



*Thinking ahead for Europe*

Ageing, work and productivity

Mikkel Barslund

CEPS

Joint CEPS-IMF workshop on 28 February under the umbrella of MoPAct, Bel-ageing, FACTAGE projects.

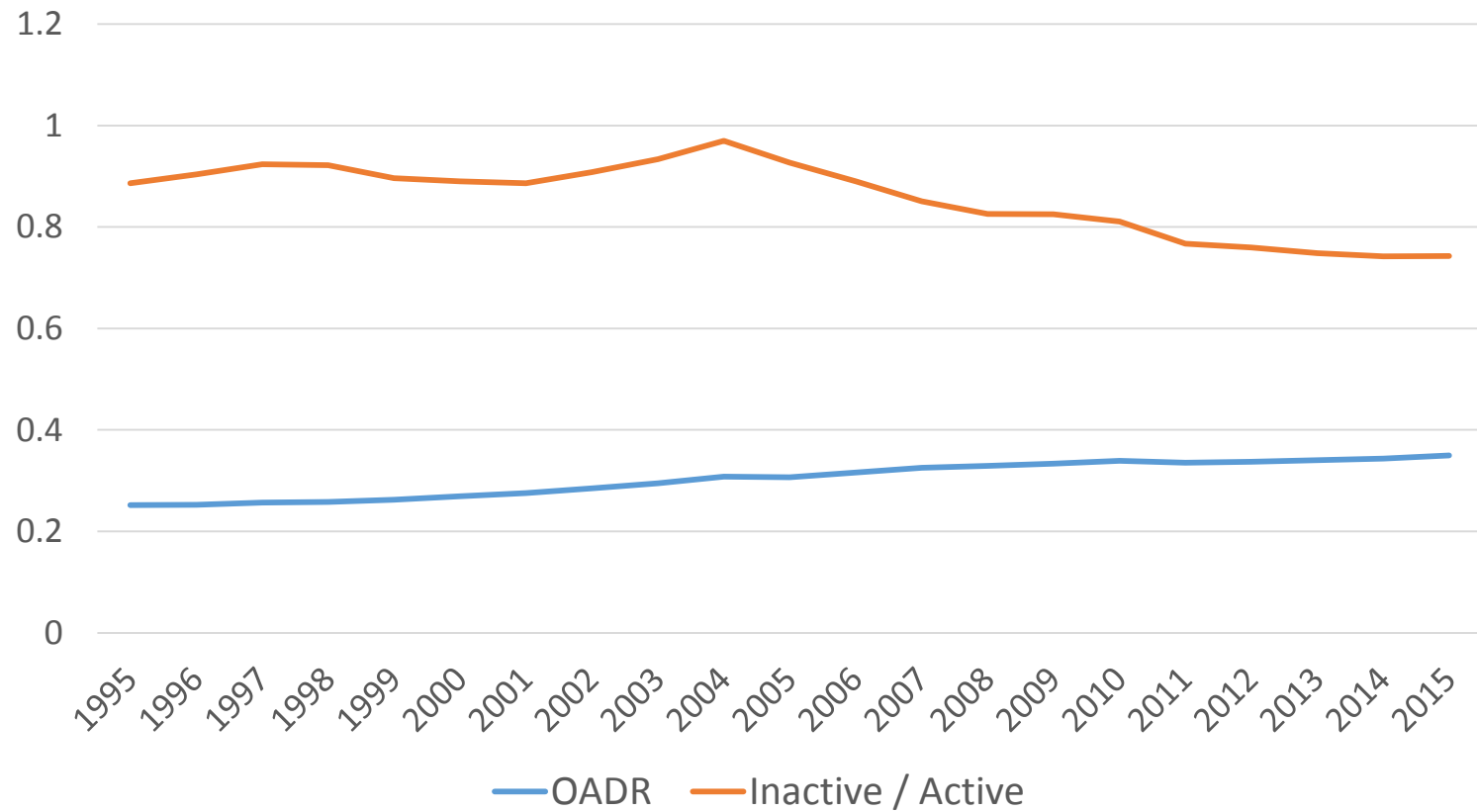


[CEPS\\_thinktank](#)

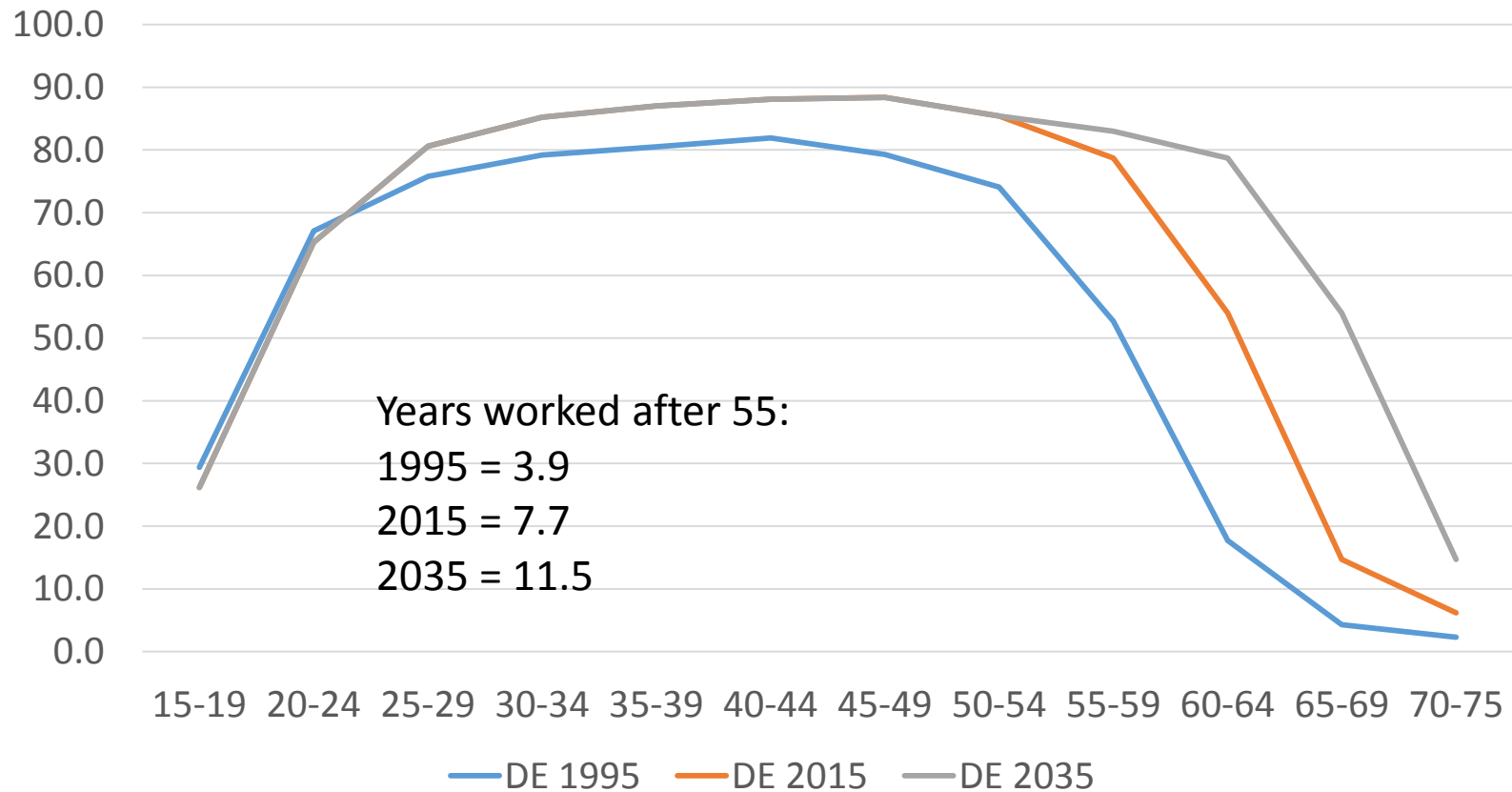


[www.ceps.eu](http://www.ceps.eu)

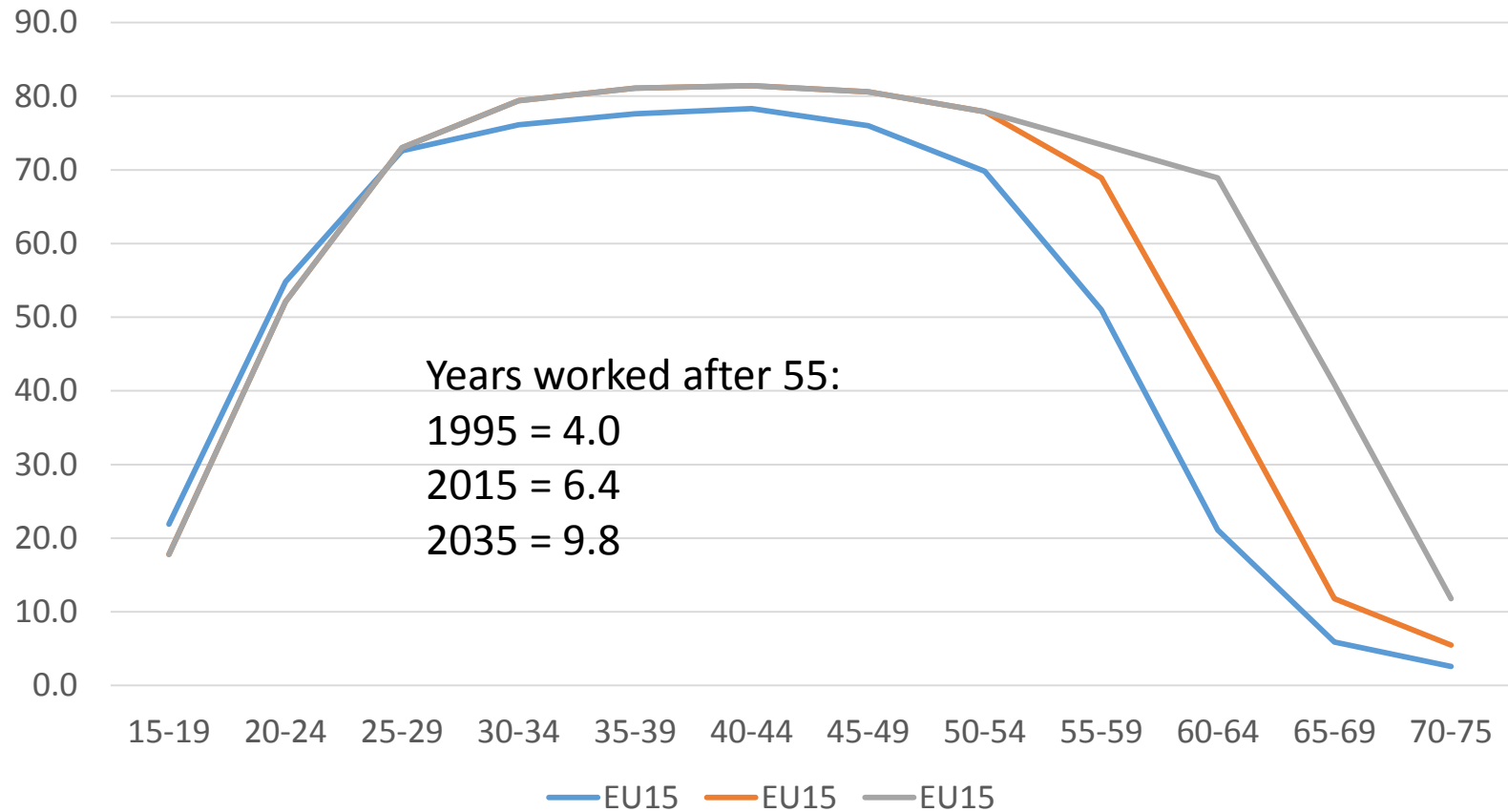
## OADR and support ratio, Germany



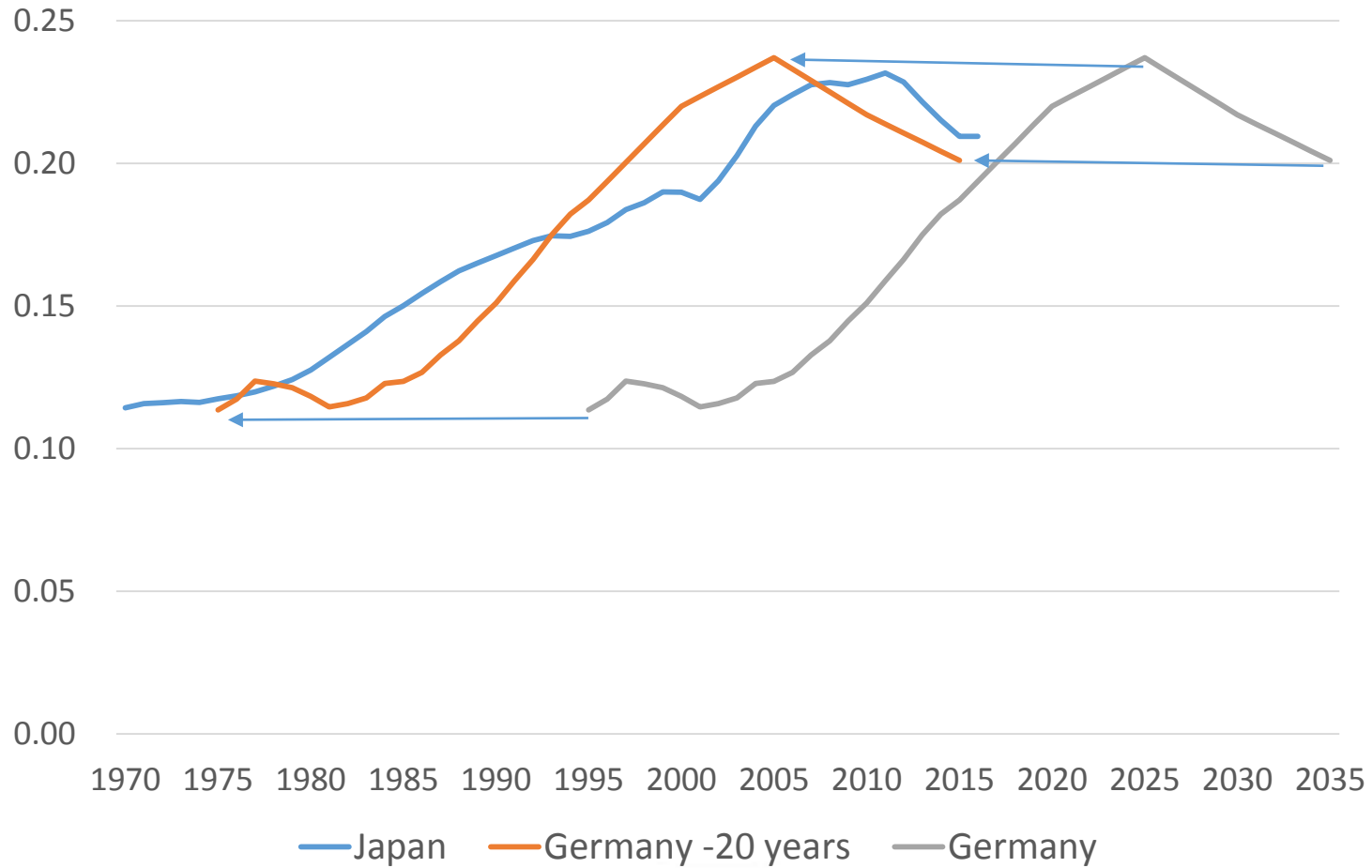
## Employment rates, Germany



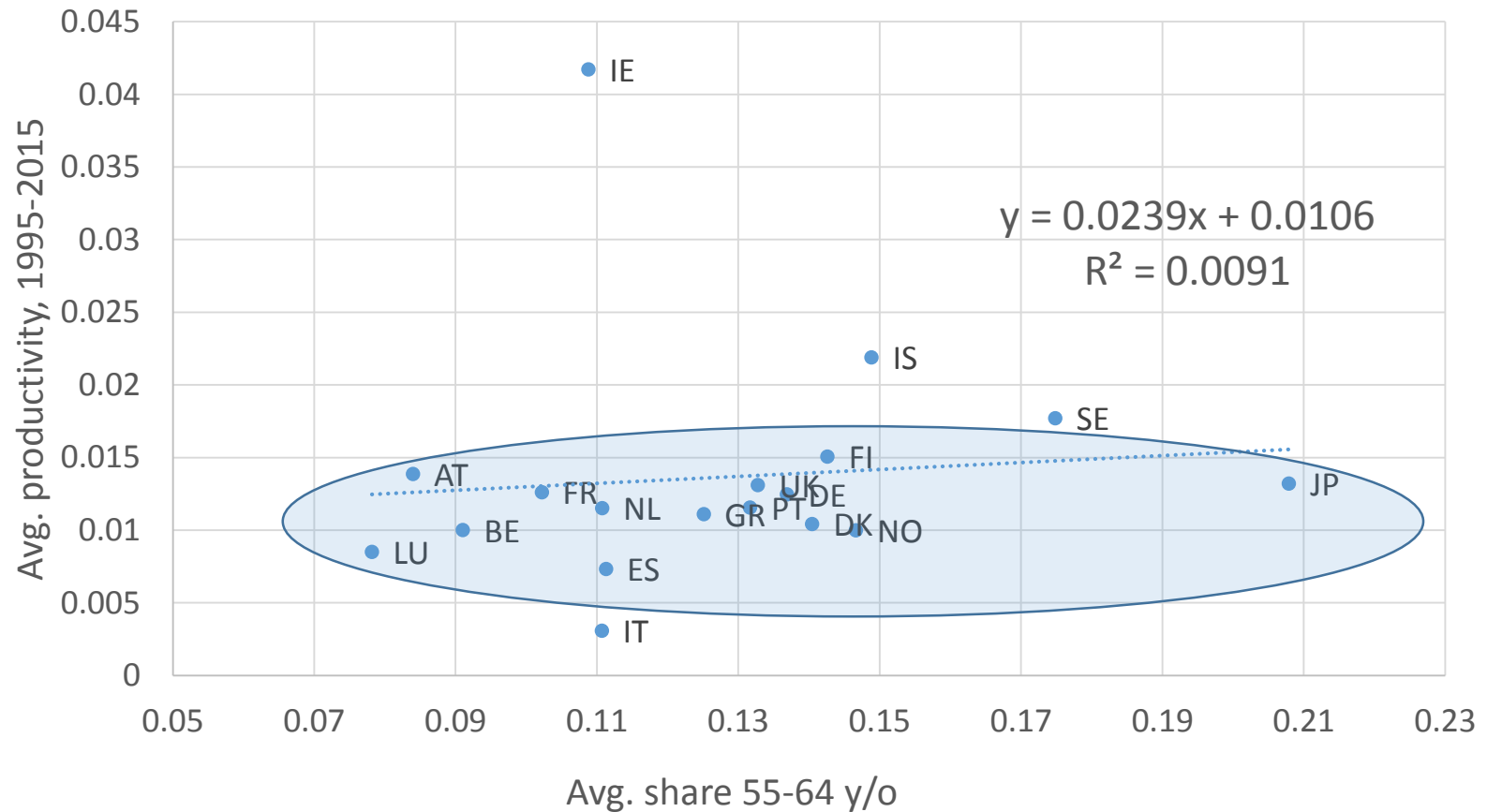
## Employment rates, EU15



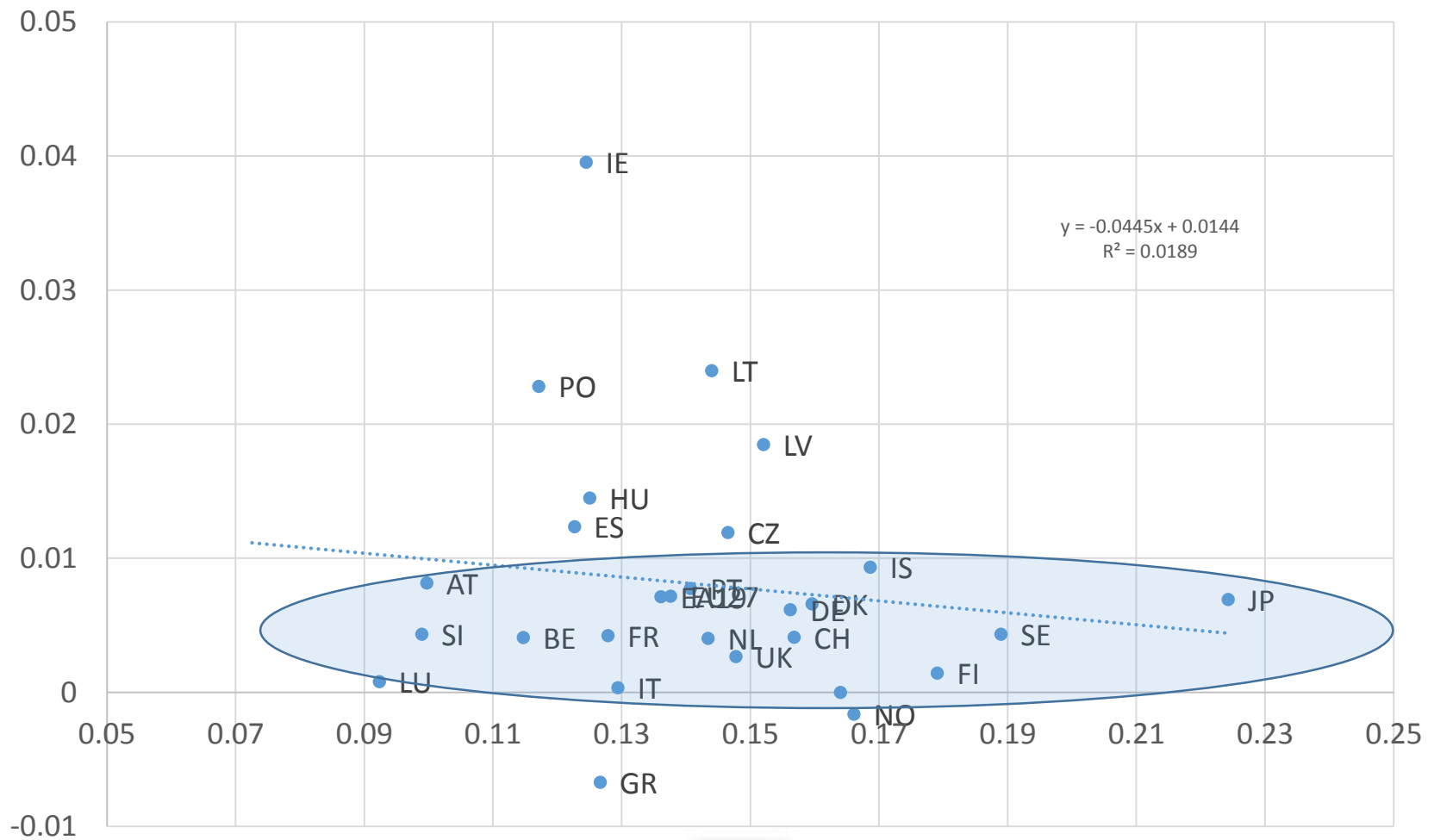
Share of 55-64: Germany = Japan 20 years ago



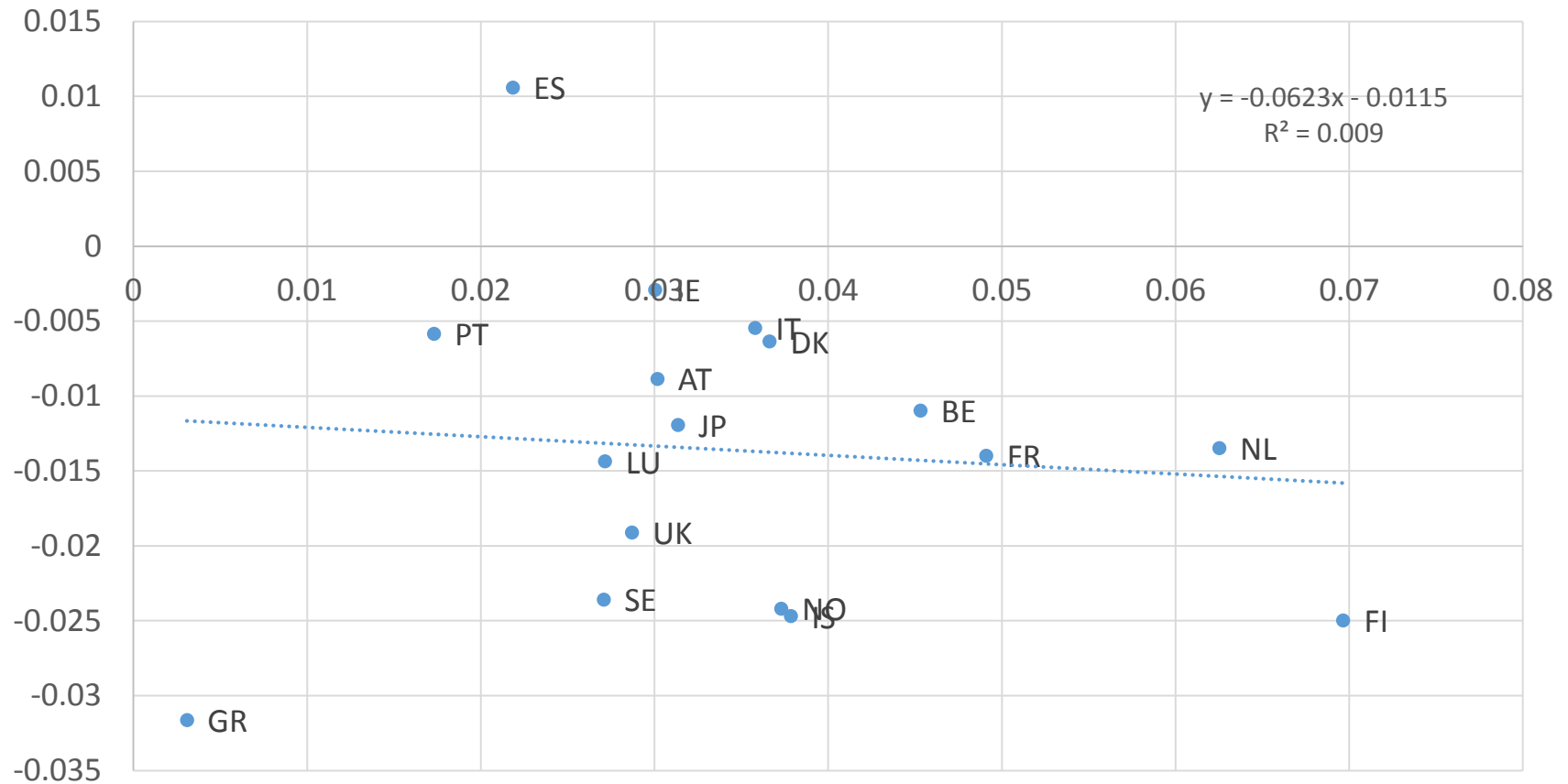
Avg. productivity (1995-2015) VS. Avg. share 55-64 y/o



# Avg. productivity (2005-2015) VS. Avg. share 55-64 y/o



Diff [old share 2005-2015, old share 1995-2005] vs. Diff [prod 2005-2015, prod 1995-2005]





# **Demography and Migration from the perspective of the labour market**

**Dr. Jörg Peschner**

# **(Projected) Demographics, labour supply, and growth**

## **Mobility / Migration and growth**

# Underlying literature:

- Growth potential of EU human resources and policy implications for future economic growth (2013)
- Demographic change, human resources constraints and economic growth - The EU challenge compared to other global players (2015)

Employment and Social Developments in Europe 2017 (forthcoming)

# The components of economic growth (ann. average 2000-16)

**GDP growth = Employment growth + Productivity gains**

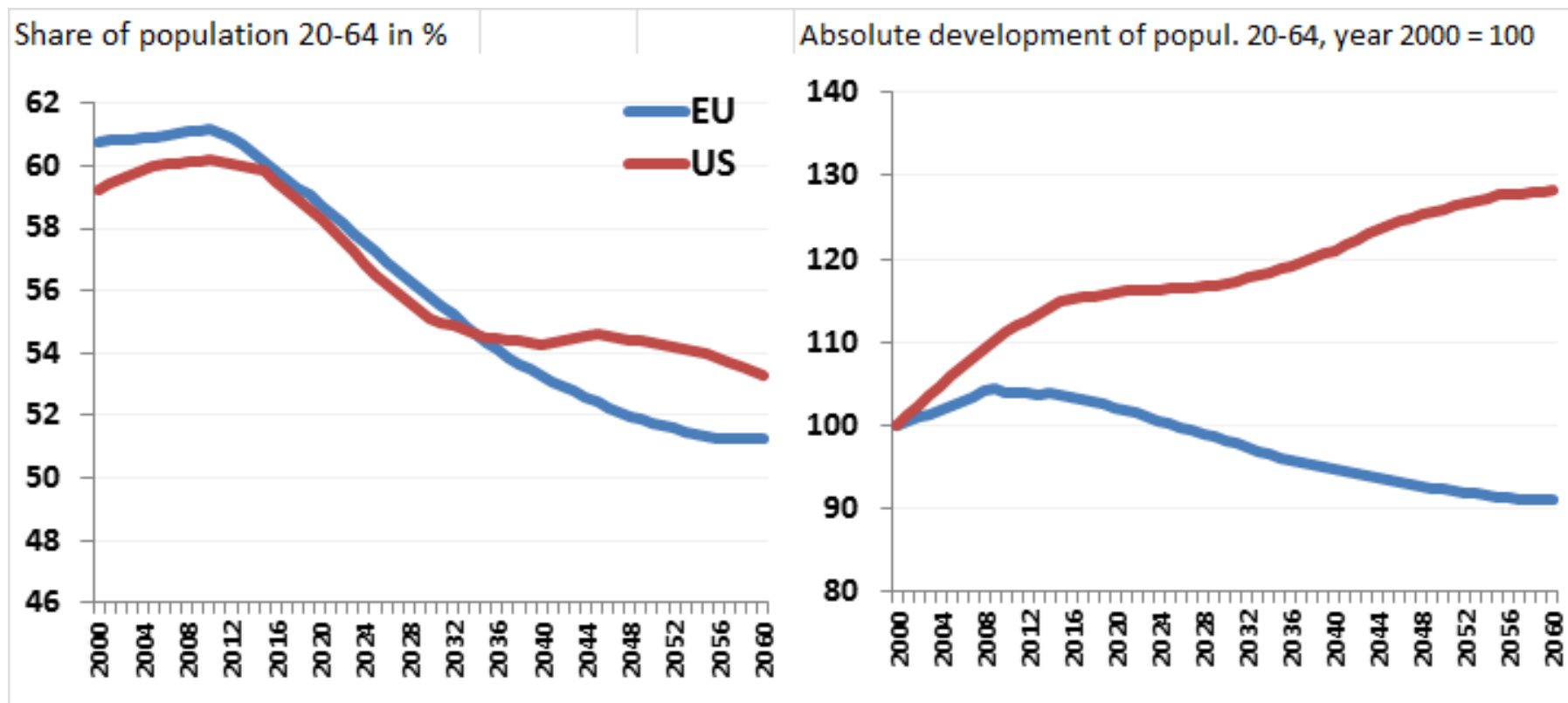
EU	1.3%	0.5%	0.8%
US	1.8%	0.6%	1.2%

# Europe...



- .. will not be the only place where ageing will take place..
- .. but ageing pattern will be particular in Europe.

**Working-age population here: age group 20-64**

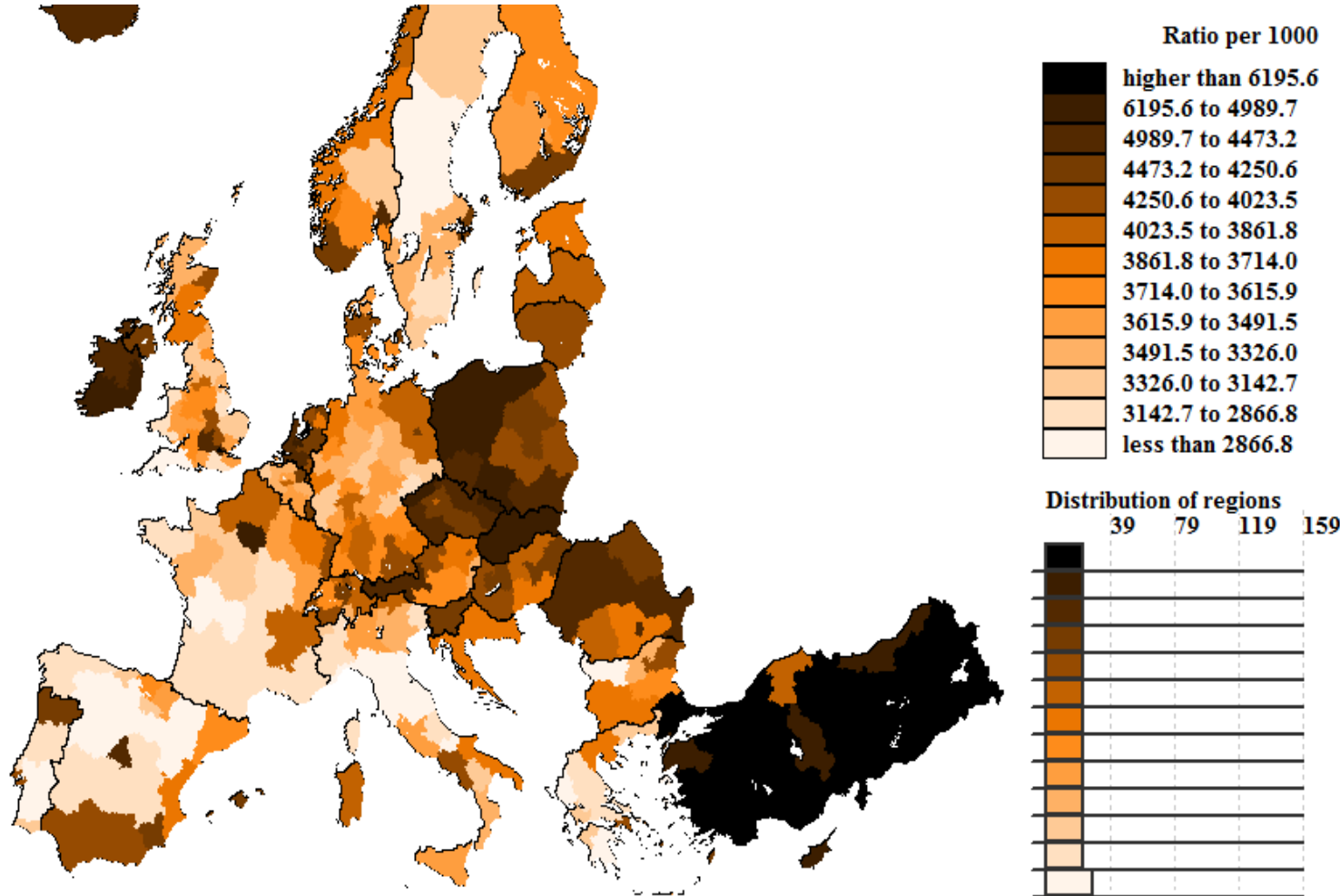


Sources: UN World Population Prospects 2015 (medium variant) for the US,  
Eurostat Europop 2013 population projection (main scenario) for the EU

# Fast population ageing: Number of people aged 20 to 64 per 10.000 aged 65+

Source: LFS data, own calculations  
based on DG EMPL's regional projection software

**2002**

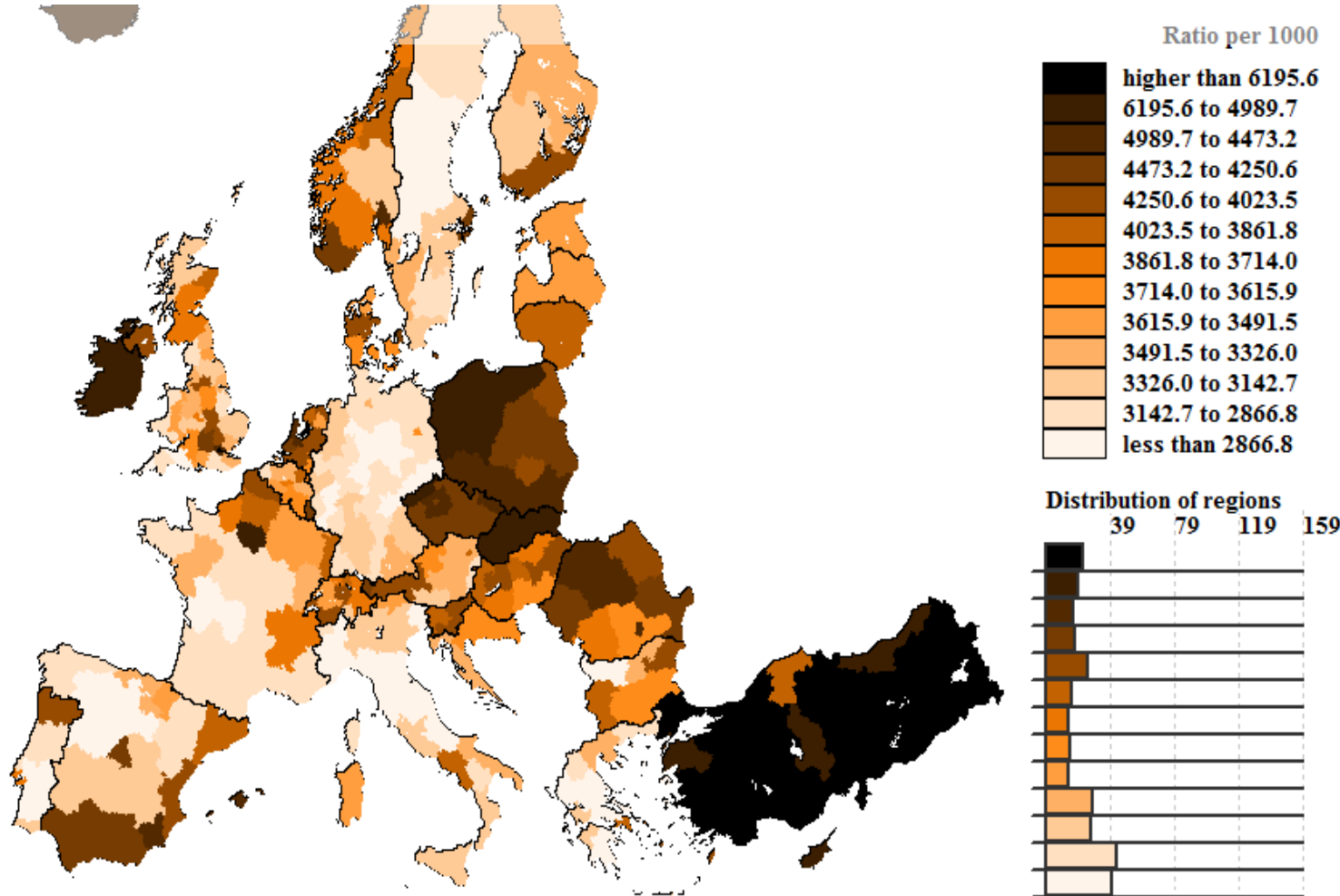


Source: Own calculations based on Eurostat EU LFS

# Fast population ageing: Number of people aged 20 to 64 per 10.000 aged 65+

Source: LFS data, own calculations  
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**2007**

