Impact of socio-economic status on loss of autonomy in the old age

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November 21
HEC-Liège Internal Seminar

Introduction - Research Context

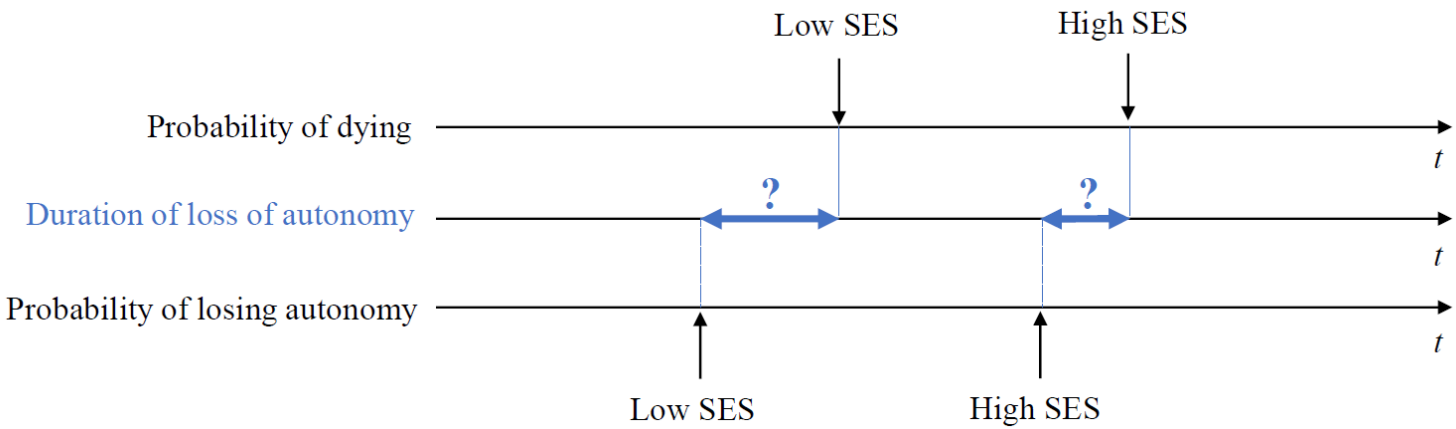
- Richer people are healthier and live longer.
- Heterogeneity: differences in mortality by socio-economic status (see Cutler et al. (2011) for an overview).
- Know very little about the relationships between socio-economic status (SES) and the dependency status.
- Research Question: What is the impact of SES on the loss of autonomy in the old population?

Introduction - Question relevance

- OECD countries facts
  - average life expectancy is increasing
  - 50% of the 65 years old and older report daily limitations (ADL)(OECD, 2021)
  - The number of dependent (old) people is expected to increase (Canta, 2020) and by 2050, the number of poeple with dementia is expected to double to 42 millions (OECD, 2021)
- LTC needs (defined as the day-to-day help with activities of daily living and additional types of medical support) will increase $\rightarrow$ will be costly for the individuals and the State.
- Essential to understand how the loss of autonomy evolves at the end of life and which individuals are more likely to suffer from dependency.

Introduction

- Identify a causal impact of the socio-economic status using wealth as a variable reflecting the socioeconomic status on
  - the probability of losing autonomy ?
  - the duration of the loss of autonomy ?



$\rightarrow$ Conclusion: "triple penalty" for the poorest citizens

Introduction

- **U.S. Health and Retirement Study (HRS) and Survey of Health, Ageing, and Retirement in Europe (SHARE)**: biennial and longitudinal surveys that follow people over 50 years old in USA and in EU. Access to the evolutions of:
  - the individual health status (possible death) and characteristics
  - time at which the person becomes dependent
  - Household socio-economic situation
- **Methods:** Correlated Random effect and IV models

Literature and Contributions

- Probability of losing autonomy?
  - effect of education or income/wealth on functional limitations (Freedman and Martin, 1999; Kim and Rhum, 2012; Lefebvre et al., 2018; Connolly et al., 2023)
- 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
  - Friedberg et al. (2014) with HRS data showed that the state of dependence is an absorbing state for the less wealthy (but not for the wealthiest classes)
- **Our contributions:**
  - *Method:* provide a stronger identification strategy
  - *Thematic:* duration of loss of autonomy

