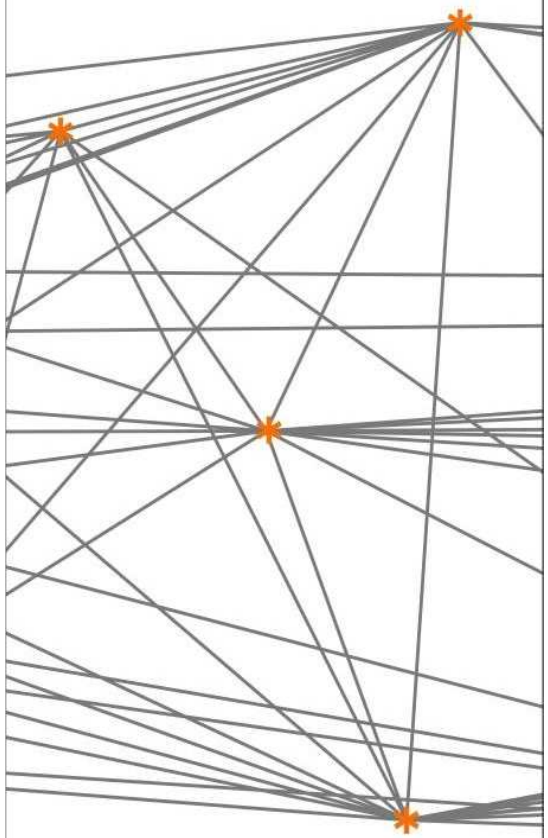

Retirement and Cognitive Decline: A Panel Data Approach using SHARE

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(Preliminary)

4th SHARE User Conference, November 2013

Goal and Contributions

- To estimate the effect of retirement on cognitive ability (measured by two different outcomes: word recall and verbal fluency tests) using three waves (Wave1, Wave 2 and Wave 4) of the SHARE data for several European countries.

- We exploit the panel dimension of the SHARE data to account for unobserved permanent individual heterogeneity and we use the exogenous variation in eligibility status for retirement to control for the remaining endogeneity of the retirement decision (e.g. due to reverse causality or measurement error).

- We investigate different sources of heterogeneity in the effect: education, gender, country pools
  - Education gradient: Preliminary results show that retirement has a negative effect on the word recall scores of the people with low education level, but it has no effect on the cognitive ability of the people with high education level.

- We investigate and report the existence of a learning or retesting effect that might bias word recall scores of the longitudinal sample in Wave 2 upwards.

Related literature

- Several studies had used retirement eligibility age rules as instruments for retirement behaviour to estimate the effect of retirement on cognition and other health outcomes. Most of them find a negative effect.

- Cross-sectional data:
  - Rohwedder and Willis (2010) for the US (HRS) and Mazzona and Peracchi (2012) for European countries (SHARE) find a negative and significant effect, whereas Coe and Zamarro (2011) find that retirement leads to better physical health but does not affect cognition.

- Longitudinal data:
  - Bonsang, Adam, and Perelman (2012) exploit in addition the panel dimension of the HRS data and find a significant negative effect.

Sample and Variables

- **Sample:** Individuals aged between 55 and 70 in 2004 and who participated in Wave 1, Wave 2 and Wave 4 of SHARE. 10 countries are represented in our sample: AT, BE, DK, FR, DE, IT, NT, ES, SE and CH.

  N=4097

- **Cognition measures:**
  - Sum of immediate and delayed word recall scores (range [0,20]): measure of episodic memory or fluid abilities (particularly affected by ageing).
  - Verbal fluency scores: measure that also might be influenced by education and lifetime experience (more related to crystallized intelligence).

- **Instruments:** Dummy variables that denote whether a person has passed the eligibility age for early and normal retirement. (Information on these rules comes from the file of context variables provided by SHARELIFE and other sources such as OECD, and the SSA database).

Model and Methods

$$
\begin{aligned}
y_{it} &= \alpha_i + \gamma_1 R_{it} + \gamma_2 age_{it} + \gamma_3 age_{it}^2 + X_{it}^{'}\gamma_4 + \varepsilon_{it} \\
R_{it} &= \eta_i + \delta_1 Z_{it} + \delta_2 age_{it} + \delta_3 age_{it}^2 + X_{it}^{'}\delta_4 + \upsilon_{it}
\end{aligned}
$$

where y_{it} represents a particular measure of cognition, R_{it} refers to different measures of retirement and Z_{it} represents the instruments. As controls $X_{it}^{'}$, we include health variables (such as having had heart problems, high blood pressure and a stroke), being married and a dummy for hearing the spouse's test to control for intrahousehold learning effects.

- **Methods:** the model in first differences is estimated by 2SLS, which allow us to account for two sources of endogeneity: unobserved permanent heterogeneity and reverse causality.