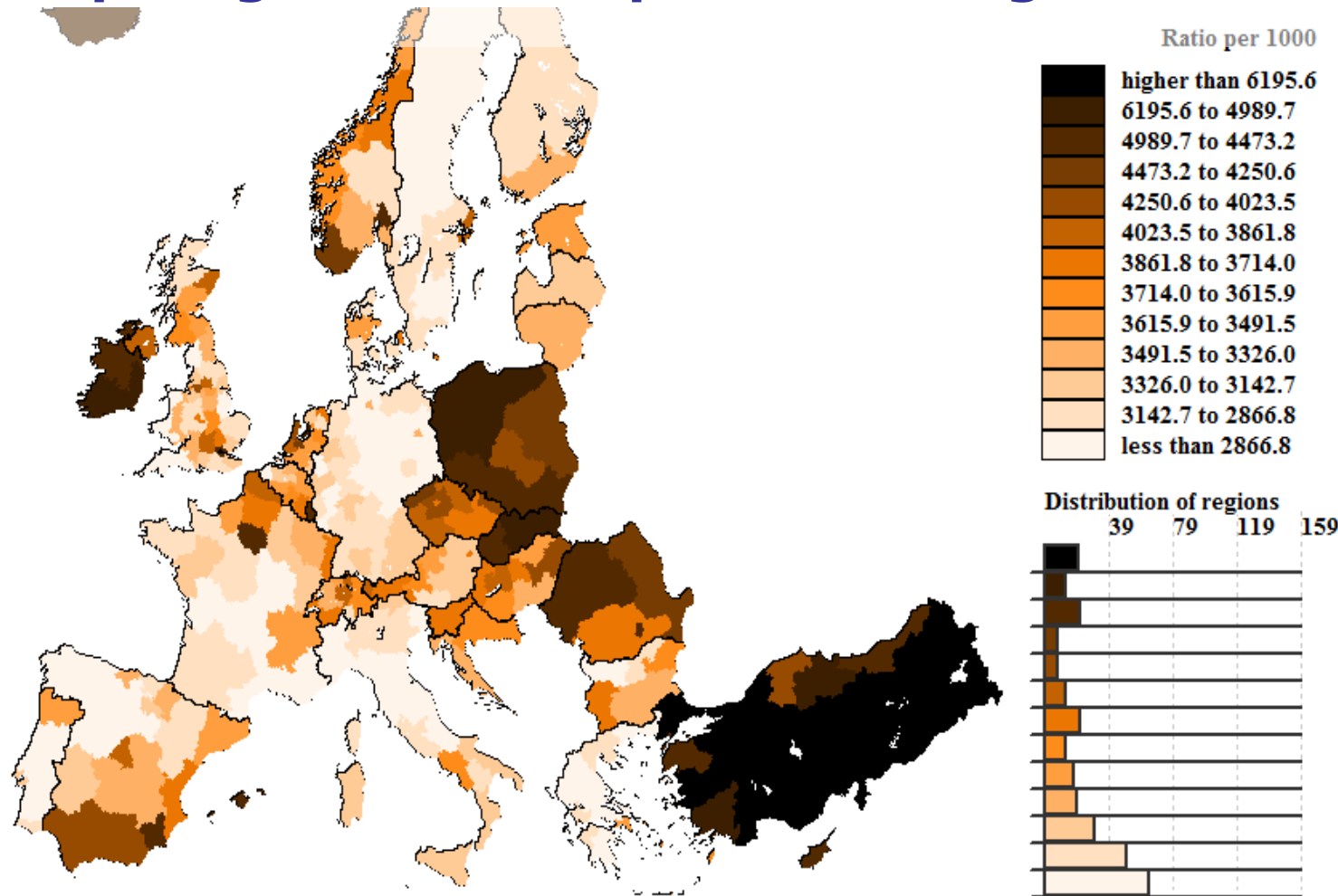


Source: Own calculations based on Eurostat EU LFS

# Fast population ageing: Number of people aged 20 to 64 per 10.000 aged 65+

Source: LFS data, own calculations  
based on DG EMPL's regional projection software

*2012*



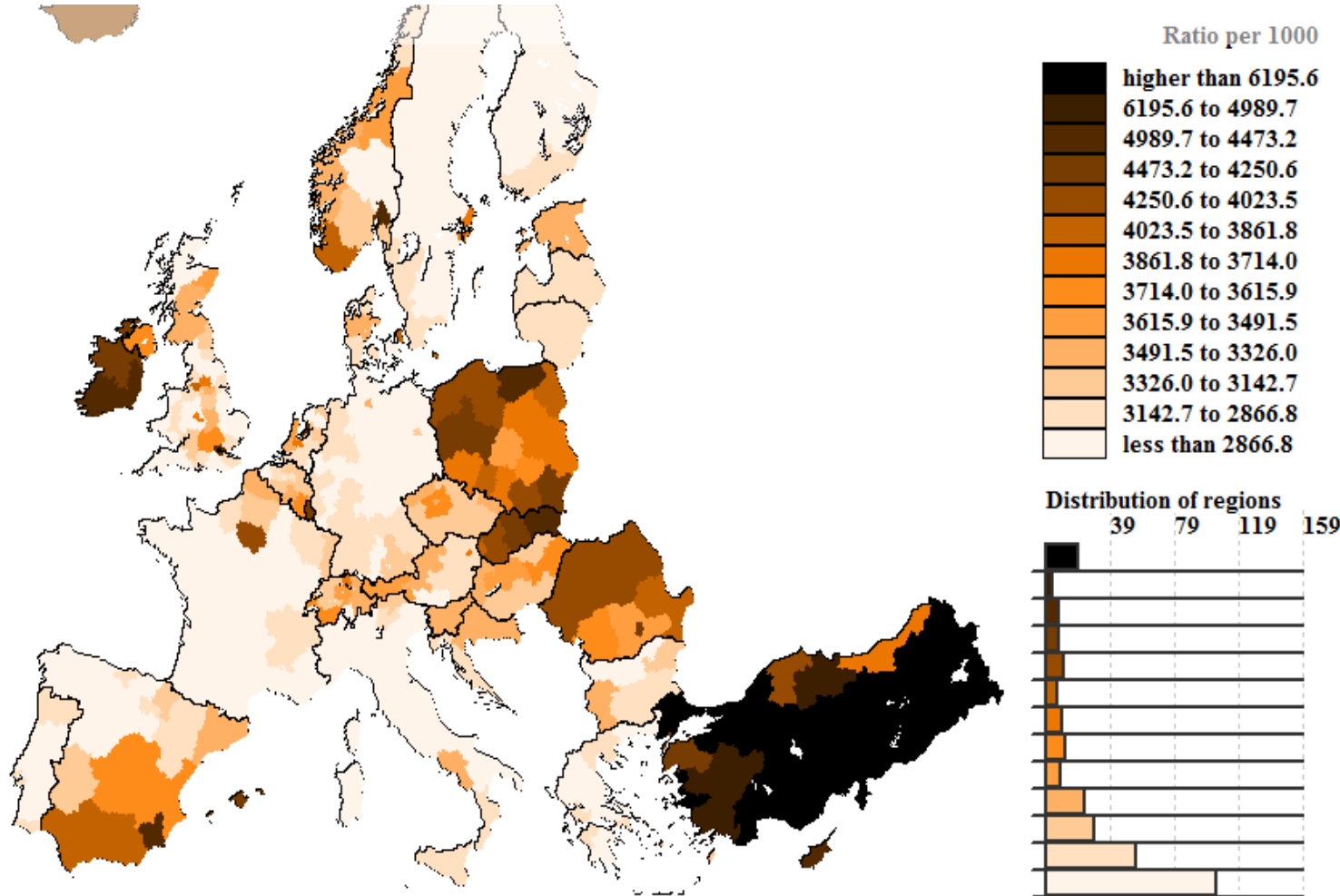
Source: Own calculations based on Eurostat EU LFS



# Fast population ageing: Number of people aged 20 to 64 per 10.000 aged 65+

Source: LFS data, own calculations  
based on DG EMPL's regional projection software

2017

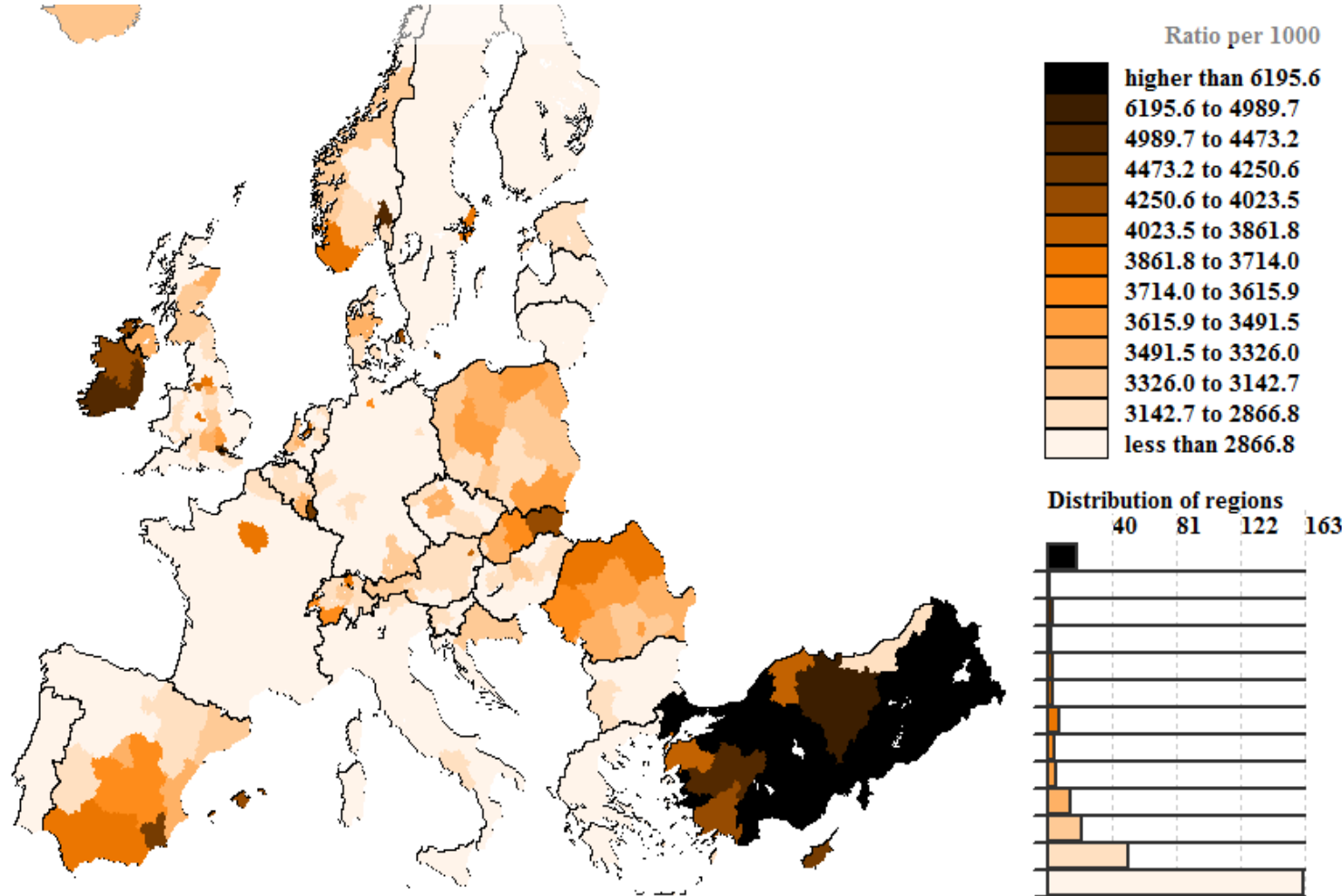


Source: Own calculations based on Eurostat EU LFS

# Fast population ageing: Number of people aged 20 to 64 per 10.000 aged 65+

Source: LFS data, own calculations  
based on DG EMPL's regional projection software

**2022**

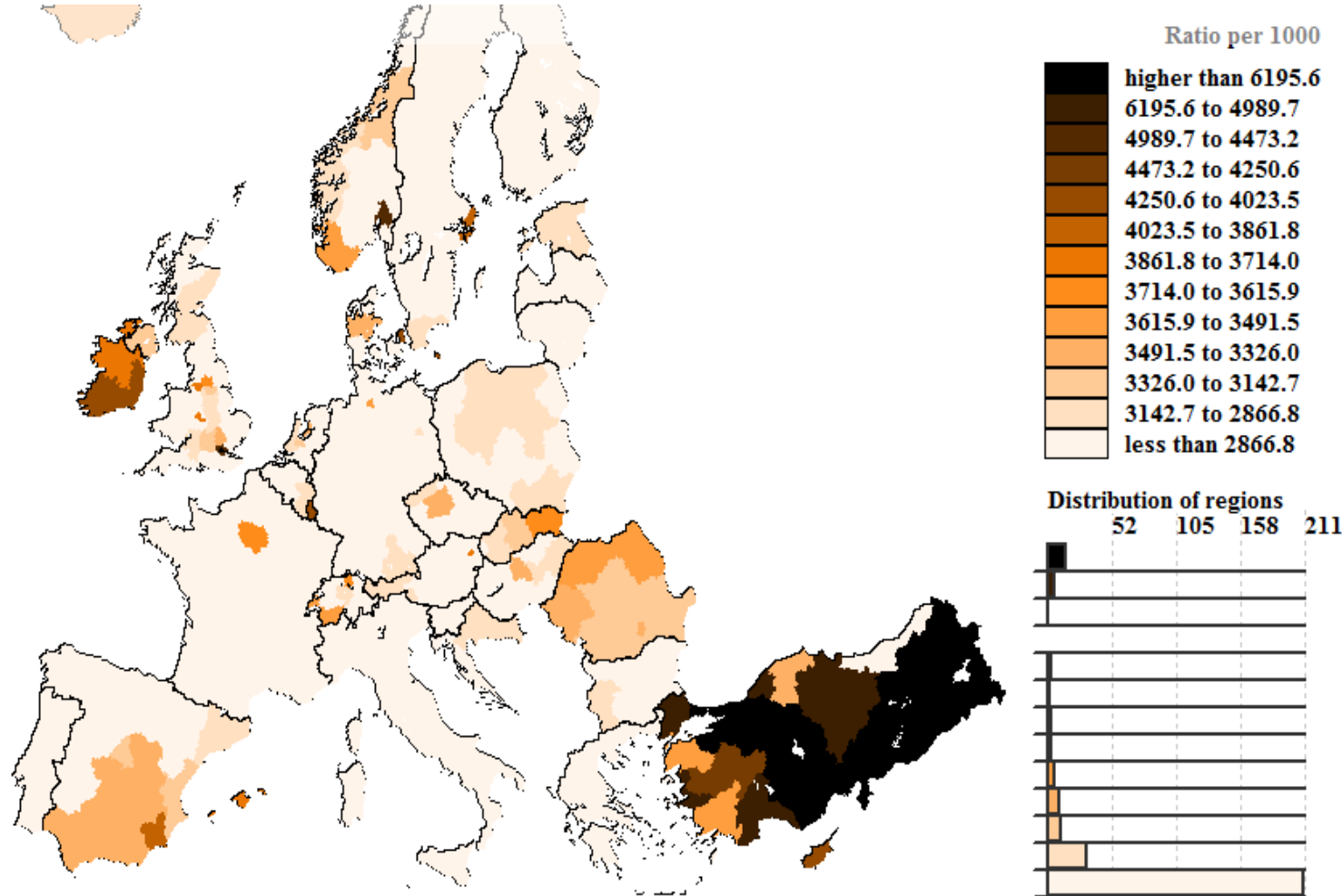


Source: Own calculations based on Eurostat EU LFS

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Source: LFS data, own calculations  
based on DG EMPL's regional projection software

**2027**

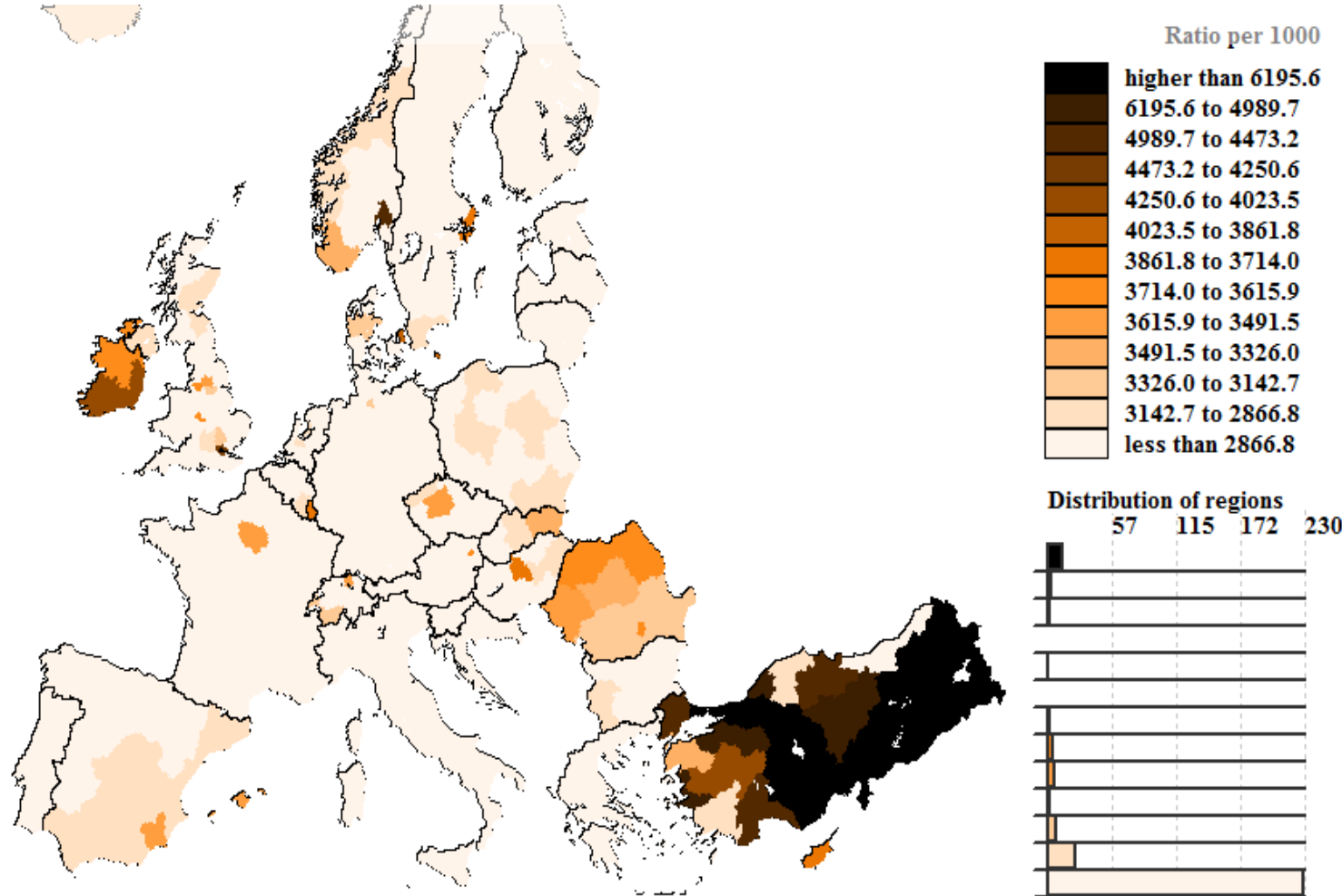


Source: Own calculations based on Eurostat EU LFS

# Fast population ageing: Number of people aged 20 to 64 per 10.000 aged 65+

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based on DG EMPL's regional projection software

**2032**

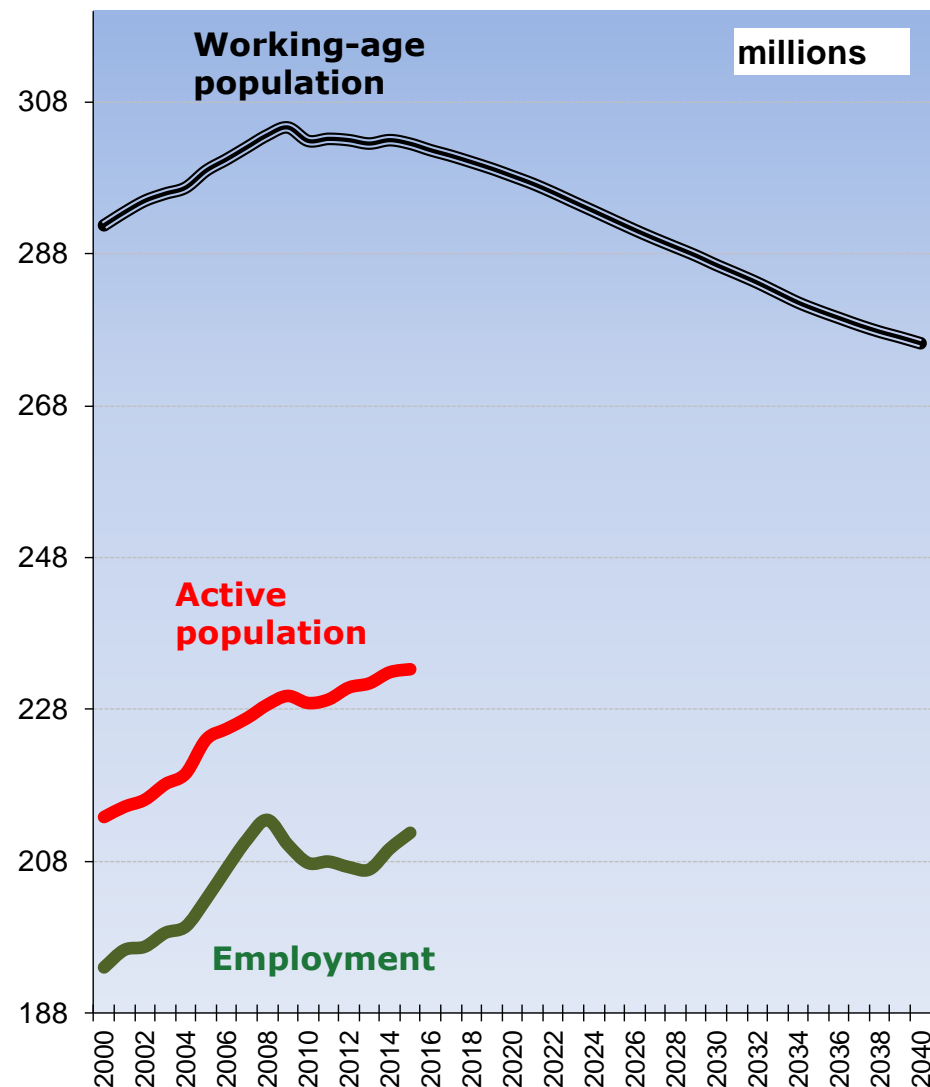


Source: Own calculations based on Eurostat EU LFS

## Potential employment paths

Workforce development, age group 20-64 years

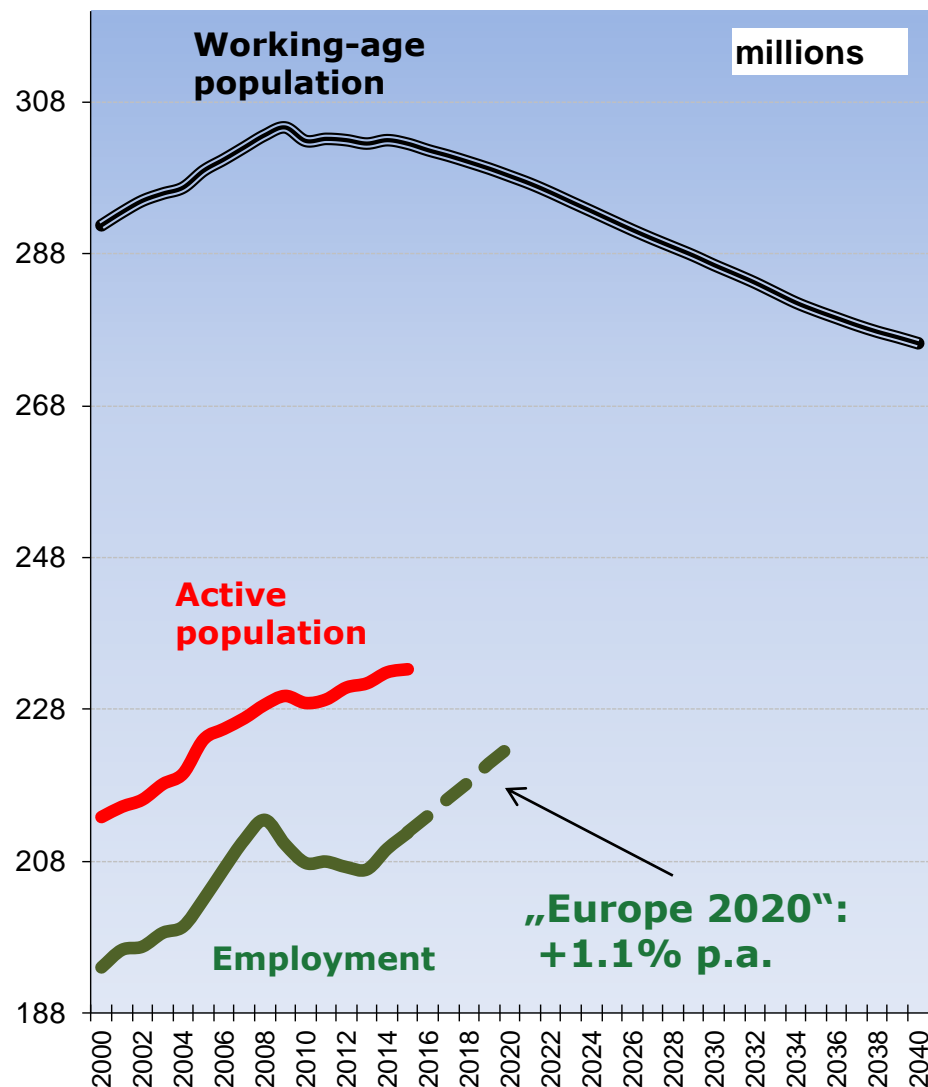
European Commission



## Potential employment paths

Workforce development, age group 20-64 years

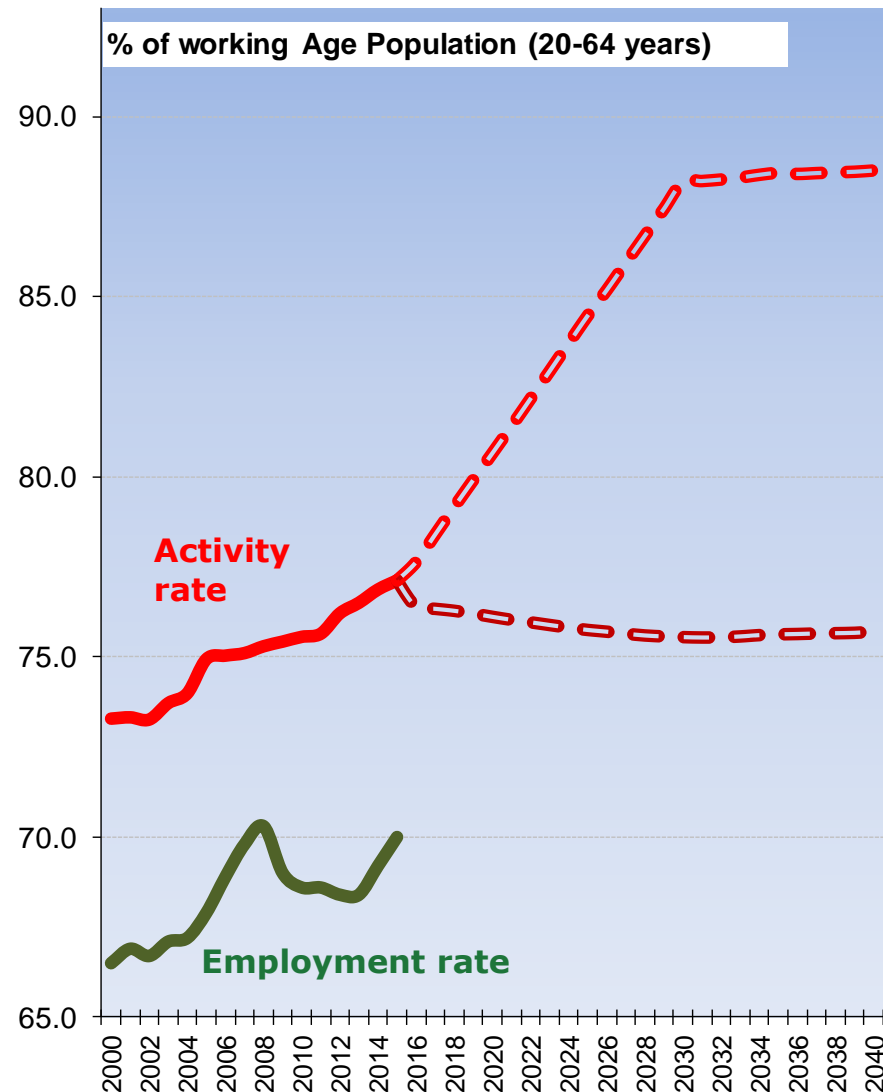
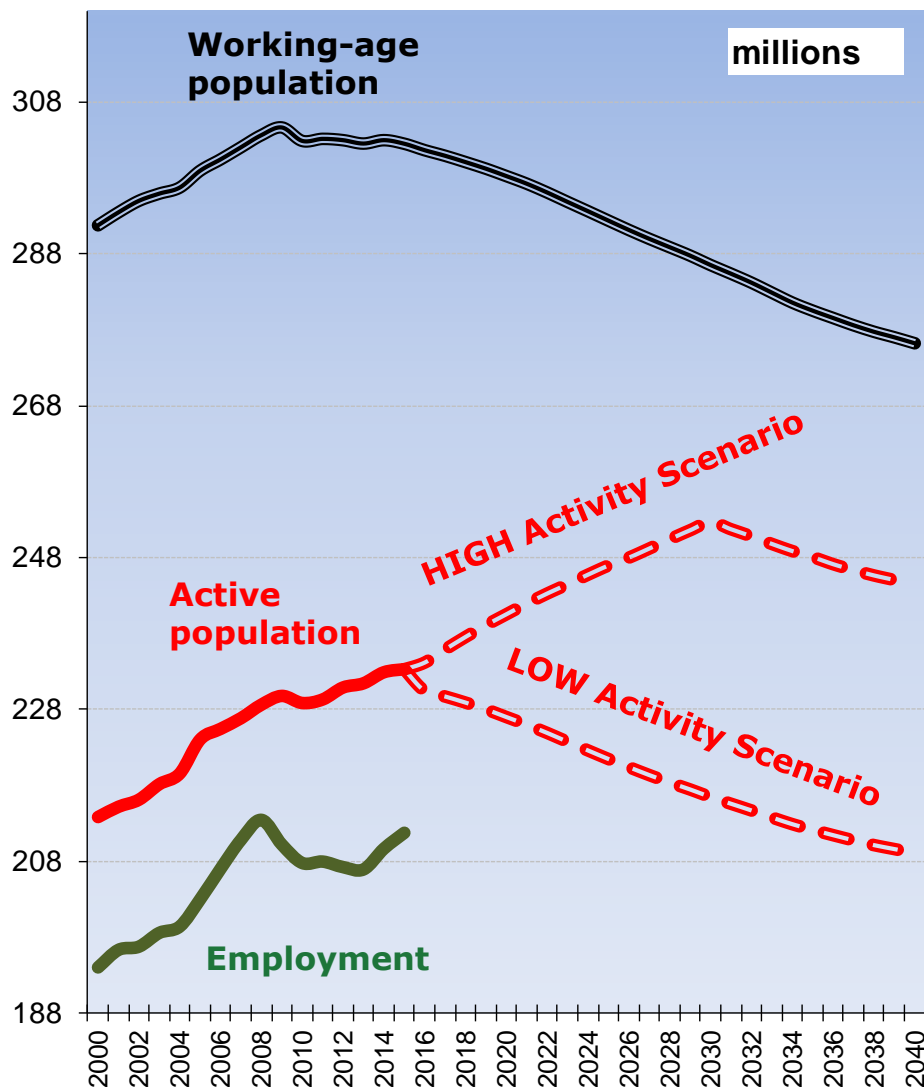
European Commission



## Potential employment paths

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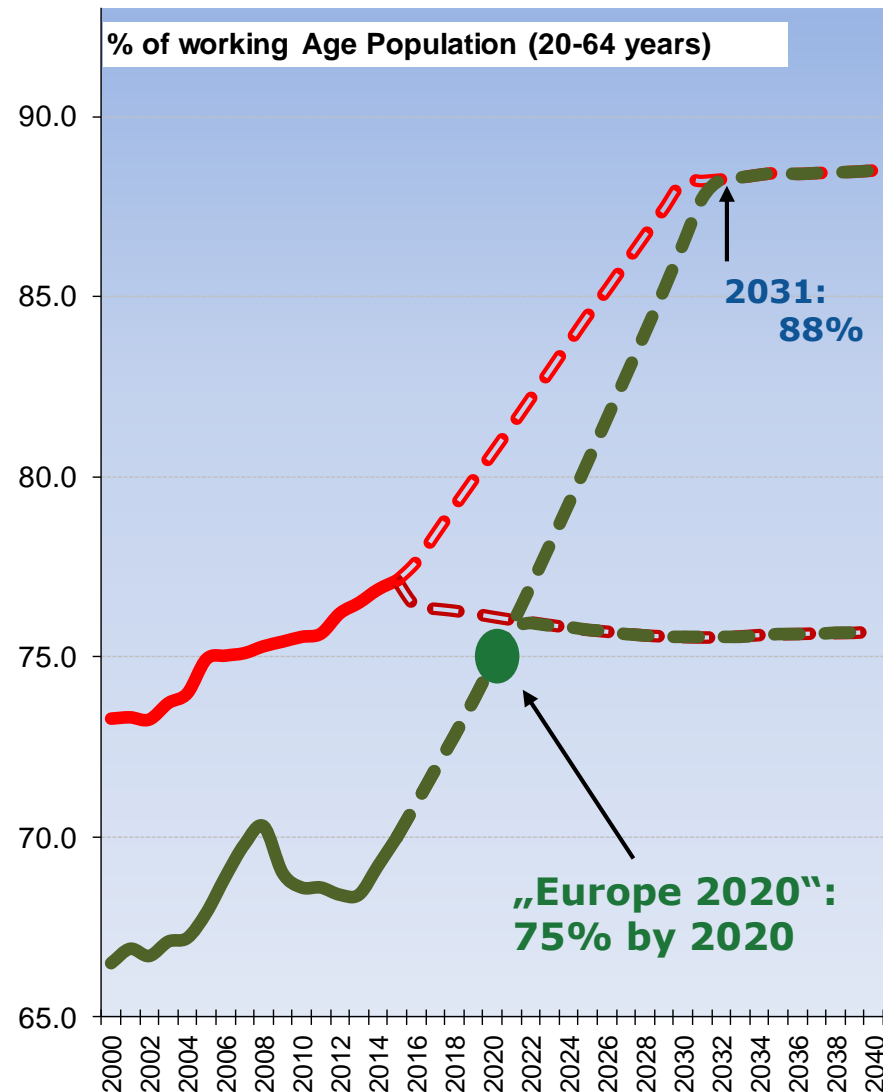
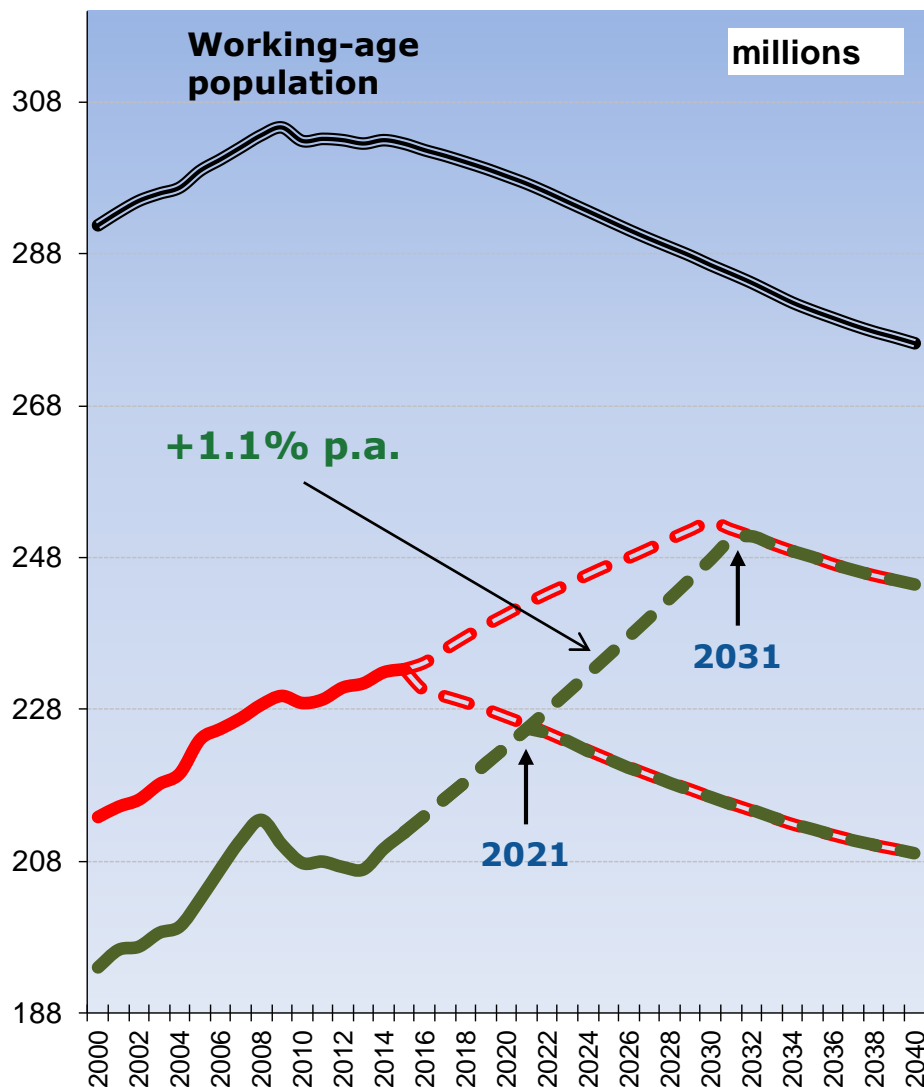
European Commission



## Potential employment paths

Workforce development, age group 20-64 years

European Commission





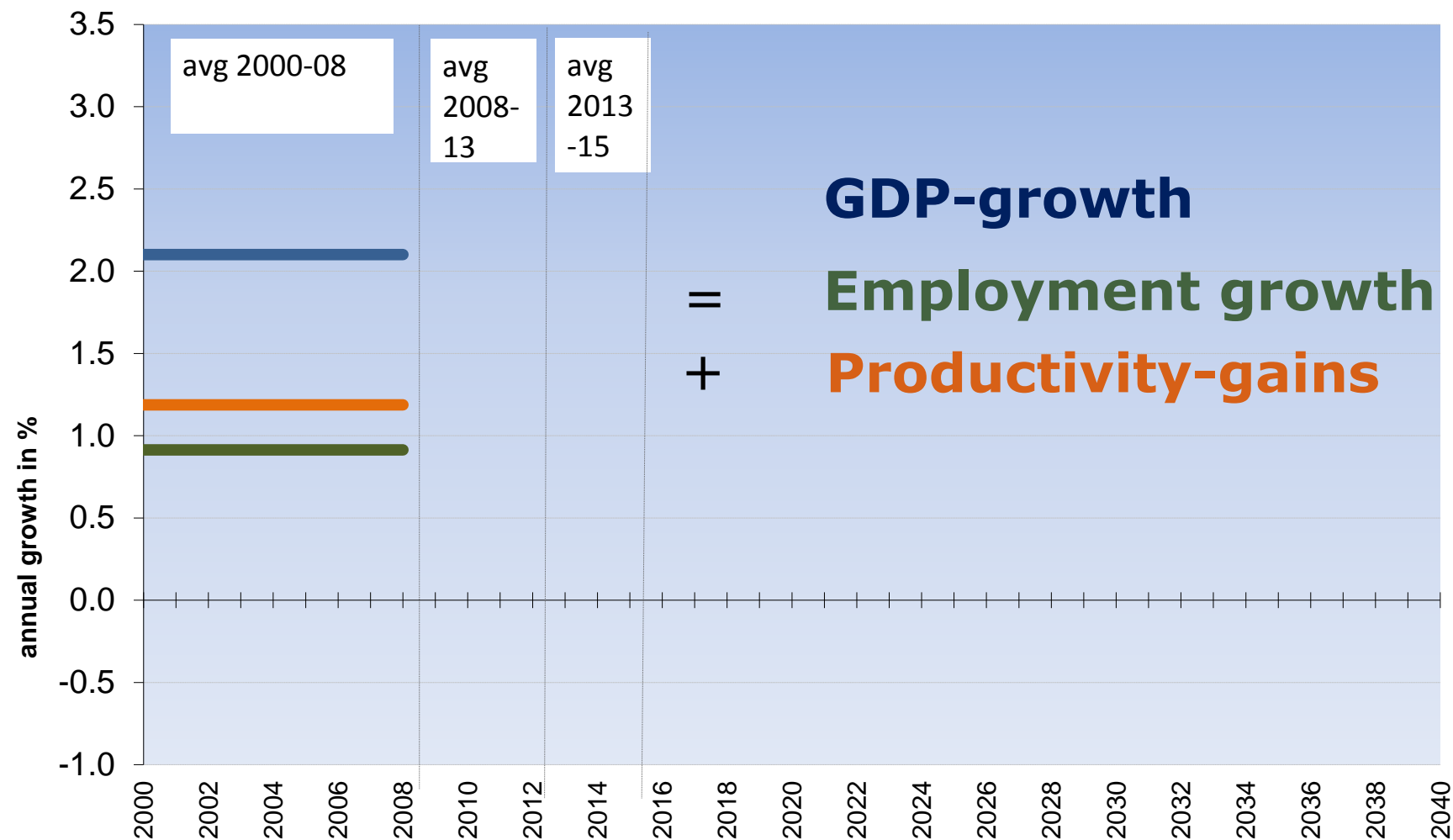


Pursuing a 'Europe 2020'-compatible 1%-employment growth path, EU's employment growth would turn negative around 2030 at the latest.

