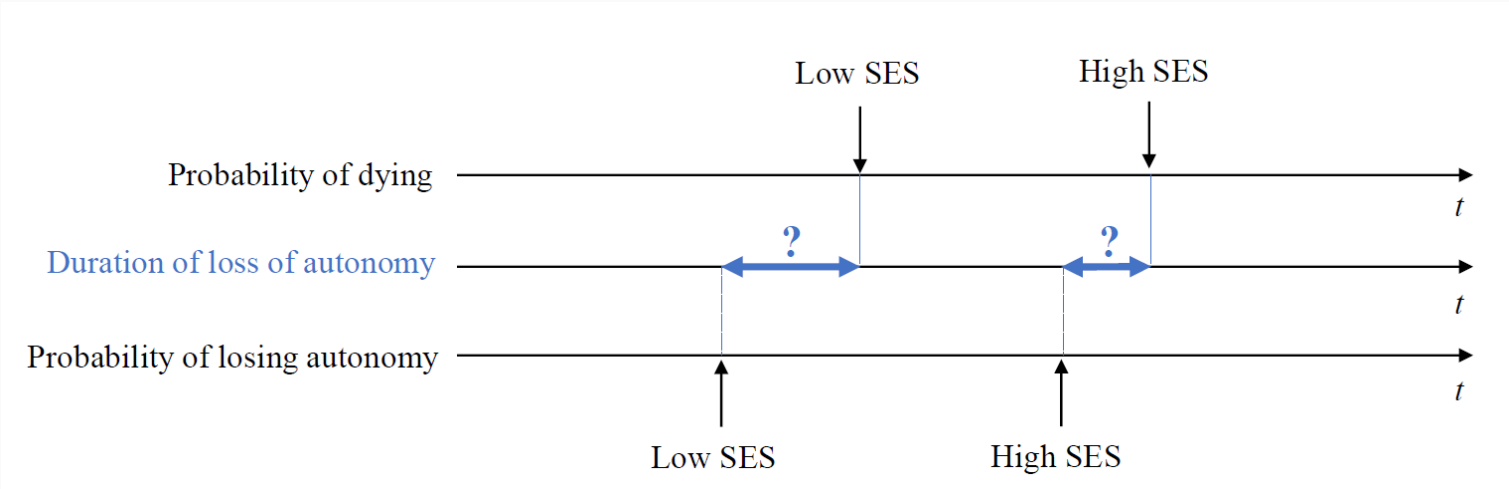
Introduction

Introduction

- Average life expectancy at birth is increasing (OECD, 2021)
- Living longer $\neq$ living longer in good health
  - In OECD countries: 50% of the 65 years old and older report daily limitations (ADL)(OECD, 2021)
  - Number of dependent people is expected to increase (Canta, 2020)
- Long-term care (LTC) needs will increase $\rightarrow$ costly for the individuals and the State.
  - LTC needs: the day-to-day help with activities of daily living and additional types of medical support
- Aim: how the loss of autonomy evolves at the end of life and which individuals are more likely to suffer from dependency.

Introduction

- **Research question:** what is the causal impact of wealth on
  - the probability of losing autonomy ?
  - the duration of the loss of autonomy ?



- **Data:** use 2 datasets: HRS (from the US) and SHARE (from Europe).
- **Methods:**
  - Probability of losing autonomy: Correlated random effect + IV
    - using inheritance/large gifts as an instrument for wealth
  - Duration of the loss of autonomy: Cox models + IV

Literature & Contributions

Probability of losing autonomy?

- negative correlation between education or income/wealth and functional limitations (Freedman and Martin, 1999; Kim and Rhum, 2012; Lefebvre et al., 2018; Connolly et al., 2025)

Duration of loss of autonomy?

- Cambois et al. (2011) with French data showed that manual workers have a double disadvantage: shorter life expectancy and more years in poor health and with disabilities
- Lefebvre et al. (2018): 1st paper looking at the duration aspect in Europe by using mainly end-of-life interviews.

