

# Prospective Ageing and Economic Growth in Europe

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# RESEARCH QUESTION AND STRUCTURE

- ▶ Are prospective ageing measures better predictors of income growth than chronological measures?
- ▶ Structure of the presentation
  - ▶ Chronological vs. prospective ageing in Europe 1980-2010
  - ▶ Explaining income growth in Europe: Do ageing measures matter?
  - ▶ Conclusions

# AGEING IN EUROPE

- ▶ The sustained fall of fertility rates and increase in life expectancy in Europe have led to a growing interest in the economic growth consequences of ageing in the continent (see for instance Gill and Raiser, 2012)
- ▶ Macroeconomic consequences of ageing are widely discussed in the theoretical literature
- ▶ Measurement of ageing has become a central research topic in this area (Sanderson and Scherbov, 2005, 2010) → from chronological to prospective age measures

# AGEING IN EUROPE

- ▶ From the standard *OADR*,

$$OADR = \frac{\text{Number of people aged 65+}}{\text{Number of people aged 20-64}}$$

- ▶ ... to the prospective *OADR*,

$$POADR = \frac{\text{People with remaining LE} < 15}{\text{People aged 20 - threshold age at which LE} < 15}$$

# AGEING IN EUROPE

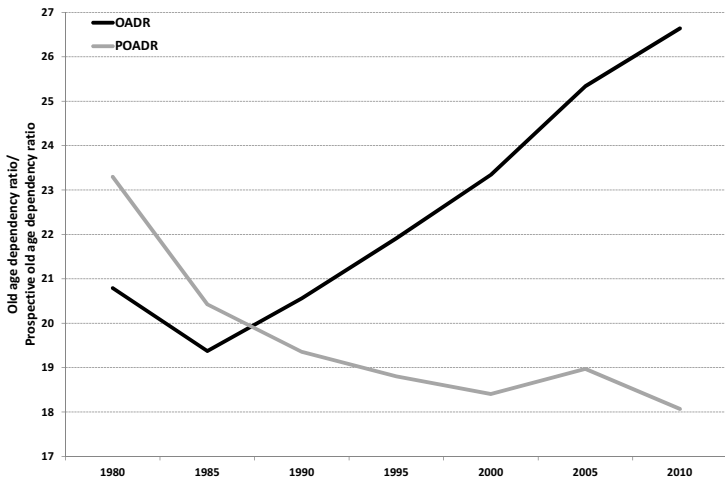
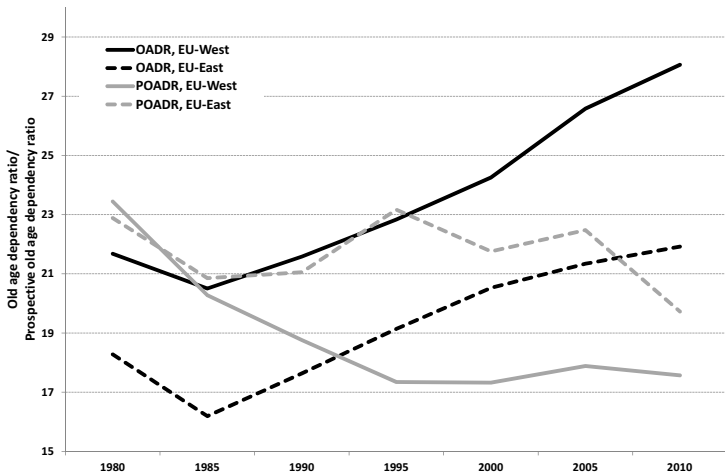


FIGURE : EU-28: Old age dependency ratio (OADR) and prospective old age dependency ratio (POADR), 1980-2010

# AGEING IN EUROPE



**FIGURE** : Western and Eastern EU regions: Old age dependency ratio (OADR) and prospective old age dependency ratio (POADR), 1980-2010

# AGEING IN EUROPE

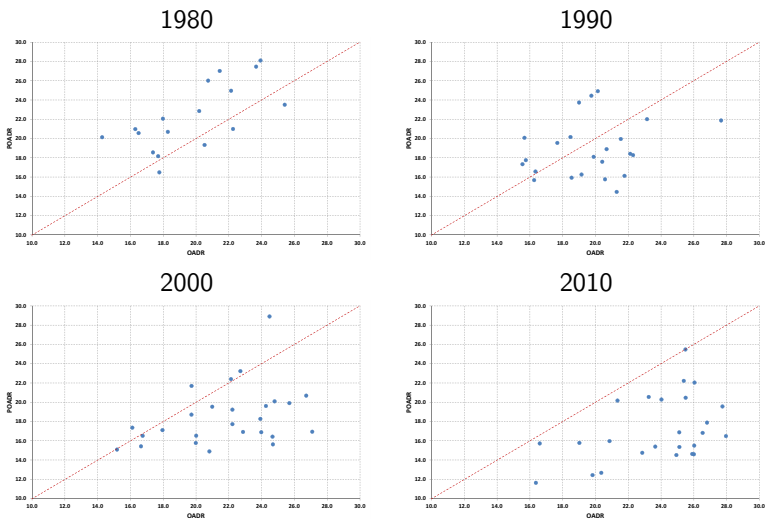


FIGURE : EU-28 countries: Old age dependency ratio (OADR) against prospective old age dependency ratio (POADR); 1980, 1990, 2000 and 2010