→ Impact on Europe's growth potential?

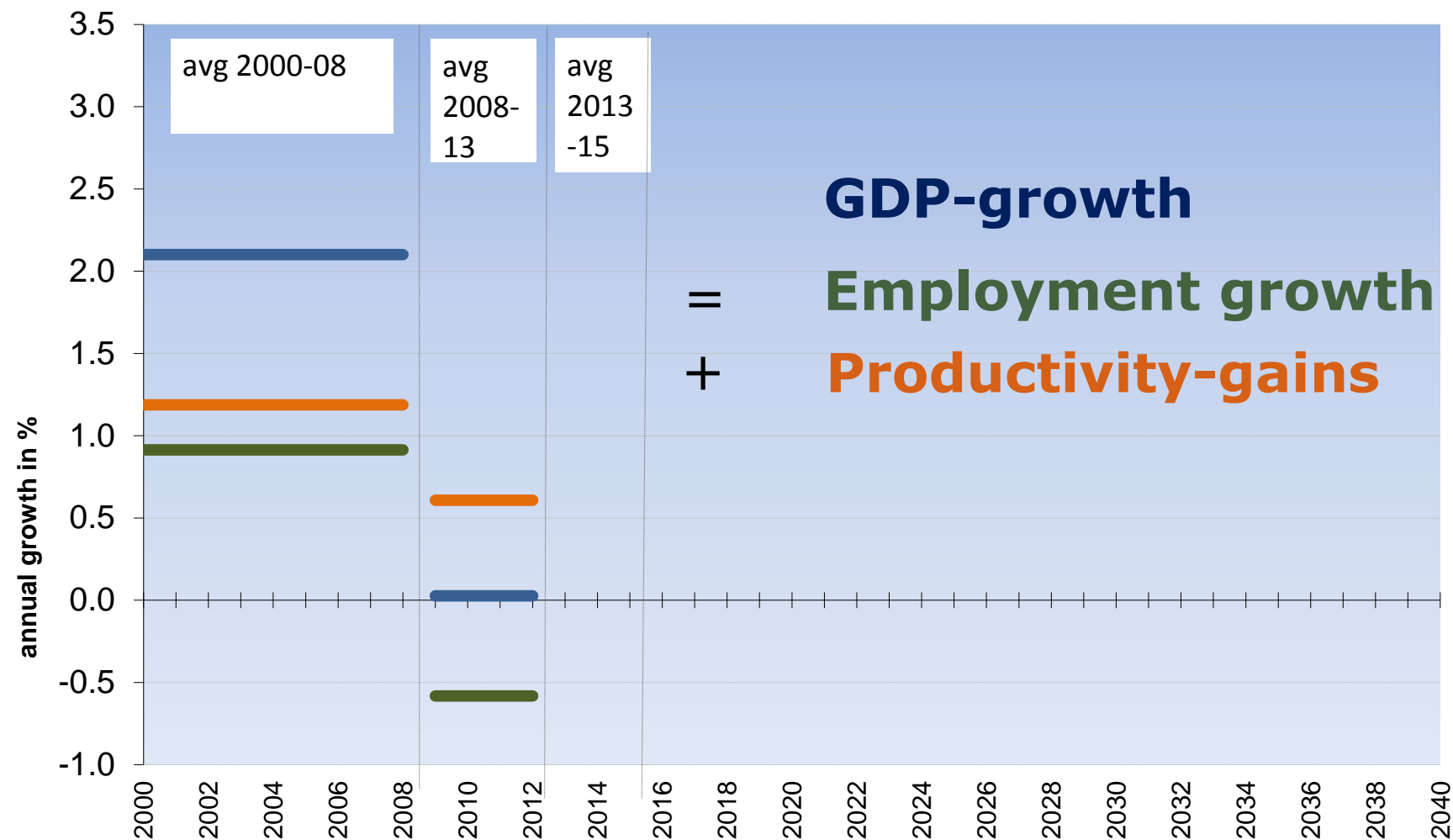


## Potential employment growth paths



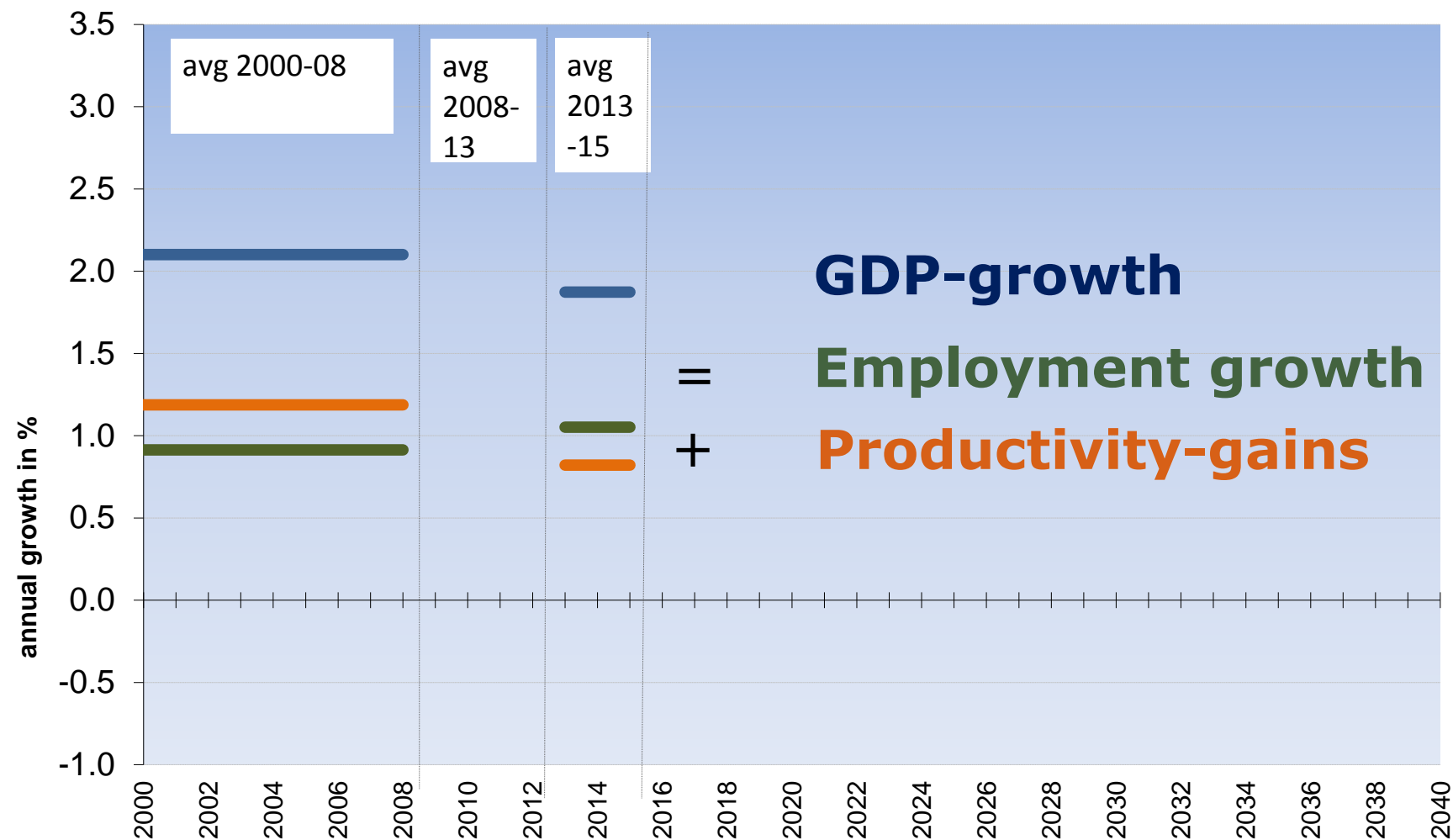


## Potential employment growth paths



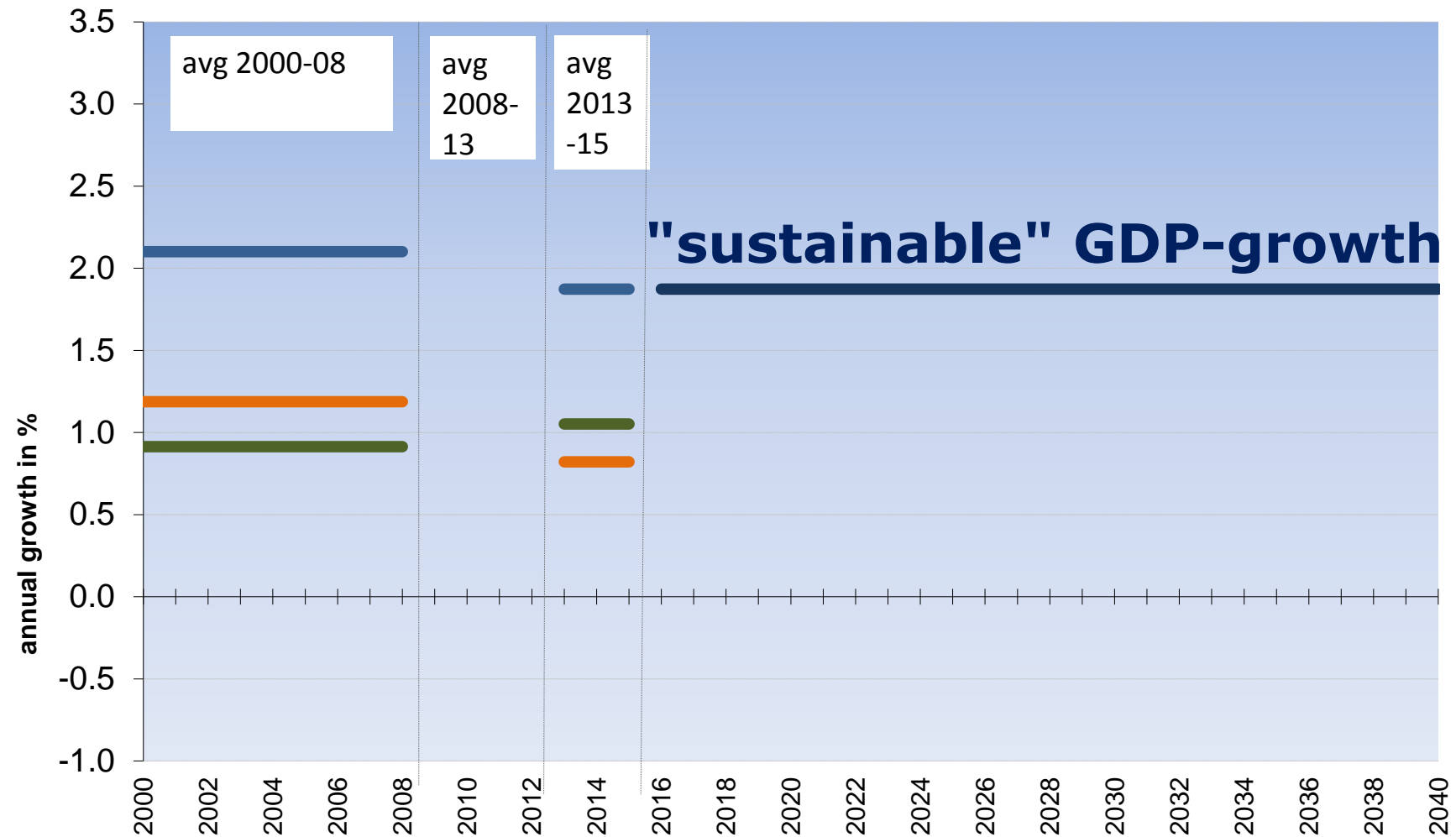


## Potential employment growth paths



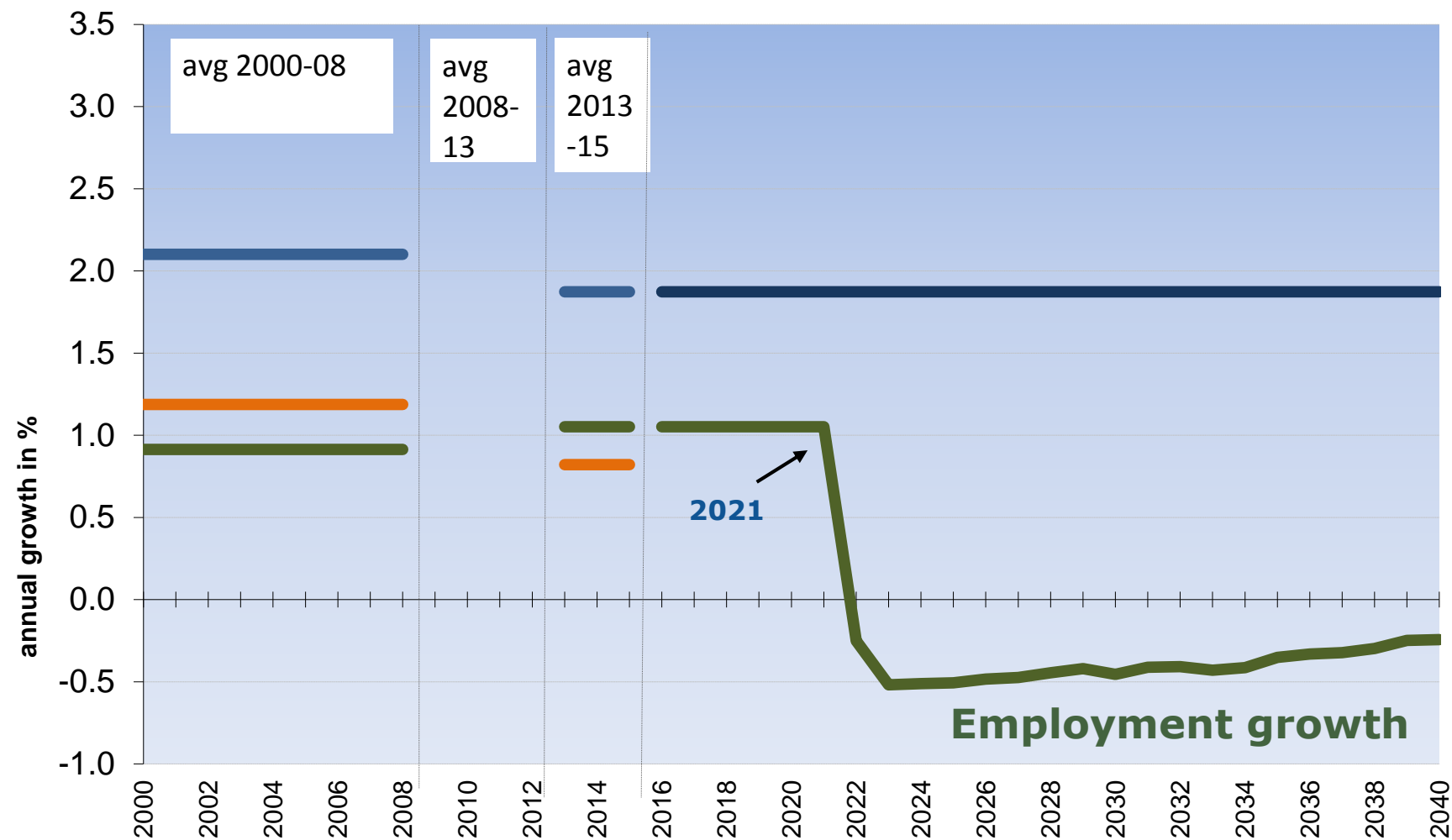


## Potential employment growth paths



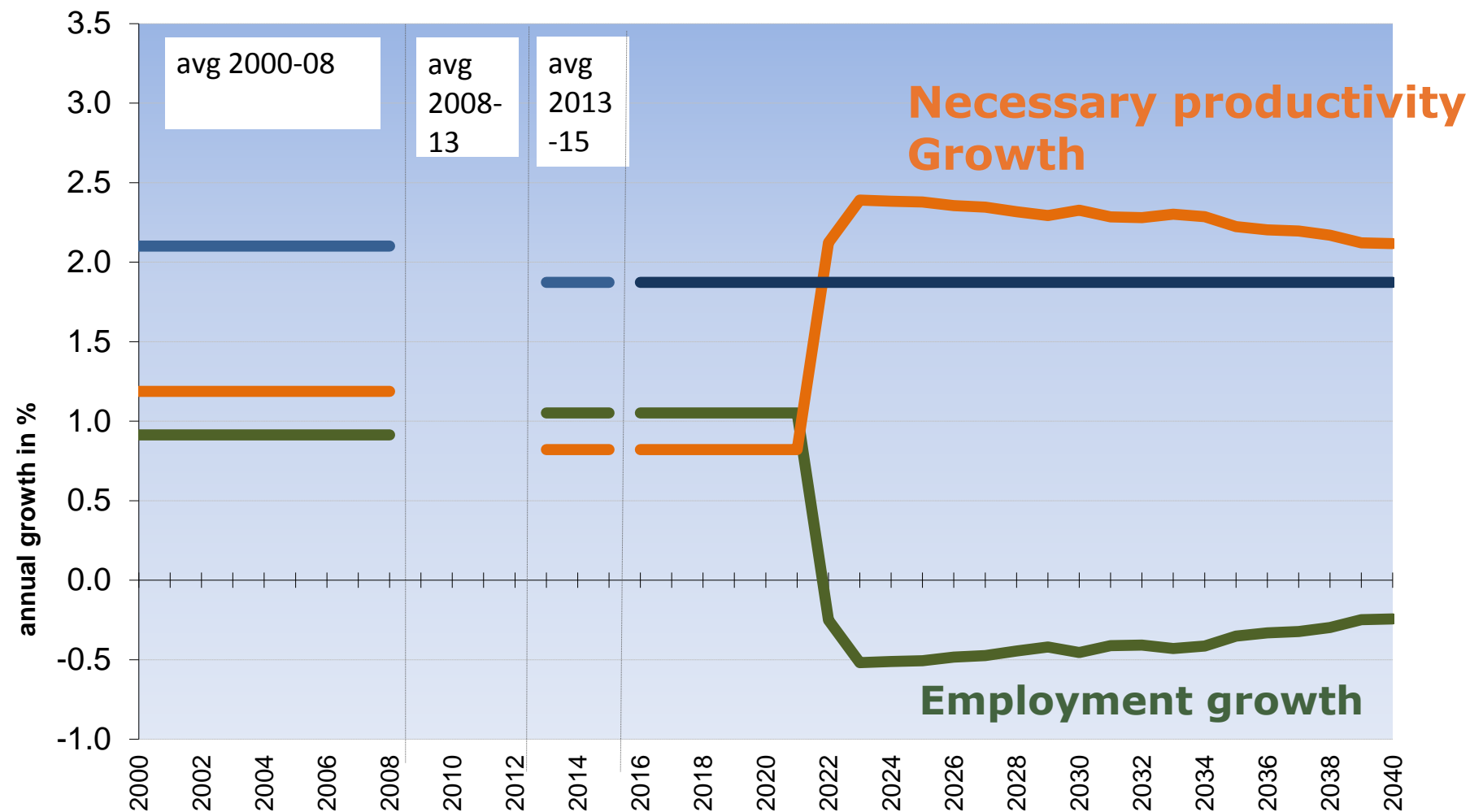


## Potential employment growth paths



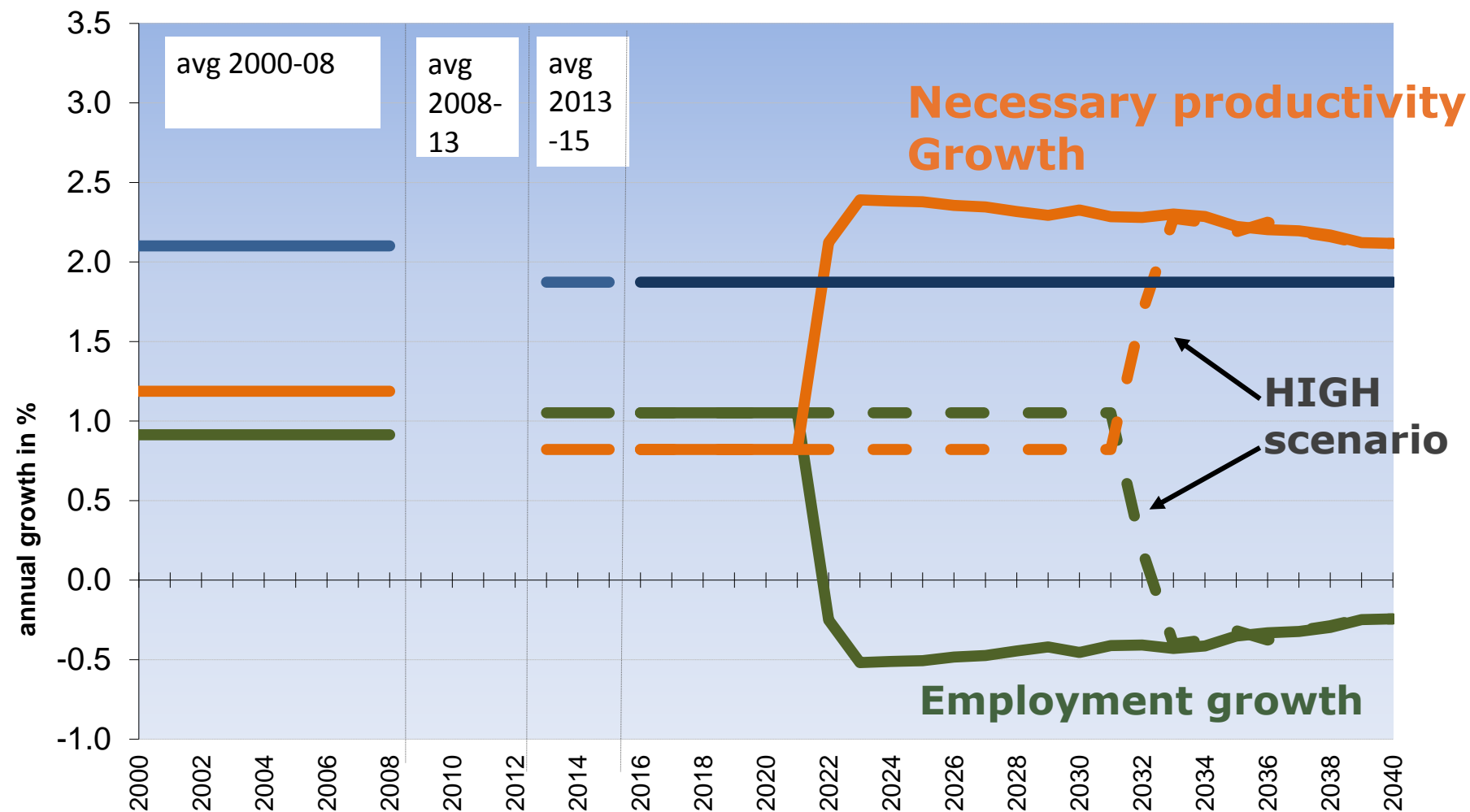


## Potential employment growth paths





## Potential employment growth paths

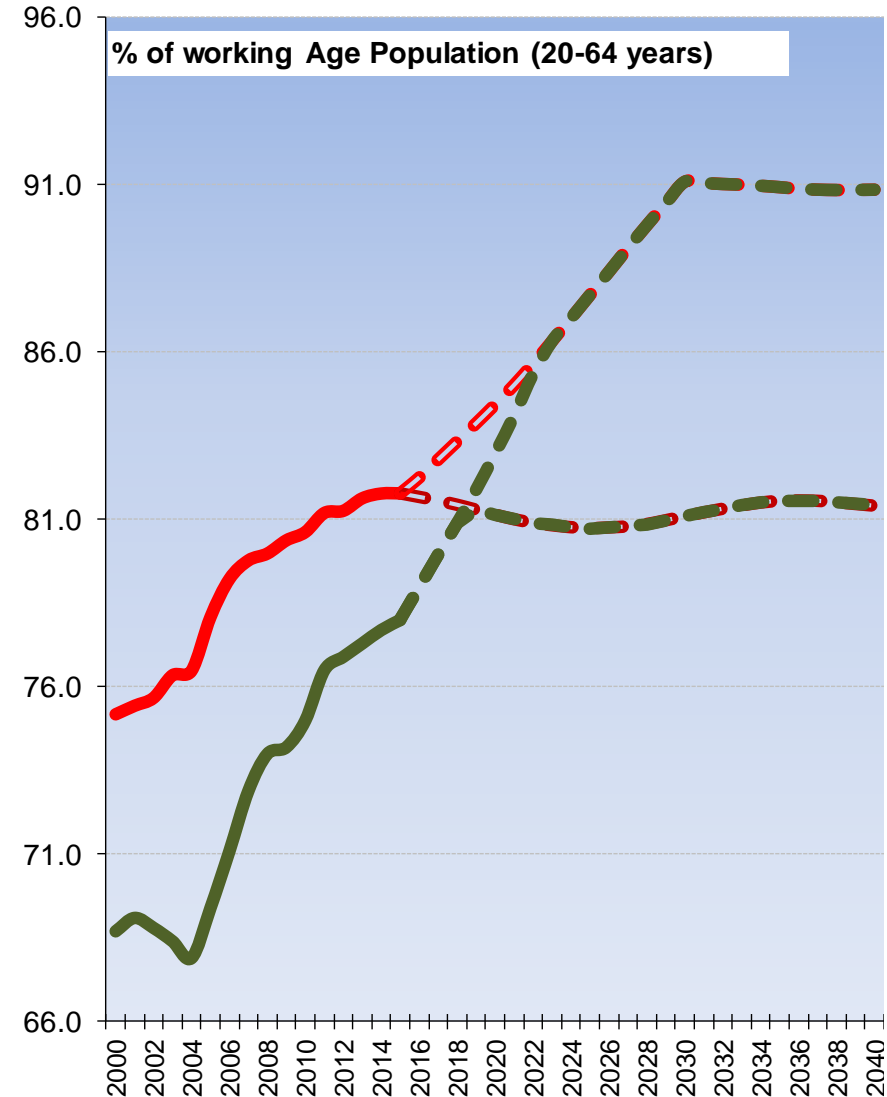
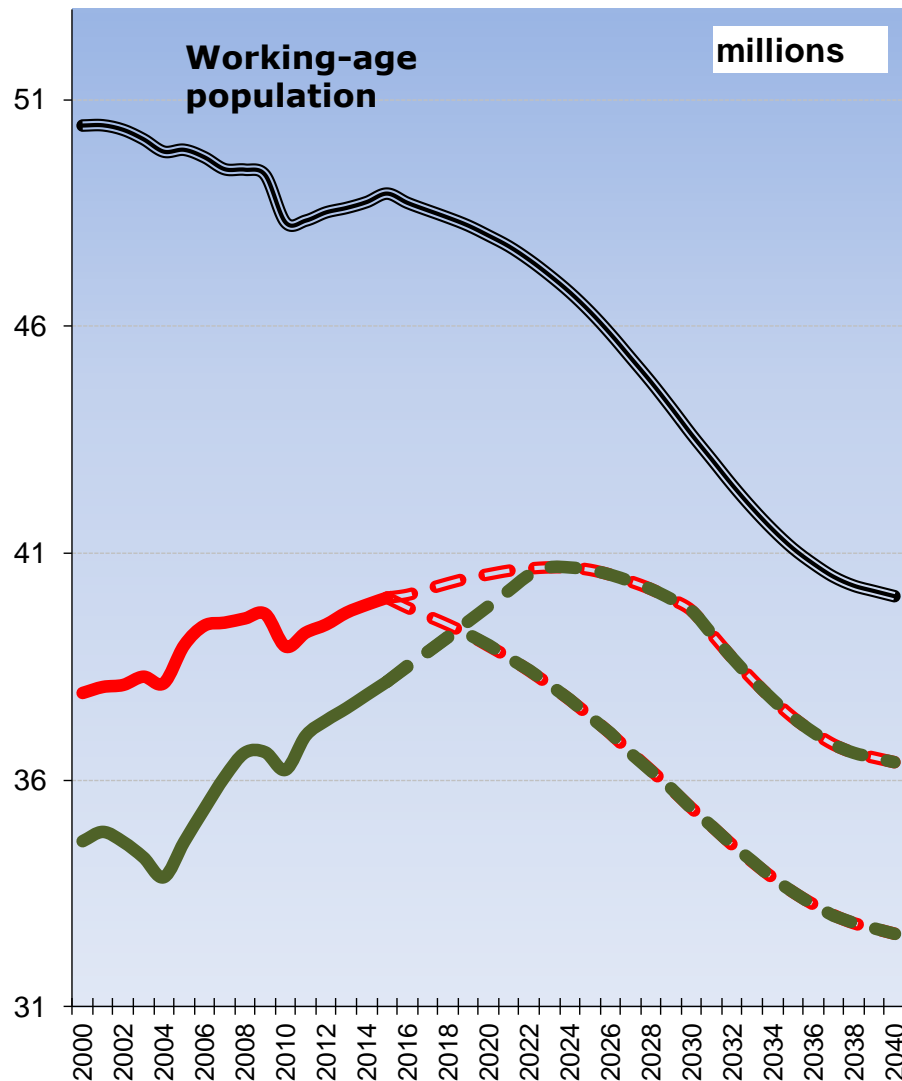