Table 1. Effect of Retirement on Cognition

	First-Stage	Cognitive Measures			
Panel A:	Retired	Word Recall		Verbal Fluency	
		FE	IV-FE	FE	IV-FE
Retired		-0.12	-0.90**	-0.15	0.47
		(0.10)	(0.44)	(0.20)	(0.89)
Instruments:					
≥Retirement Age	0.19***				
	(0.01)				
≥Early Retirement Age	0.09***				
	(0.01)				
F-test (p-value)	0.00				
Test overidentifying restrictions (p-value)			0.52		0.97
Panel B:	Retired for at least 1 year	Word Recall		Verbal Fluency	
Retired for at least 1 year		-0.09	-0.64**	0.01	-0.61
		(0.09)	(0.34)	(0.20)	(0.68)
Instruments:					
≥Retirement Age+1	0.25***				
	(0.01)				
≥Early Retirement Age+1	0.09***				
	(0.01)				
F-test (p-value)	0.00				
Test overidentifying restrictions (p-value)			0.38		0.64

Table 2. Effect of Retirement on Cognition

	First-Stage	First-Stage	Cognitive Measures	
	Retired less than 1 year	Retired at least 1 year	Word Recall	Verbal Fluency
			IV-FE	IV-FE
Retired less than 1 year			-0.79	1.95*
			(0.58)	(1.17)
Retired at least 1 year			-1.22**	0.82
			(0.54)	(1.10)
Instruments:				
>Retirement Age	-0.12***	0.25***		
	(0.01)	(0.01)		
>Early Retirement Age	-0.001	0.09***		
	(0.01)	(0.01)		
=Retirement Age	0.18***	0.005		
	(0.02)	(0.02)		
=Early Retirement Age	0.07***	0.003		
	(0.02)	(0.02)		
F-test (p-value)	0.00	0.00		
Test overidentifying restrictions (p-value)			0.34	0.98

Table 3. Effect of Retirement on Cognition

	First-Stage	First-Stage	Cognitive Measures	
	Retired less than 1 year	Retired at least 1 year	Word Recall	Verbal Fluency
LOW EDUCATED:			IV-FE	IV-FE
Retired less than 1 year			-1.11*	3.40**
			(0.67)	(1.33)
Retired at least 1 year			-1.55**	2.20*
			(0.65)	(1.29)
Instruments:				
>Retirement Age	-0.12***	0.25***		
	(0.01)	(0.02)		
>Early Retirement Age	0.007	0.09***		
	(0.02)	(0.02)		
=Retirement Age	0.19***	-0.01		
	(0.02)	(0.02)		
=Early Retirement Age	0.11***	-0.0002		
	(0.02)	(0.02)		
F-test (p-value)	0.00	0.00		
Test overidentifying restrictions (p-value)			0.99	0.94
HIGH EDUCATED	First-Stage	First-Stage	IV-FE	IV-FE
Retired less than 1 year			0.80	-1.37
			(1.10)	(2.36)
Retired at least 1 year			-0.03	-2.06
			(0.93)	(2.04)
Instruments:				
>Retirement Age	-0.11***	0.07**		
	(0.03)	(0.03)		
>Early Retirement Age	-0.02	0.27***		
	(0.03)	(0.03)		
=Retirement Age	0.17***	0.04		
	(0.04)	(0.03)		
=Early Retirement Age	-0.02	0.01		
	(0.04)	(0.04)		
F-test (p-value)	0.00	0.00		
Test overidentifying restrictions (p-value)			0.09	0.94

Heterogenous effects

- For all measures of retirement, we find a **clear education gradient**: retirement has a negative effect on the word recall tests of the people with low education level, but it has no effect on the cognitive ability of the people with high education level.