Our contributions:

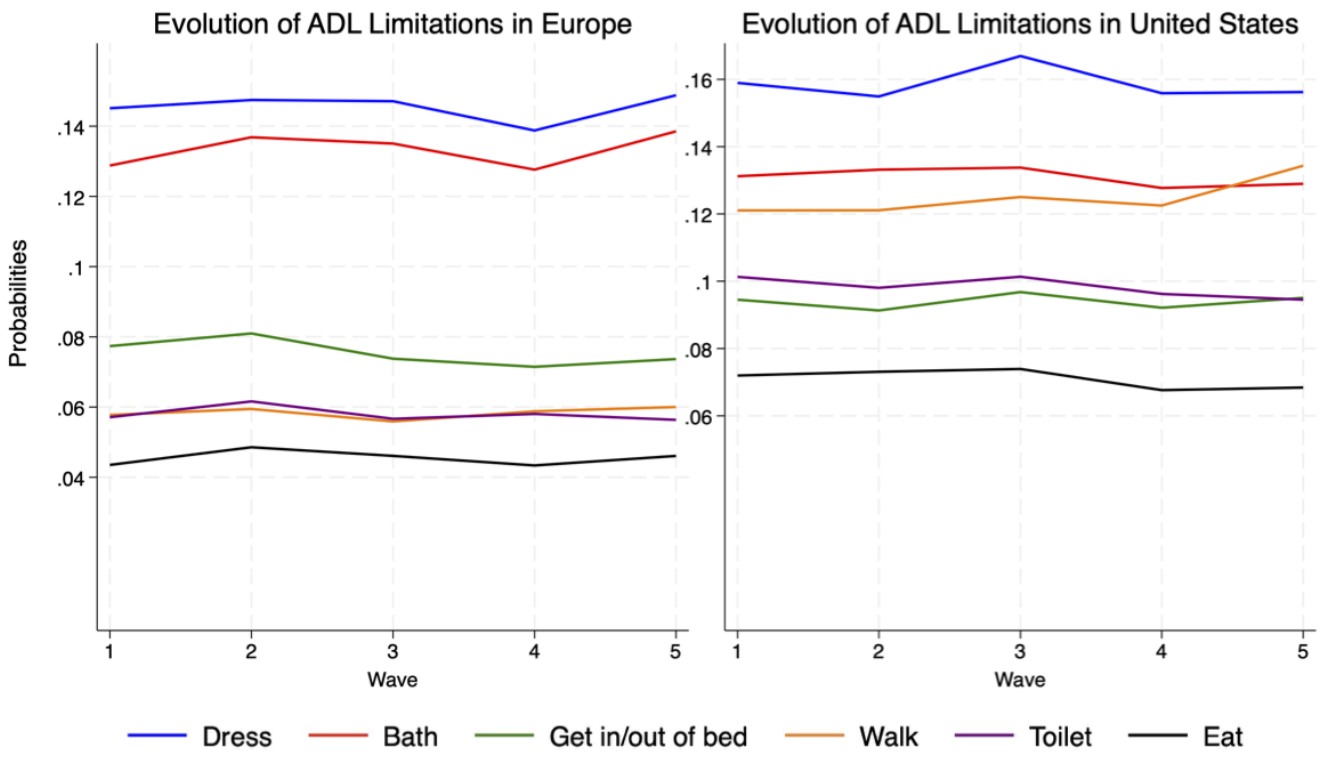
- *Method:* provide a stronger identification strategy
- *Thematic:* duration of loss of autonomy in Europe and US

Data

Data

- **HRS:** Health and Retirement Study (US)
- **SHARE:** Survey of Health, Ageing, and Retirement in Europe
- biennial and longitudinal surveys that follow people over 50 years old
- Access to the evolutions of:
  - the individual health status and characteristics
  - time at which the person becomes dependent/dies
  - Household/individual socioeconomic situation
- Highly harmonized: be used for pooled or comparative analyses
- Waves 10 to 14 for HRS; 4 to 8 for SHARE
  $\rightarrow$ time period: 2010/2011 - 2019/2020
- Focus on **65y and more**

Data: ADL Limitations



Data: Household Wealth

Household Wealth

- net sum of all assets = estimated value of real estate, amounts on bank accounts, value of shares and bonds, etc. to which any debts are subtracted
- Terciles and percentiles by country

Control for demographic (gender, age, education), health (mental and physical conditions) and family (partner and children) variables

