



# Cognitive functioning and retirement in Europe

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# Motivation and literature

- Ageing societies put pressure on sustainability of pension systems. Individuals are increasingly asked to work longer (retire later)
- Questions: what are the effects of longer working careers on health and/or cognitive abilities?
- Previous findings on cognition are mixed: Rohwedder and Willis (2010), Bonsang et al. (2012), Mazzonna and Peracchi (2012) find a negative effect of retirement on cognitive abilities; Coe et al. (2012) and Coe and Zammaro (2011) do not find a causal relationship between retirement and cognitive functioning.

# Theoretical background

- From a theoretical point of view, the effect of retirement on investment in cognitive ability is ambiguous.
- Using the Grossman (1972) model for human capital as a framework to model the individuals' maximization problem when utility depends on consumption and on generic cognitive capital, as Mazzonna and Peracchi (2012) propose, an increase in free time upon retirement may lead individuals to raise their investment in cognitive abilities after retirement, because of its effects on life satisfaction captured by the utility function. On the other hand, while total labour market earnings are positively affected by cognitive capital, investment in cognitive capital is not reflected into higher income after retirement, and should therefore be lower.

# Theoretical background - continued

- In the psychological literature, it has been highlighted that the available evidence favors the hypothesis that maintaining an engaged and active lifestyle reduces or even reverses cognitive decline at older ages (Hertzog et al., 2008). A major change in daily activities and lifestyle, such as retirement from work, may result in disuse and decline of cognitive abilities; alternatively, the additional free time may be spent in leisure activities that can preserve cognitive functioning or delay decline.
- The prevailing effect of retirement on HC is theoretically ambiguous.

# This paper

- Estimates effect of retirement on total word recall. While immediate effect is absent, delayed effect is positive.
- Uses a panel data set with fixed effects to control for unobserved characteristics such as innate ability
- As retirement may be correlated also with time varying factors that influence cognitive ability, such as health, applies an instrumental variable (IV) technique to the fixed effects transformation, using country-specific retirement rules as an instrument.
- Investigates possible heterogeneous effect of retirement on word recall (gender, education...)

# Empirical strategy

- $WR_{it} = \alpha_1 R_{it} + \beta X_{it} + \varepsilon_{it} + \nu_t + \mu_i$
- $WR_{it} = \alpha_2 (age_{it} - age_i^R) R_{it} + \beta X_{it} + \varepsilon_{it} + \nu_t + \mu_i$
- Fixed effects, 2SLS estimator. Instruments constructed using legal ages for old age and early retirement, vary with time and country.
- Sample selection: individuals aged 50 to 70, who were working at the age of 50, who declare themselves as either working or retired, living in Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Switzerland and Belgium. We exclude individuals who returned to work after retirement and individuals who report themselves sick, unemployed or homemaker. Our final sample is unbalanced and consists of 21,934 observations.

## Average number of words recalled by main categories

	Word recall		
	Observations	Mean	Standard deviation
Total Sample	<b>21,934</b>	<b>10.0</b>	<b>3.2</b>
<b>Retired</b>	<b>9,540</b>	<b>9.4</b>	<b>3.3</b>
<b>Employed</b>	<b>12,394</b>	<b>10.4</b>	<b>3.1</b>
Male	11,991	9.4	3.2
Female	9,945	10.7	3.2
White-collar	12,520	10.4	3.1
Blue-collar	4,760	8.4	3.2
High-skilled	10,910	10.1	3.2
Low-skilled	6,370	9.4	3.3
High-school degree or more	14,800	10.5	3.1
No High-school degree	7,136	8.7	3.2
Activities last year			
-No social activities	3,379	9.5	3.2
-Social activities	11,512	10.5	3.1
-No reading	1,657	8.7	3.3
-Reading books	13,234	10.5	3.1

# The effect of retirement status and duration on word recall

	FE	FE-2SLS	FE	FE-2SLS	FE	FE-2SLS
	b/se	b/se	b/se	b/se	b/se	b/se
retired	<b>0.0088</b>	<b>0.1876</b>				
	<b>(0.0833)</b>	<b>(0.3478)</b>				
retired at least 1 year						
retirement duration						
age <sup>2</sup> /100	-0.5142***	-0.5393***				
	(0.0784)	(0.0912)				
learning	0.2006**	0.2122**				
	(0.0916)	(0.0941)				
contextual factor	-0.5357***	-0.5346***				
	(0.0983)	(0.0982)				
first stage						
normal retirement age		0.1866***				
		(0.0109)				
early retirement age		0.1560***				
		(0.0096)				