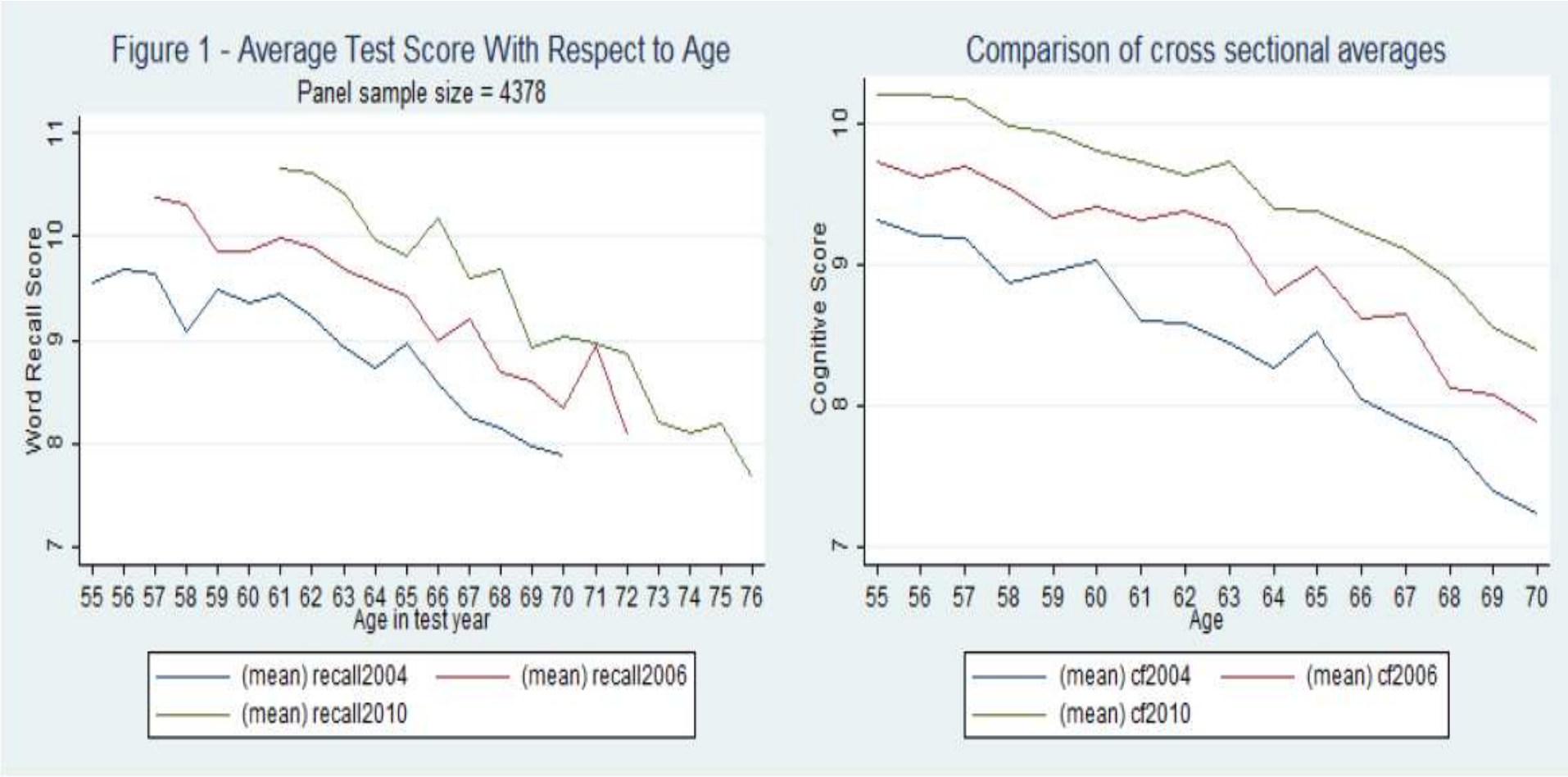
- One reason might be differences across education groups in the lifestyle changes brought about by retirement. But
  - Number of social activities: preliminary results show that retirement has a positive effect on the number of social activities performed in an intensive way for people with low education level and none effect for high educated people. This seems to be the opposite to what expected. Needs further investigation.

Heterogenous effects

- Other sources of heterogeneity:
  - **Gender:** No significant effects are found for men and women separately (as opposed to Mazzona and Peracchi (2012)).
  - **Country pools:** There is a North-South gradient: retirement has a negative effect on the word recall tests for Southern countries, but no effect in Northern countries. This might be related to the education gradient, given that in Southern countries the percentage of high educated people is low.
  - However, the analysis by group of education at the country pool level can not be properly performed since sample sizes get small and standard errors become large.

Retesting effect

- We also observe that, in the balanced panel and in the cross-sections, the age profile of word recall scores shifts upwards between wave 1 and wave 2, and again between wave 2 and wave 4. We interpret this as suggestive of “retest” effects:



Retesting effect in word recall

- More formal evidence based on cross-sectional regressions in Wave2 where we distinguish among three groups of individuals:
  - those who are longitudinal: β_1
  - those who are baselines and participate in Wave4: β_2
  - those who are baselines and do not participate in Wave4.
  - β_2 or the comparison between the last two groups allows us to measure the selection or attrition effect.
  - If baselines not participating in Wave 4 is the excluded dummy variable in the regression, then the difference between the first two coefficients $(\beta_1 - \beta_2)$ gives us a measure of the retesting effect net of selection (under the assumption that selection between Wave 1 and Wave 2 is the same as the selection between Wave 2 and Wave 4).

- By using interactions with respondents' characteristics such as gender and level of education we can test the existence of a retesting effect for different groups of individuals.

Retesting effect in word recall

Tests for retesting in Word Recall (Wave 2)

F-statistics and p-values

SUBSAMPLES:	Males	Females
No schooling or primary education	1.72	0.09
p-value	(0.1901)	(0.7616)
Lower level of secondary education	4.49	1.64
p-value	(0.0342)	(0.2007)
Upper level of secondary education	1.32	0.00
p-value	(0.2512)	(0.9665)
Tertiary education	14.68	7.70
p-value	(0.0001)	(0.0055)

- We obtain that retesting is important for the high educated people, both for men and for women. We do not find evidence of retesting effects for the verbal fluency test.
- Is this a problem for our analysis? It is reasonable to conjecture that this bias should not represent a problem for our panel data analysis as long as we assume that the effect of retesting does not vary by retirement status.