Data: Alive individuals descriptive statistics

	1		2		3		4		5	
Variables	EU	US	EU	US	EU	US	EU	US	EU	US
N	11,046	7,249	9,332	6,549	8,187	5,646	7,088	4,833	6,006	4,180
HH wealth (thousands)	246.0	497.8	263.6	526.3	258.2	560.4	139.9	603.7	291.8	724.8
	(496.0)	(989.7)	(552.2)	(1,236.9)	(472.3)	(1,070.3)	(351.9)	(1,173.2)	(577.5)	(2,518.8)
Women	0.543	0.555	0.555	0.561	0.563	0.571	0.578	0.582	0.593	0.587
	(0.498)	(0.497)	(0.497)	(0.496)	(0.496)	(0.495)	(0.494)	(0.493)	(0.491)	(0.492)
Age	74.768	75.244	75.863	76.353	77.268	77.555	78.669	78.980	80.492	80.439
	(6.763)	(6.956)	(6.304)	(6.533)	(5.968)	(6.160)	(5.553)	(5.687)	(5.083)	(5.362)
low level education	0.482	0.225	0.461	0.213	0.446	0.200	0.431	0.194	0.408	0.183
	(0.500)	(0.418)	(0.498)	(0.409)	(0.497)	(0.400)	(0.495)	(0.396)	(0.491)	(0.387)
high level education	0.232	0.426	0.246	0.436	0.257	0.444	0.266	0.457	0.279	0.465
	(0.422)	(0.495)	(0.431)	(0.496)	(0.437)	(0.497)	(0.442)	(0.498)	(0.449)	(0.499)
Bad health status	0.582	0.728	0.581	0.757	0.605	0.782	0.627	0.806	0.626	0.830
	(0.493)	(0.445)	(0.493)	(0.429)	(0.489)	(0.413)	(0.484)	(0.396)	(0.484)	(0.376)

Table 1: Sample of alive individuals by regions overtime

Data: Dependent individuals descriptive statistics

	1		2		3		4		5	
Variables	EU	US	EU	US	EU	US	EU	US	EU	US
N	1,453	1,367	1,313	1,161	1,097	1,072	888	863	807	794
HH wealth (thousands)	141.5	283.6	152.0	234.4	107.8	277.7	61.0	363.4	125.1	360.2
	(519.5)	(709.7)	(489.7)	(521.3)	(196.4)	(629.2)	(145.9)	(1,100.8)	(205.5)	(878.7)
Women	0.591	0.652	0.595	0.657	0.624	0.648	0.623	0.650	0.628	0.680
	(0.492)	(0.477)	(0.491)	(0.475)	(0.484)	(0.478)	(0.485)	(0.477)	(0.484)	(0.467)
Age	80.60	80.50	81.48	81.70	82.50	82.06	83.61	83.11	84.87	83.35
	(7.84)	(8.56)	(7.35)	(8.18)	(7.00)	(7.66)	(6.69)	(7.00)	(6.08)	(6.36)
Low level education	0.695	0.414	0.678	0.414	0.646	0.403	0.624	0.379	0.618	0.363
	(0.460)	(0.493)	(0.467)	(0.493)	(0.478)	(0.491)	(0.485)	(0.485)	(0.486)	(0.481)
High level education	0.105	0.279	0.117	0.289	0.128	0.318	0.149	0.319	0.165	0.344
	(0.306)	(0.449)	(0.321)	(0.453)	(0.334)	(0.466)	(0.356)	(0.466)	(0.371)	(0.475)
Bad health status	0.827	0.903	0.839	0.929	0.852	0.932	0.836	0.952	0.845	0.947
	(0.379)	(0.295)	(0.368)	(0.258)	(0.355)	(0.252)	(0.370)	(0.213)	(0.362)	(0.224)