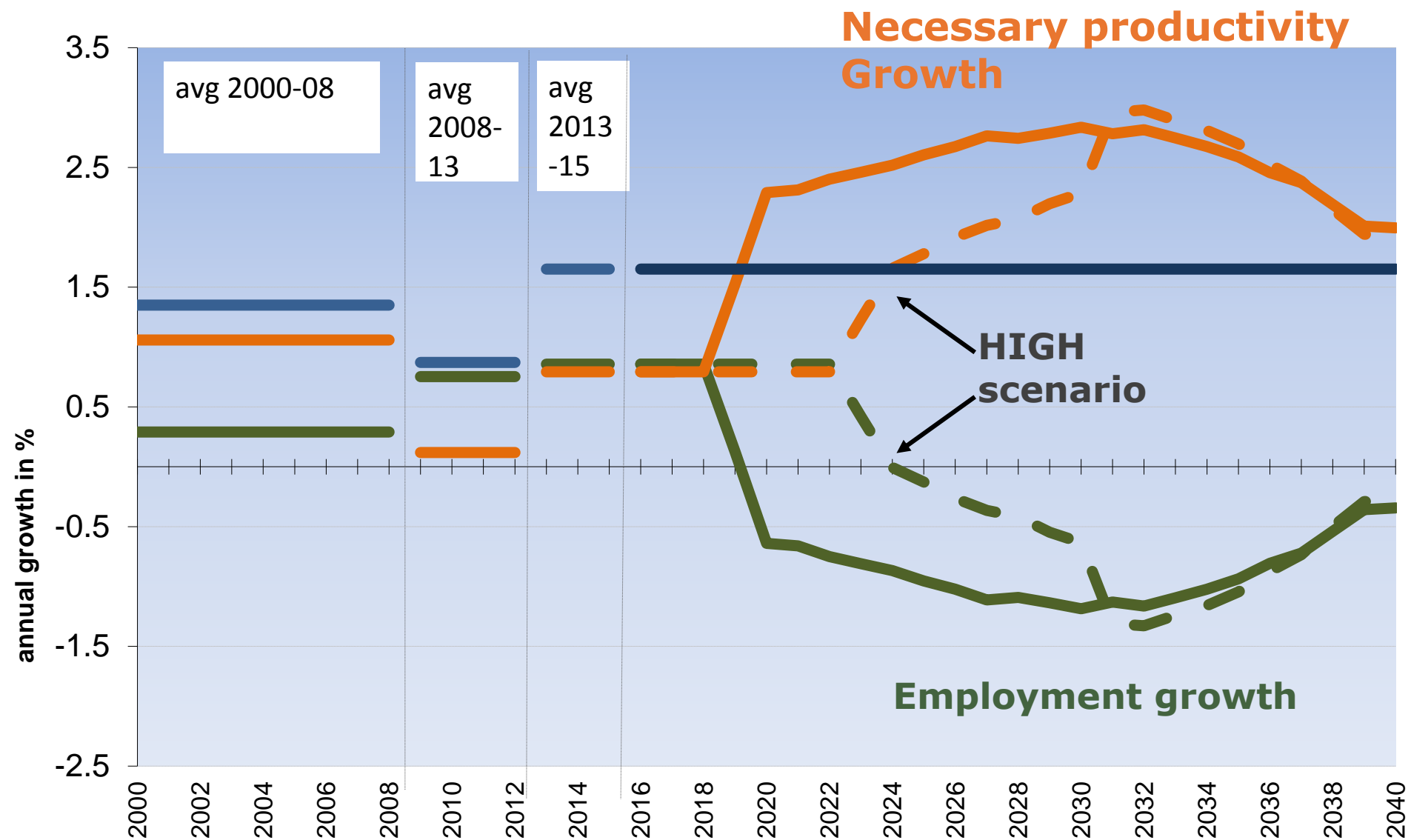


# Potential employment paths

## Workforce development, age group 20-64 years

European Commission





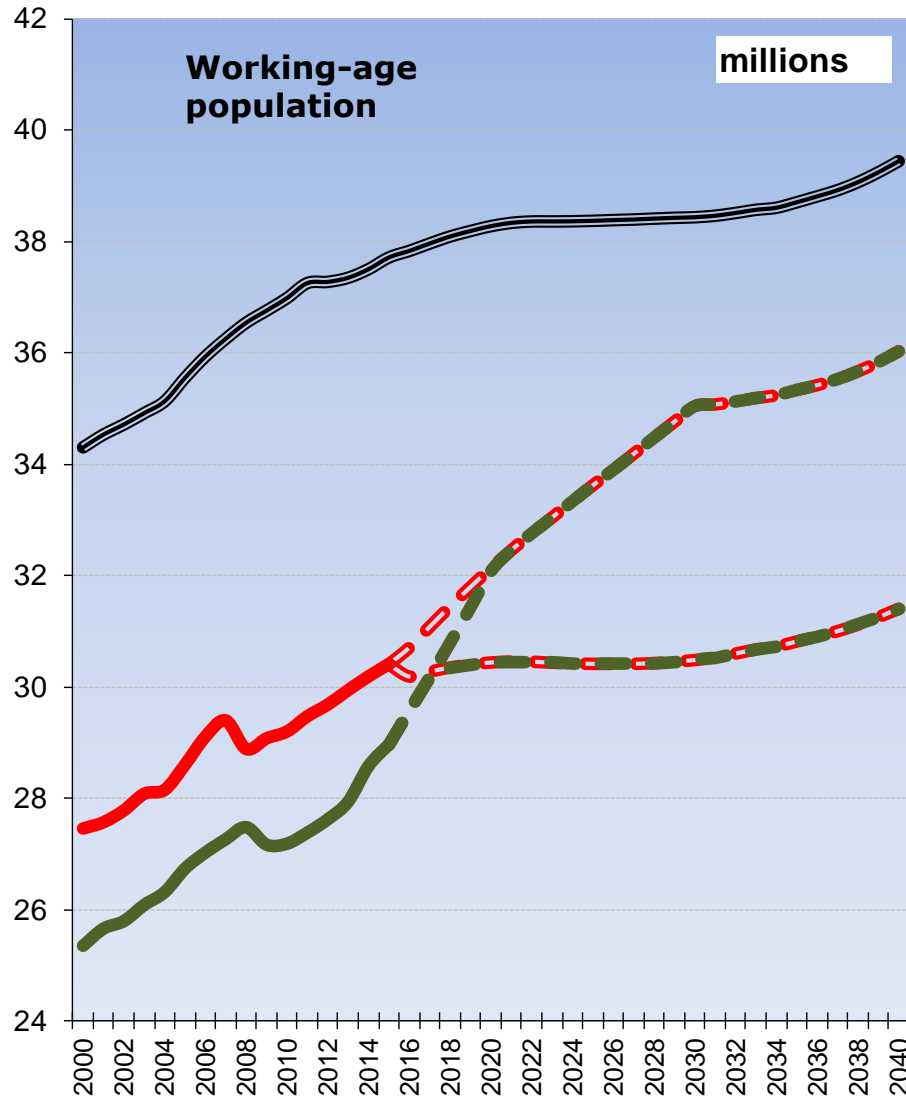
# Potential employment paths

Workforce development, age group 20-64 years

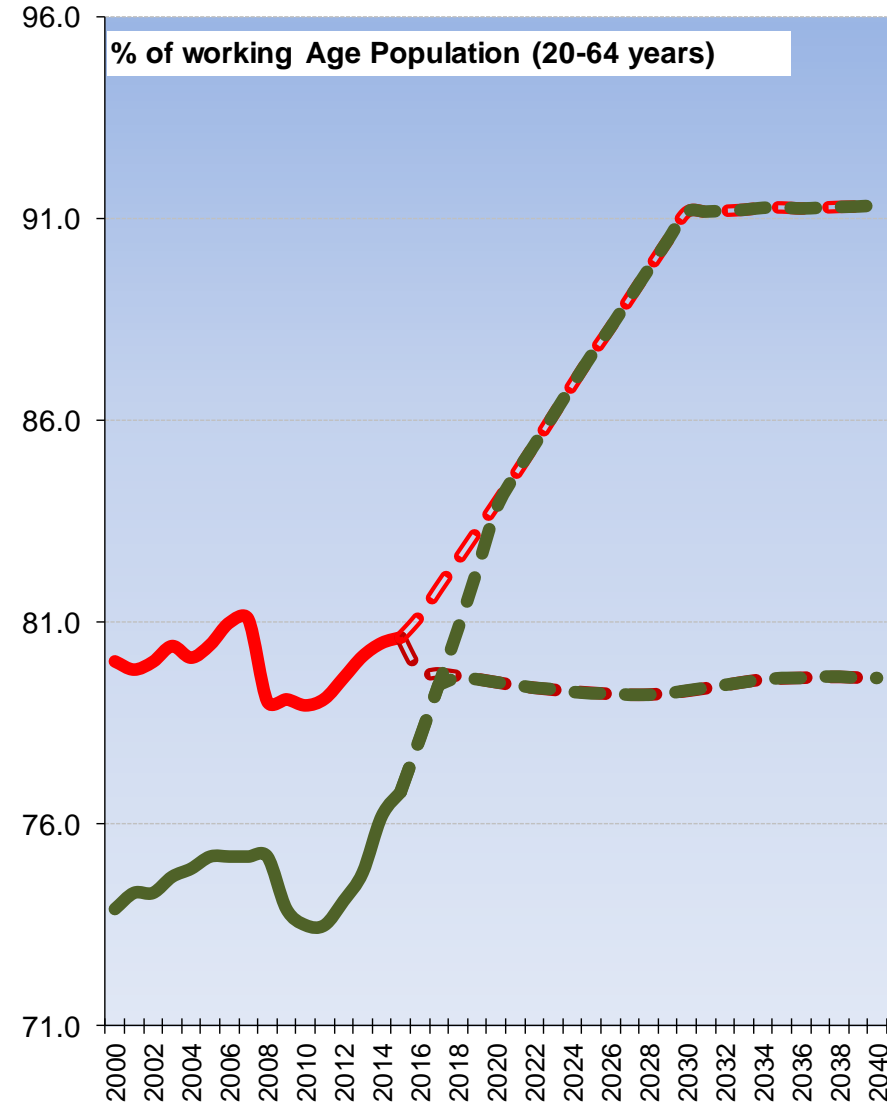
European  
Commission

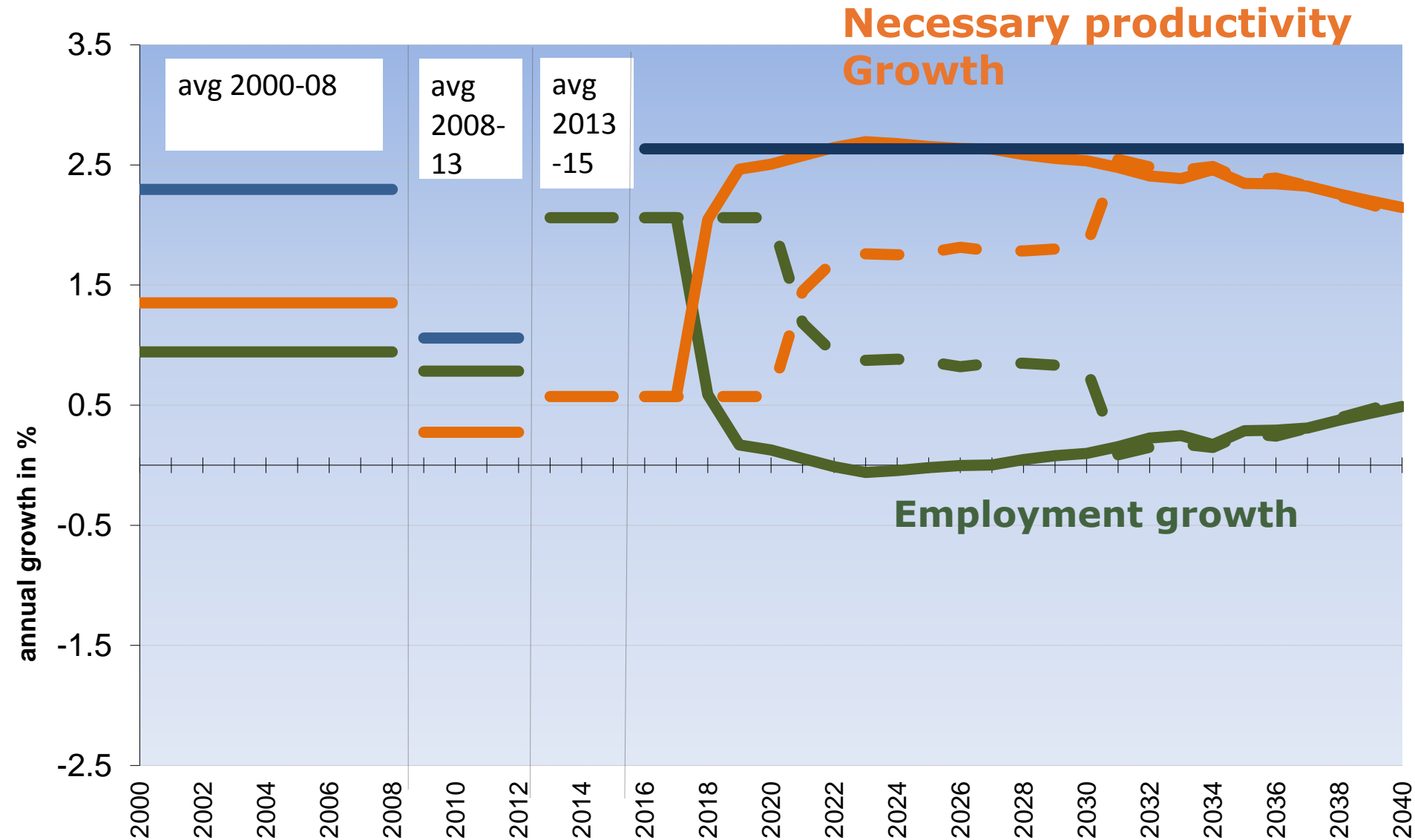
**Working-age  
population**

**millions**



**% of working Age Population (20-64 years)**



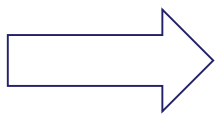


## Conclusion for growth:

### Putting the whole pressure

- **ONLY** on employment rate
- **ONLY** on productivity gains
- **ONLY** on migration

**No option!**

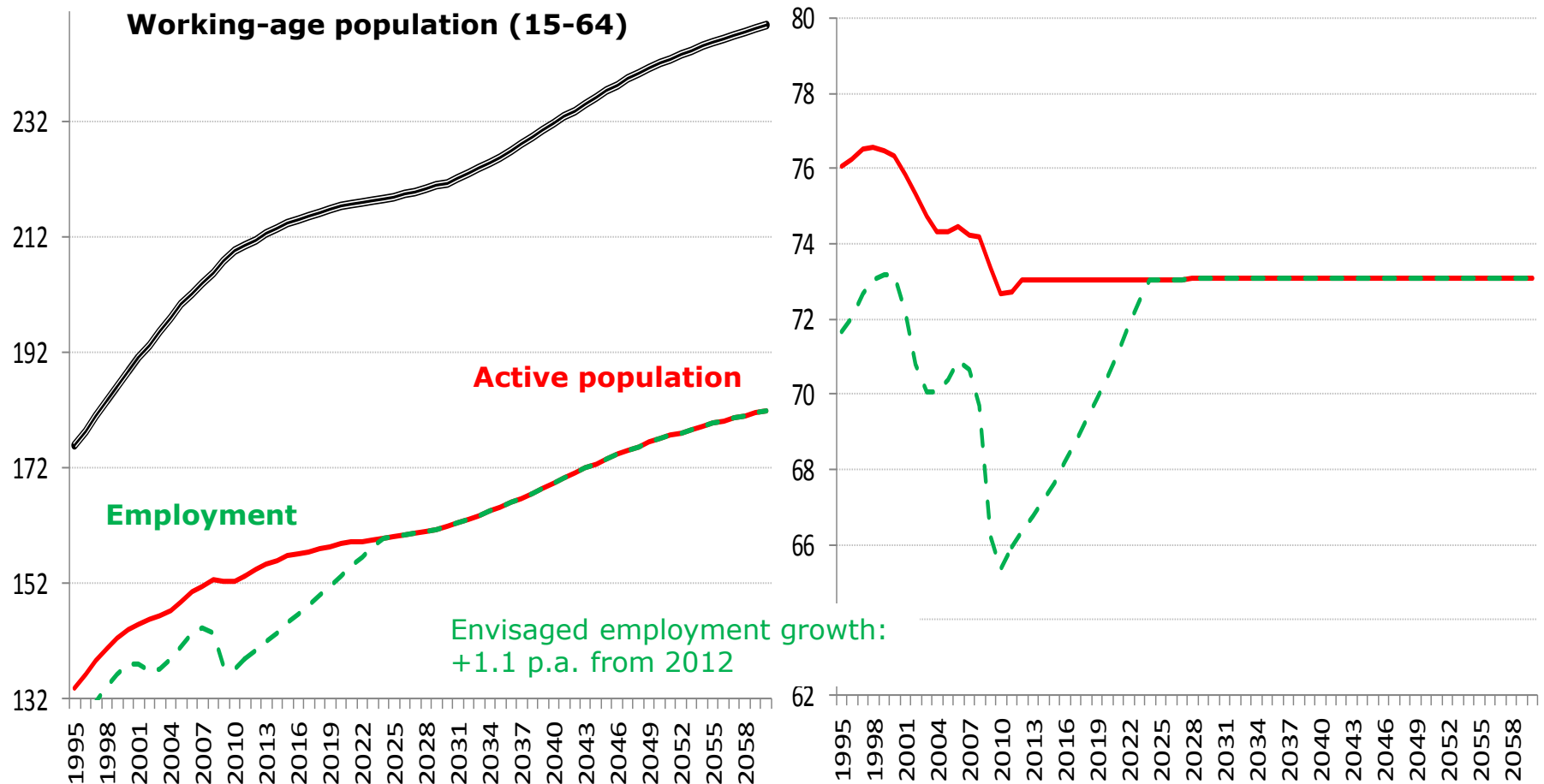


**Comprehensive policy mix,  
no waste of resources**

# **A quick look beyond Europe..**

in million people

in % of working-age population (15-64)

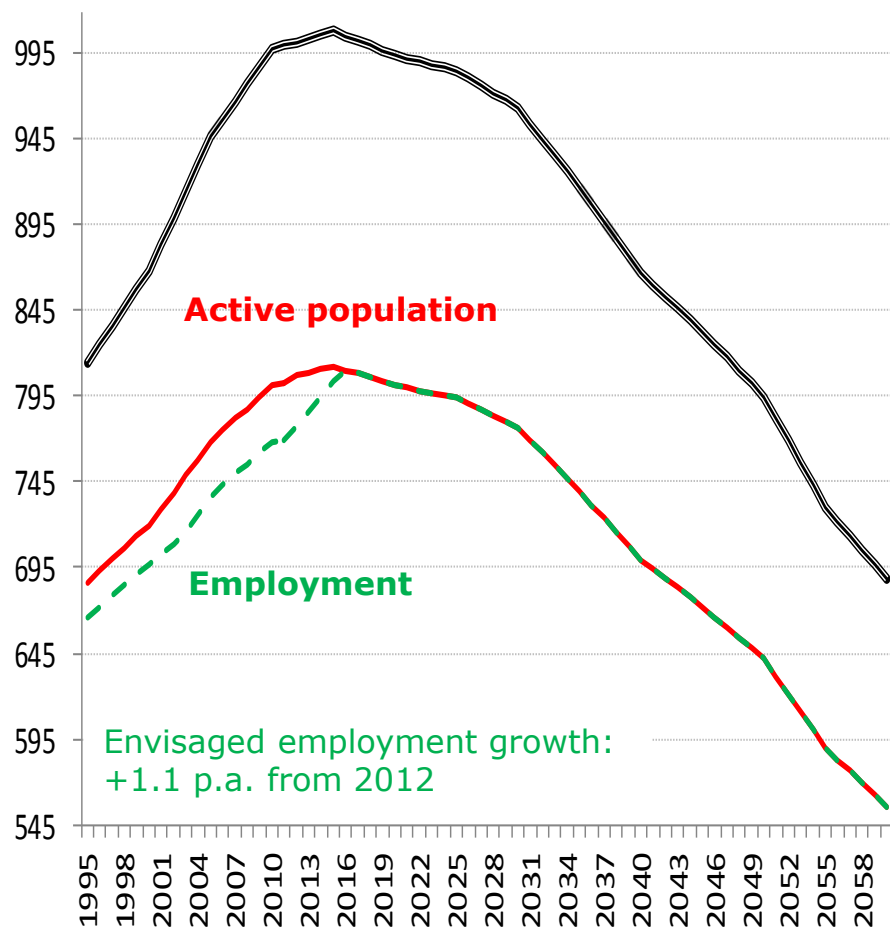


Own projections based on UN population prospects, 2015 revision, medium variant (except EU: Eurostat Europop2013, main scenario);

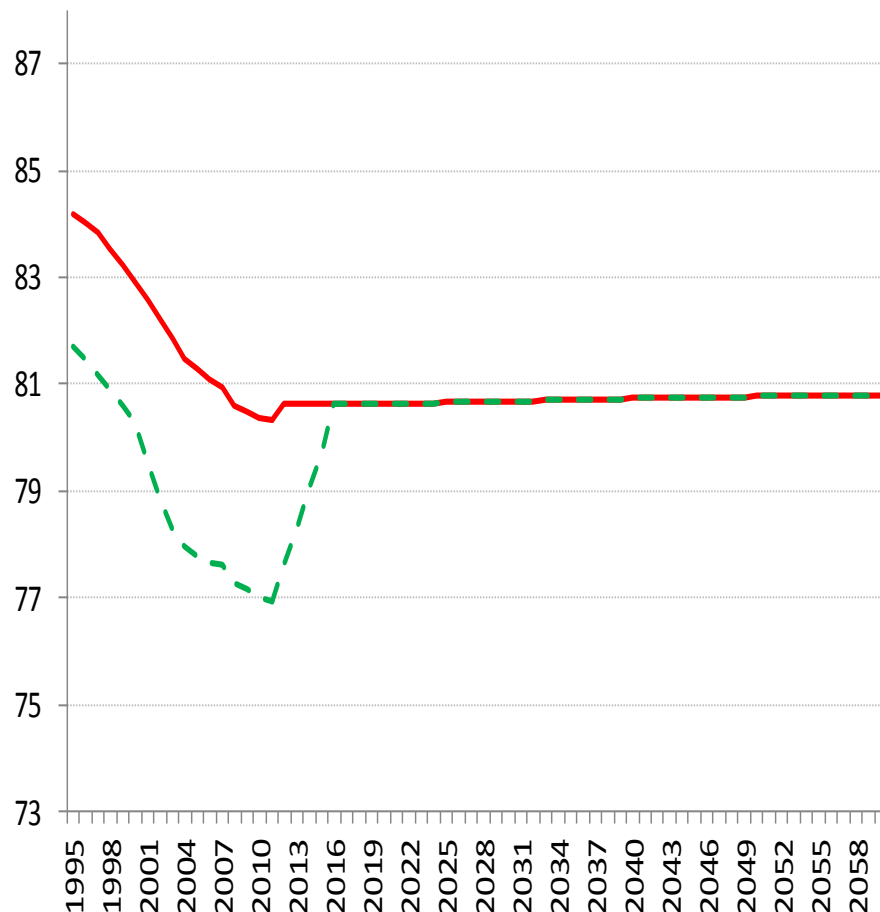
World Bank labour market data (employment and participation rates, <http://data.worldbank.org/country>)

in million people

### Working-age population (15-64)



in % of working-age population (15-64)



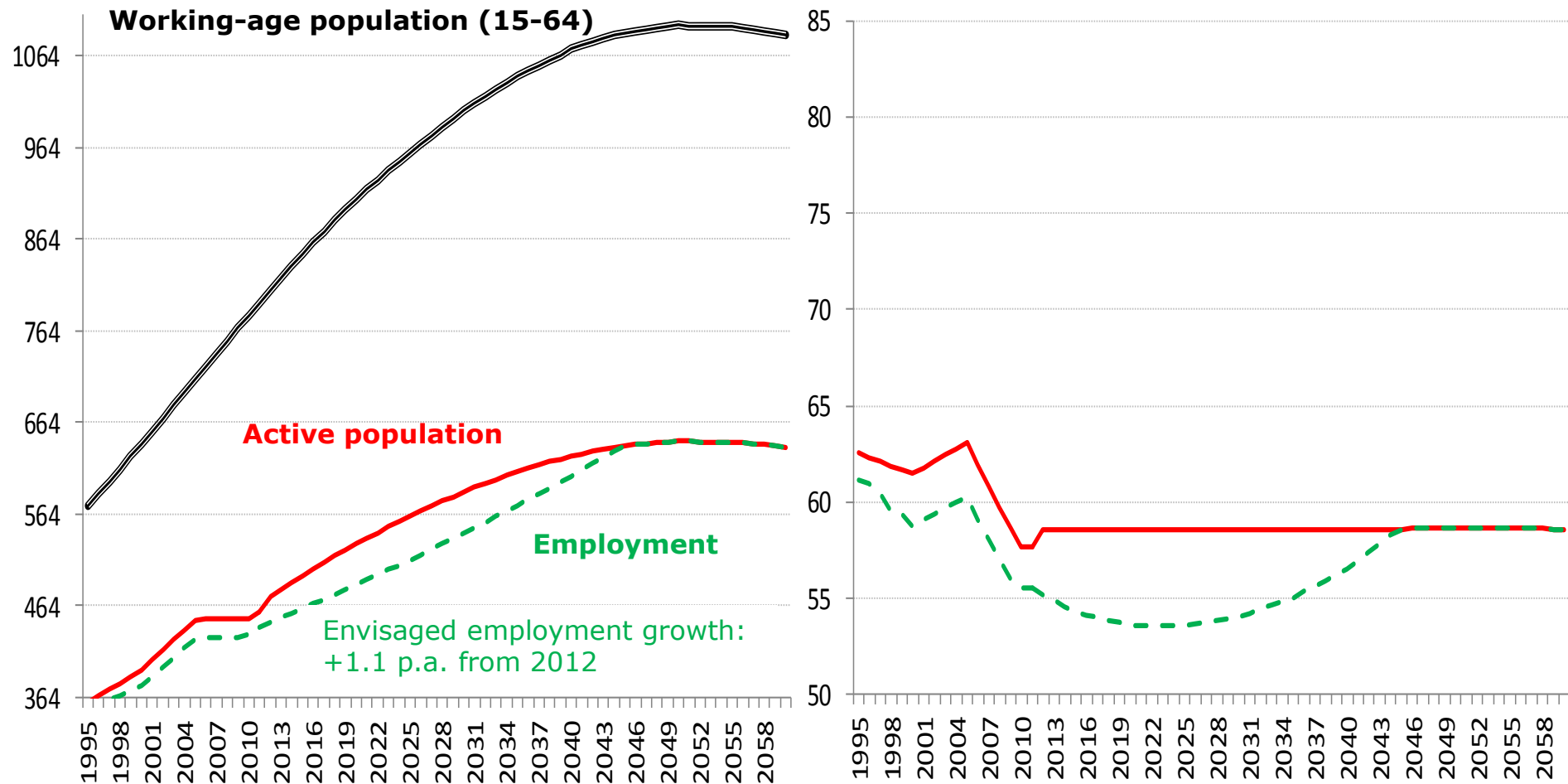
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in million people

in % of working-age population (15-64)



Own projections based on UN population prospects, 2015 revision, medium variant (except EU: Eurostat Europop2013, main scenario);

World Bank labour market data (employment and participation rates, <http://data.worldbank.org/country>)

# (Projected) Demographics, labour supply, and growth

## **Mobility / Migration and growth**

# Employment and Social Developments in Europe Review

## **2015 edition**

Mobility and migration in the EU: Opportunities and challenges

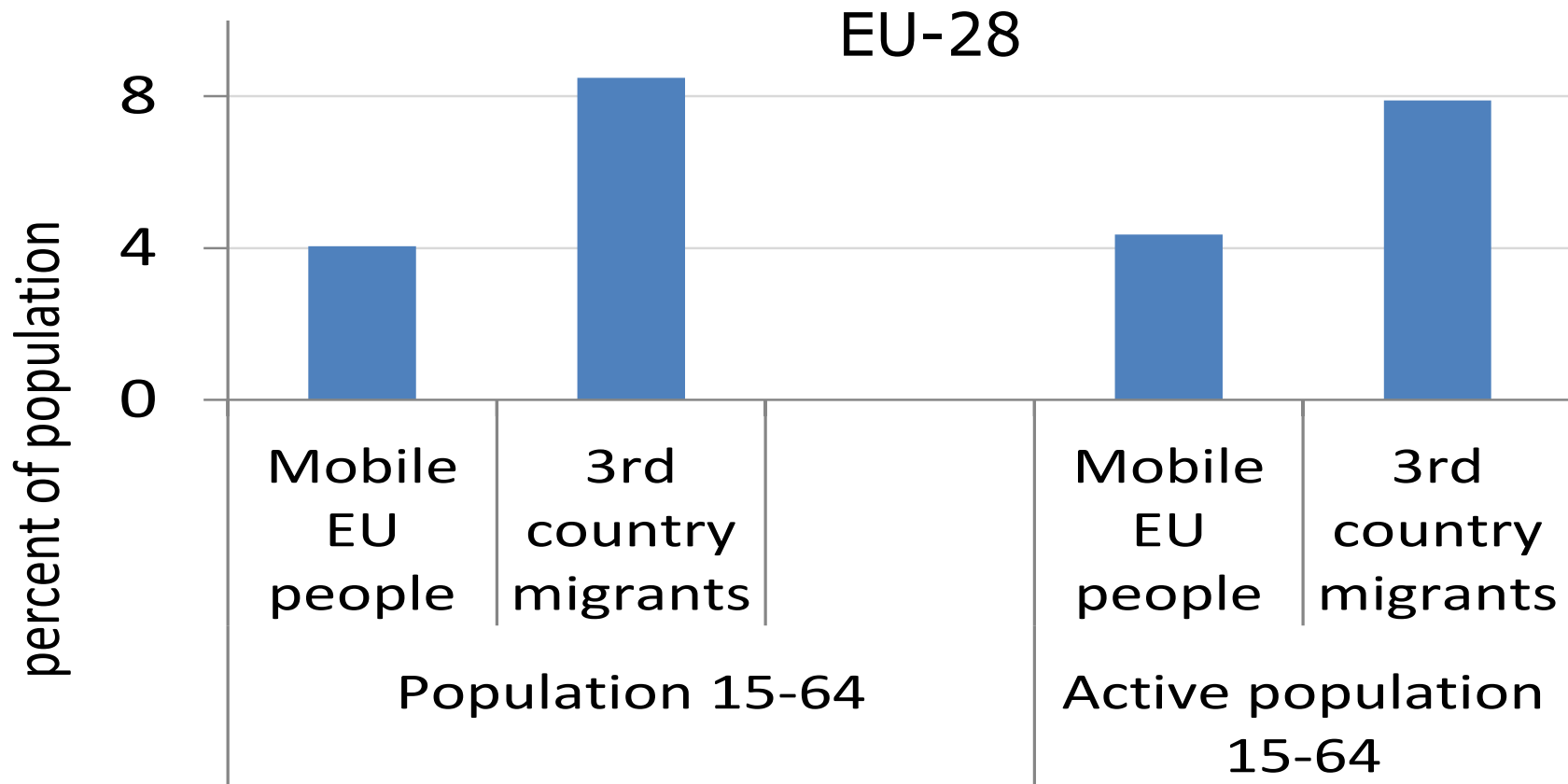
## **2016 edition:**

On the labour market integration of refugees in the EU

# We distinguish...

- ➔ **Intra-EU mobility, that is:**  
**Mobile EU citizens (crossing EU borders) born in:**
  - ➔ **EU-15: Member States that made the EU before 2004**  
Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Austria, Finland, Sweden, United Kingdom
  - ➔ **EU-10: Member States that joined in 2004**  
Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, Slovakia
  - ➔ **EU-3: Member States that joined in 2007, 2014**  
Bulgaria, Romania, Croatia
- ➔ **Third-country migrants born outside the EU**

# Intra-EU mobility and migration: No mass phenomena



## Push and pull-factors of intra-EU mobility



**Pushed** by own unemployment or inactivity



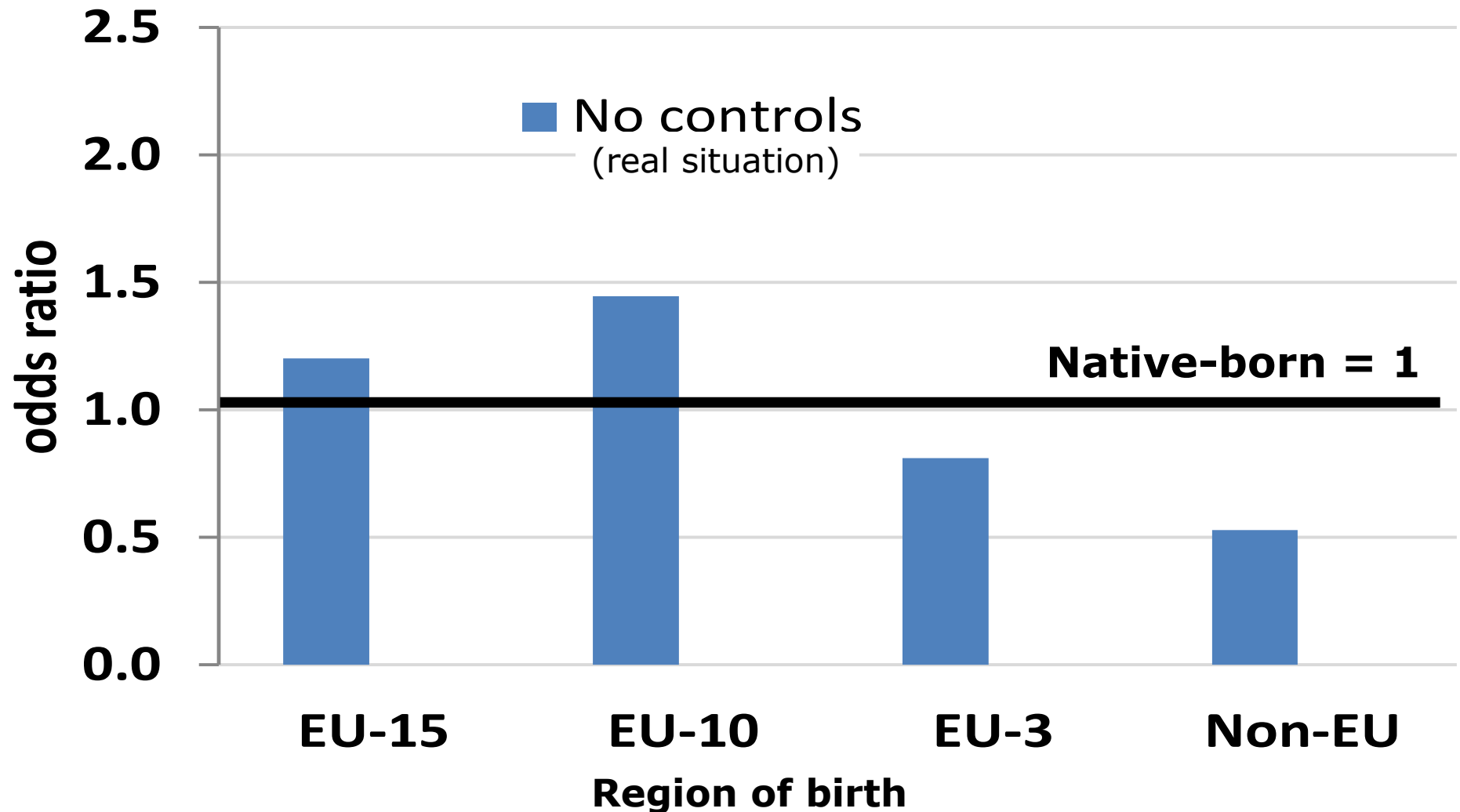
**Pulled** by good labour-market performance in destination country

Intra-EU mobility **improves labour allocation** across the EU and **helps reducing unemployment** EU-wide.



## Labour market performance 2012/13 (STATIC), EU

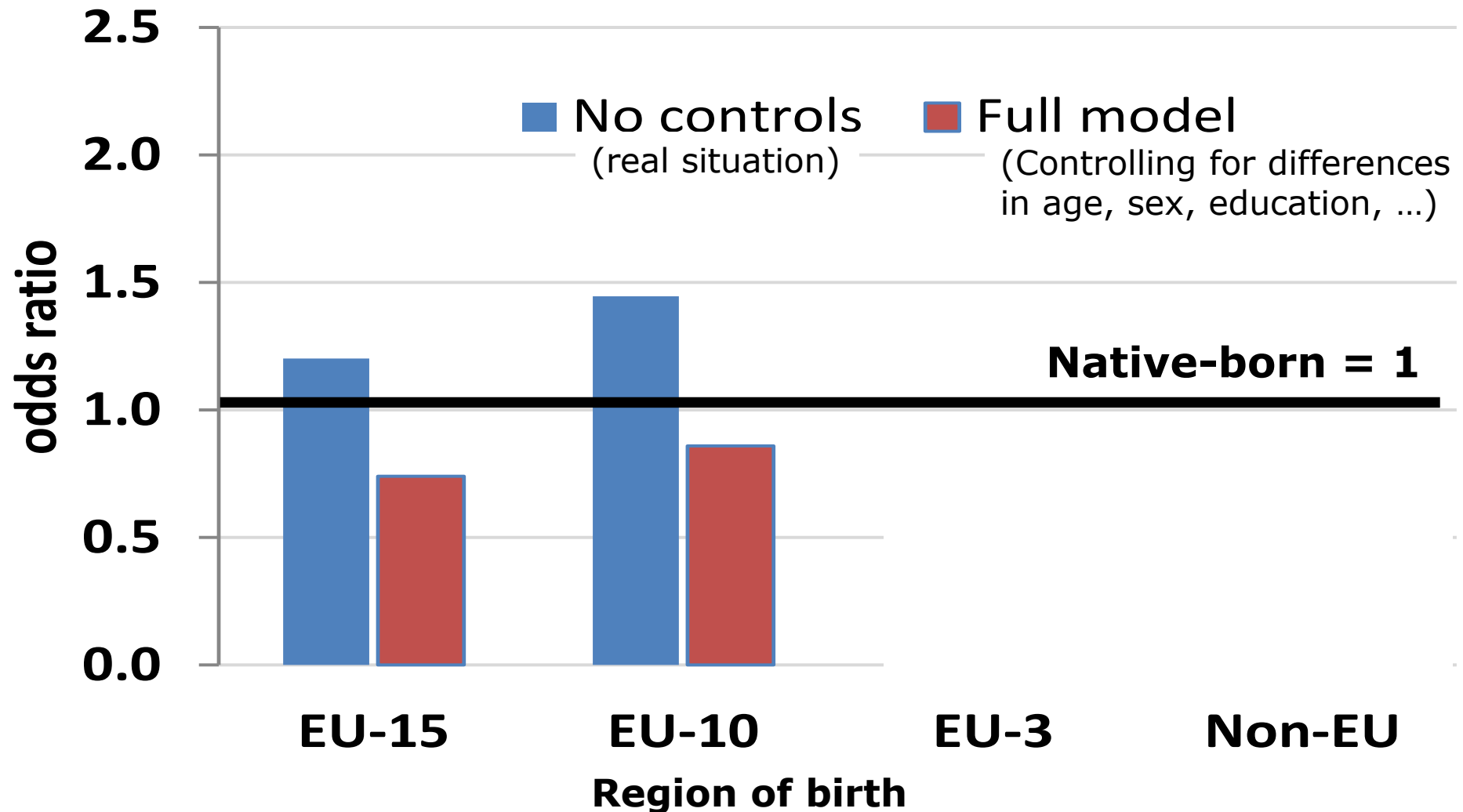
Odds (chance) of being in employment, age 20-64, resident  $\leq 10$  years





## Labour market performance 2012/13 (STATIC), EU

Odds (chance) of being in employment, age 20-64, resident  $\leq 10$  years



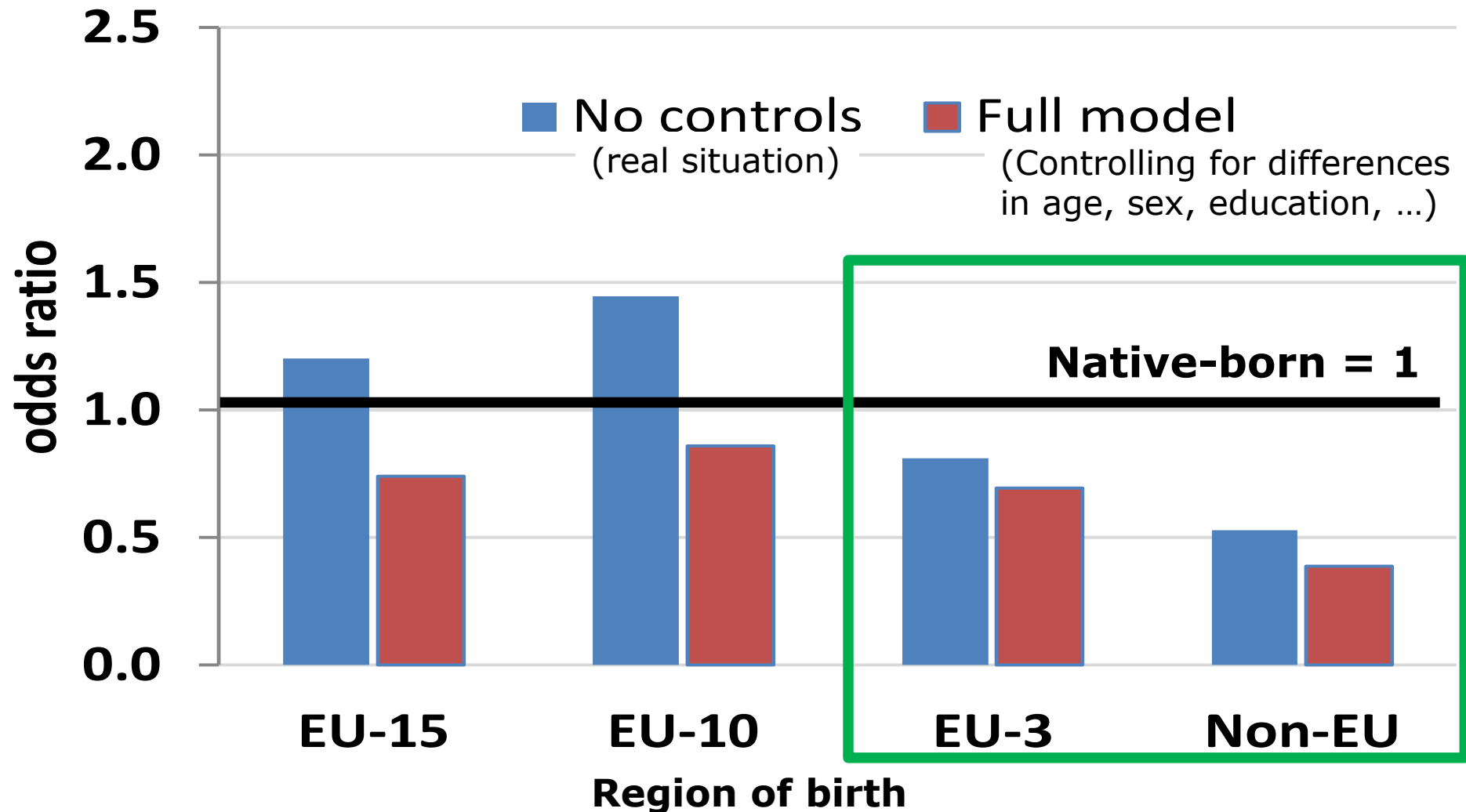




EU

## Labour market performance 2012/13 (STATIC), EU

Odds (chance) of being in employment, age 20-64, resident  $\leq 10$  years



➔ **EU-3 and third-country migrants:**  
**Individual factors don't make a big difference,**  
**especially the return on education is low.**

➔ **Potential external (unobserved) labour  
market barriers:**

- **Labour legislation (legal restrictions)?**
- **Discrimination?**
- **Low assessment of formal education?**

# Related findings

## Third country migrants:

- **Low job-finding dynamics**

## Third country migrants and mobile EU citizens:

- **Significant wage-penalty**
- **High risk of over-qualification**
- **Over-represented in low-growth,  
under-represented in high-growth sectors**

...

# The potential of migration to enhance growth ?

In the absence of external barriers:

What difference could migrants make for a typical EU immigration country?

