Health and Heterogeneity

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Part I

Data

(The socio-economic gradient of longevity)

Mortality and life expectancy differences

- **Mortality rates** are strongly associated to **socio-economic status**

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▷ However, these results present a **static picture** of the relationship between longevity and SES:

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- Need to **develop a methodology** to compute expected longevity at age 50 conditional on a given socio-economic characteristic at age 50

Objective of the project

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▷ Eventually, try to **understand the determinants** of this level of individual heterogeneity

The Health and Retirement Study

- Bi-annual panel, 10 waves, from 1992 to 2010
- Initial HRS cohort aged 50-61 in 1992 and 68-79 in 2010
- Two additional younger cohorts and two additional older cohorts
- This gives around 140,000 individual-year observations
  (white, aged 50-92, non-missing)
- Rich socio-economic data
  (marital status, education, income, wealth, labor market)
- Rich health-related data:
  - health stock: self-assessed and diagnostics
  - health investment: expenditures and behavior
  - mortality: keeps track of mortality

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- We use data of all HRS years to increase sample size

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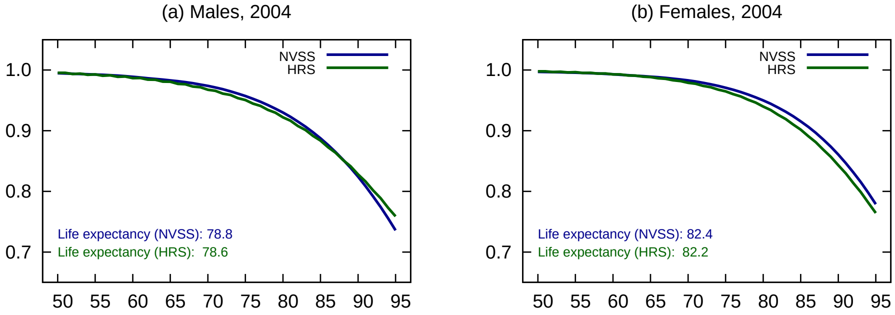

Expected longevity at age 50

- Compute EL conditional on a characteristic $z \in Z$ at age 50:
  - Education: college *vs* high school dropout
  - Wealth: top *vs* bottom quintile
  - Labor market status: strongly attached *vs* inactive
  - Marital status: married *vs* non-married
  - Smoking: non-smoker *vs* smoker

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- Then:

$$
\begin{aligned}
\ell_{50}(z_j) &= \sum_{i=50}^{92} i \sum_{z \in Z} [1 - \gamma_i(z)] \, x_i(z) + 1 \\
x_{i+1}(z') &= \sum_{z \in Z} p_i(z'|z) \;\; \gamma_i(z) \;\; x_i(z) \qquad \forall z' \in Z, \forall i \geq 50 \\
x_{50}(z_j) &= 1; \quad x_{50}(z) = 0 \;\; \forall z \neq z_j
\end{aligned}
$$

Expected longevities at age 50

	LE	Longevity differentials						
		edu	wea	lms	mar	smok	m-s	h
Expected Longevities								
Male	78.1	5.8	3.1	1.4	2.2	2.2	4.9	5.6
Female	81.8	5.8	2.6	0.7	1.2	1.8	2.9	4.7

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Life Expectancies								
Male	78.1	5.8	10.6	9.2	4.9	6.7	10.9	22.3
Female	81.8	5.8	9.3	6.7	3.1	5.2	7.2	20.3

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- Life expectations computed only from cross-sections largely overstate the importance of the socio-economic conditions at age 50
- This tells us that there may be useful information contained in changes in characteristics z

Fine tunning

	Longevity differentials						
	edu	wea	lms	mar	smok	m-s	h
Male							
(1) All	5.8	3.1	1.4	2.2	2.2	4.9	5.6
(2) College graduates	—	2.0	0.9	1.5	1.3	3.5	5.2
(3) High school dropouts	—	2.6	1.5	2.6	2.5	5.7	4.8
Female							
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(4) Education and z	–	7.4	6.9	8.2	7.3	10.5	9.2
Female							
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(4) Education and z	–	7.1	6.1	7.1	7.5	8.3	8.8

- Larger heterogeneity for the less educated
- Gaps between education-z categories are enormous