Table 2: Sample of dependent individuals by regions overtime

Data: probability of dependency w.r.t. wealth terciles

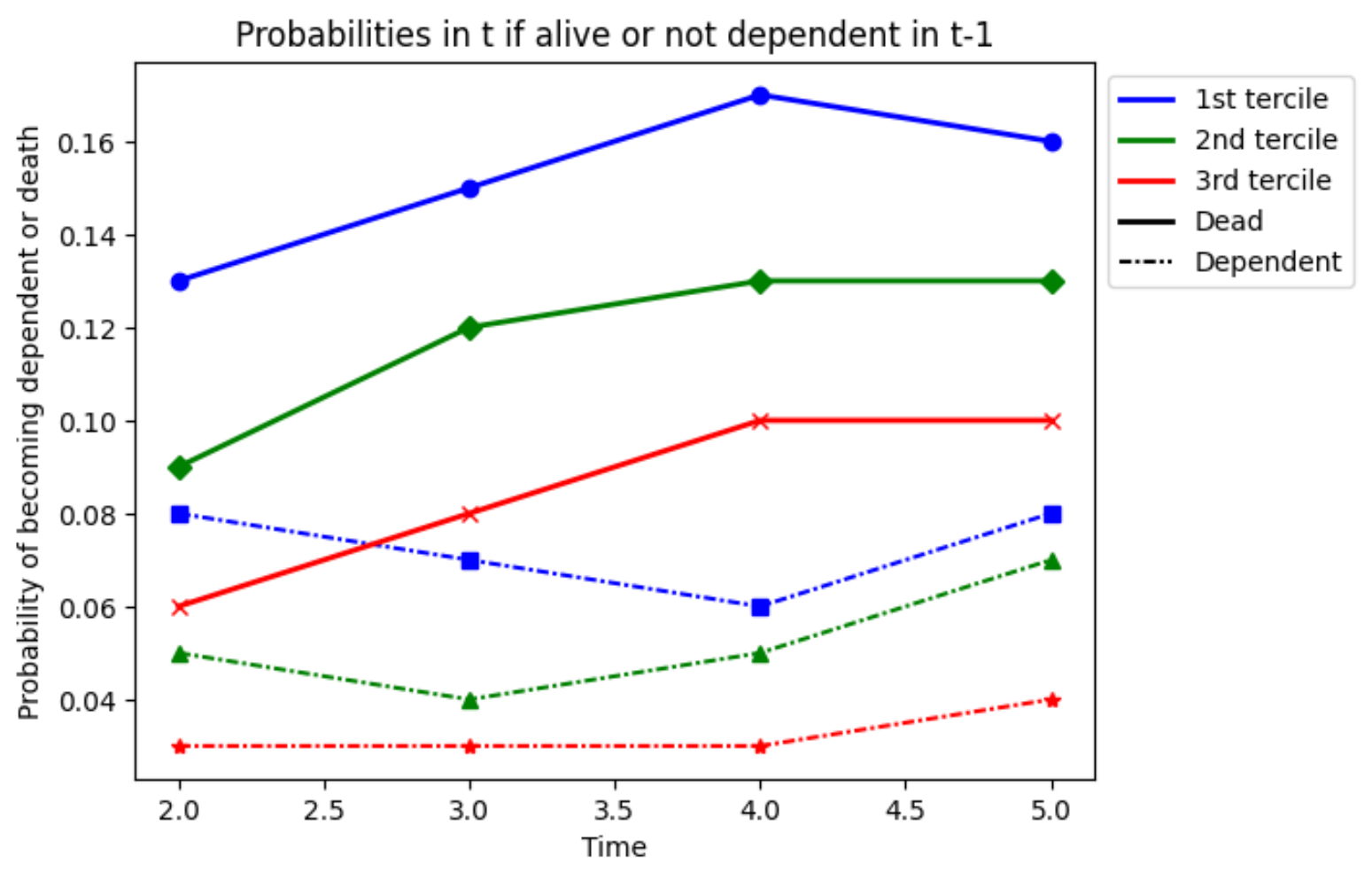


Figure 1: Probability of the event (death/loss of autonomy) in *t* if not dependent in *t-1* w.r.t wealth terciles

Dependency

Empirical Strategy

- Baseline regressions

$$D_{it+1} = \beta W_i + X_{it}^{'}\gamma + \alpha_i + \varepsilon_{it} | D_{it} = 0$$

$$ADL_{it+1} = \beta W_i + X_{it}^{'}\gamma + \alpha_i + \varepsilon_{it} | D_{it} = 0$$

- W_{it} is the indicator of the percentile of wealth in which the individual belongs in $t = 1$
- **Correlated Random Effects model** (Mundlak, 1978): individual specific effect is expressed as a linear function of average time-varying explanatory variables and random individual specific effect that is assumed to be independent of the explanatory variables:

$$\alpha_i = \bar{X}_i\zeta + \xi_i$$

- Baseline equation can be rewritten as

$$D_{it+1} = \beta W_i + X_{it}^{'}\gamma + \bar{X}_i\zeta + \xi_i + \varepsilon_{it} | D_{it} = 0$$