HRS and SHARE data (1/5)

- Advantage of the 2 data sources: micro longitudinal datasets 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
- Information on ADL limitations:
  - 1.Dressing, including putting on shoes and socks; 2.Walking across a room; 3.Bathing or showering; 4.Eating, such as cutting up your food; 5.Getting in or out of bed; 6.Using the toilet, including getting up or down
- Dependent if at least 2 limitations
- Keep respondents that
  - are ALIVE and NOT dependent in $t = 1$
  - are 65+ (mostly affected by dependence)
  - have an "absorbing state"

HRS and SHARE data (2/5)

- Information on 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
  - **Wealth is fixed in t=1**: accumulation of wealth and not affected by LTC
- Information on other demographic (gender, age, education), health (mental, conditions, mobility) and family (partner and children) variables
  - can evolve over time (5 periods)

HRS and SHARE data (3/5)

	Regions					
	US	north EU	center EU	south EU	East EU	Total
N	6,928 (40.0%)	1,297 (7.5%)	3,953 (22.8%)	1,617 (9.3%)	3,513 (20.3%)	17,308 (100.0%)
Household wealth (in thousands)	505.97 (1,003.89)	313.22 (384.86)	386.97 (707.47)	252.41(410.55)	81.18 (119.66)	354.44 (757.02)
Household income (in thousands)	52.86 (72.77)	35.40 (22.80)	49.61 (63.06)	21.01 (35.17)	11.71 (22.43)	39.48 (59.74)
Gender (=1 women)	0.553 (0.497)	0.527 (0.499)	0.534 (0.499)	0.485 (0.500)	0.573 (0.495)	0.544 (0.498)
Number of children	3.421 (2.119)	2.312 (1.279)	2.253 (1.490)	2.506 (1.621)	1.973 (1.142)	2.692 (1.820)
Age	75.231 (6.962)	74.929 (7.362)	74.749 (6.862)	75.337 (6.769)	74.241 (6.407)	74.907 (6.854)
low education	0.221 (0.415)	0.407 (0.491)	0.385 (0.487)	0.863 (0.344)	0.422 (0.494)	0.372 (0.483)
medium education	0.351 (0.477)	0.263 (0.441)	0.348 (0.477)	0.083 (0.276)	0.329 (0.470)	0.315 (0.465)
high education	0.428 (0.495)	0.330 (0.470)	0.266 (0.442)	0.053 (0.225)	0.250 (0.433)	0.313 (0.464)
Bad mental health = 1	0.150 (0.357)	0.161 (0.368)	0.236 (0.425)	0.343 (0.475)	0.323 (0.468)	0.224 (0.417)
Bad health condition = 1	0.723 (0.447)	0.502 (0.500)	0.535 (0.499)	0.615 (0.487)	0.622 (0.485)	0.633 (0.482)

Table: Sample by regions

European Regions (SHARE): Denmark, Sweden (North); Austria, Belgium, France, Germany, Switzerland (Center); Italy, Spain (South); Czech Rep., Estonia, Slovenia (East)