# The effect of retirement status and duration on word recall

	FE	FE-2SLS	FE	FE-2SLS	FE	FE-2SLS
	b/se	b/se	b/se	b/se	b/se	b/se
retired	<b>0.0088</b>	<b>0.1876</b>				
	<b>(0.0833)</b>	<b>(0.3478)</b>				
retired at least 1 year			<b>0.0432</b>	<b>0.6111*</b>		
			<b>(0.0825)</b>	<b>(0.3295)</b>		
retirement duration						
age <sup>2</sup> /100	-0.5142***	-0.5393***	-0.5209***	-0.6244***		
	(0.0784)	(0.0912)	(0.0790)	(0.0980)		
learning	0.2006**	0.2122**	0.2021**	0.2290**		
	(0.0916)	(0.0941)	(0.0915)	(0.0928)		
contextual factor	-0.5357***	-0.5346***	-0.5354***	-0.5308***		
	(0.0983)	(0.0982)	(0.0983)	(0.0981)		
first stage						
normal retirement age		0.1866***		0.1568***		
		(0.0109)		(0.0115)		
early retirement age		0.1560***		0.2089***		
		(0.0096)		(0.0101)		

# The effect of retirement status and duration on word recall

	FE	FE-2SLS	FE	FE-2SLS	FE	FE-2SLS
	b/se	b/se	b/se	b/se	b/se	b/se
retired	<b>0.0088</b>	<b>0.1876</b>				
	<b>(0.0833)</b>	<b>(0.3478)</b>				
retired at least 1 year			<b>0.0432</b>	<b>0.6111*</b>		
			<b>(0.0825)</b>	<b>(0.3295)</b>		
retirement duration					<b>0.0284</b>	<b>0.2870***</b>
					<b>(0.0220)</b>	<b>(0.0741)</b>
age <sup>2</sup> /100	-0.5142***	-0.5393***	-0.5209***	-0.6244***	-0.6220***	-1.6136***
	(0.0784)	(0.0912)	(0.0790)	(0.0980)	(0.1155)	(0.2957)
learning	0.2006**	0.2122**	0.2021**	0.2290**	0.1986**	0.1855**
	(0.0916)	(0.0941)	(0.0915)	(0.0928)	(0.0915)	(0.0922)
contextual factor	-0.5357***	-0.5346***	-0.5354***	-0.5308***	-0.5343***	-0.5208***
	(0.0983)	(0.0982)	(0.0983)	(0.0981)	(0.0984)	(0.0989)
first stage						
normal retirement age		0.1866***		0.1568***		0.3039***
		(0.0109)		(0.0115)		(0.0156)
early retirement age		0.1560***		0.2089***		0.2760***
		(0.0096)		(0.0101)		(0.0176)

# Robustness to age trend

	FE-2SLS	FE-2SLS	FE-2SLS
	b/se	b/se	b/se
retirement duration	<b>-0.0841***</b>		
	<b>(0.0197)</b>		
retirement duration <sup>2</sup> /100			
age <sup>2</sup> /100			
age <sup>3</sup> /10000			
Learning	0.2280**		
	(0.0914)		
contextual factor	<b>-0.5427***</b>		
	<b>(0.0984)</b>		

# Robustness to age trend

	FE-2SLS	FE-2SLS	FE-2SLS
	b/se	b/se	b/se
retirement duration	<b>-0.0841***</b>	<b>0.3206***</b>	
	<b>(0.0197)</b>	<b>(0.0765)</b>	
retirement duration <sup>2</sup> /100			
age <sup>2</sup> /100		4.2744*	
		(2.3687)	
age <sup>3</sup> /10000		-3.3348**	
		(1.3402)	
Learning	0.2280**	0.2302**	
	(0.0914)	(0.0938)	
contextual factor	-0.5427***	-0.5217***	
	(0.0984)	(0.0988)	

# Robustness to age trend

	FE-2SLS	FE-2SLS	FE-2SLS
	b/se	b/se	b/se
retirement duration	<b>-0.0841***</b>	<b>0.3206***</b>	<b>0.2998***</b>
	<b>(0.0197)</b>	<b>(0.0765)</b>	<b>(0.0909)</b>
retirement duration <sup>2</sup> /100			<b>-0.3015</b>
			<b>(0.3609)</b>
age <sup>2</sup> /100		4.2744*	-1.4854***
		(2.3687)	(0.2813)
age <sup>3</sup> /10000		-3.3348**	
		(1.3402)	
Learning	0.2280**	0.2302**	0.1942**
	(0.0914)	(0.0938)	(0.0925)
contextual factor	<b>-0.5427***</b>	<b>-0.5217***</b>	<b>-0.5226***</b>
	<b>(0.0984)</b>	<b>(0.0988)</b>	<b>(0.0987)</b>