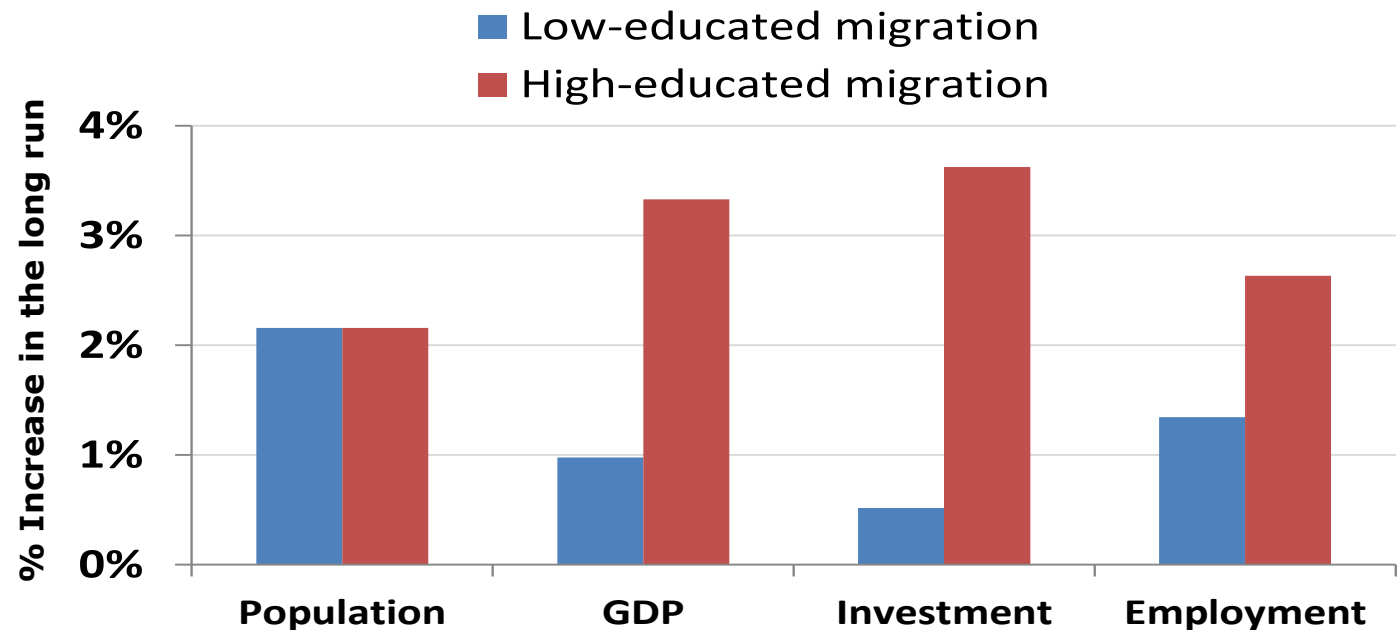


**Evidence from the  
Labour Market Model:  
Simulation of higher migration  
into Germany**

# Long-run impact depends on education

Simulation with DG EMPL's Labour Market Model: Migration shifts each year by 0.1 %  
of the population aged between 25 and 49

Long-run  
impact for  
Germany



Public budget effect (net transfers back to households):  
**-0%**, **0.6%** of GDP, resp.



## Intra-EU mobility and migration: Efficient tools to generate higher growth?

**Yes! But their potential is not always efficiently used.**

- Education helps a lot, but return on migrants' education is often low.
- Low mobility rates across the EU (4% of working-age population)



# Thank you!

**Dr. Jörg Peschner**

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Social Affairs and Inclusion

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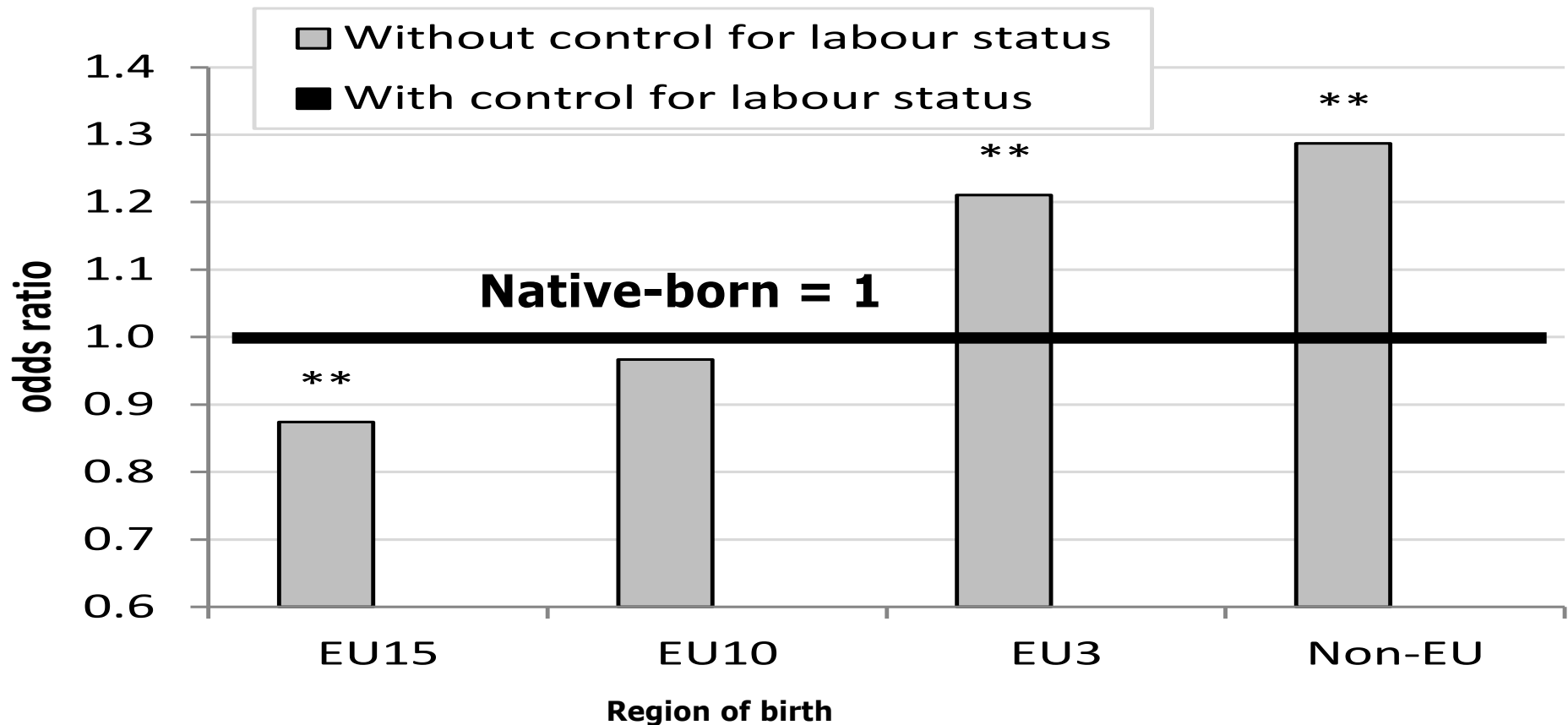
Tel. +32 2 29 64290

[jorg.peschner@ec.europa.eu](mailto:jorg.peschner@ec.europa.eu)

# **Supplement on 'welfare dependency'**

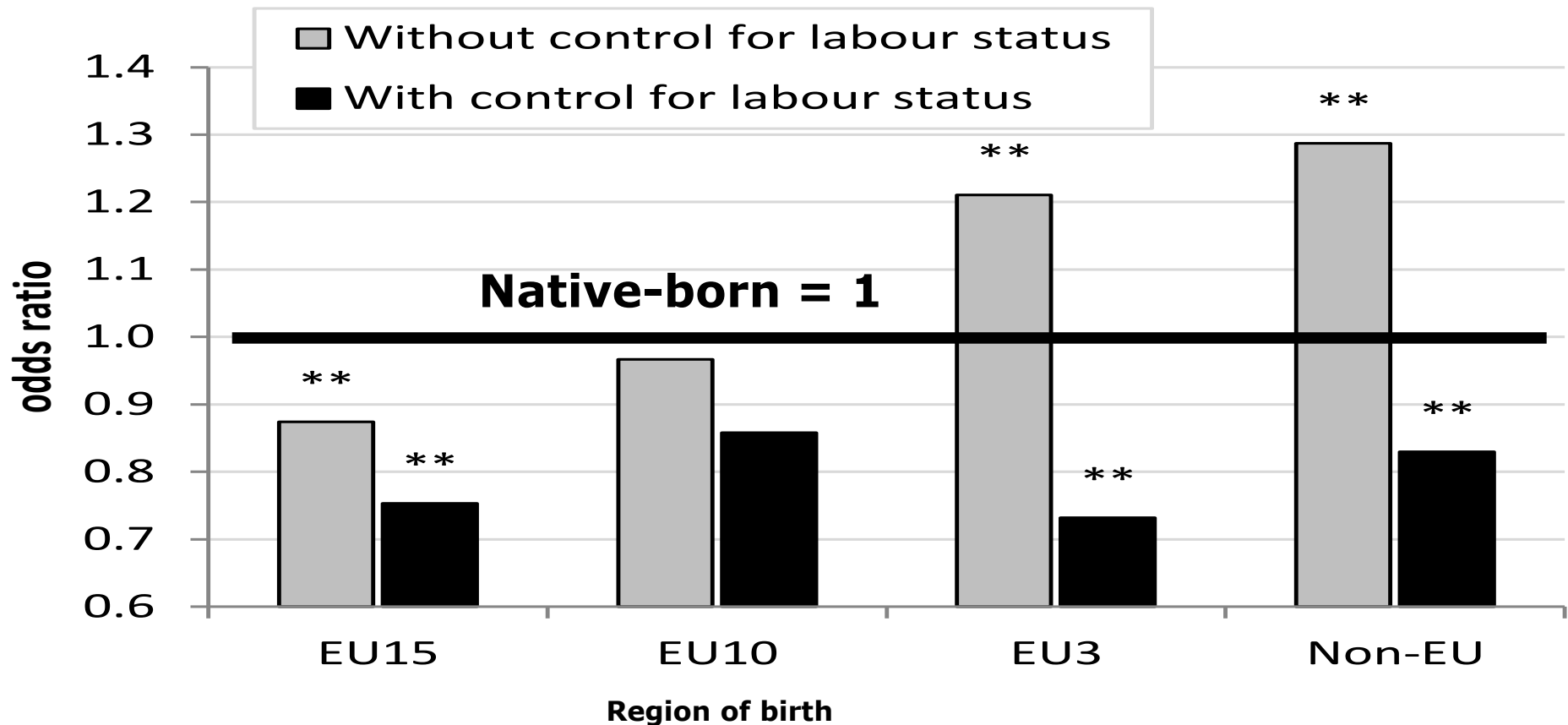


## Odds ratio for **receiving some benefit or assistance**, relative to the native-born population (=1), by region of birth



Controlled for Sex, Age, family context, education

## Odds ratio for **receiving some benefit or assistance**, relative to the native-born population (=1), by region of birth



Controlled for Sex, Age, family context, education, **and employment status**

## Compared to natives:

- ➔ Lower dependency of EU-15 and EU-10 mobile citizens
- ➔ Higher dependency of EU-3 citizens and third country migrants

**.. due only to their specific labour market situation**



INTERNATIONAL MONETARY FUND

# IMPACT OF **WORKFORCE AGING** ON **EUROPEAN PRODUCTIVITY**

**Shekhar Aiyar, Christian Ebeke, Xiaobo Shao**  
*International Monetary Fund, European Department*

February, 2017

# AGING AND THE MACROECONOMY

## Population aging



### **Workforce shrinks**

Lower private savings, lower investment  
Pressure on fiscal sector  
Shrinking manufacturing



### **Lower GDP and lower per capita GDP**

Increased volatility due to lack of buffers  
Lower productivity due to financial constraints

## Workforce aging



Age-related trends in physical and mental capabilities  
Accumulated experience then depreciation of skills  
Slower innovation and invention

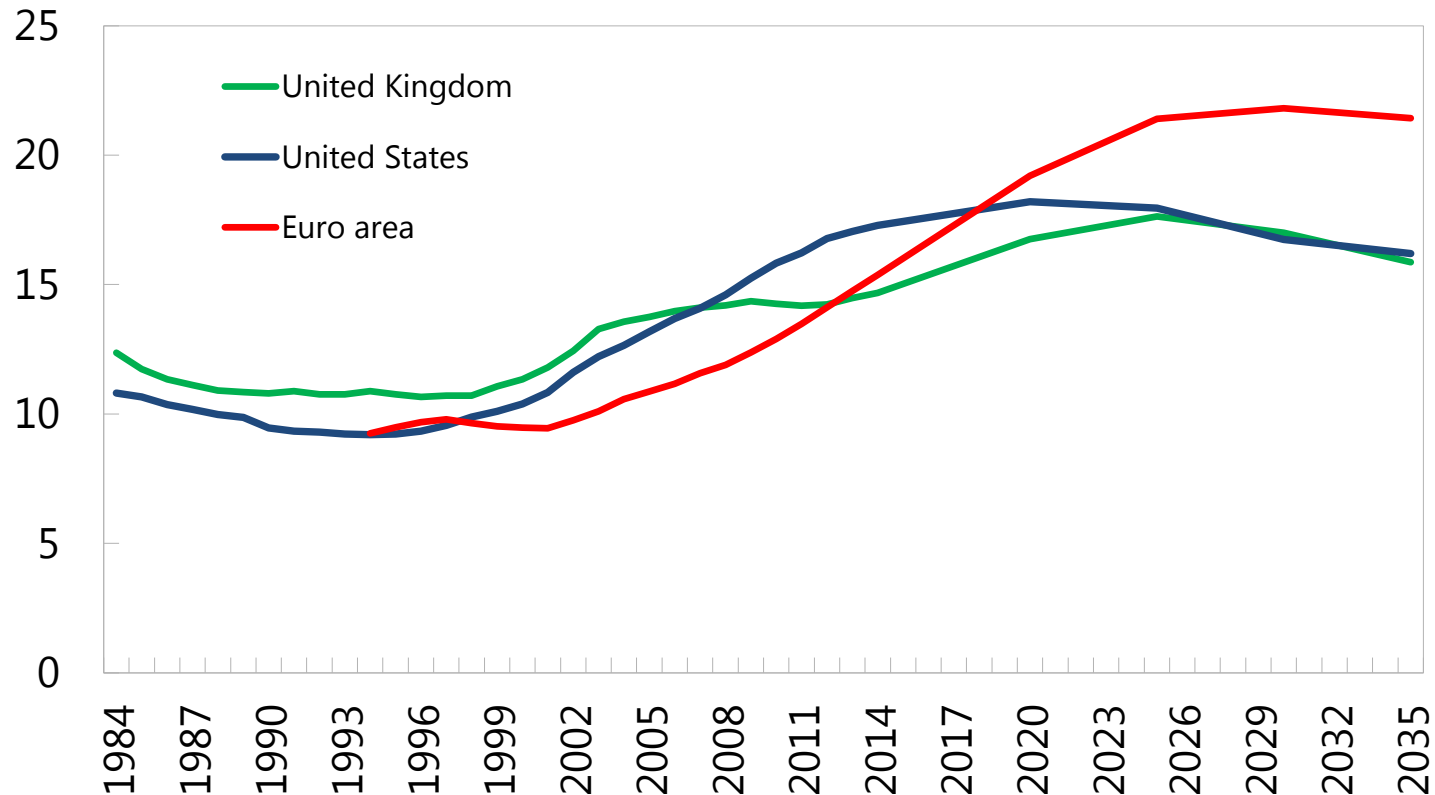


Lower productivity growth

# WORKFORCE IS AGING FAST IN EUROPE

## Old Worker (55-64) Share

(Percent of labor force 15-64)



Sources: OECD; European Commission; BLS; and IMF staff calculations.

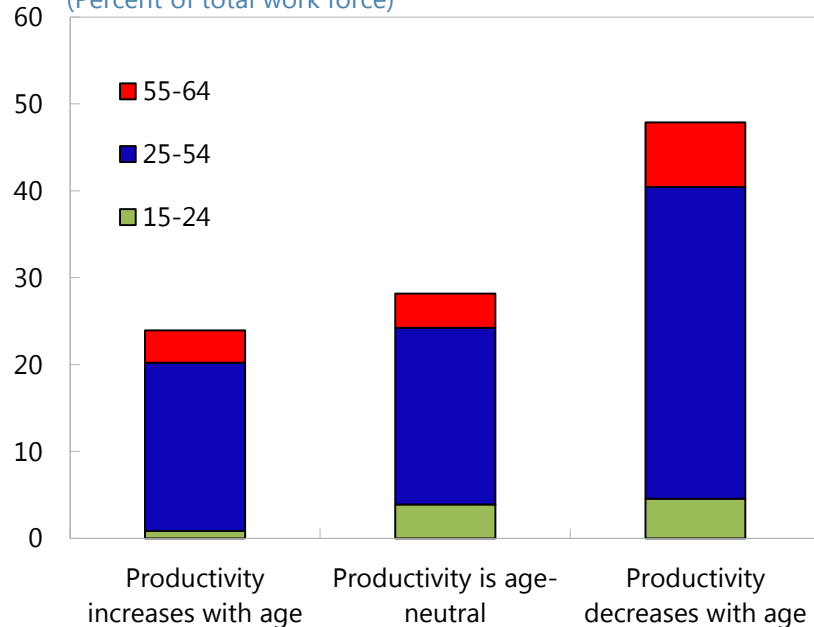
## RESEARCH QUESTIONS

- Impact of **workforce aging** on **productivity** growth
- Key **transmission channels**:
  - TFP
  - Factor accumulation
- **Living with Aging**: Role of structural policies

# AGING AND PRODUCTIVITY: A GRANULAR VIEW

## EU28: Work Force Decomposition by Occupations, 2015

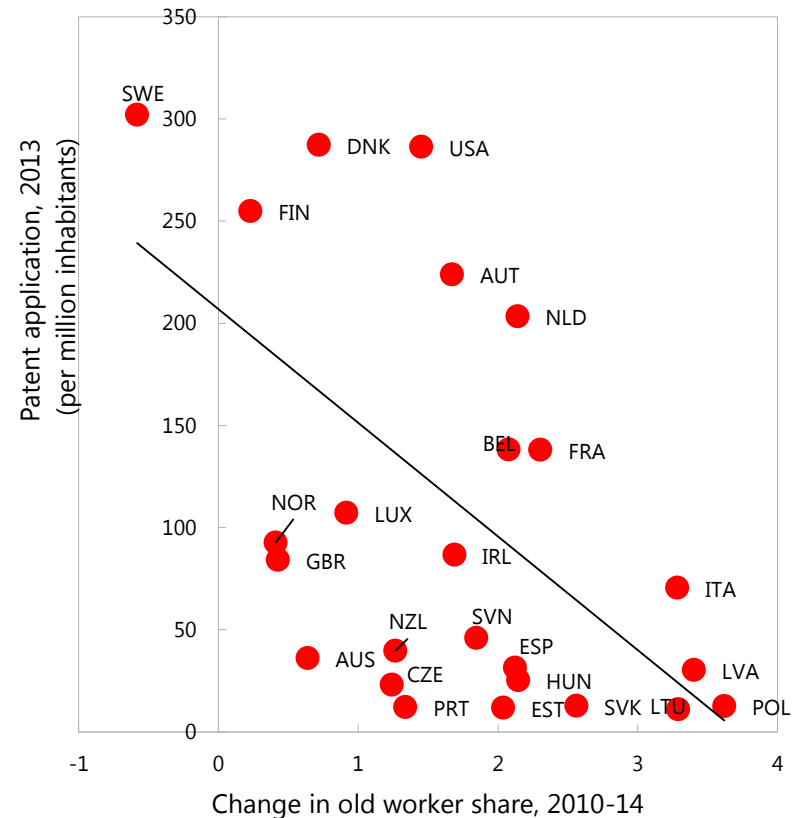
(Percent of total work force)



Note: Category "...increase with age" includes: managers, and professionals; Category "...age-neutral" includes: clerical support workers and services and sales workers; Category "...decrease with age" includes: technicians, skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers, elementary occupations and armed forces occupations.

Sources: Venn (2008); Eurostat; and IMF staff calculations.

## Patent Application and Workforce Aging



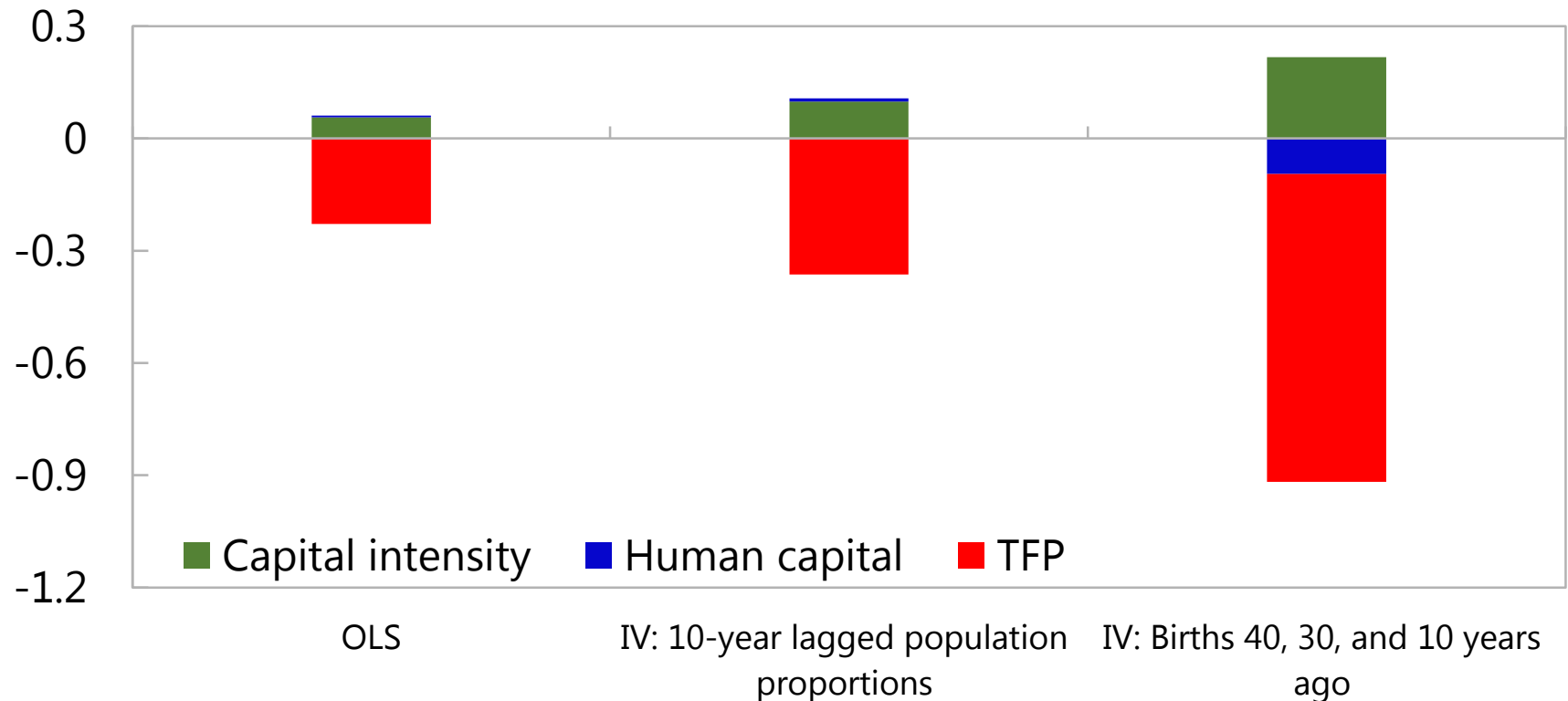
Sources: Eurostat and IMF staff calculations.  
Patent data for US are 2010.



# WORKFORCE AGING LOWERS PRODUCTIVITY GROWTH

## Impact of Workforce Aging on Labor Productivity Growth

(Response following a 1pp increase in workforce aging ratio (55-64))



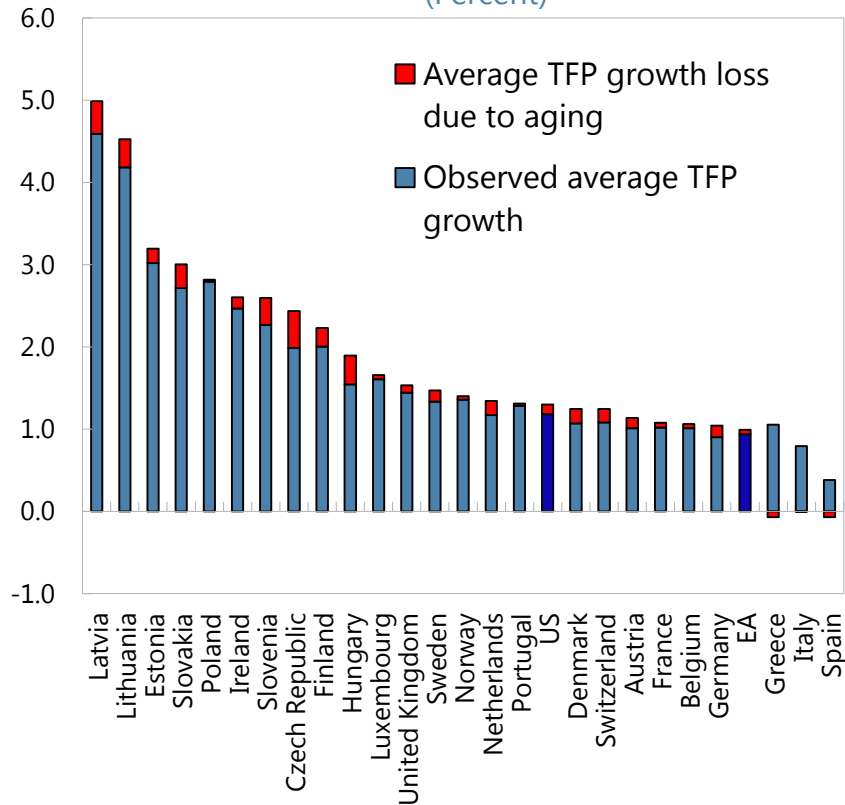
Effects derived from panel regressions fitting each dependent variable on workforce aging ratio, old-age dependency ratio, youth dependency ratio, country and time-fixed effects. The decomposition of labor productivity growth follows Wong (2007) and Feyrer (2007). The sample includes all European OECD member countries. Period covers 1950 through 2014.

# ROBUSTNESS

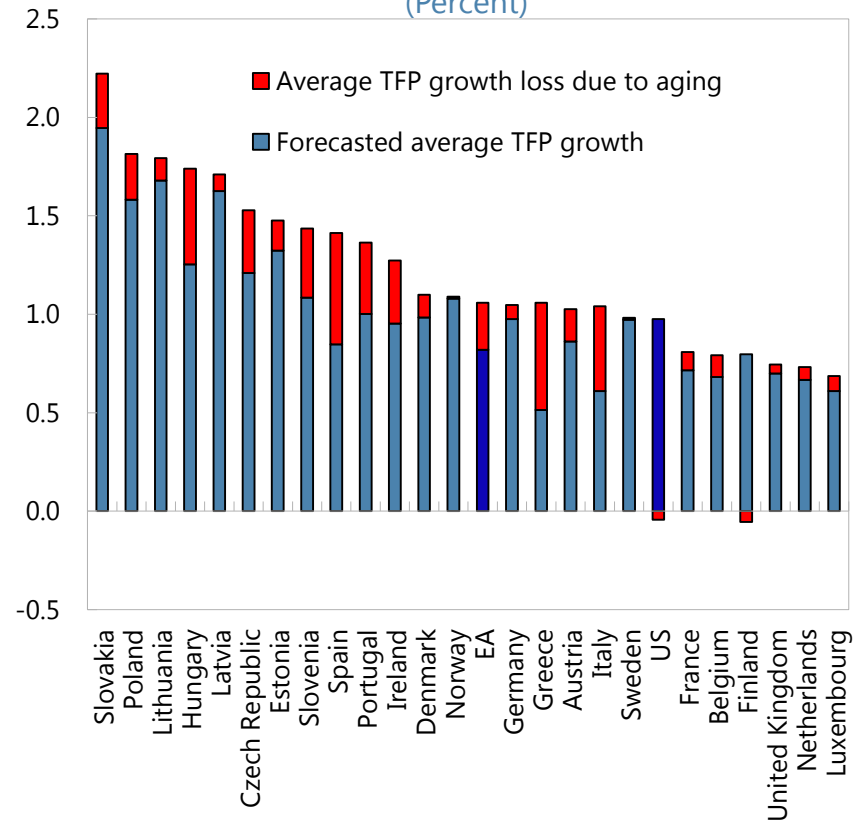
- Controlling for hours worked (Output per hour, TFP per hour)
- Controlling for the entire age distribution of the workforce  
**w**: 30–39, 40–49, 50–54, and **55–64**
- Using Penn World Table TFP growth estimates

# PROJECTED AGING WILL REDUCE TFP GROWTH

**Demographic Impact on Annual TFP Growth, 1984-2007**  
(Percent)



**Demographic Impact on Annual TFP Growth, 2014-2035**  
(Percent)

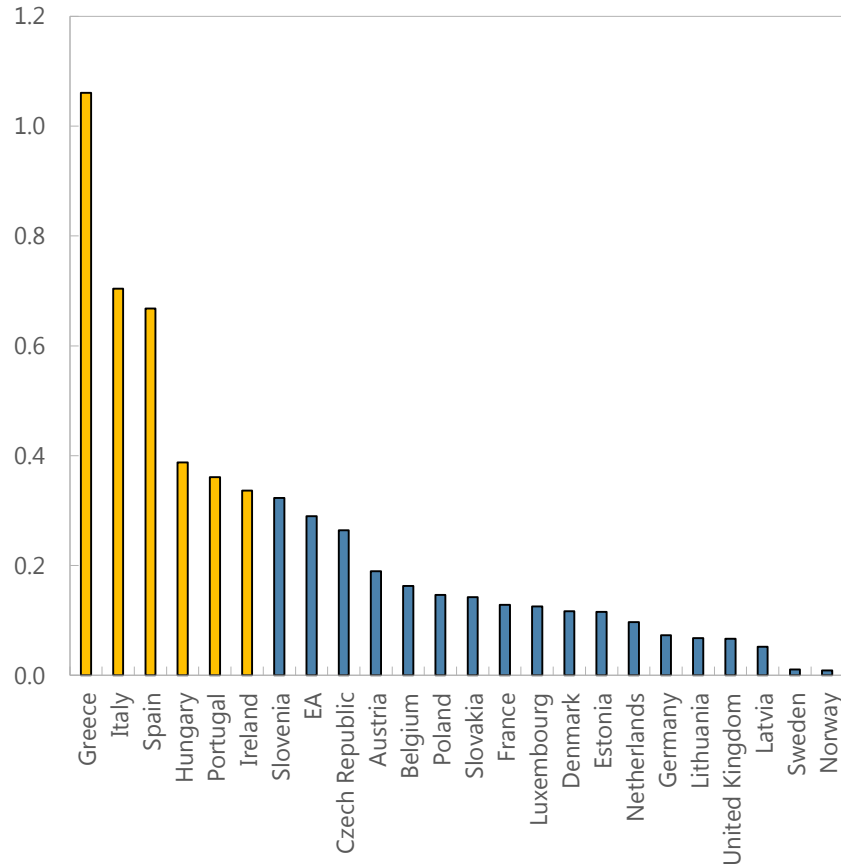


Sources: OECD; European Commission; and IMF staff calculations.

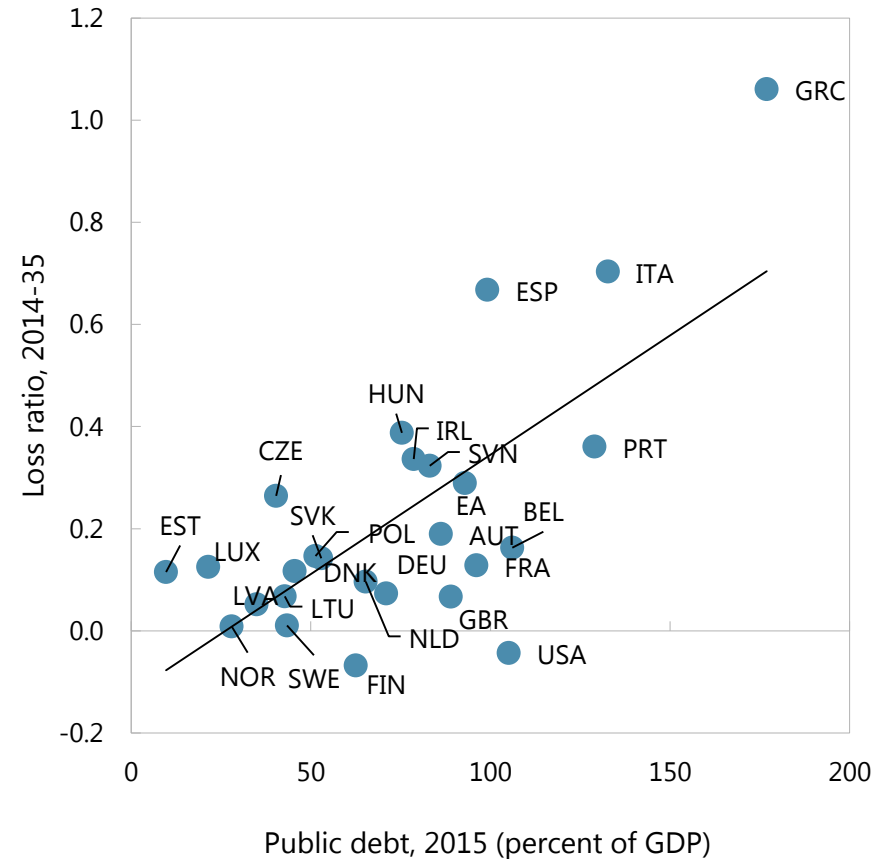
Notes: United Kingdom starts from 1985; Switzerland starts from 1992; Austria and Ireland start from 1995; Estonia and Slovakia start from 1996; Latvia, Lithuania, and Slovenia start from 2001. EA comprises Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, and Spain.

# UNFAVORABLE DISTRIBUTION OF EXPECTED TFP LOSSES

TFP Growth Loss Ratio, 2014-35



Public Debt and TFP losses



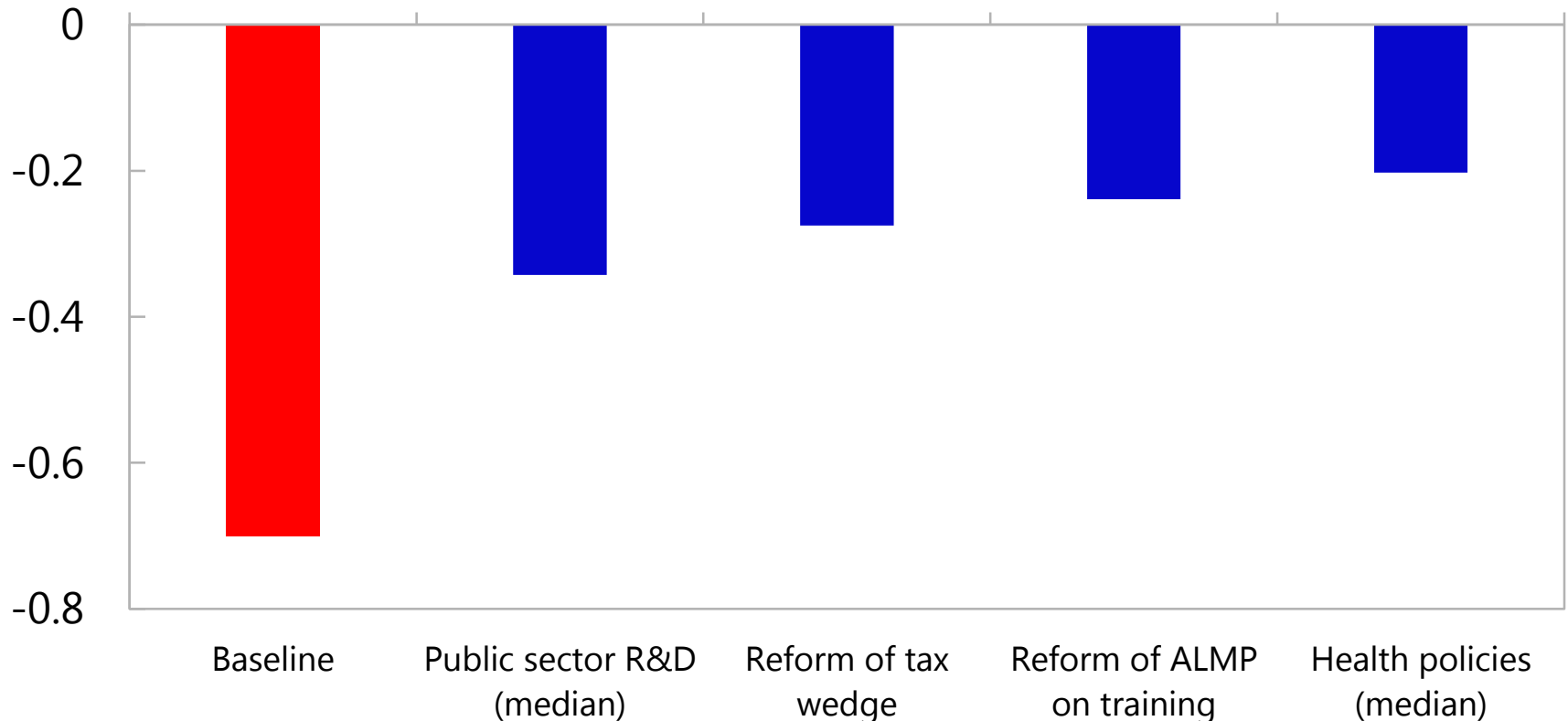
Sources: OECD; European Commission; WEO and IMF staff calculations.

Notes: Loss ratio is the ratio of projected TFP growth loss over projected TFP growth.

# LIVING WITH AGING

## Mitigating the Impact of Workforce Aging on TFP Growth

(Response of TFP growth to a 1pp increase in workforce aging conditional on policies)



Effects derived from panel regressions fitting each dependent variable on workforce aging ratio, old-age dependency ratio, youth dependency ratio, country and time-fixed effects. The decomposition of labor productivity growth follows Wong (2007) and Feyrer (2007). The sample includes all European OECD member countries. Period covers 1950 through 2014.

Source: IMF staff estimates.