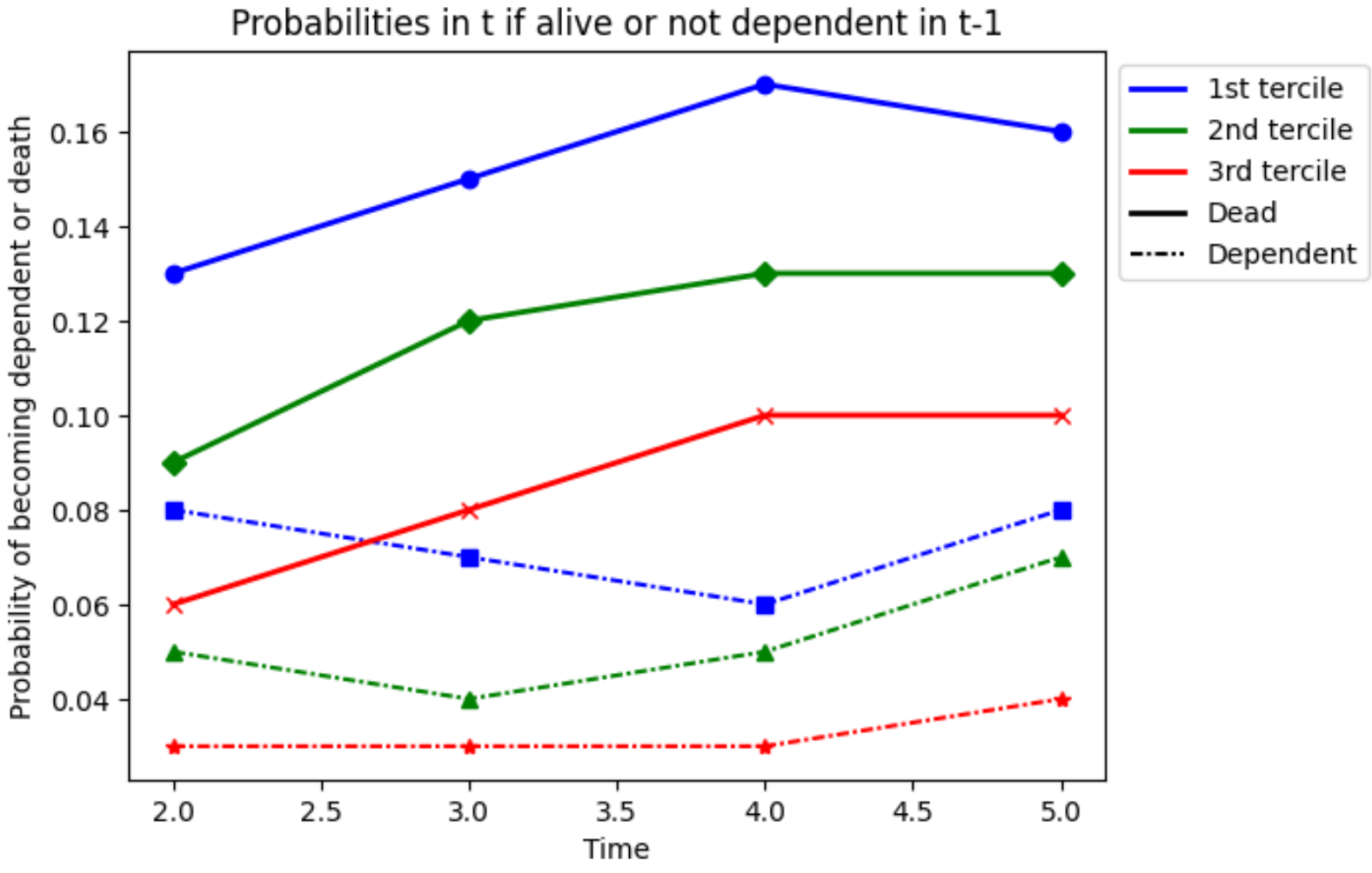
HRS and SHARE data (4/5)

Regions	***Terciles***	**t1**	**t2**	**t3**	**t4**	**t5**
HRS	*1*	0	0.09	0.13	0.15	0.18
HRS	*2*	0	0.06	0.07	0.09	0.13
HRS	*3*	0	0.02	0.05	0.06	0.08
SHARE	*1*	0	0.07	0.09	0.10	0.12
SHARE	*2*	0	0.04	0.05	0.07	0.09
SHARE	*3*	0	0.03	0.04	0.05	0.07

Table: Cumulative Probabilities of losing autonomy in t w.r.t. wealth terciles *(in t=1)* and regions

HRS and SHARE data (5/5)

Figure: Probability of the event (death/loss of autonomy) in *t* if no dependent in *t-1* w.r.t wealth terciles



Empirical strategy - Plan

- **Goal:** effect of SES, represented by the HH wealth, on (1) dependency and (2) its duration
- **(1) Dependent**
  - *Probability of becoming dependent in* t *if not in* $t-1$
  - *Intensity in* t $[0;6]$ *if not in* $t-1$
- **(2) Duration**
  - *Probability of being alive in* $t+1$ *once dependent in* t
  - *Number of periods of dependency once dependent* $[1;4]$