## Additional controls and gender heterogeneity

	FE-2SLS b/se	FE-2SLS b/se	FE-2SLS b/se
<b>retirement duration</b>	<b>0.2821***</b>	<b>0.2836***</b>	<b>0.2441***</b>
	<b>(0.0742)</b>	<b>(0.0743)</b>	<b>(0.0722)</b>
<b>ret. duration*female</b>			<b>0.0188</b>
			<b>(0.0246)</b>
couple	0.1611	0.1642	0.1674
	(0.1434)	(0.1436)	(0.1436)
smoke	0.0565	0.0587	0.0563
	(0.0789)	(0.0789)	(0.0789)
drink	-0.1140	-0.1116	-0.1176
	(0.0841)	(0.0841)	(0.0840)
physical inactivity	-0.5405***	-0.5261***	-0.5245***
	(0.1417)	(0.1417)	(0.1416)
learning	0.2017**	0.2042**	0.2062**
	(0.0934)	(0.0936)	(0.0935)
contextual factor	-0.5250***	-0.5244***	-0.5269***
	(0.0987)	(0.0987)	(0.0986)
2 or more chronic dis.		<b>0.0605</b>	0.0711
		(0.0621)	(0.0620)
self-perceived health (us)		<b>0.0331</b>	0.0217
		(0.0568)	(0.0568)
# limitations adl		<b>0.0326</b>	0.0277
		(0.0857)	(0.0855)
# limitations iadl		<b>-0.1094</b>	-0.1085
		(0.0919)	(0.0917)

Note: includes polynomial in age and wave dummies

# Education and previous job

	FE-2SLS b/se	FE-2SLS b/se	FE-2SLS b/se	FE-2SLS b/se
retirement duration	0.2365*** (0.0715)	0.2466*** (0.0702)	0.2380*** (0.0787)	0.2408*** (0.0789)
ret.dur.* higher edu	0.0451* (0.0250)			
Ret.dur.*college		0.1081*** (0.0299)		
ret.dur.* white collar			0.0471* (0.0288)	
ret.dur.*high skilled worker				0.0492* (0.0272)
Number of obs	21934	21934	17278	17278

# Activities after retirement (wave 4)

	FE-2SLS b/se	FE-2SLS b/se	FE-2SLS b/se
retirement duration	0.2809*** (0.0741)	0.2467*** (0.0860)	0.1562* (0.0845)
ret.dur.*still working	-0.0030 (0.0251)		
ret.dur.*activities social		0.0003 (0.0371)	
ret.dur.*read			0.1066** (0.0513)
Number of obs	21934	14663	14663

# Heterogeneity of the effect of retirement on word recall

- We test for differences in the effect of retirement on WR, and find:
  - no statistically significant difference for men/women
  - positive difference for college graduates
  - positive difference for skilled workers
  - positive difference for individuals who read books
- Evidence is consistent with theories highlighting role of cognitive reserve in shaping old-age cognitive decline. Individual's lifestyle is associated to effect of retirement on cognition.

# Pooled regressions with retirement duration – robustness to age trend

	OLS	2SLS	OLS	2SLS
	b/se	b/se	b/se	b/se
retirement duration	-0.0420***	-0.0246		
	(0.0083)	(0.0181)		
age	-0.0904***	-0.1007***		
	(0.0069)	(0.0119)		
age <sup>2</sup> /100				
Learning	0.3371***	0.3439***		
	(0.0808)	(0.0812)		
contextual factor	-0.8278***	-0.8289***		
	(0.0988)	(0.0987)		
Number of obs	21934	21934		

# Pooled regressions with retirement duration – robustness to age trend

	OLS	2SLS	OLS	2SLS
	b/se	b/se	b/se	b/se
retirement duration	-0.0420***	-0.0246	-0.0314***	0.1815***
	(0.0083)	(0.0181)	(0.0092)	(0.0482)
age	-0.0904***	-0.1007***	0.2502***	1.1693***
	(0.0069)	(0.0119)	(0.0964)	(0.2269)
age <sup>2</sup> /100			-0.2879***	-1.1561***
			(0.0818)	(0.2104)
Learning	0.3371***	0.3439***	0.3187***	0.3337***
	(0.0808)	(0.0812)	(0.0811)	(0.0827)
contextual factor	-0.8278***	-0.8289***	-0.8267***	-0.8357***
	(0.0988)	(0.0987)	(0.0988)	(0.0996)
Number of obs	21934	21934	21934	21934

# Retirement age distribution