# SUMMARY

- **Workforce aging (55+)** is negatively associated with productivity mainly through **lower TFP growth**
- Historical impact on Europe has so far been limited
- Projected **aging** will **reduce TFP growth in the decades to come** by an average of **0.2pp every year** over the next two decades
- Policies improving **health, labor market reforms, and innovation** are found to significantly lower adverse effects

**THANK YOU.**



# BACKUP SLIDES





# NAÏVE ESTIMATES (OLS-FE)

Table: OLS estimates of the effects of aging on output per worker and TFP growth

Dependent variables	(1) $\Delta \log(\text{GD PW})$	(2) $\frac{\alpha}{1-\alpha} \Delta \log(\text{K/Y})$	(3) $\Delta \log(\text{HC})$	(4) $\Delta \log(\text{A})$	(5) $\Delta \log(\text{AP WT})$
<b>Workforce share aged 55-64</b>	<b>-0.165**</b> <b>(-2.409)</b>	<b>0.0562**</b> <b>(2.237)</b>	<b>0.00480</b> <b>(0.829)</b>	<b>-0.228**</b> <b>(-2.491)</b>	<b>-0.149***</b> <b>(-3.023)</b>
Old age dependency ratio	0.0287 (0.203)	-0.0546 (-1.066)	-0.0602*** (-5.095)	0.161 (0.854)	0.0313 (0.310)
Youth dependency ratio	-0.0245 (-0.250)	0.0159 (0.461)	0.00854 (1.071)	-0.0405 (-0.311)	0.00442 (0.0649)
Intercept	0.0293 (0.842)	0.00209 (0.169)	0.0132*** (4.632)	0.00985 (0.213)	0.0148 (0.606)
County fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	679	700	700	679	700
Number of countries	22	22	22	22	22

# FIRST-STAGE ESTIMATES (a)

First-stage estimates (a)

	(1) W5564 ratio	(2) Old age dependency ratio	(3) Young age dependency ratio
Population share aged 45-54 t-10	1.345*** (11.60)	-0.114 (1.31)	0.075 (0.95)
Population share aged 55-59 t-10	0.237* (1.81)	0.997*** (9.95)	-0.292* (1.81)
Population share aged 00-04 t-10	0.273 (1.81)	-0.720*** (9.95)	1.653*** (1.81)
Observations	1.345*** 679	-0.114 679	0.075 679
No of countries	22	22	22
F-stat first stage	45.51	47.23	174.96

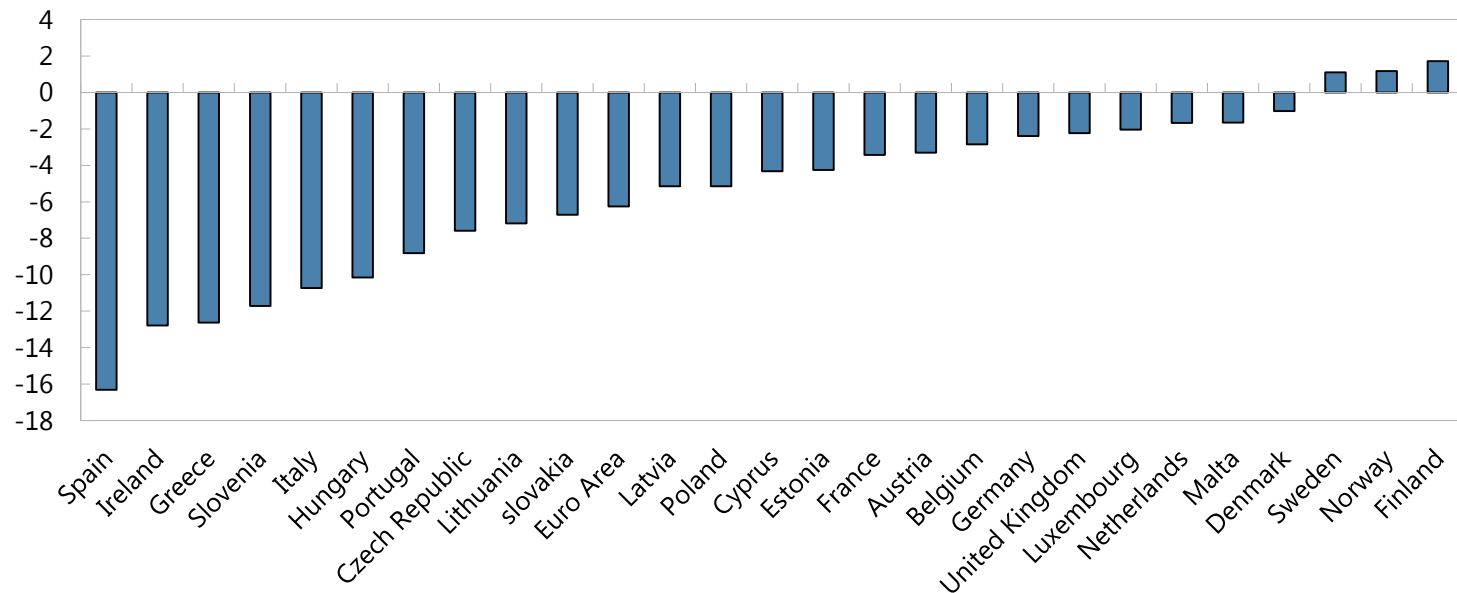
# FIRST-STAGE ESTIMATES (b)

First-stage estimates (b)

	(1) W5564 ratio	(2) Dependency ratio
Birth number t-40	-0.043*** (4.76)	-0.005 (1.15)
Birth number t-30	-0.064*** (8.87)	-0.039*** (11.98)
Birth number t-20	-0.040*** (5.37)	-0.020*** (5.92)
Birth number t-10	-0.062*** (8.32)	0.025*** (7.35)
Observations	391	391
No of countries	21	21
F-stat first stage	39.68	73.56

# PRIME-AGE WORKERS

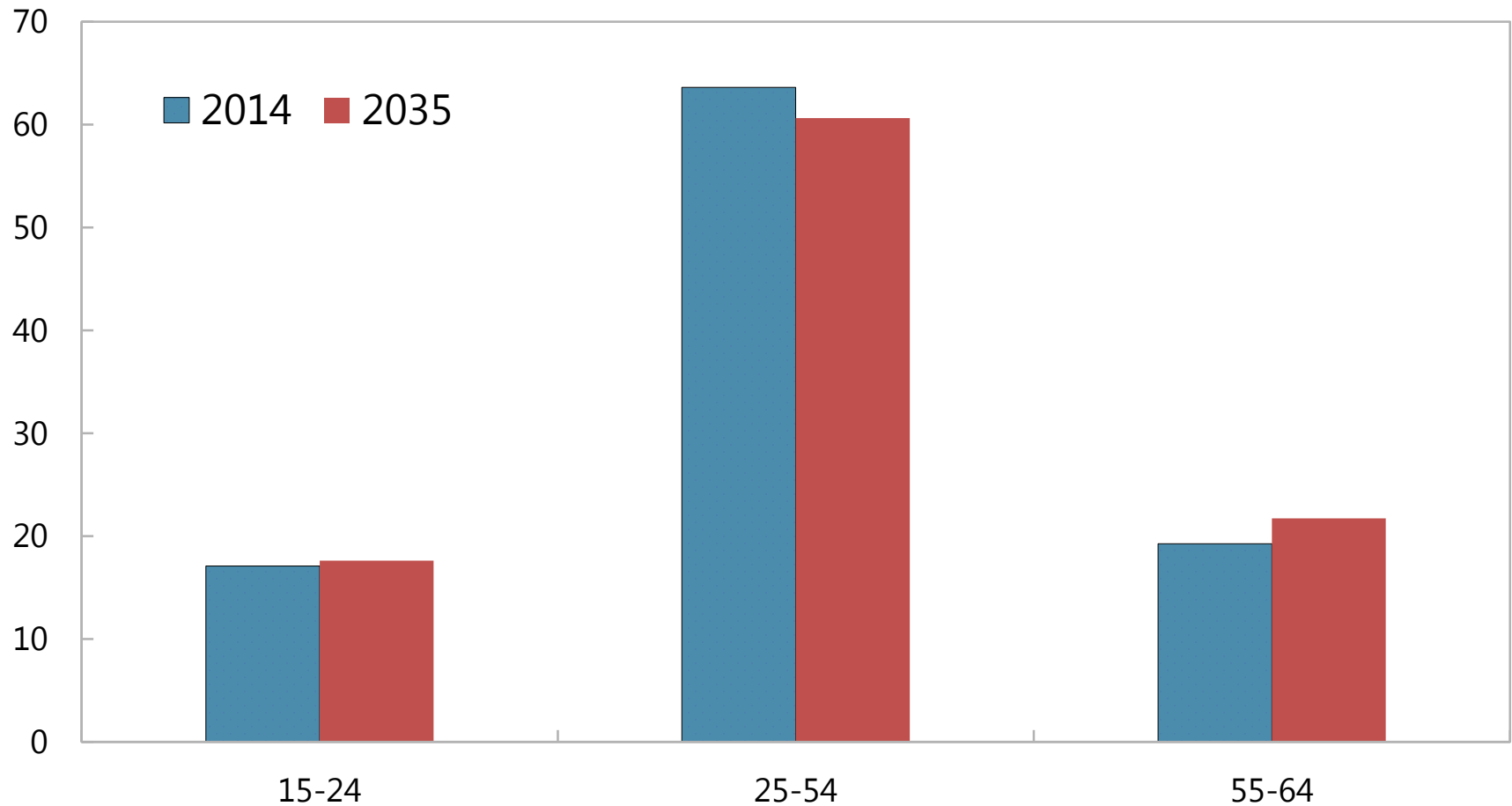
Change in Prime Age Workers (25-54) Share, 2013-2035  
(Percentage points)



Sources: European Commission and IMF Staff calculations.

# PROJECTION OF WORKFORCE DISTRIBUTION

## Europe: Share of Working Age Population by Age Group (Percent )



Sources: OECD and IMF staff calculations.

# Older workers and workplace performance

Evidence for Britain from the  
Workplace Employment Relations Survey

CEPS-IMF workshop, 28 February 2017

Lucy Stokes, Alex Bryson,  
Helen Bewley & John Forth

# Acknowledgements

- This presentation is based on research commissioned by the Department for Work and Pensions
- We acknowledge the Department for Business, Innovation and Skills, the ESRC, Acas and NIESR as the originators of the Workplace Employment Relations Survey data and the UK Data Archive as the distributor of the data.
- None of these organisations bears any responsibility for the authors' analysis and interpretations of the data.

# Introduction

- Older workers account for an increasing proportion of the UK workforce. This is driven by:
  - an ageing population
  - rising labour market participation rates among older workers
  - falling participation rates among young workers (increased participation in further and higher education)
- Many employers see benefits of older workers
  - e.g. skills, experience, reliability
- But some negative perceptions still persist
- What does an ageing workforce mean for workplace performance?
- We explore this using data for Britain from the Workplace Employment Relations Survey



# Overview

- Existing evidence
- About the WERS
- Our approach
  - Identifying older workers
  - Measuring workplace performance
- Results
- Summary

# Older workers and workplace performance

- What happens to workplace performance if share of older workers at a workplace rises or falls?
- Some firms may benefit more than others
  - e.g. those with a particular customer base, or where firm-specific knowledge is particularly important
- But could be disadvantages if firms reliant on physical fitness, or if older workers slower at adopting new procedures/technology
- Age diversity may also matter- but direction of effect is also unclear

# Existing evidence

- Findings from existing studies are mixed
  - No real evidence that older average age associated with lower organisational performance
  - Evidence on age diversity appears inconclusive
- Disparate findings likely to reflect differences in samples, settings and measures – none conducted in Britain
- Most existing studies use some measure of labour productivity to measure performance. But as older workers may be more or less costly than other workers, effect on overall performance/profitability could be different

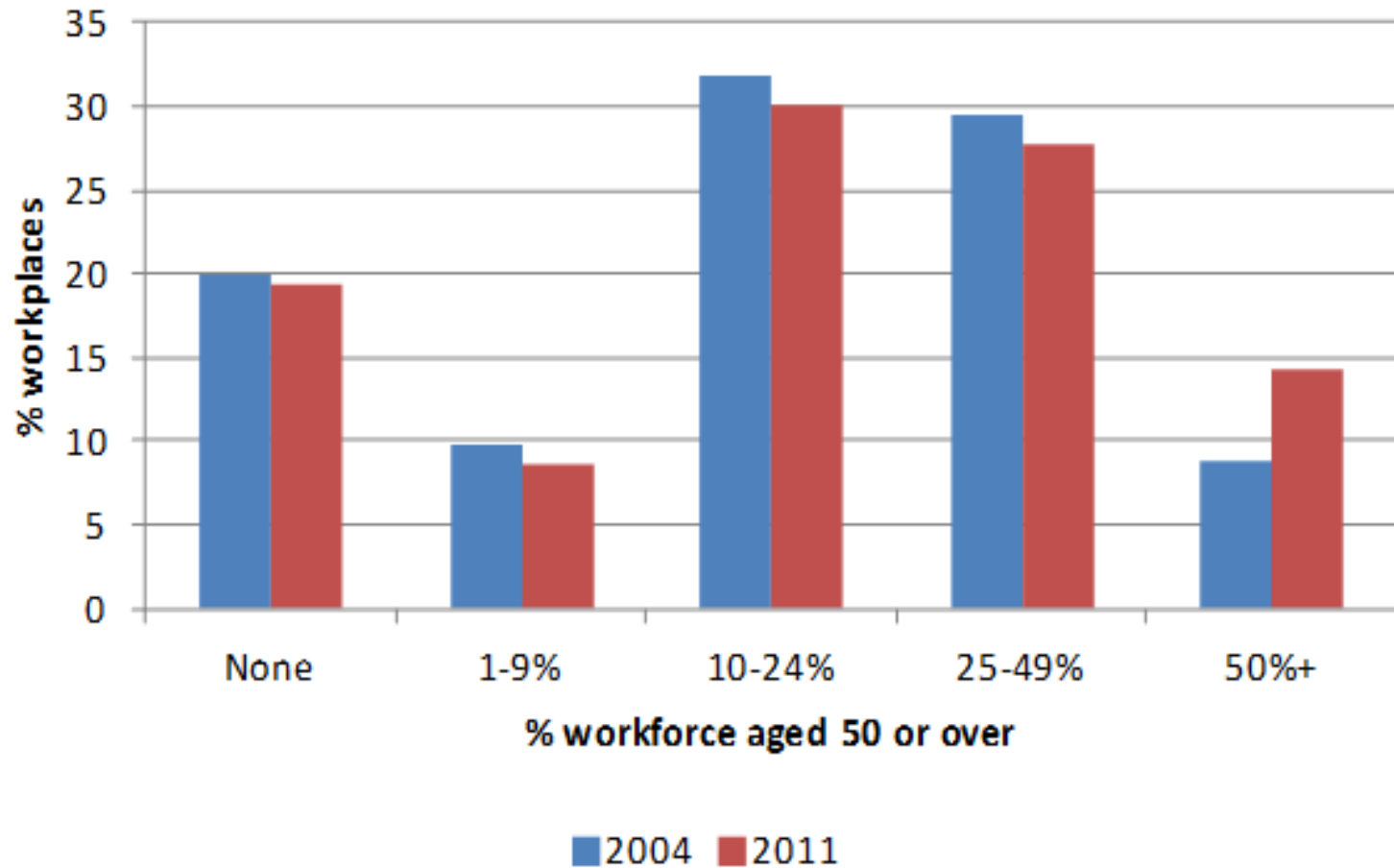
# The Workplace Employment Relations Survey (WERS)

- Nationally representative survey of British workplaces with 5 or more employees
- Responses from 2,680 workplaces in 2011
- Collects rich set of data from managers, worker representatives and employees within the same workplaces
- We use the two most recent surveys in the WERS series: 2004 & 2011
- And panel component following almost 1,000 workplaces in 2004 & 2011
- Covers all industries except agriculture and mining and quarrying
- This population accounted for around a third of all workplaces and around 90 per cent of employees in Britain in 2011
- WERS covers both the public and private sector – but our analysis of workplace performance focuses on the private sector only

# Identifying older workers

- Managers are asked how many employees in the workplace are aged 16-17, 18-21, 22-49, and 50 and over.
- We use this information to calculate the % of employees in the workplace aged 50 and over (“older workers”)
- We define “younger workers” as those aged 16-21

# Per cent workforce aged 50 and over, 2004 and 2011



# Our analysis

- We explore both:
  - Workforce composition: share of employees in the workplace by age group
  - Workforce diversity: spread of workers across the age distribution (Herfindahl index)
- Private sector only
- Panel analysis – change in performance associated with change in age measures
- Limitations – sample size, 2 periods only

# Measures of workplace performance (1)

- Subjective measures
- “Compared with other workplaces in the same industry how would you assess your workplace’s...”
  - Financial performance
  - Labour productivity
  - Quality of service or product?”
- Respond on five point scale from “a lot better than average” to “a lot below average” (combine bottom two in analysis)
- Also construct additive scale from the 3 items
- Although accounting measures are more conventional, existing studies provide validation for the subjective measures



# Measures of workplace performance (2)

- Quit rates:
  - “In total, how many employees (full-time and part-time) were on the payroll at this workplace 12 months ago?”
  - “And how many of these employees stopped working here, because they...left or resigned voluntarily”
- Absence rates:
  - “Over the last 12 months what percentage of work days was lost through employee sickness or absence at this workplace?”

# Results: change in labour productivity

	Model 1	Model 2	Model 3	Model 4
Δ Share 50+	-0.774** (2.25)	-0.796** (2.03)	-2.836* (1.91)	-2.817* (1.92)
Δ Share 16-21	-1.248*** (2.74)	-1.408*** (3.03)	-3.487** (2.30)	-3.491** (2.30)
Δ Age diversity	0.737 (1.28)	0.995* (1.89)	0.498 (0.33)	0.574 (0.38)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.025	0.118	0.208	0.212
Observations	411	411	300	300

Notes: t-stats in parentheses, \*\*\*significant at 1 per cent, \*\*significant at 5 per cent, \* significant at 10 per cent.

Management controls: number of employees; share female; gender diversity; share non-white; share part-time; share in largest occupational group; union density; number of age-related EO practices; EO policy mentioning age; EO policy not mentioning age; age important in recruitment; special procedures for recruiting older workers.

Employee controls: mean hourly wage; mean job satisfaction; mean job-related anxiety

# Results: change in quality of output

	M1	M2	M3	M4
$\Delta$ Share 50+	-0.38 (0.92)	-0.428 (1.05)	-1.149 (1.23)	-0.994 (1.08)
$\Delta$ Share 16-21	-0.252 (0.46)	-0.319 (0.62)	-0.044 (0.05)	-0.094 (0.12)
$\Delta$ Age diversity	-0.026 (0.06)	0.05 (0.11)	0.714 (1.01)	0.656 (0.91)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.01	0.09	0.081	0.106
Observations	411	411	300	300

# Results: change in financial performance

	M1	M2	M3	M4
Δ Share 50+	0.006 (0.01)	0.186 (0.5)	-1.511 (1.12)	-1.459 (1.09)
Δ Share 16-21	-0.182 (0.39)	0.079 (0.17)	-2.315* (1.88)	-2.325* (1.91)
Δ Age diversity	0.259 (0.53)	0.197 (0.43)	0.248 (0.2)	0.414 (0.33)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.002	0.057	0.164	0.187
Observations	411	411	300	300

# Results: change in additive performance scale

	M1	M2	M3	M4
Δ Share 50+	-1.016 (1.38)	-0.91 (1.13)	0.918 (0.83)	1.281 (1.12)
Δ Share 16-21	-1.604* (1.73)	-1.578* (1.72)	-0.504 (0.38)	-0.545 (0.41)
Δ Age diversity	0.827 (0.8)	1.094 (1.18)	0.572 (0.46)	0.22 (0.17)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.011	0.081	0.127	0.189
Observations	411	411	241	241

# Results: change in quit rate

	M1	M2	M3	M4
Δ Share 50+	-11.684 (-1.32)	-7.573 (-0.87)	-8.859 (-1.17)	-9.623 (-1.23)
Δ Share 16-21	21.456 (1.2)	20.537 (1.16)	13.191 (0.91)	13.691 (1.01)
Δ Age diversity	5.003 (0.56)	3.958 (0.41)	18.254 (1.54)	16.471 (1.42)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.037	0.134	0.157	0.193
Observations	479	479	275	275

# Results: change in absence rate

	M1	M2	M3	M4
Δ Share 50+	1.016*	1.027*	0.889	0.997
	(1.8)	(1.77)	(1.43)	(1.45)
Δ Share 16-21	-0.181	-0.164	-0.662	-0.548
	(0.28)	(0.27)	(0.81)	(0.66)
Δ Age diversity	-0.978*	-0.844	-0.843	-0.831
	(1.67)	(1.38)	(0.95)	(0.93)
Management controls	No	Yes	Yes	Yes
Employee Controls	No	No	No	Yes
R-sq	0.034	0.071	0.15	0.19
Observations	393	393	229	229

# Results: summary

	Labour productivity	Quality	Financial performance	Additive scale	Quits	Absence
$\Delta$ Share 50+	-	ns	ns	ns	ns	[+]
$\Delta$ Share 16-21	-	ns	ns*	[-]	ns	ns
$\Delta$ Age diversity	[+]	ns	ns	ns	ns	ns

Results including workplace controls

\*Negative association between  $\Delta$  Share 16-21 in model including employee-level data (at 10% significance level)





# Summary

- In general, there are weak or no associations between changes in age shares, changes in age diversity and workplace performance
- Some evidence that a higher percentage of both older and younger employees results in a fall in labour productivity
- But this does not carry through to financial performance
- Workplaces may benefit from older workers in other ways – e.g. reduced labour costs, firm-specific knowledge, “matching” staff profile to customer base

# Further information

- Full report available at:

<https://www.gov.uk/government/publications/older-workers-and-the-workplace-evidence-from-the-workplace-employment-relations-survey>

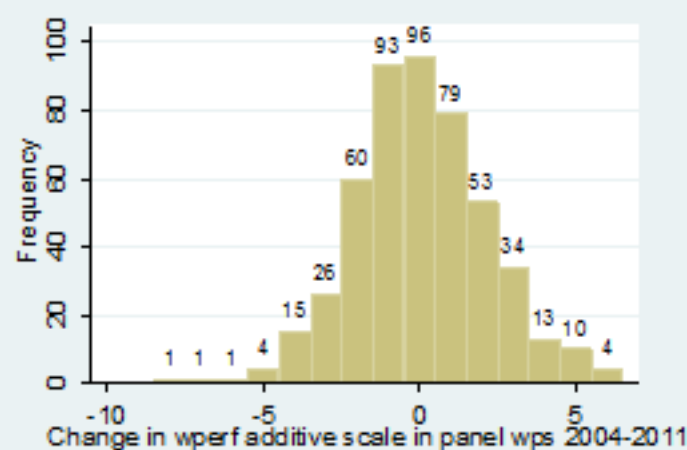
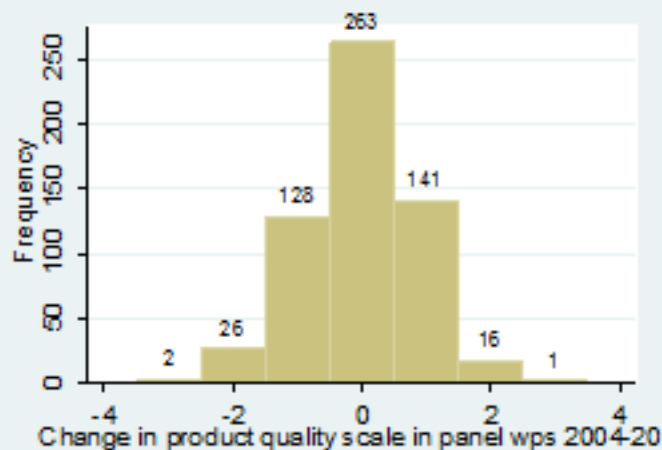
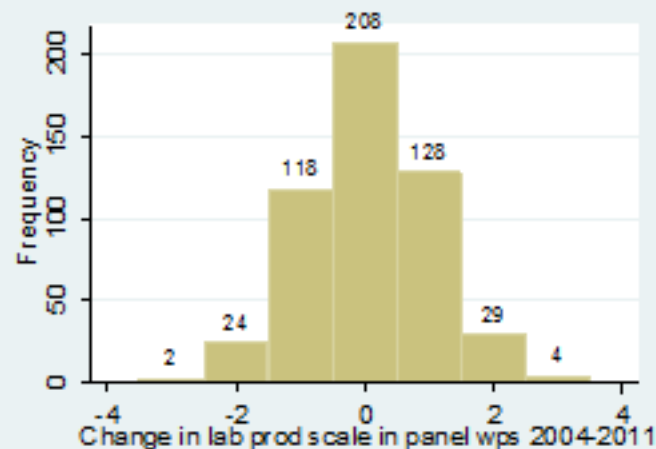
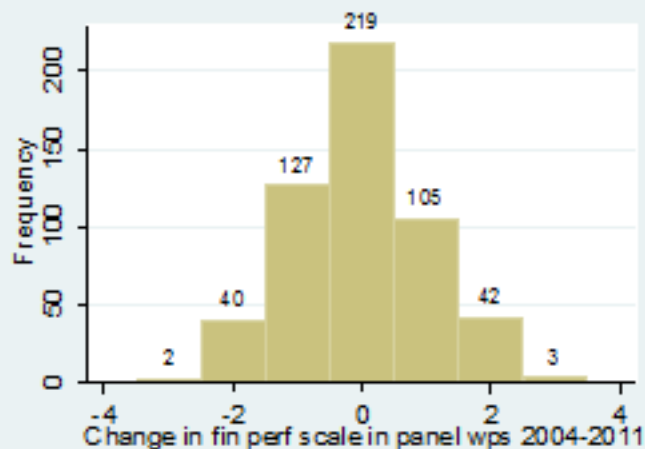
- Further information about WERS:

<http://www.wers2011.info/>

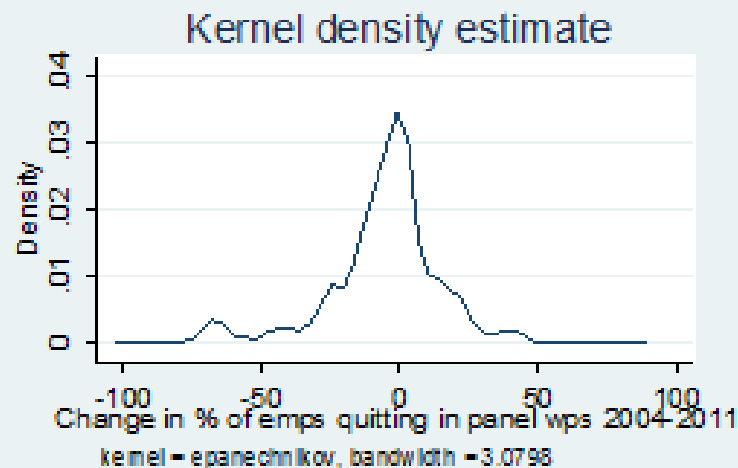
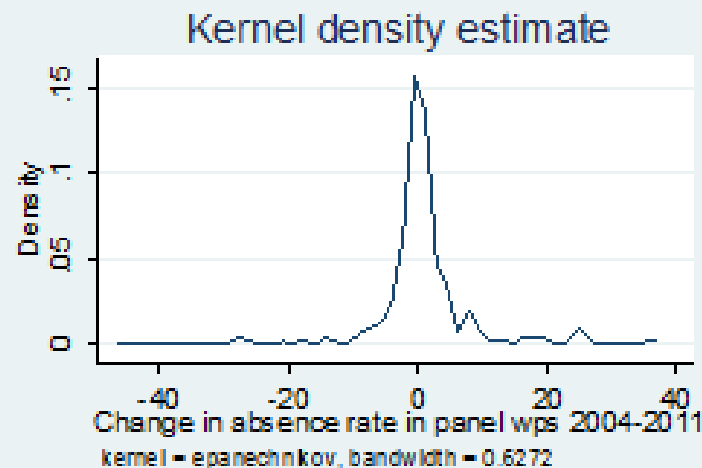
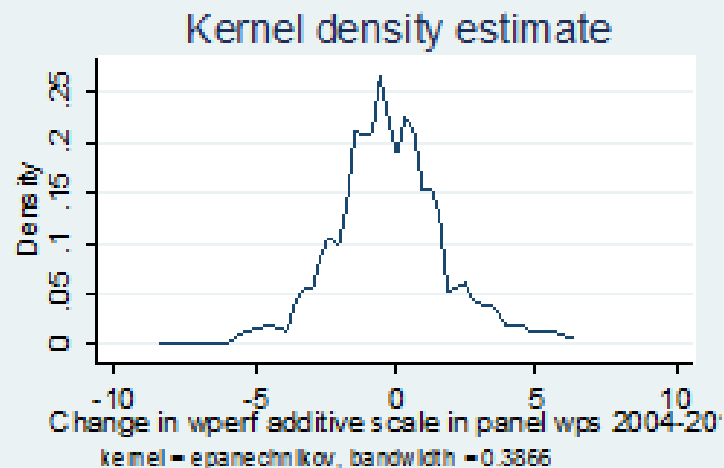
# Additional slides



# Within-Workplace Changes in Workplace Performance



# Within-Workplace Changes in Workplace Performance



# Macroeconomic effects of demographic change in a small open economy

## – the case of Belgium –

Willem Devriendt

Freddy Heylen

- Ghent University -

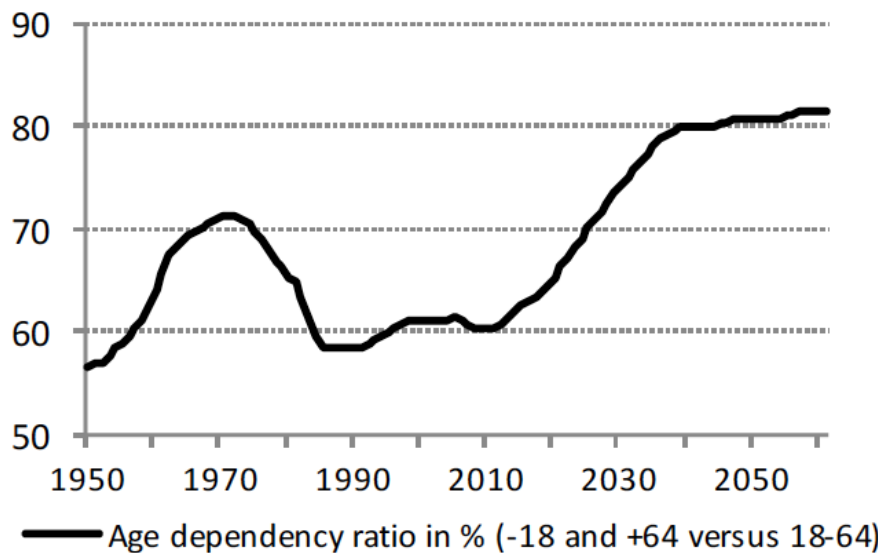
CEPS Workshop: *Ageing and productivity – what economic impact?*

28 February 2017

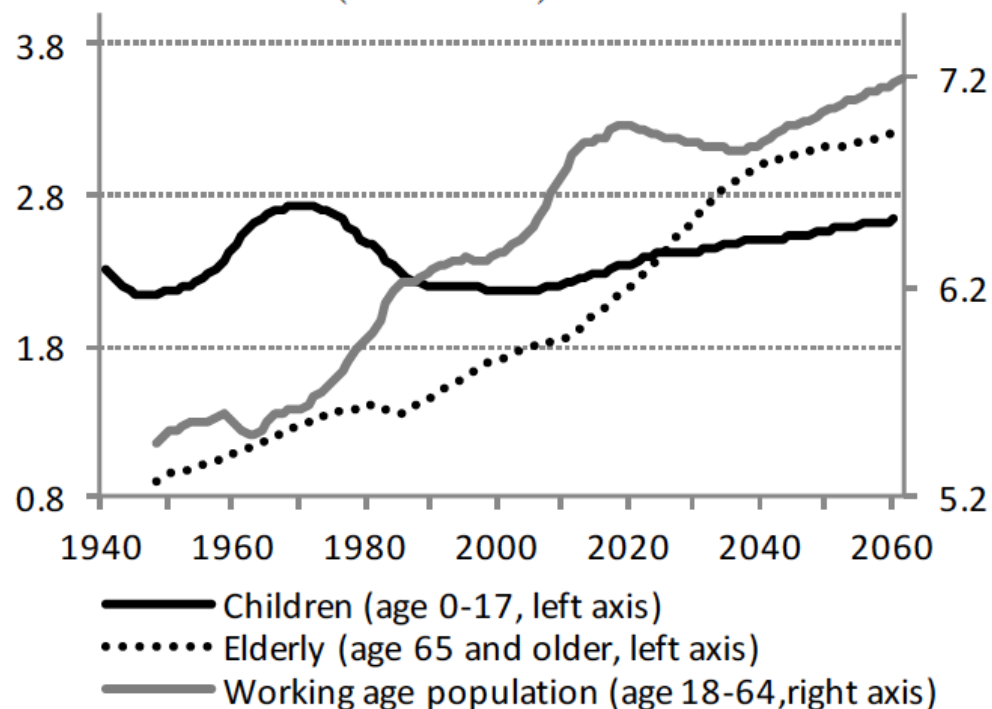


# Main research question and outline

**Figure 1:** Age dependency ratio in Belgium (%)



**Figure 2:** Size of three age groups (millions)



Data sources: Federal Planning Bureau (2016),  
Belgian Federal Government

# Main research question and outline

---

Is ageing bad for the economy (per capita growth)? If the answer is yes, how bad?

Unfortunate demographic arithmetic

Behavioural effects / adjustments to demographic change

Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

Conclusions and policy implications



# Unfortunate arithmetic of demographic change

---

In the very long run, per capita growth is equal to the rate of technical progress.

In the medium to long run, per capita growth may be different.

Demography!

$$\frac{Y_t}{Pop_t} = \frac{Y_t}{Hours_t} \frac{Hours_t}{N_t} \frac{N_t}{Pop_t}$$

$Y$  : real output (GDP)

$Pop$  : total population

$Hours$  : aggregate hours worked

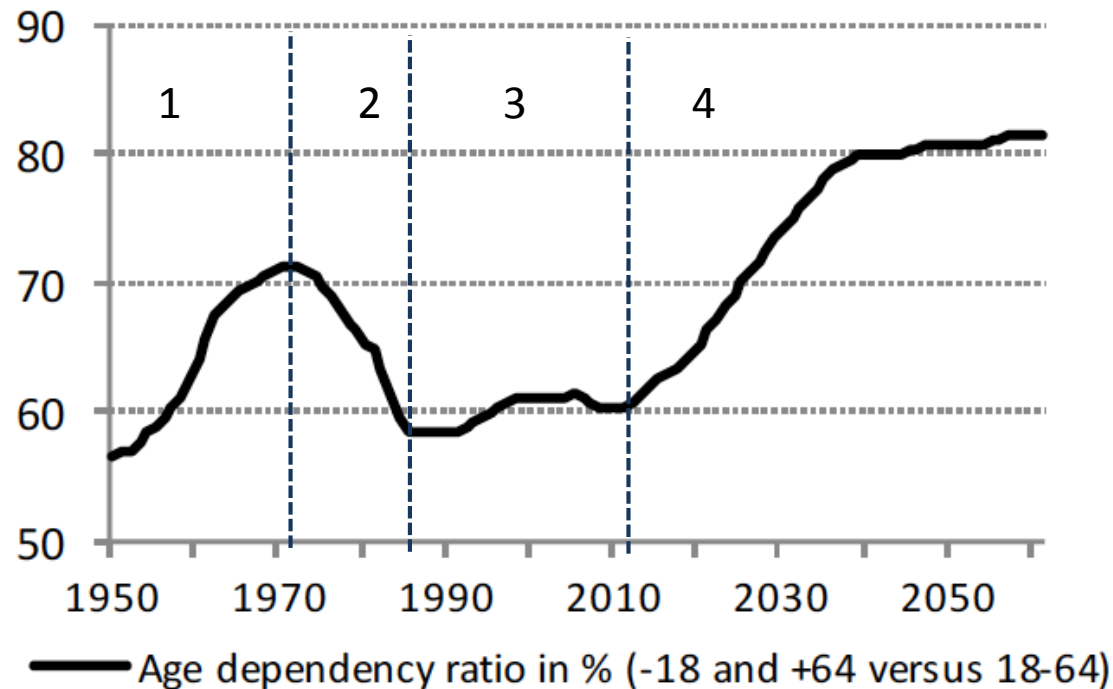
$N$  : population at working age

$$\Delta Y/Y - n_{POP} = g_{yh} + (n_{hours} - n_N) + (n_N - n_{POP}).$$

Negative effect from  
rising dependency rate

# Unfortunate arithmetic of demographic change

**Figure 1:** Age dependency ratio in Belgium (%)



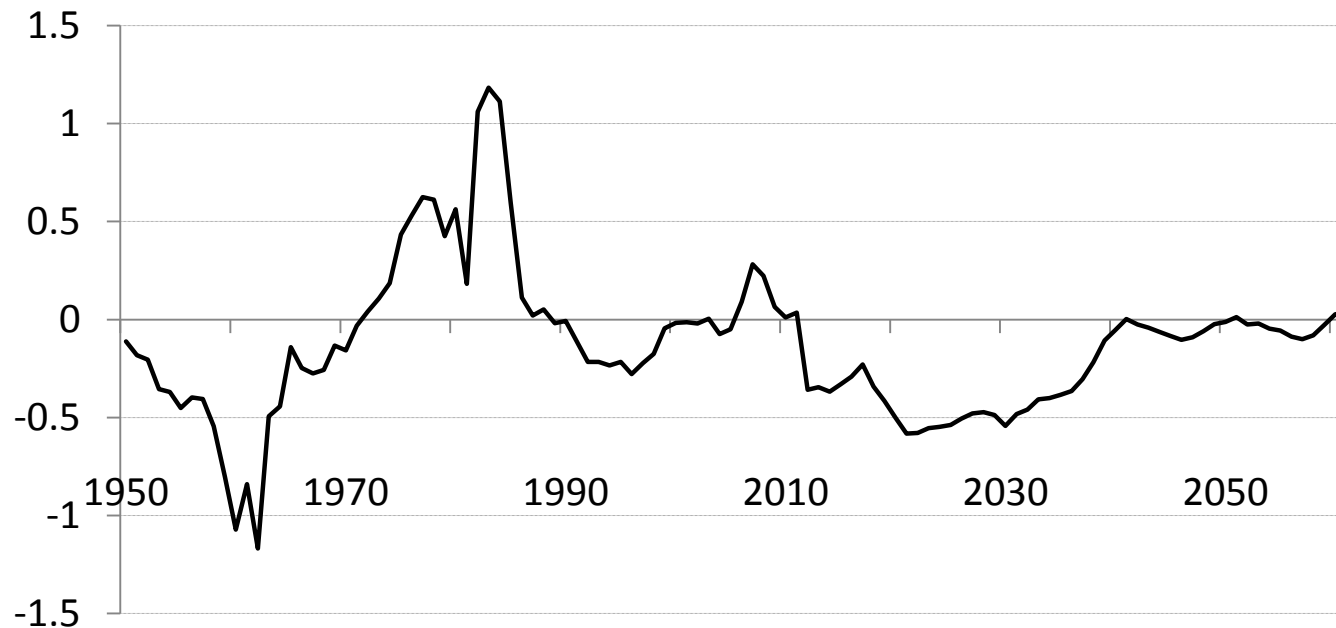
1, 4 : demography weighs negatively on per capita growth

2: demography raises per capita growth

# Unfortunate arithmetic of demographic change

Arithmetical per capita growth effects of changing dependency – for unchanged behaviour (Belgium)

Average annual growth rate of population at working age relative to total population ( $n_N - n_{POP}$ , in %-points).