Empirical strategy - Baseline regression

- (1) Becoming dependent

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

where D_{it+1} is equal to 1 if the individual is dependent in wave *t+1*, 0 otherwise.
W_{it} is the indicator of the tercile/percentile of wealth in which the individual belongs in $t = 1$
$X_{it}^{'}$ is a set of control variables, α_i and ε_{it} is the idiosyncratic error term

robust and clustered standard errors et the individual level

Empirical strategy - CRE

- as wealth is fixed, cannot use FE
- **Correlated Random Effects model** (Mundlak, 1978) to control for the within individual changes in the variables of interest.
- individual specific effect is expressed as a linear function of the (a) average time-varying explanatory variables (b) a random individual specific effect that is assumed to be independent of the explanatory variables:

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

where $\bar{X}_i$ is the individual means of X_{it} and ξ is. i.i.d. normal distributed with mean zero and variance σ^2_ξ.

- Baseline equation can be rewritten as

$$D_{it+1} = \beta W_i + X'_{it} \gamma + \bar{X}_i \zeta + \xi_i + \varepsilon_{it}$$

Empirical strategy - IV

- To address the endogeneity problem, we estimate a two-stage model (2SLS) by instrumentalising wealth by **having inherited**
  - induce a wealth shock but not loss of autonomy
- **CRE + IV** (Joshi and Wooldridge, 2019)
  - used in previous research (both linear and nonlinear models) (Papke, 2005; Papke and Wooldridge, 2008)
- The first-stage and reduced-form equations of the analysis are

$$W_{it} = \varphi_1 I_{it} + X_{it}^{'}\pi_1 + \bar{X}_i\zeta_1 + \xi_{1i} + \mu_{1it}$$

$$D_{it+1} = \varphi_2 I_{it} + X_{it}^{'}\pi_2 + \bar{X}_i\zeta_2 + \xi_{2i} + \mu_{2it}$$

where I_{it} is a dummy variable for having inherited. The covariates contained in $X_{it}^{'}$ are the same as in the model above.

Empirical strategy - IV

- Good instrument?
- Inheritance receipt has been used as an instrument for wealth in studies investigating the effect of wealth on health behaviors (Kim et al. (2012) and Kippersluis et al. (2014)) or the effect of wealth on health outcomes (Meer et al. (2003) and Carman (2013))
- First stage estimations confirm the predictive power of this instrument.

Empirical strategy - IV

- Good instrument? Exclusion restriction
  - Possible that the inheritance received also reflects the poor state of health in the family (Apouey et al.(2015))
  - Robustness test: inheritance excluding from a family member.
- Other concern: a third variable driving both our instrumental varibales and dependence. 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))
  - include observable variable such as education
  - Robustness check: include parent's health and education

Empirical strategy

- **Goal:** effect of SES, represented by the HH wealth, on (1) dependency and (2) its duration
- **(1) Dependent**
  - *Probability of becoming dependent: CRE IV*
  - *Intensity* $[0; 6]$*: CRE IV*
- **(2) Duration**
  - *Probability of being alive in* $t+1$ *once dependent in* t*: CRE IV*
  - *Number of periods of dependency once dependent* $[1; 4]$*: Tobit CRE IV*

Results - Becoming Dependent

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

	POLS		CRE		CRE-IV	
	(1) SHARE	(2) HRS	(3) SHARE	(4) HRS	(5) SHARE	(6) HRS
Wealth terciles	-0.00509***	-0.0142***	-0.00949***	-0.0187***	-0.0361***	-0.0538***
	(-3.07)	(-6.96)	(-4.14)	(-7.07)	(-3.56)	(-2.94)
Gender	-0.0130***	-0.00136	-0.0161***	-0.000672	-0.0157***	0.000106
	(-4.95)	(-0.44)	(-4.33)	(-0.16)	(-4.72)	(0.03)
Age	-0.0512***	-0.0372***	-0.202***	-0.151***	-0.222***	-0.173***
	(-8.31)	(-5.87)	(-19.19)	(-12.84)	(-20.24)	(-13.68)
Mental health	0.0442***	0.0442***	0.0169***	0.0150**	0.0171***	0.0138**
	(12.14)	(7.72)	(4.29)	(2.22)	(4.40)	(2.10)
Health conditions	0.0124***	0.0208***	-0.00509*	-0.0173**	-0.00492*	-0.0194***
	(5.14)	(7.35)	(-1.75)	(-2.34)	(-1.72)	(-2.68)
Number of observations	26040	20160	26040	20160	25988	20119