Empirical Strategy - CRE IV

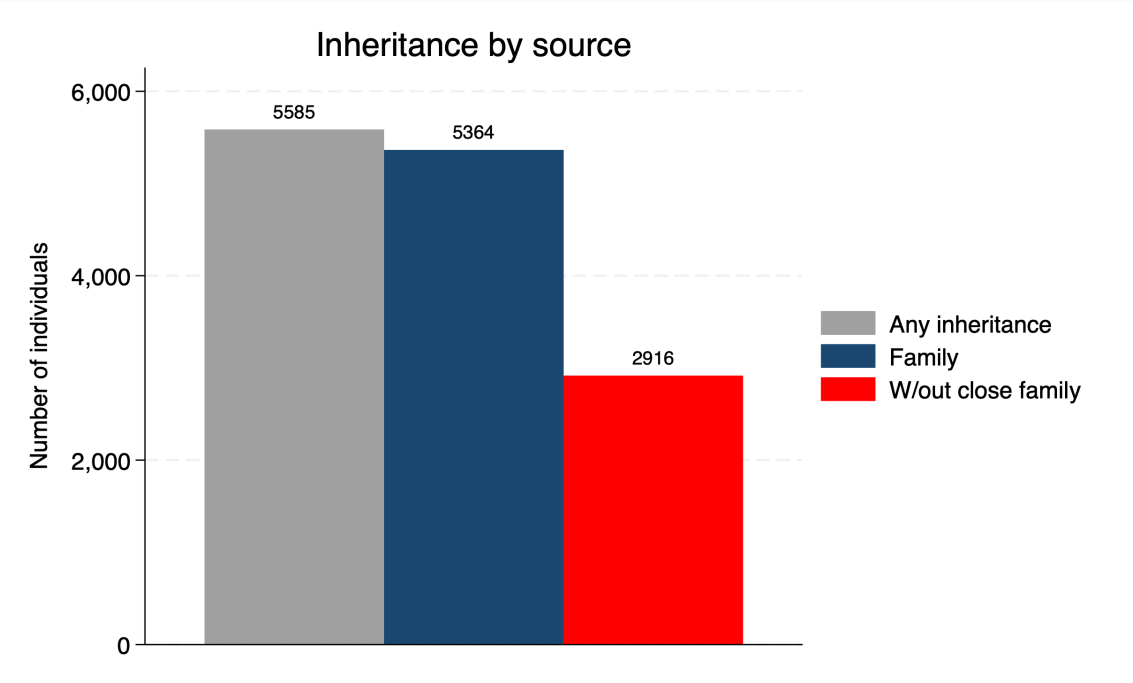
Wealth might be endogenous: instrument wealth in $t = 1$ by **having inherited or received large gifts in $t = 1$ (or before)**

CRE + IV (Joshi and Wooldridge, 2019)

- used in previous research (Papke, 2005; Papke and Wooldridge, 2008)
- estimate a two-stage model (2SLS)
- **Relevance:**
  - First stage estimations confirm the predictive power
  - Inheritance/large gifts receipt have been used as an instrument for wealth in studies investigating the effect of wealth on health behaviors (Kim et al., 2012; Kippersluis et al., 2014) and health outcomes (Meer et al., 2003; Carman, 2013)

Empirical Strategy - CRE IV

- **Exclusion Restriction:**
  - inheritance receipt reflects the poor state of health in the family (Apouey et al., 2015)
  - $\rightarrow$ **inheritance excluding close family members**
  - wealthy or "priviledged" backgrounds are : particularly likely to receive inheritance and benefited from the childhood care that leads to good health as adults (Meer et al., 2003)
    - $\rightarrow$ **include observable variable such as education**



Results - Become Dependent

dep.var.: Probability of becoming dependent in $t+1$ if not in t

	CRE		CRE-IV		CRE-IV no family	
	(1) SHARE	(2) HRS	(3) SHARE	(4) HRS	(5) SHARE	(6) HRS
Wealth percentiles	-0.00413***	-0.00913***	-0.00648*	-0.00919***	-0.00299	-0.00494
	(-4.96)	(-8.86)	(-1.89)	(-2.60)	(-0.60)	(-1.25)
Gender	-0.0139***	-0.00237	-0.0138***	-0.00261	-0.0136***	-0.00274
	(-3.11)	(-0.45)	(-3.40)	(-0.56)	(-3.36)	(-0.59)
Age	-0.182***	-0.142***	-0.196***	-0.155***	-0.198***	-0.157***
	(-16.25)	(-11.81)	(-17.14)	(-12.40)	(-17.26)	(-12.59)
Age_sq	0.00133***	0.00107***	0.00144***	0.00117***	0.00145***	0.00118***
	(17.44)	(13.26)	(18.43)	(13.94)	(18.56)	(14.13)
Number of observations	27550	21385	27440	21201	27550	21385