Time trends

	LE	Longevity differentials						
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Male								
1992	77.3	5.1	2.5	1.2	1.7	1.7	3.8	5.5
2010	79.1	6.4	4.7	1.9	2.8	3.7	6.7	5.5
Δ	+1.8	+1.3	+2.2	+0.7	+1.1	+2.0	+2.9	0.0
Δ_{NVSS}	+2.6							
Female								
1992	82.0	5.1	2.3	0.4	0.4	1.4	1.6	4.1
2010	81.5	7.1	3.7	1.1	2.1	2.4	4.6	5.6
Δ	-0.5	+2.0	+1.4	+0.7	+1.7	+1.0	+3.0	+1.5
Δ_{NVSS}	+1.4							

- Longevity differentials are increasing over time

Measuring health

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- Observing individual health, we can determine whether:
  - Life expectancy heterogeneity is due to factors present at age 50
  - Or health conditions evolve differently for different people after age 50
  - Or mortality rates are different even conditional on measured health

Expected Longevities: the role of self-rated health

How to build them

- Estimate the following elements:
  a) Initial distribution of health by characteristic z: $\varphi_{50}(h|z)$
  b) Joint health and z transitions: $p_i(z', h'|z, h)$
  c) z and health specific survival rates: $\gamma_i(z, h)$
- Then, compute:

$$\ell_{50}^{h}(z_j) = \sum_{i=50}^{92} i \sum_{h \in H, z \in Z} [1 - \gamma_i(z,h)]\ x_i(z,h) + 1$$

$$x_{i+1}(z', h') = \sum_{h \in H, z \in Z} p_i(z', h'|z, h)\ \gamma_i(z,h)\ x_i(z,h) \quad \forall z' \in Z,\ \forall h' \in H,\ \forall i$$

$$x_{50}(z_j, h) = \varphi_{50}(h|z_j) \text{ and } x_{50}(z,h) = 0 \ \ \forall z \neq z_j$$

Expected Longevities: the role of self-rated health

How to decompose them

- Is it initial health differences by socio-economic type?

$$\{\varphi_{50}(h|z), \quad p_i(h'|h), \quad \gamma_i(h)\}$$

- Is it type-specific health evolution?

$$\{\varphi_{50}(h), \quad p_i(z', h'|z, h), \quad \gamma_i(h)\}$$

- Is it type-specific mortality?

$$\{\varphi_{50}(h), \quad p_i(h'|h), \quad \gamma_i(z, h)\}$$

Expected Longevities: the role of self-rated health

Results

	EL	Longevity differentials					
		edu	wea	lms	mar	smok	m-s
Male							
All type-specific	78.2	6.0	3.7	3.3	2.4	2.9	6.0
(a) type-specific initial health		1.6	1.2	2.1	0.4	0.5	1.0
(b) type-specific transition		4.7	1.7	0.5	0.7	1.0	1.8
(c) type-specific mortality		0.0	0.9	0.4	1.4	1.4	3.3
Female							
All type-specific	81.8	5.9	3.6	1.3	1.4	2.3	3.4
(a) type-specific initial health		1.1	1.2	0.9	0.3	0.2	0.4
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(c) type-specific mortality		0.3	0.8	0.2	0.4	1.2	1.6

Expected Longevities: the role of self-rated health

Education

- **Education** (and wealth)
  - 1/3 of gradient due to better health at age 50
  - 2/3 of gradient due to health-protection of education over life
  - Mortality rates independent of education once controlling for health

▷ More educated (and wealthy) experience a better evolution of health
  - More investment?
  - Better built?

▷ Education (and wealth) do little to help when bad conditions arise

Expected Longevities: the role of self-rated health

Marital status

- **Marital stauts** (and smoking)
  - small differences due to better health at age 50
  - larger health-protection of marital stauts over life
  - Mortality rates do depend on marital status once controlling for health: 2/3 of gradient for men

▷ What is it that helps survial of married over non-married when bad conditions arise?

(Recent widowhood kills you, but widows die less than other non-married)

Where is the advantage from education coming from?

- Our estimates say clear things
  - $\gamma^{i}(h)$ is independent of education
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▷ More importantly, we need a way to identify the health production technology. We do not have it.