t statistics in parentheses

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

controlling for education, marital status and children

Results - Becoming Dependent (intensity)

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

	(1) CRE-IV SHARE	(2) CRE-IV HRS
Wealth terciles	-0.204***	-0.221***
	(-4.95)	(-2.61)
Gender	-0.0643***	0.0132
	(-4.64)	(0.85)
Age	-0.749***	-0.623***
	(-19.00)	(-14.01)
Age_sq	0.00547***	0.00461***
	(20.27)	(15.32)
Mental health	0.0589***	0.0471**
	(3.87)	(2.12)
Health conditions	-0.0220*	-0.0558**
	(-1.95)	(-2.05)
Number of observations	20119	20119

t statistics in parentheses

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

controlling for education, marital status and children

Results - Duration of Dependency

dep.var.: being alive in t+1 if dependent in t

	(1) CRE-IV SHARE	(2) CRE-IV HRS
Wealth terciles	-0.00469	0.0325
	(-0.05)	(0.35)
Gender	0.0724***	0.0956***
	(2.71)	(2.93)
Age	0.362**	0.443**
	(2.50)	(2.48)
Mental health	-0.0799	-0.0406
	(-1.36)	(-0.60)
Health conditions	-0.0338	-0.0259
	(-0.44)	(-0.13)
Number of observations	822	735

t statistics in parentheses

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

controlling for education, marital status and children

Results - Duration of Dependency

dep.var.: being alive in **t+2** if dependent in *t*

	(1) CRE-IV SHARE	(2) CRE-IV HRS
Wealth terciles	-0.0461	-0.102*
	(-0.76)	(-1.70)
Gender	0.0353*	0.0677***
	(1.83)	(2.62)
Age	-0.390***	-0.176
	(-3.15)	(-1.24)
Mental health	0.0609	-0.0783
	(0.75)	(-0.85)
Health conditions	-0.0460	-0.0284
	(-0.58)	(-0.12)
Number of observations	681	474

t statistics in parentheses

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

controlling for education, marital status and children

Results - Duration of Dependency

dep.var.:Number of dependency periods on alive people

	(1) OLS	(2) CRE-IV	(3) TOBIT CRE-IV
Wealth terciles	-0.0455***	-0.0366***	-0.624***
	(-7.72)	(-6.26)	(-4.29)
Gender	-0.00372	-0.0209**	-0.225***
	(-0.41)	(-2.27)	(-6.24)
Age	-0.0324***	0.0800***	0.285***
	(-2.74)	(11.08)	(3.40)
Mental health	0.190***	0.00830***	0.0669
	(17.58)	(7.36)	(1.25)
Health conditions	0.0730***	-0.0134***	-0.160**
	(11.67)	(-3.54)	(-2.55)
Number of observations	62097	61928	61928

t statistics in parentheses

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

controlling for education, marital status and children

Next steps:

- Dependence intensity:
  - estimate with TOBIT-CRE-IV
- Duration:
  - Probability of becoming dependent in $t + 2$ if dependent in t
  - Number of dependency periods on *dead* and *alive* people with TOBIT-CRE-IV
- Instrument:
  - exclude inheritance/gifts from closed family members
- Considering the non absorbing state
- Mechanisms:
  - Impact on the type of daily limitations
  - Impact on the probability of becoming dependent by occupation. Ex: blue and white collar jobs

Conclusion

- With HRS and SHARE data, we are looking the causal impact of the socio-economic status on dependency and its duration.
- With CRE-IV models, we provided evidence that people with lower economic status are more likely to become dependent. And once they are dependent, their dependence duration is higher compared to wealthier individuals.