On average for 2010-40

Effect on the annual per capita growth rate : **-0,4%-points.**

# Behavioural effects / adjustments to demographic change

---

The effects of demographic change will not be limited, however, to the arithmetic described above.

The different components of demographic change may affect the behaviour of households and firms....

$$\Delta Y/Y - n_{POP} = g_{yh} + (n_{hours} - n_N) + (n_N - n_{POP}).$$

Negative effect from  
rising dependency rate

... but the sign and size of these effects are unclear.

# Behavioural effects / adjustments to demographic change

---

## Savings:

- : rising share of dependent versus active people (rising share of dissavers and borrowers) (Goodhart and Erfurth, 2014)
- + : increasing life expectancy → more resources needed to maintain consumption (Krueger and Ludwig, 2007; Onder and Pestieau, 2014)

## Labour supply (hours worked):

- + : increasing life expectancy → more resources needed to maintain consumption, work more and longer

## Investment in education :

- + : increasing life expectancy, perspective of a longer working life → higher return to education when young (Ben-Porath, 1967; Cervellati and Sunde, 2013, ...)

# Behavioural effects / adjustments to demographic change

---

## Investment in physical capital by firms:

- : Decline in working age population → fall in the productivity of physical capital and reduced need for capital (Ludwig et al., 2012; Heylen and Van de Kerckhove, 2013; Summers, 2014)
  - Counterargument: the end of cheap labour → reduction of relative cost of capital → more investment (Goodhart and Erfurth, 2014)
- + : if individuals work more/longer, if investment in education and human capital increase → increase in the productivity of physical capital
- + : if savings increase, the interest rate **may** fall, reducing the cost of investment

Important : In a small open economy the interest rate is exogenous (need not fall). Rather than being invested at home, accumulated non-human wealth (savings) may flow out.

# Main research question and outline

---

Is ageing bad for the economy (per capita growth)? If the answer is yes, how bad?

Unfortunate demographic arithmetic

Behavioural effects / adjustments to demographic change

## **Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)**

- Main characteristics
- Parameterization (see paper)
- Backfitting
- Model simulation: macro effects of demographic change

Conclusions and policy implications

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

---

## Main characteristics

- **Small open economy** (exogenous world interest rate), physical capital is internationally perfectly mobile, labour is assumed immobile.
- 28 generations of **households** (youngest 18-20, oldest 99-101)
- with different ability (high, medium, low)
- the size of these generations has changed over time due to exogenous changes in fertility and life expectancy
- decisions?
- **Firms** produce output from employed labour, human and physical capital and (exogenous) technology.



# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

---

- The **goods market** and **labour markets** are competitive except the labour market for low ability households (union involvement in wage setting, which may imply involuntary unemployment).
- **Three pillar pension system:** 1) public PAYG, 2) Pension fund organized by private firms, 3) individual accumulated wealth
- **Fiscal government:**
  - taxes on labour income, capital income, and consumption
  - expenditures: goods, unemployment benefits, productive expenditures promoting human capital, payments to the public pension system

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

---

Parameterization (see paper)

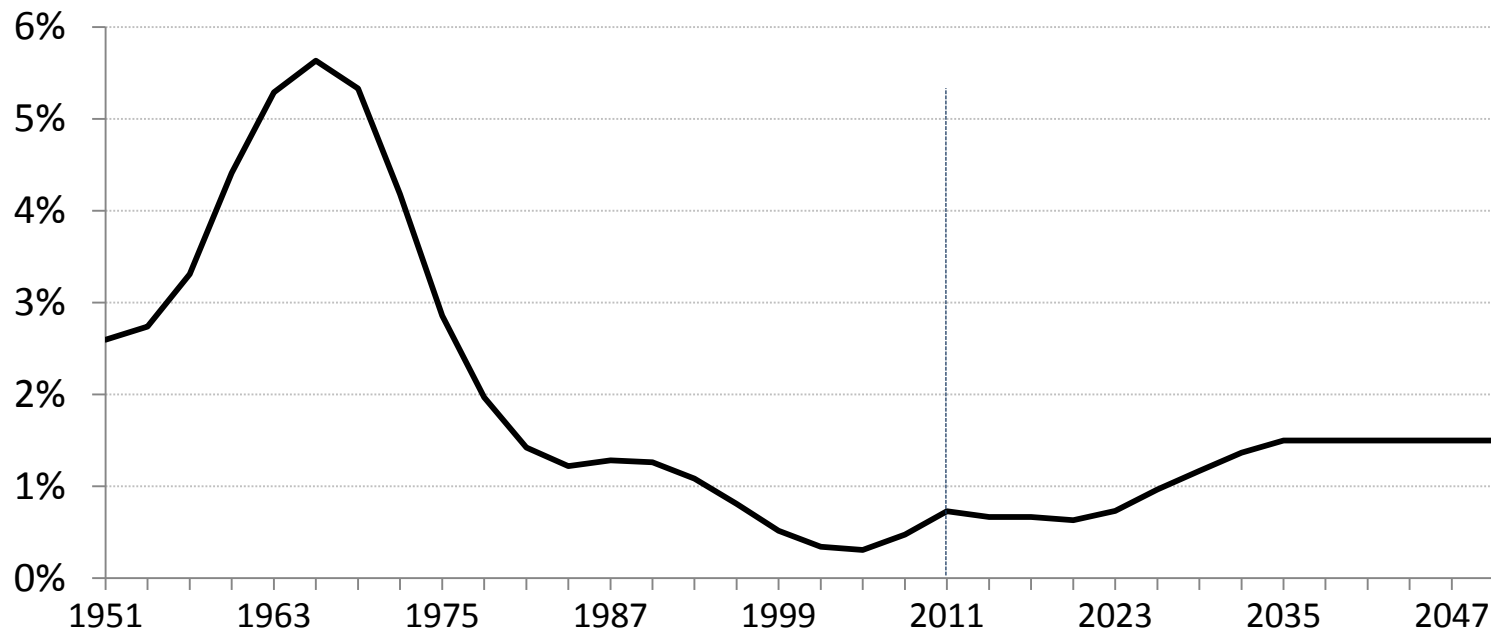
## Backfitting

- Introduce exogenous variables (world interest rate, technological progress, fertility, life expectancy, fiscal policy) into the parameterized model
- Check if the model replicates key data in the past.
- Only if this is reliable, use the model for simulations of the future. These simulations make use of projections for the future evolution of the exogenous variables.

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Exogenous variables

### Average annual rate of technical progress



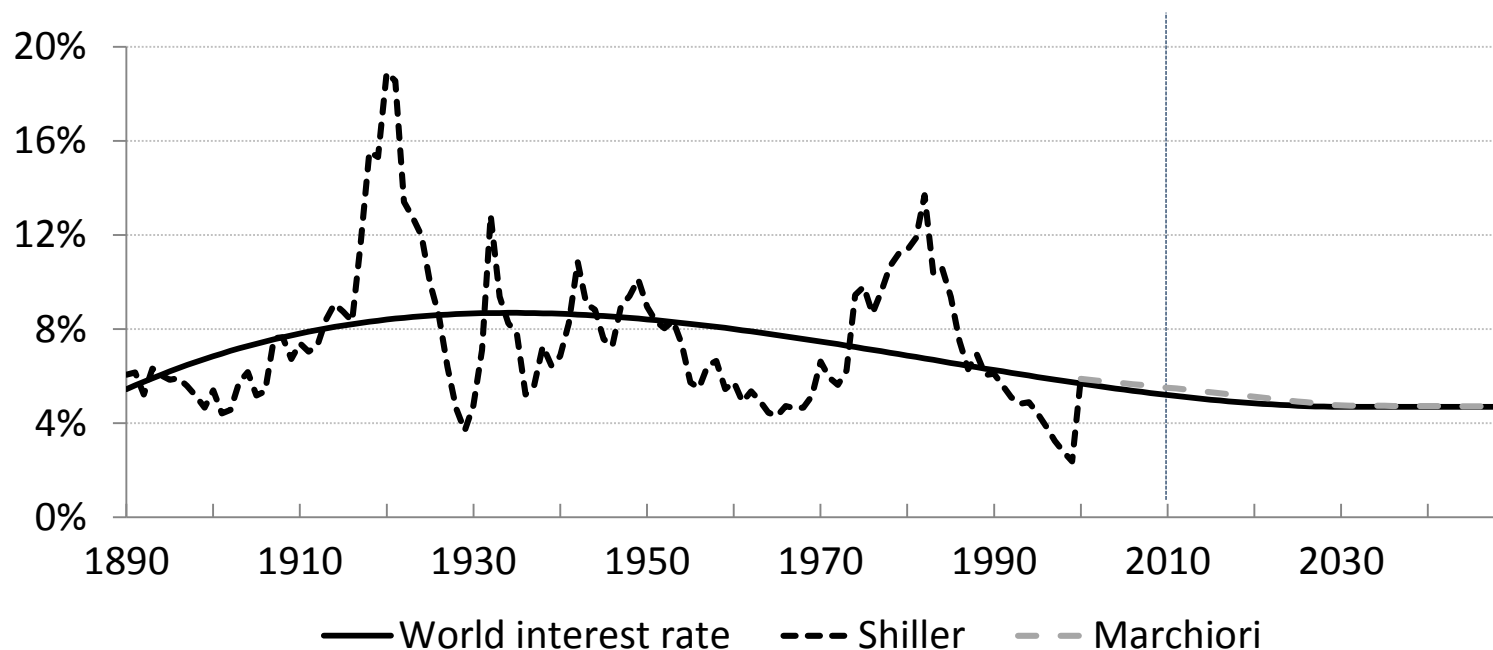
Data sources: past: Penn World Tables 8.1

future: Studiecommissie Vergrijzing, EU Commission Working Group on Ageing

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Exogenous variables

### World real interest rate

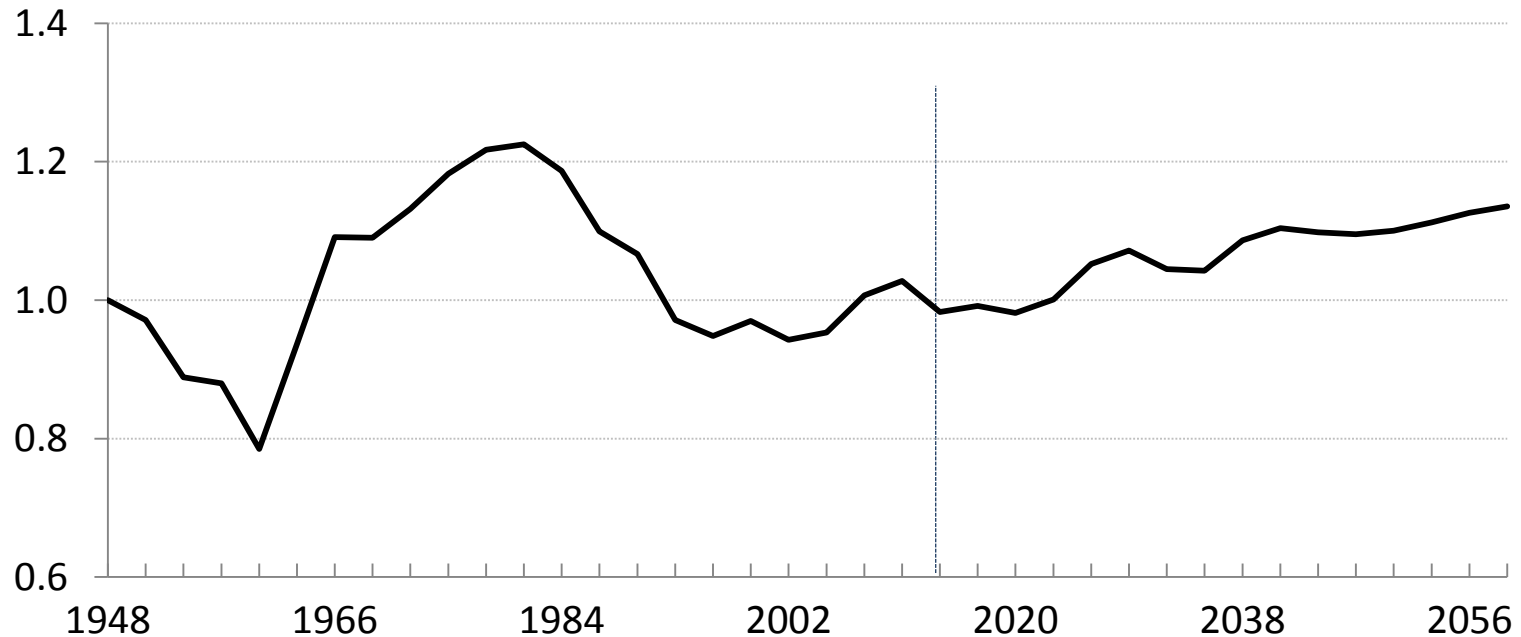


Data sources: past: Shiller (2015); future: Marchiori et al. (2015)

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Exogenous variables

Size of the youngest cohort (18-20 years old, normalized to 1 in 1948-50)

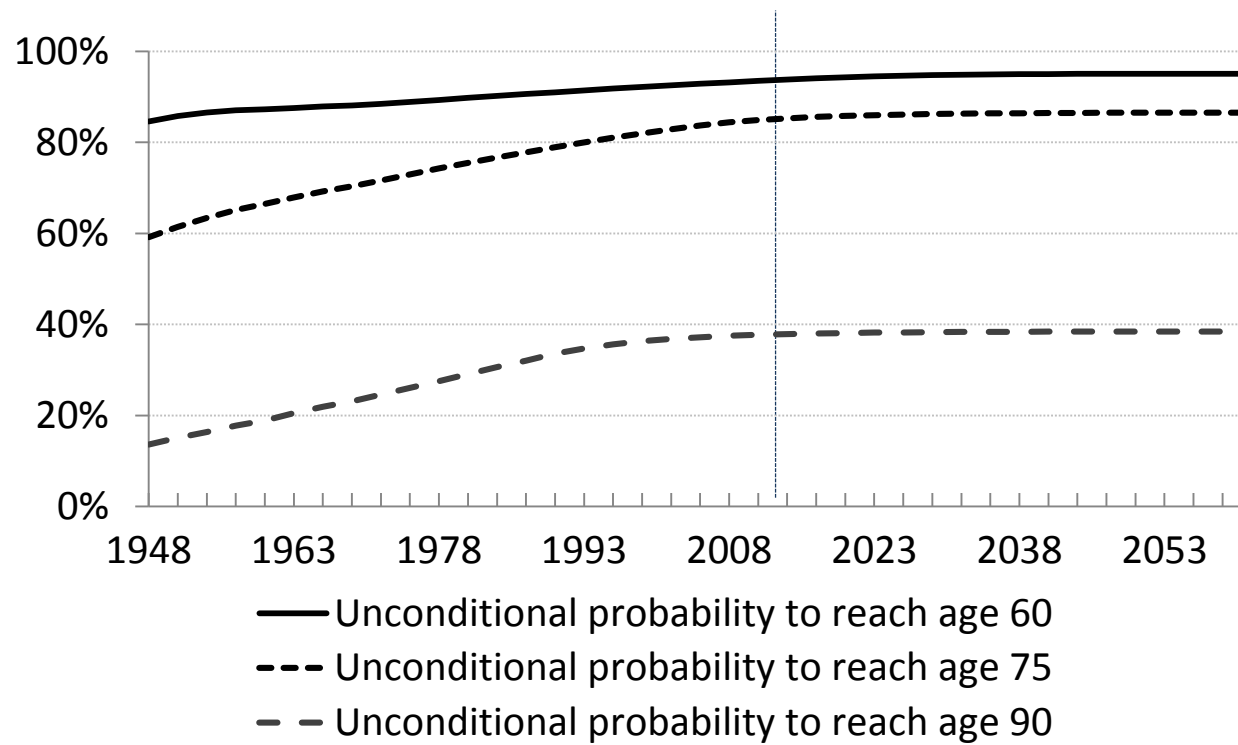


Data sources: Federal Planning Bureau (2016), Population forecasts; Belgian Federal Government

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Exogenous variables

Life expectancy: probability to reach high ages

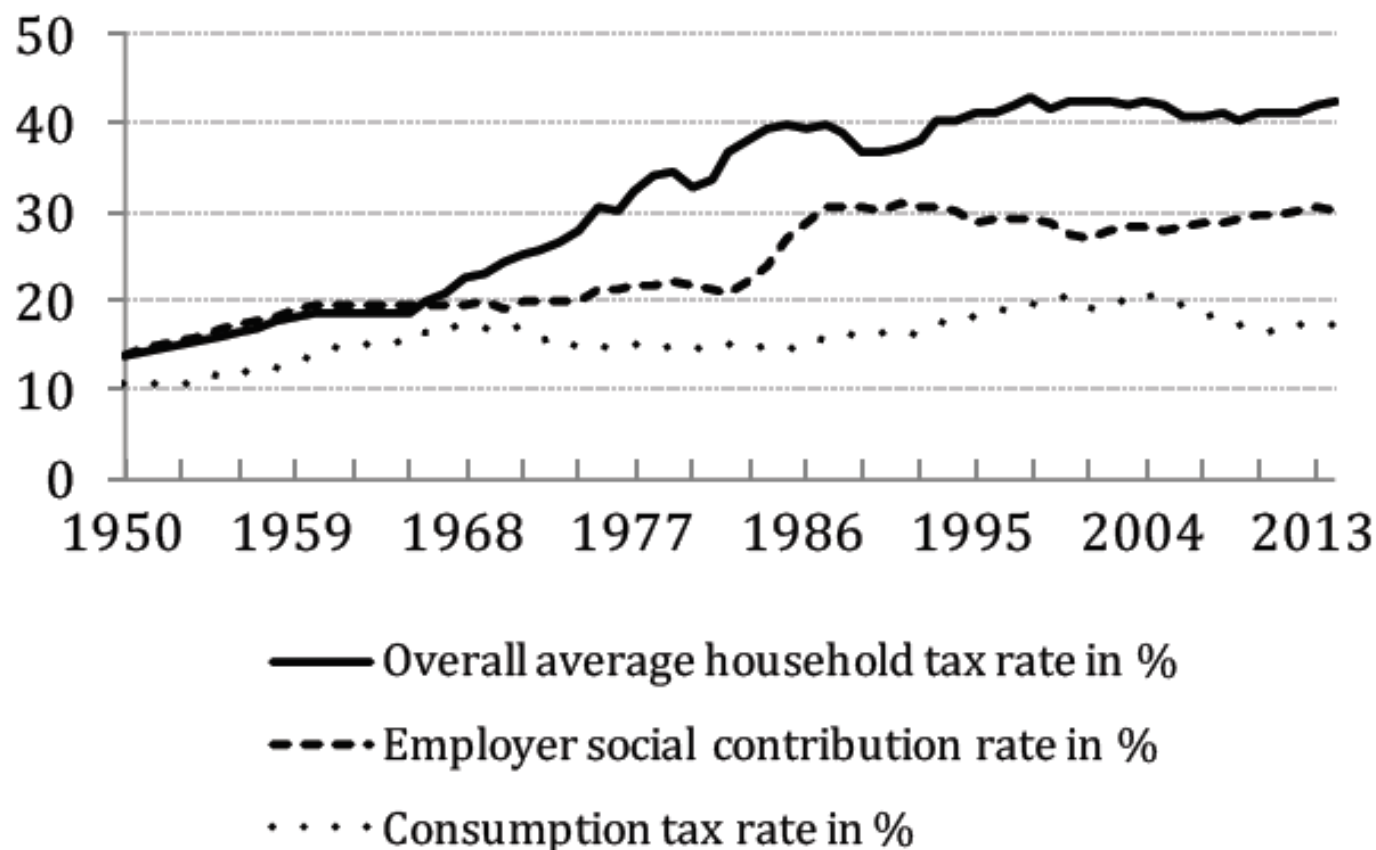


Data sources: Federal Planning Bureau (2016), Population forecasts; Belgian Federal Government

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Exogenous variables

Fiscal policy variables: tax rates

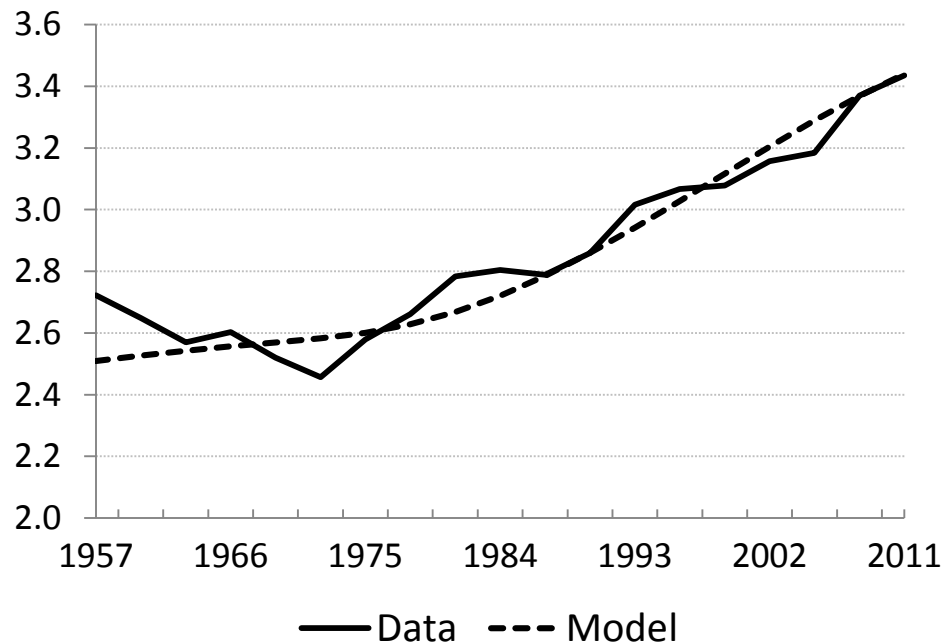


# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

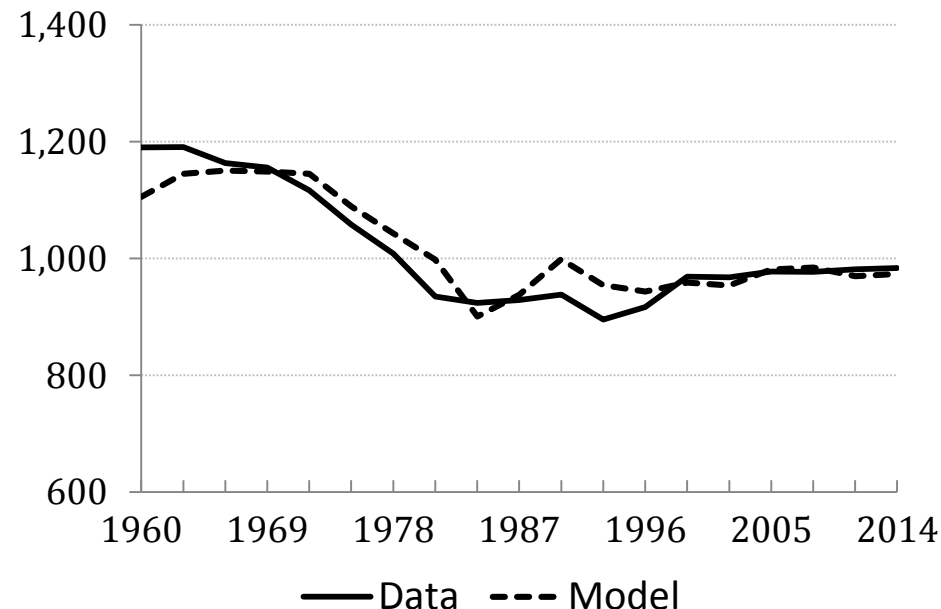
## Backfitting

- Before simulating the future: What is the quality of the model to match the evolution of key macroeconomic variables for Belgium since about 1960 ?

Physical capital-output ratio



Average annual per capita hours worked



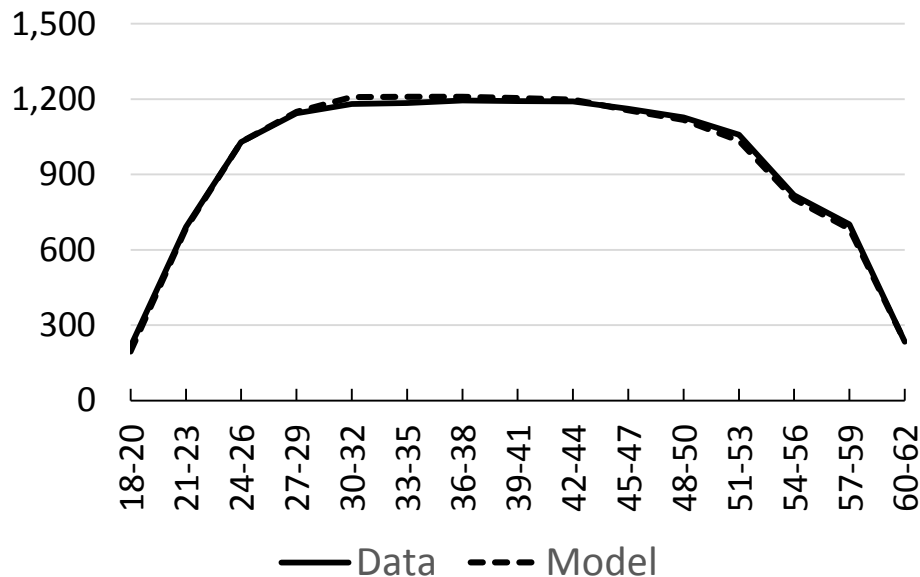


# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

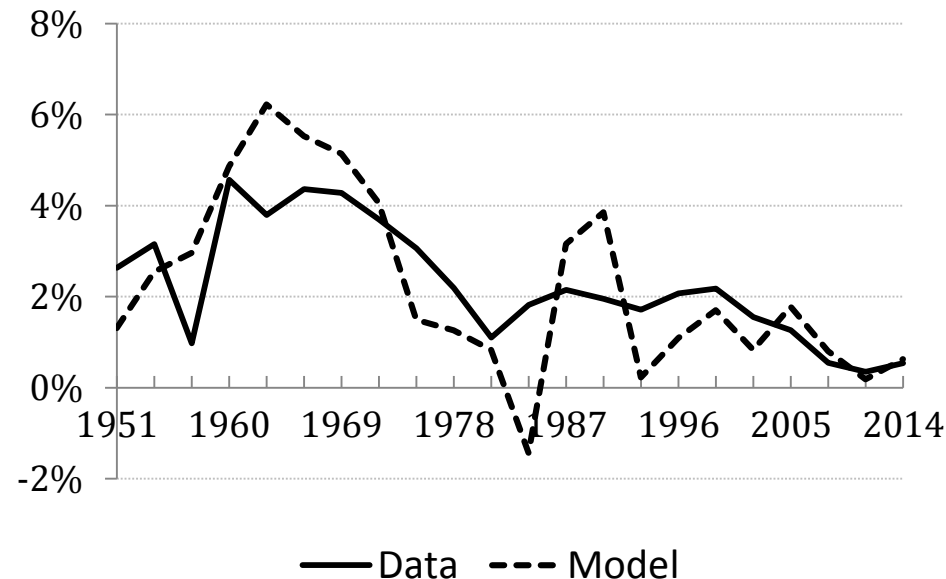
## Backfitting

- Before simulating the future: What is the quality of the model to match the evolution of key macroeconomic variables for Belgium since about 1960 ?

Annual per capita hours worked by age (2005-2007)



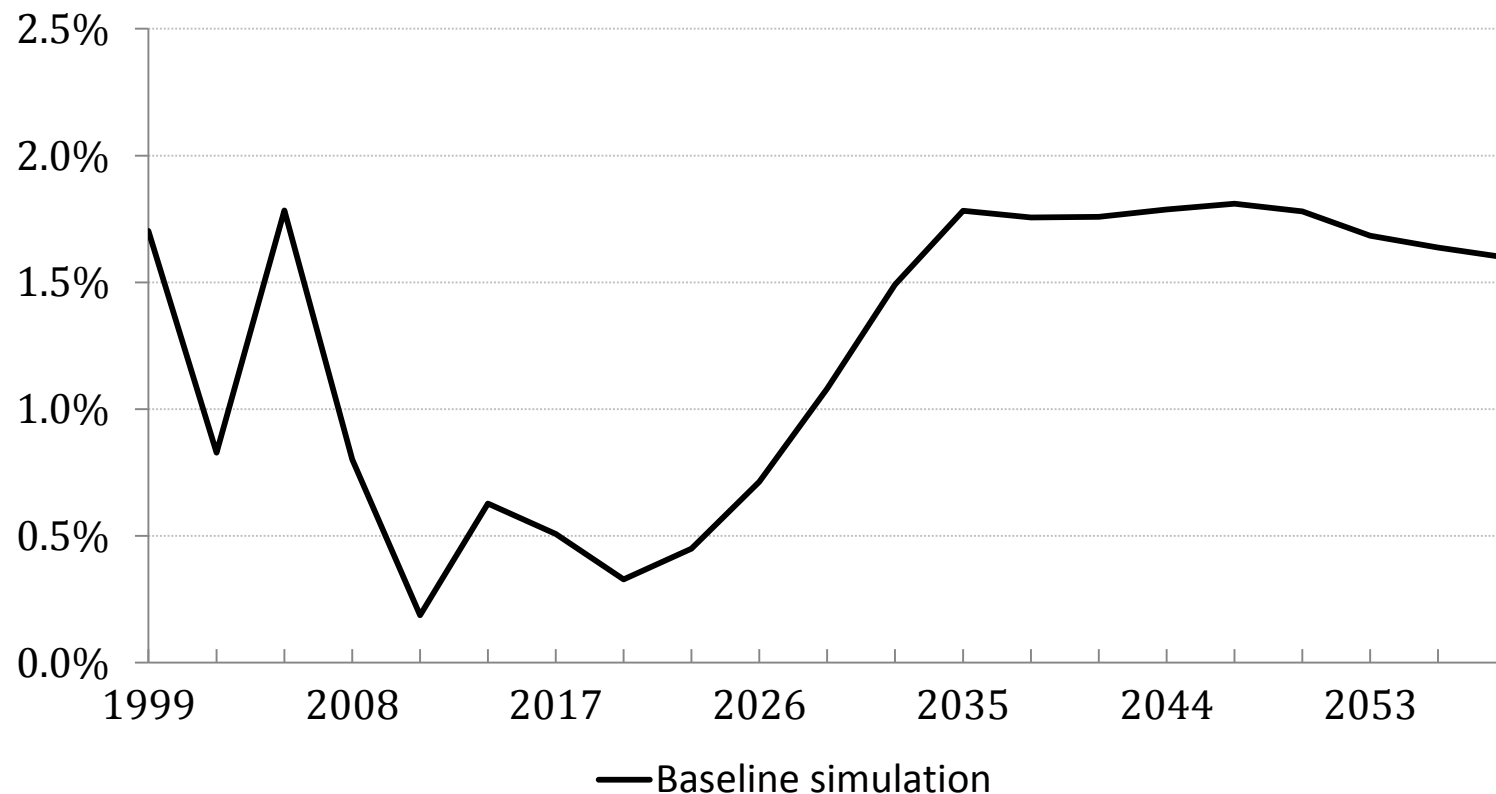
Average annual growth rate of potential GDP per capita



# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

Model simulations: macroeconomic effects of demographic change

Average annual per capita growth rate (baseline simulation)



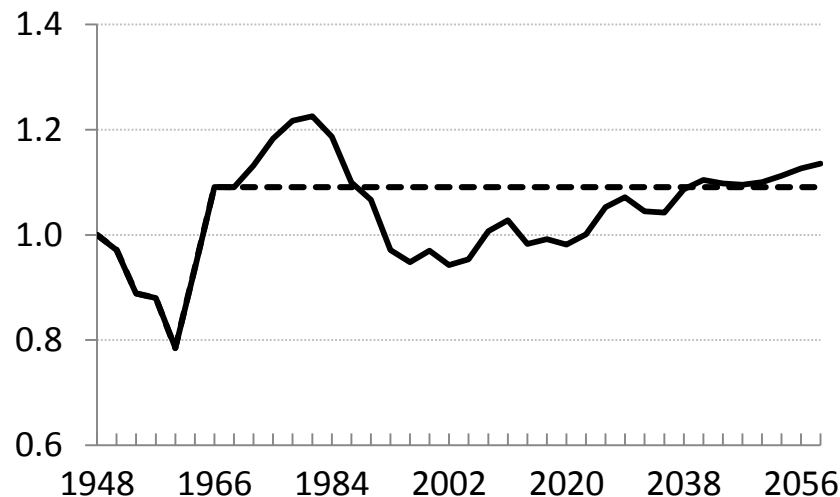
# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Model simulations: macroeconomic effects of demographic change

Counterfactual "no demographic change":

- The size of the youngest cohort remains constant at its 1966-68 level (year of birth 1948-50)
- The unconditional probability to survive remains constant at the level that holds for this cohort of 1966-1968

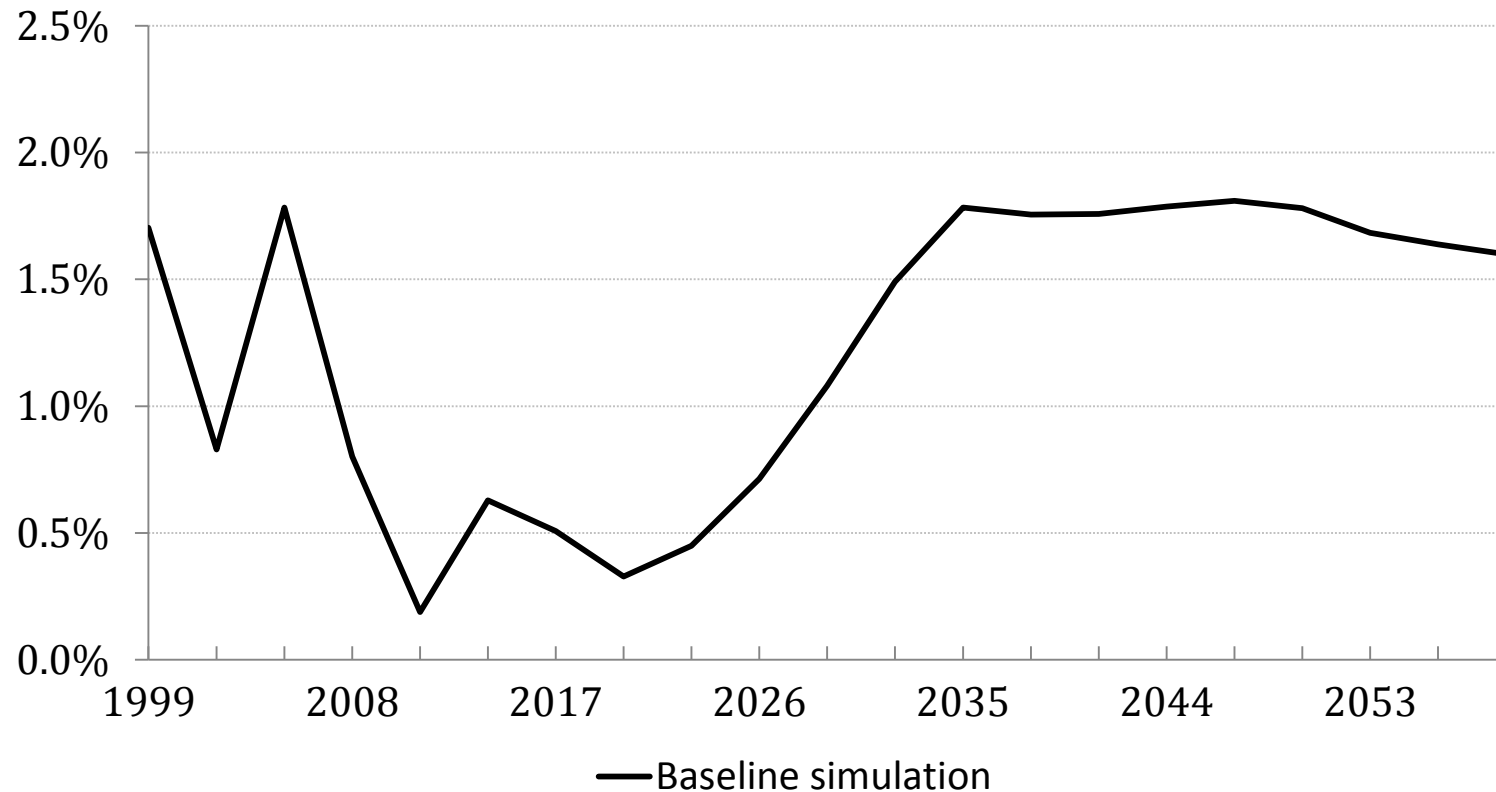
Size of the  
youngest cohort



# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

Model simulations: macroeconomic effects of demographic change

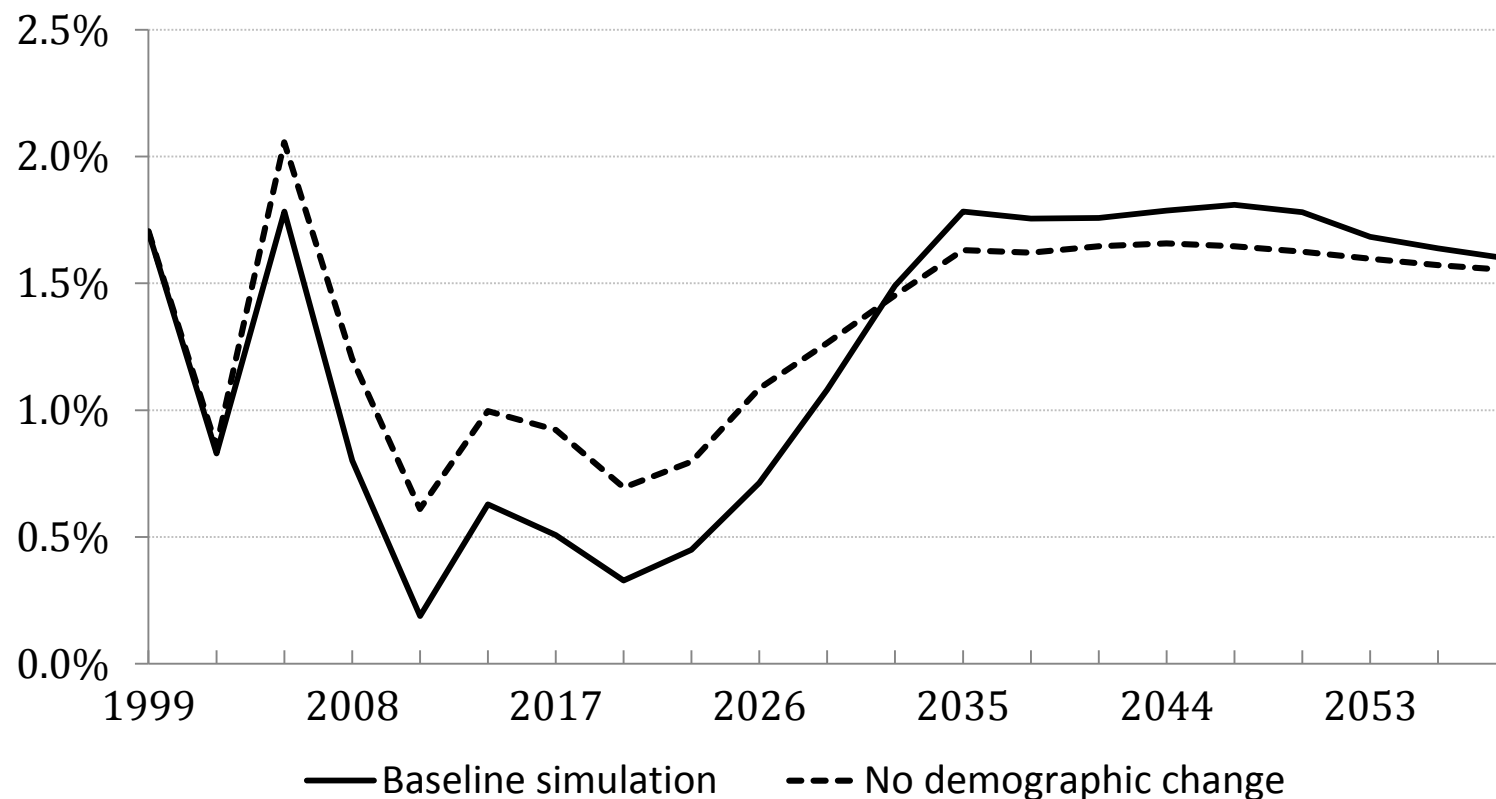
Average annual per capita growth rate (baseline simulation)



# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

## Model simulations: macroeconomic effects of demographic change

Average annual per capita growth rate



On average for 2010-40, effect of demographic change on per capita growth  
Arithmetical: **-0,4%-points**. Taking into account behavioural effects: **-0,2%-points**

# Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

What explains these net positive behavioural effects of demographic change?