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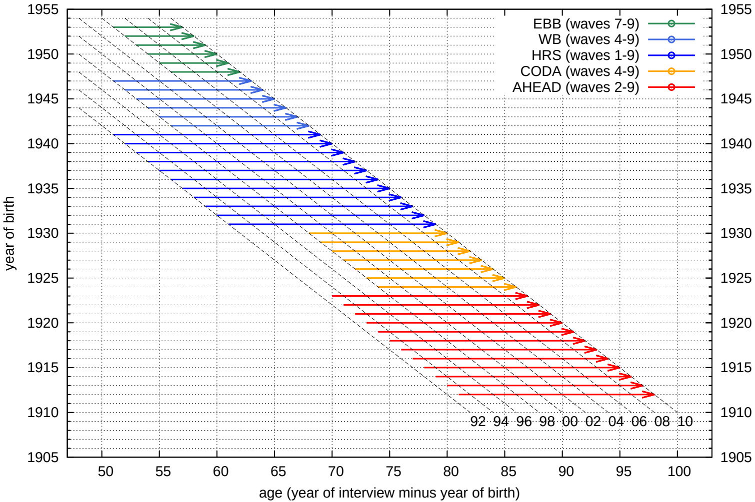
Conclusions

- There are large differences in education specific life expectancy.
- These are associated to health as measured via self assessment.
- What matters is the health to health transition to which non-smoking and marriage contributes.
- To identify the root of the advantages of education, we need to estimate rich models. Still a long way out.
- However, we have some ideas of how to use the findings of this paper to learn important things about people.

HRS age-cohort structure



Survival probabilities

Health and education

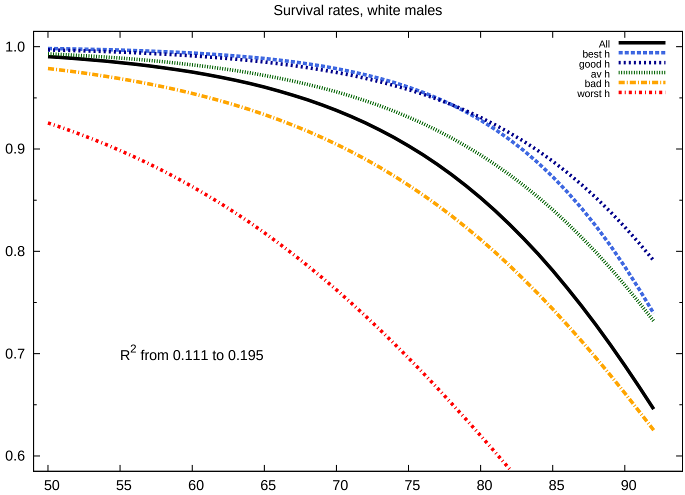
- **Education** is almost uninformative about two-year survival when we observe **health**:
  - Odds ratios for health much larger than for education
  - When health and education put together, education gives no advantage
  - LR test shows little value added by education

Logit regressions for survival (white males)

	Odds ratios				LR test	
	cg vs hsd		h2 vs h4		χ^2	p-value
	65	75	65	75		
only education	4.46	4.30			1897.89	0.000
only health			171.19	170.90	9.32	0.054
both together	1.08	1.16	202.29	202.02		

Survival probabilities

Survival by health groups



Source: HRS

Survival probabilities

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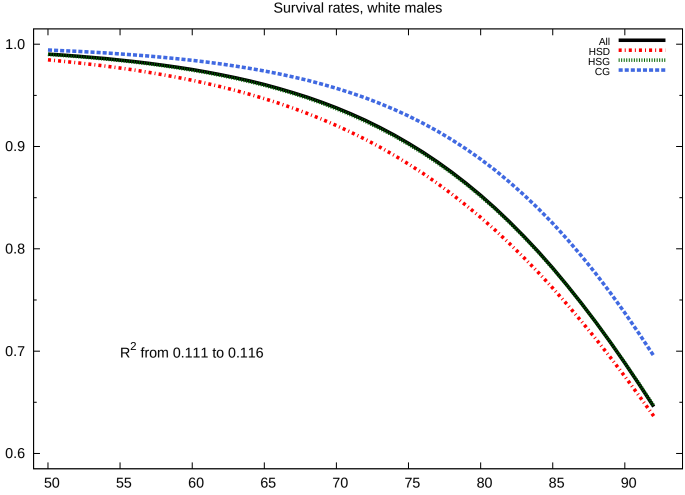

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Survival probabilities

Survival by health and education groups