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

controlling for education, marital status, children and physical/mental conditions

Results - Become Dependent (intensity)

dep.var.: Number of daily limitations $[0, 6]$ in $t + 1$ if not dependent in t

	CRE		CRE-IV		CRE-IV no family	
	(1) SHARE	(2) HRS	(3) SHARE	(4) HRS	(5) SHARE	(6) HRS
Wealth percentiles	-0.0167***	-0.0350***	-0.0411***	-0.0379***	-0.0326*	-0.0194
	(-5.39)	(-9.22)	(-3.30)	(-2.80)	(-1.93)	(-1.27)
Woman	-0.0578***	0.00875	-0.0580***	0.00543	-0.0576***	0.00482
	(-3.42)	(0.44)	(-3.73)	(0.31)	(-3.71)	(0.27)
Age	-0.646***	-0.549***	-0.699***	-0.593***	-0.700***	-0.597***
	(-16.72)	(-13.13)	(-17.49)	(-13.65)	(-17.56)	(-13.80)
Age_sq	0.00473***	0.00407***	0.00512***	0.00440***	0.00513***	0.00443***
	(17.89)	(14.44)	(18.75)	(15.02)	(18.82)	(15.17)
Number of observations	27550	21385	27440	21201	27550	21385

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

controlling for education, marital status, children and physical/mental conditions

Duration of Dependency

Empirical Strategy - Cox Model

- Dependency = absorbing state (Connolly et al., 2025): approximate the duration of dependence as the probability to survive once dependent via Cox proportional hazards model with respect to wealth
- Again wealth may be endogenous: use our instrument
  - Cox model is nonlinear and semi-parametric: 2SLS inconsistent (Terza et al., 2008; Tchetgen Tchetgen et al., 2015)
  - $\rightarrow$ control function approach by applying the two-stage residual inclusion (2SRI) method
  - Estimate first-stage regression:

$$W_{i,t_0} = \gamma_0 + I_{i,t_0}\gamma_1 + X'_{i,t}\gamma_2 + \nu_{i,t}$$

  - include both the wealth variable and the first-stage residuals in the Cox model:

$$\lambda(i, t \mid W_{i,t_0}, \hat{\nu}_i, X_i) = \lambda_0(t) \exp(\beta_1 W_{i,t_0} + X'_{i,t}\beta_2 + \beta_3 \hat{\nu}_{i,t})$$

    - β_1: the hazard of death with respect to wealth, conditional on entering dependence.

Results - Dependency duration (Cox model)

Cox models: Impact of Wealth on dependence duration

	Baseline		2SRI	
	(1)	(2)	(3)	(4)
	SHARE	HRS	SHARE	HRS
Wealth percentiles	0.997***	1.002	0.983	1.014*
	(-2.85)	(0.94)	(-1.14)	(1.74)
Gender	0.624***	0.675***	0.612***	0.692***
	(-6.38)	(-3.20)	(-6.38)	(-2.98)
Age	1.044	0.833	1.076	0.819
	(0.50)	(-1.13)	(0.79)	(-1.23)
Age squared	1.000	1.001	1.000	1.001
	(0.05)	(1.47)	(-0.28)	(1.50)
Residuals			1.014	0.987
			(0.92)	(-1.55)
Observations	3069	1086	3069	1086

Exponentiated coefficients; t statistics in parentheses

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

controlling for education, marital status, children and physical/mental conditions

Conclusion - Discussion

Conclusion/Discussion

- Our results:
  - EU: negative effect of wealth on dependency (not on duration)
  - US: negative effect of wealth on duration (not on dependency)
- Next steps:
  - Apply the Cox model to estimate the probability of becoming dependent
  - Robustness and heterogeneity analysis
  - Investigate mechanisms

Thanks! Questions?