# ECONOMIC GROWTH AND AGEING IN EUROPE

- ▶ Do ageing measures help explain income growth differences in Europe?
- ▶ Panel dataset spanning the period 1970-2010, alternatively at 5, 10 and 20-year intervals.
- ▶ Simple income growth specification

$$\Delta \log y_{it+\tau} = \beta_1 \Delta \log POP_{it+\tau} + \beta_2 \Delta \log K_{it+\tau} + \beta_3 \log y_{0,it} + \gamma \Delta AGE_{it+\tau} + \theta \Delta AGE_{it+\tau} \times \log y_{0,it} + \varepsilon_{it+\tau},$$

- ▶ Country and period fixed effects



# ECONOMIC GROWTH AND AGEING IN EUROPE

	5-year periods			
Pop. Growth	0.0705 [0.763]	0.149 [0.751]	-0.0543 [0.806]	-0.113 [0.792]
Phys. Cap. Growth	0.564** [0.238]	0.512** [0.246]	0.574** [0.237]	0.554** [0.237]
Initial Income	-0.416*** [0.0921]	-0.395*** [0.0862]	-0.418*** [0.0903]	-0.419*** [0.0895]
Change in OADR			-1.169 [0.844]	-20.08** [9.474]
Change in OADR × Initial Income				1.904* [0.958]
Change in POADR	-0.673 [0.503]	-15.00* [8.572]		
Change in POADR × Initial Income		1.462* [0.849]		
Observations	152	152	152	152
R-squared	0.541	0.554	0.542	0.552
Number of countries	27	27	27	27

# ECONOMIC GROWTH AND AGEING IN EUROPE

	10-year periods			
Pop. Growth	-0.722 [0.373]	-0.441 [0.357]	-0.963* [0.556]	-0.817 [0.549]
[0.339]	[0.348]	[0.558]	[0.531]	
Phys. Cap. Growth	0.606** [0.268]	0.477* [0.260]	0.637** [0.271]	0.557** [0.252]
Initial Income	-0.745*** [0.128]	-0.685*** [0.121]	-0.731*** [0.108]	-0.753*** [0.109]
Change in OADR			-1.485 [1.010]	-28.59 [20.03]
Change in OADR × Initial Income				2.719 [1.997]
Change in POADR	-0.818 [0.798]	-19.13** [9.197]		
Change in POADR × Initial Income		1.870* [0.940]		
Observations	71	71	71	71
R-squared	0.679	0.703	0.686	0.705
Number of countries	26	26	26	26

# ECONOMIC GROWTH AND AGEING IN EUROPE

	20-year periods			
Pop. Growth	0.312 [1.539]	-2.012** [0.835]	0.201 [1.504]	-0.0688 [1.566]
Phys. Cap. Growth	-0.0236 [0.149]	-0.540* [0.266]	-0.174 [0.204]	-0.00297 [0.305]
Initial Income	-0.938*** [0.276]	-1.232*** [0.264]	-0.979*** [0.303]	-0.894** [0.380]
Change in OADR			-0.261 [0.796]	38.73 [50.06]
Change in OADR × Initial Income				-3.899 [5.026]
Change in POADR	-0.619 [0.656]	62.66** [22.46]		
Change in POADR × Initial Income		-6.340** [2.269]		
Observations	31	31	31	31
R-squared	0.825	0.894	0.816	0.824
Number of countries	22	22	22	22

# ECONOMIC GROWTH AND AGEING IN EUROPE

- ▶ Comparable results for chronological and prospective ageing measures at relatively short horizons, the effects are only significant for prospective ageing measures once we move to longer
- ▶ The results indicate that the negative effects of ageing on economic growth appear to be more important in economies with a relatively lower income per capita level
- ▶ The model estimates give thus evidence that ageing is a particularly serious challenge to sustainable income growth in Eastern European economies, whose income per capita level is below EU average and which are precisely expected to experience further increases in old age dependency ratios (see World Bank, 2013)
- ▶ A bunch of robustness checks:
  - ▶ The results remain unchanged if country fixed effects are not included in the specification
  - ▶ The results remain unchanged if we control for trade openness and educational attainment

# OUT-OF-SAMPLE PREDICTIONS

- ▶ Do prospective ageing measures improve out-of-sample predictions?
- ▶ Estimate two alternative 5-year models (using lagged regressors) with OADR and POADR for 1970-1995 and use 1995-2000 as an out-of-sample period
- ▶ Repeat for the periods 2000-2005 and 2005-2010 as out-of-sample periods
- ▶ Obtain prediction errors. Root mean squared error  $\rightarrow$  for OADR & POADR = 0.16
- ▶ Estimate two alternative 10-year models (using lagged regressors) with OADR and POADR for 1970-2000 and use 2000-2010 as an out-of-sample period
- ▶ Obtain prediction errors. Root mean squared error  $\rightarrow$  for OADR = 0.66, for POADR = 0.25
- ▶ A Diebold-Mariano test confirms that the differences in prediction error are indeed statistically significant for the 10-year model

# CONCLUSIONS

- ▶ We evaluate empirically for the first time whether prospective ageing measures are better able to explain the effect of such demographic changes on economic growth than chronological age indicators
- ▶ The results of our panel regressions provide clear empirical evidence concerning the superiority of measures based on prospective ageing as predictors of future economic growth at long horizons
- ▶ Our results indicate that the effect of ageing on income dynamics is heterogeneous across countries and that the negative consequences of ageing societies are stronger in relatively poorer economies
- ▶ Monitoring prospective ageing measures should be a priority in the framework of designing policies aimed at combating the negative economic consequences of ageing