Remember 
$$\frac{Y_t}{Pop_t} = \frac{Y_t}{Hours_t} \frac{Hours_t}{N_t} \frac{N_t}{Pop_t}$$

- A small positive effect on per capita hours worked (caused mainly by the rise in life expectancy)
- A very small positive effect on productivity growth (growth of output per hour)
  - Due to a positive effect on fraction of time allocated to education (caused by the rise in life expectancy)
  - DESPITE: Negative effect on investment in physical capital (mainly due to fall in fertility and population at working age)
- Strong increase in savings (due to rising life expectancy), but this is not invested in the domestic economy). We observe sizeable capital outflow.

# Main research question and outline

---

Is ageing bad for the economy (per capita growth)? If the answer is yes, how bad?

Unfortunate demographic arithmetic

Behavioural effects / adjustments to demographic change

Net macroeconomic effects in dynamic general equilibrium (OLG model for a small open economy)

- Main characteristics
- Parameterization (see paper)
- Backfitting
- Model simulation: macro effects of demographic change

**Conclusions and policy implications**

# Conclusions, policy implications

---

Assuming unchanged (fiscal and pension) policies, and with technological progress and the world interest rate being given,...

... demographic change is expected to cut off about 0,2%-point from average annual per capita growth in Belgium in the next 25 years.

This negative effect is smaller than one could expect if households and firms did not adjust their behaviour.

Although theory is not unambiguous, the behavioural effects of demographic change are positive (especially the effects of increasing life expectancy).



# Conclusions, policy implications

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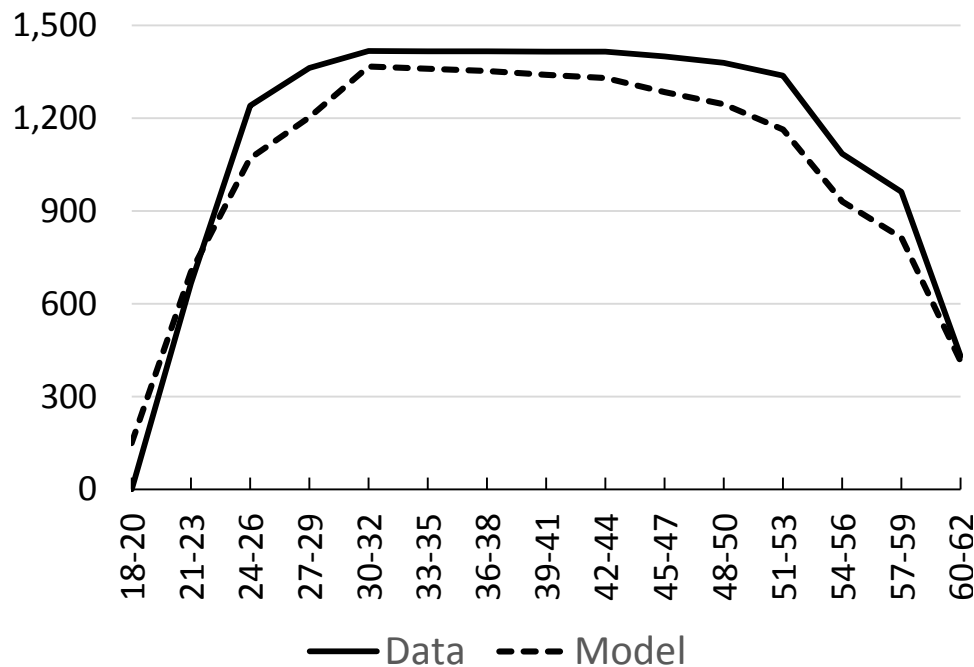
The potential for policy changes to reinforce these positive behavioural effects in Belgium is huge:

- Enormous potential to raise hours worked per capita (Hours/N), which is currently far below the level in most other countries... due to low hours worked among older workers, high unemployment among low educated workers  
(tax shift, pension reform.... )
- Labour productivity growth in Belgium is below productivity growth in the EU for almost 2 decades.

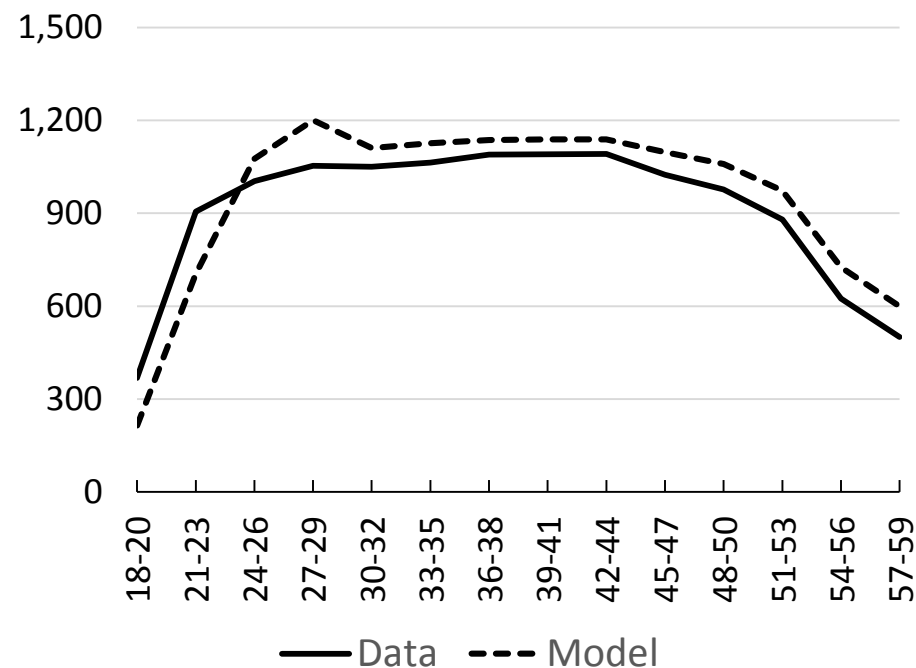
# Auxiliary slides

## Backfitting

Average annual per capita hours worked (2005-07):  
high educated (tertiary degree)

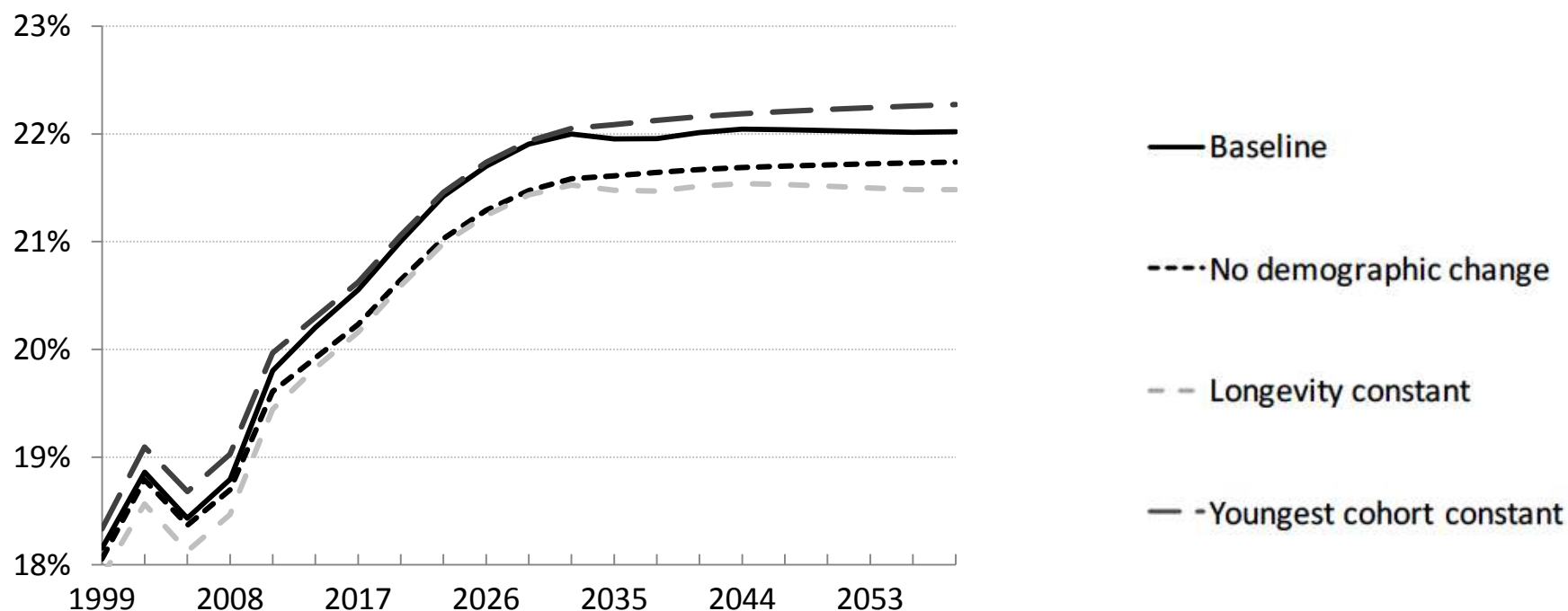


low educated (no higher secondary)

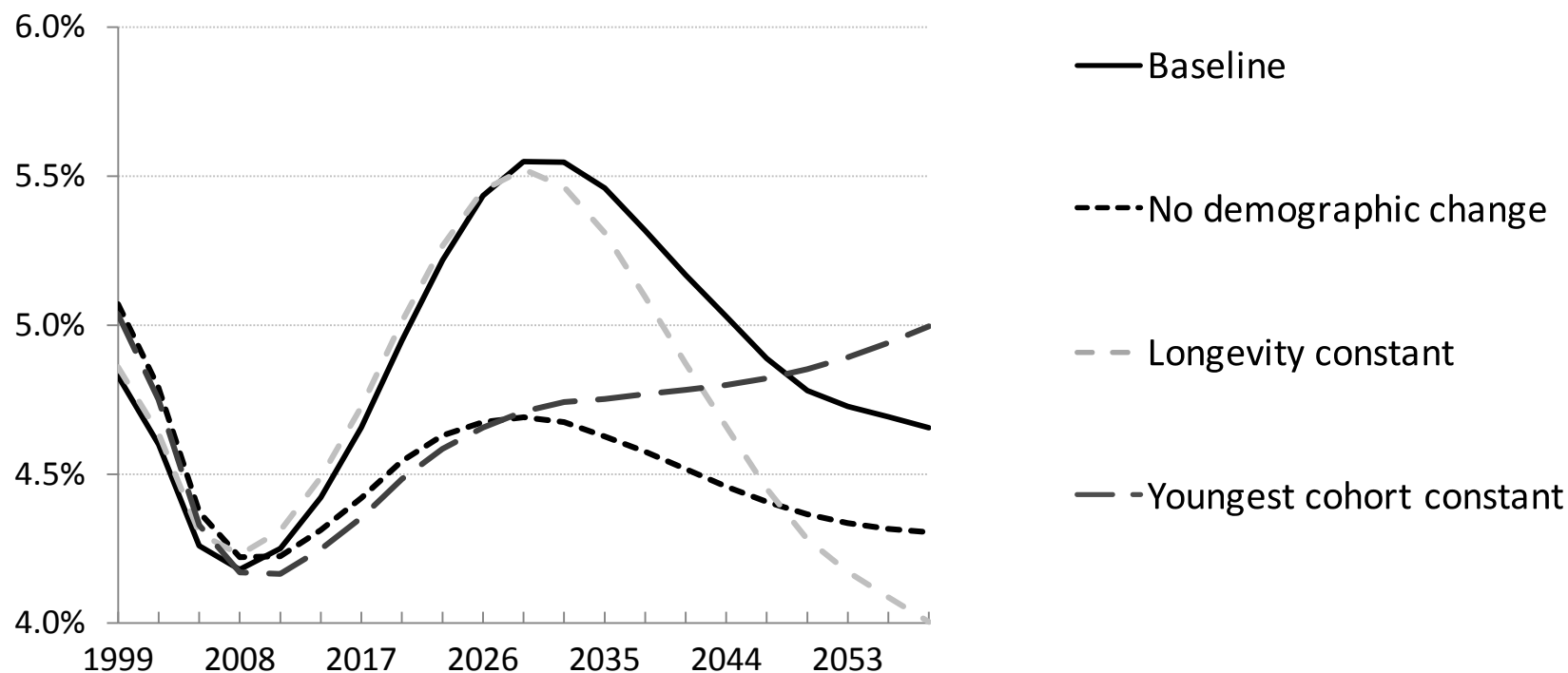


# Counterfactuals: effect of demographic change

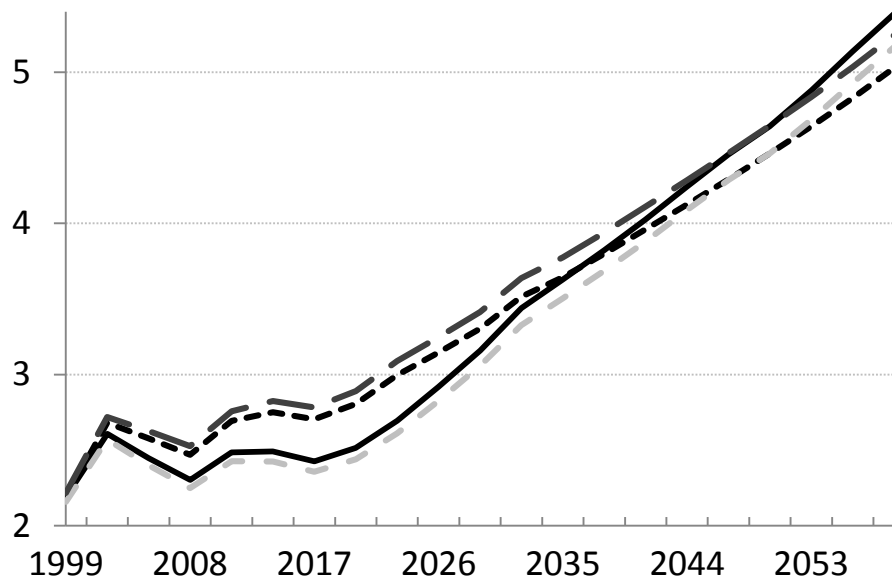
- Positive effect on fraction of time allocated to education by high ability



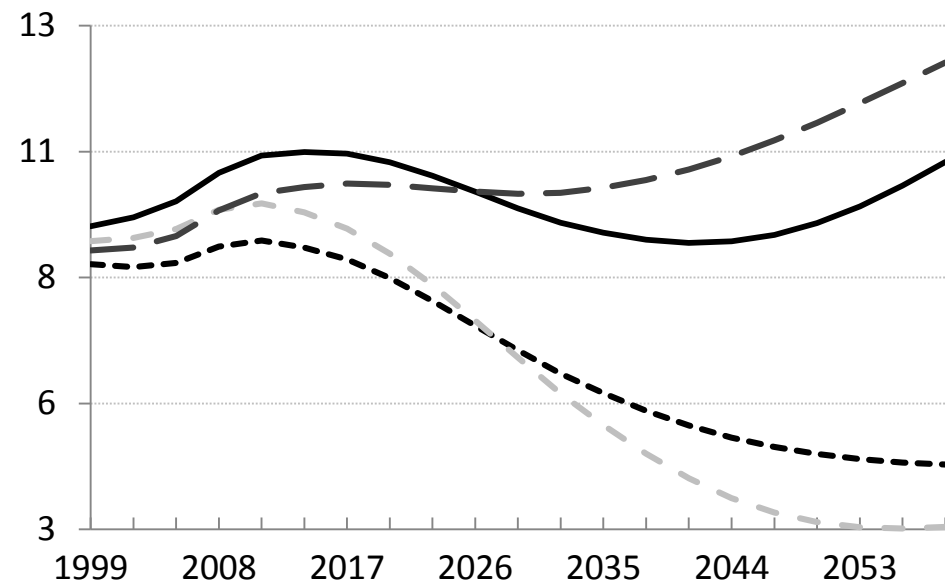
## Public pension expenditures (% GDP)



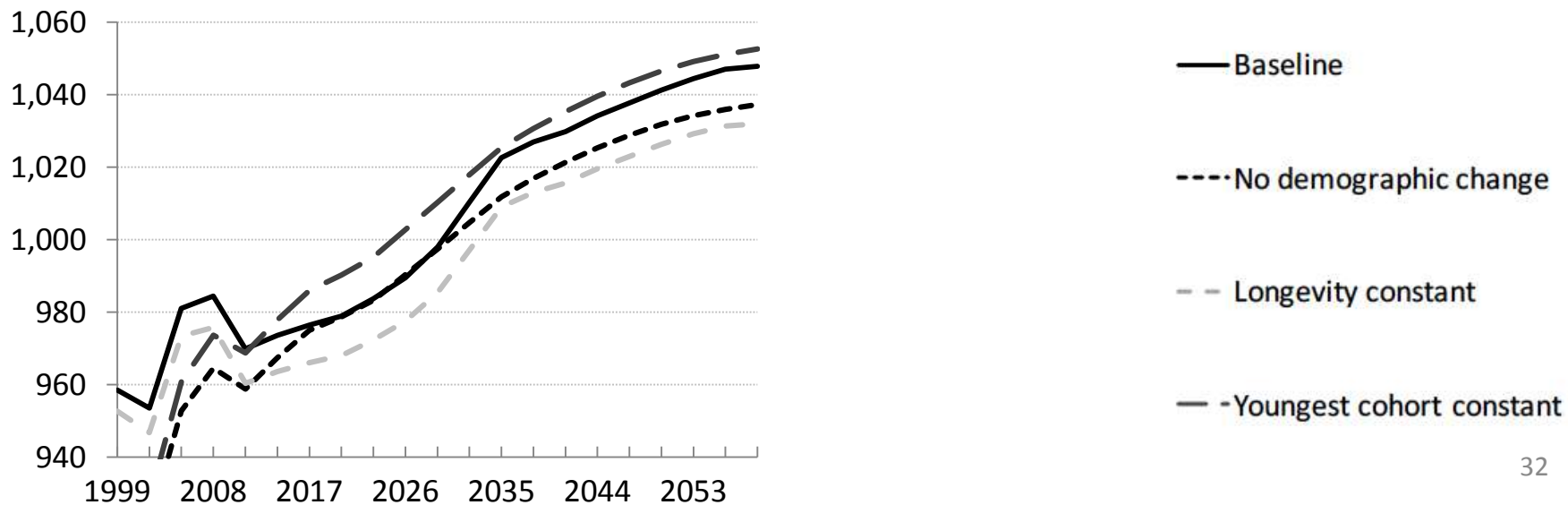
### Gross investment



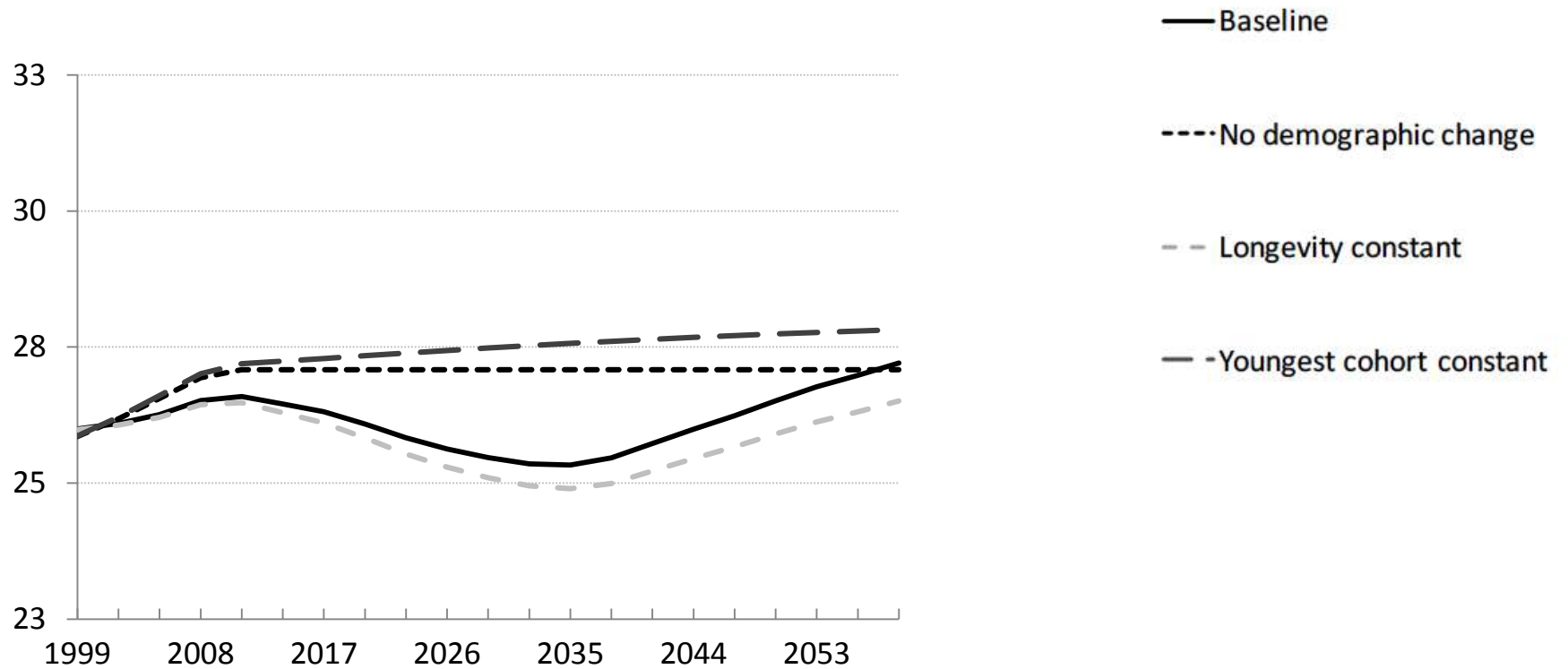
### Stock of non-human wealth



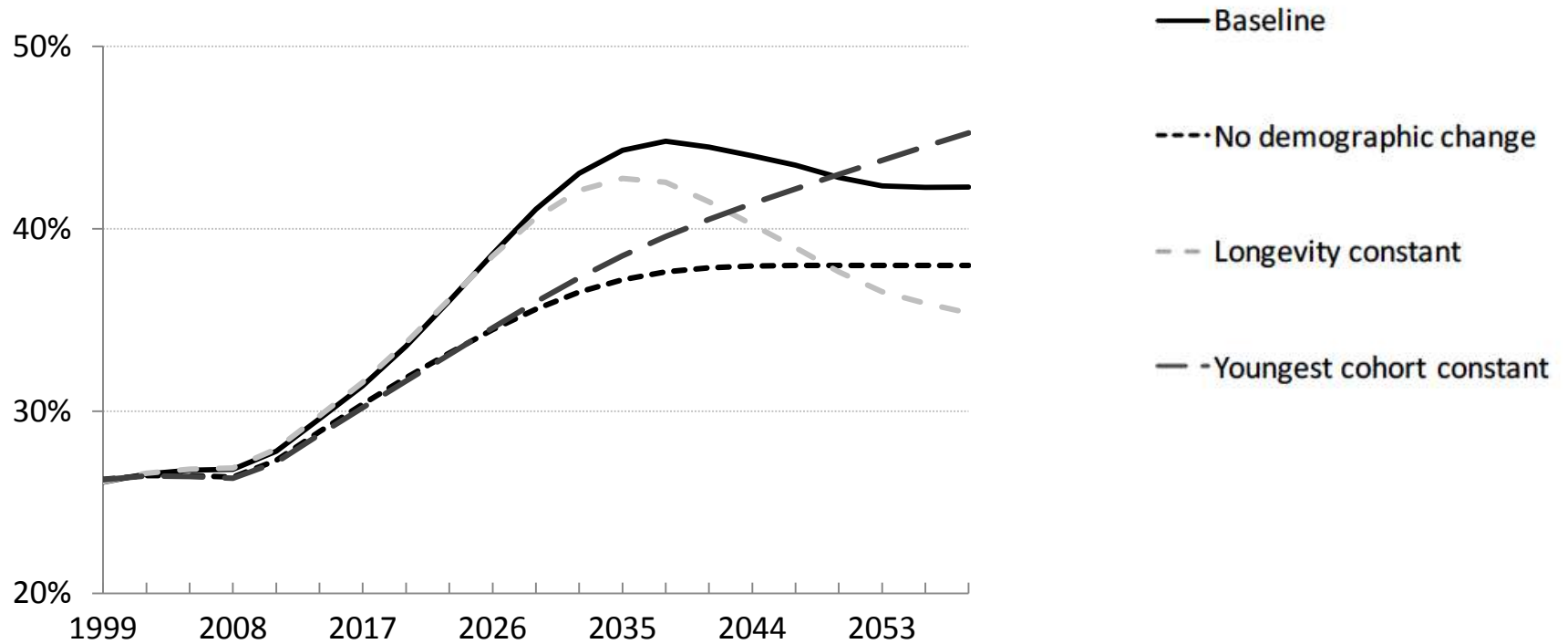
### Average annual hours worked per person at working age



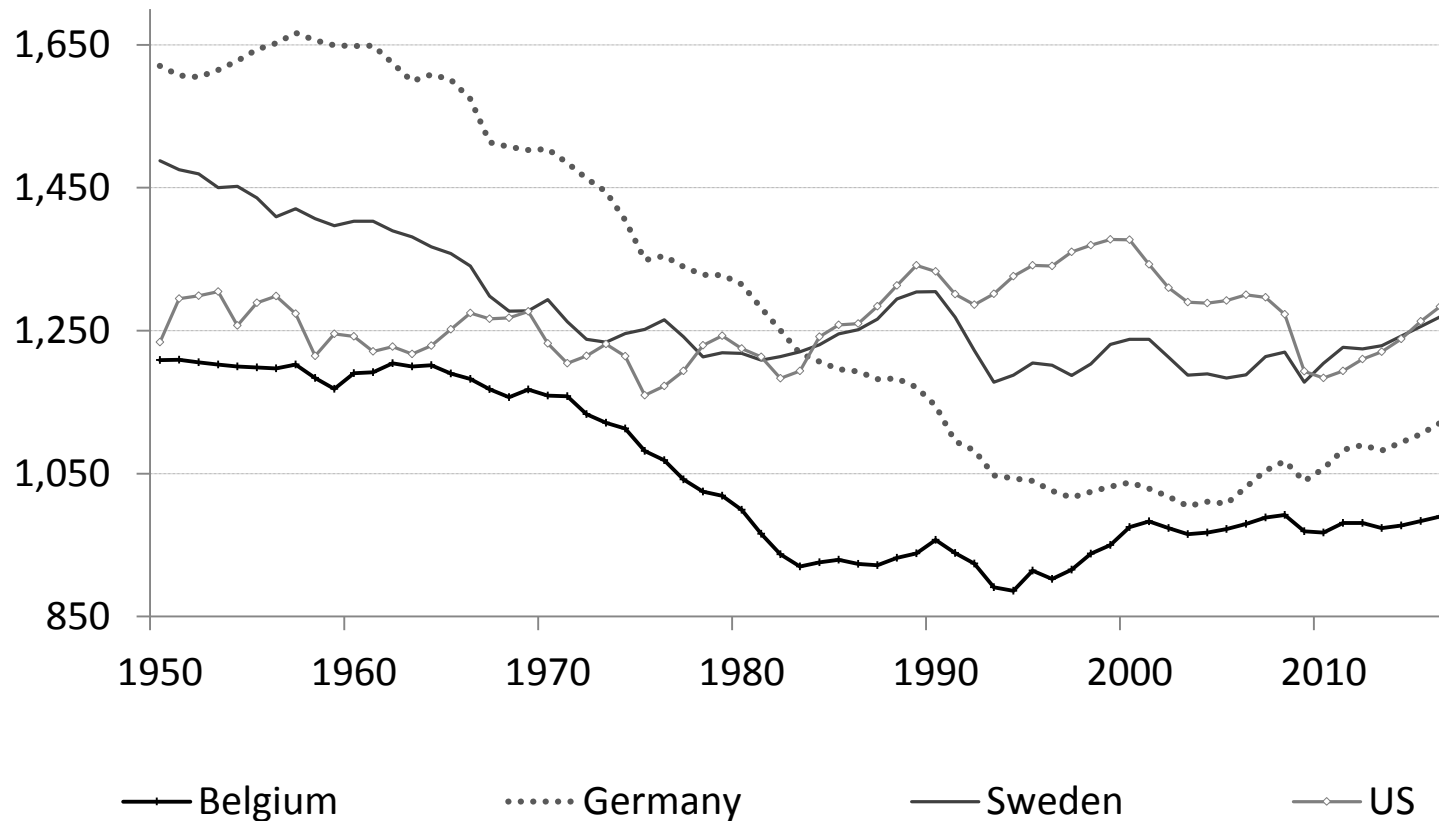
## Population at working age (18-64)



## Old-age dependency ratio

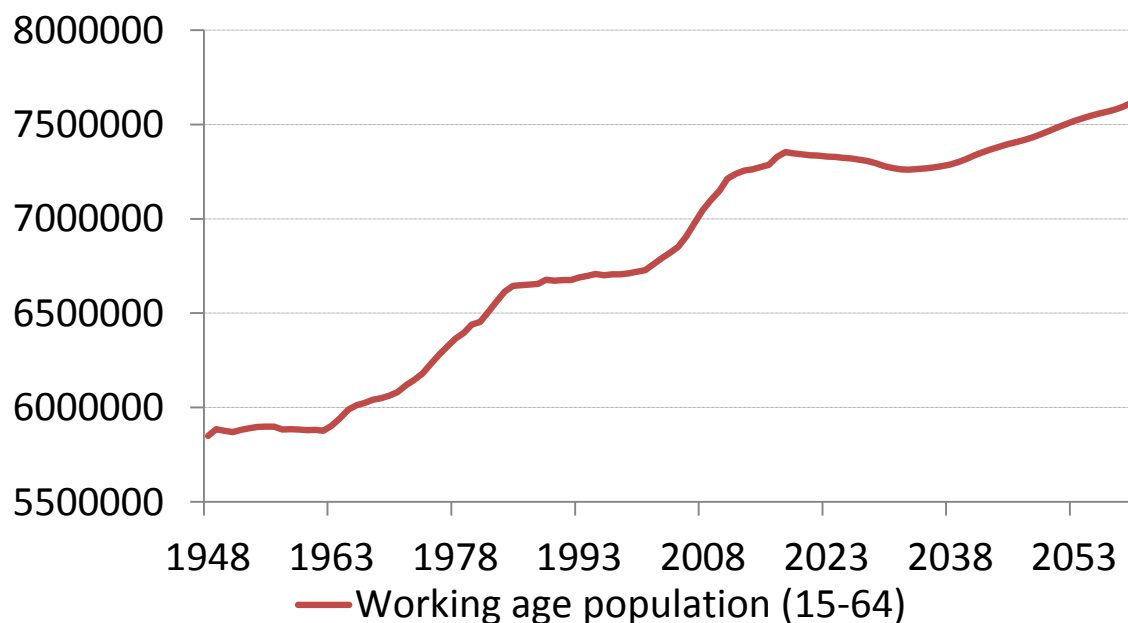
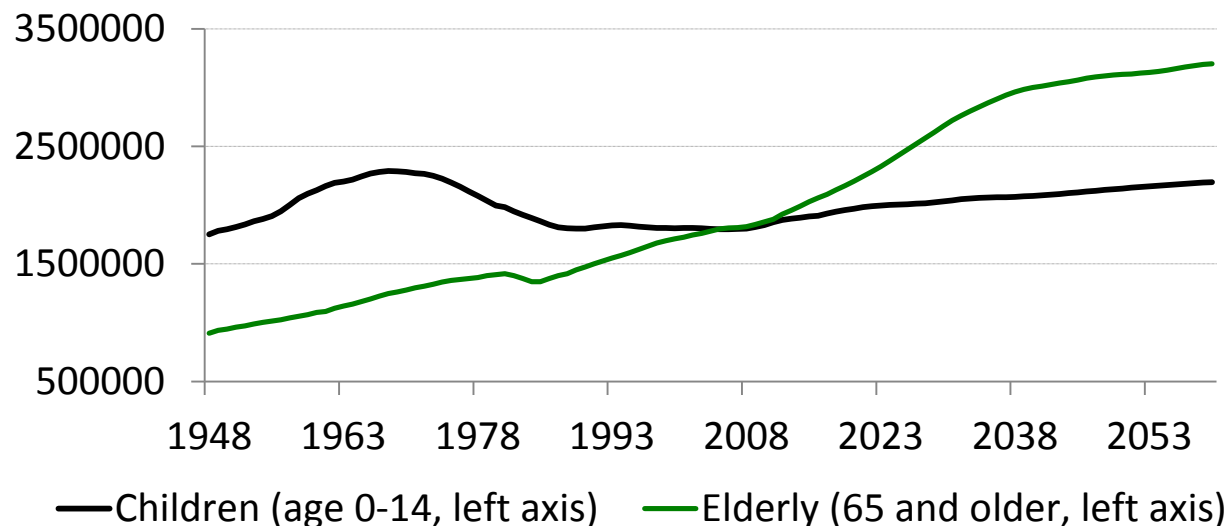


## Average annual hours worked per person at working age in four countries





## Appendix: demography and projections for future demography in Belgium



Data : Federal Planning Bureau,  
"Bevolkingsvooruitzichten 2016-  
2061"

# A quantitative evaluation of education with an aging population in Germany

Thomas Davoine

February 2017



INSTITUT FÜR HÖHERE STUDIEN  
INSTITUTE FOR ADVANCED STUDIES  
Vienna

# Next

- Motivation
- Approach and Model
- Quantitative results
- Concluding remarks

# Context

Old-age social security (pensions, healthcare and long-term care) expenditures will increase much as the age pyramid in developed economies is projected to shift up:

Ratio of 65+ over 15-64 years old, Germany, 2013: 32 %

Ratio of 65+ over 15-64 years old, Germany, 2060: 59 %

Increase in these expenditures, Germany, 2013-2060: 5.0 pp of GDP\*

\*: Total public expenditures, Germany, 2014: 45 % of GDP

Source Ageing Working Group (2015)

# Ageing and aggregate productivity: the role of education

- Population ageing with current trend of pension reforms: financing challenge
- Main driver: drop in labor supply per capita (over *entire* population)
- More education can increase *aggregate* productivity ...
- ... which could increase the wage base, government revenue and thus ease the financing challenge
- Questions: is that so? how much?

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# What we know so far

What is the effect of population aging (and institutions) on education incentives ?

Study	Driver	Education
Bouccekine et al. (2002)	Longer amortization period	More
Lau - Poutvaara (2006)	Larger flat part in pensions	Less
Casarico-Devillanova (2008)	Larger redistribution via pensions	Less

⇒ net effect (population aging, pension systems with redistribution) ?

- Ludwig, Schelkle and Vogel (2012) quantitative analysis (with representative agent) ⇒ more education
- ... but does not capture redistribution
- ... and ignores differences in labor market realities across education levels



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- ... and ignores differences in labor market realities across education levels

# Contribution

What is the effect of population aging (and institutions) on education incentives ?

The analysis here is performed with:

- Redistribution between skill classes
- Differences in labor supply elasticities across skill classes
  - In particular, low-skilled more responsive along the participation margin
  - Presumably, reason 1: household preferences
  - Presumably, reason 2: labor market constraints (assumed: only reason)

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- Quantitative results
- Concluding remarks

# Approach

Simulations with a Computable General Equilibrium model:

- Used for tax and pension reforms analysis (EU, Austria)
- Standard model with overlapping-generations (OLG) and endogenous labor supply decisions
- Extended to 3 skill levels with endogenous education decisions following Heckman, Lochner and Taber (1998)

With a conservative choice for labor supply elasticities differences. For example:  
Evidence:

Elasticity	Low	Medium	High	Interpretation
Participation	0.30	0.20	0.10	% increase in participation rate for 1% increase in labor income

Source: Immervoll, Kleven, Kreiner and Saez (2007) simulations

Model choice:

Elasticity	Low	Medium	High	Interpretation
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# Scenarios

Scenarios considered:

Scenario	Demographics	Education	Financing
<i>CONST</i>	Aging	Constant	Labor income taxes
<i>EDUC</i>	Aging	Endogenous	Labor income taxes

Demographic and institutional changes (pensions, health and long-term care) following Ageing Working Group (2012)

# Simulation results

	2010	<i>CONST</i> 2060	<i>EDUC</i> 2060
Population (15+)	100.0	86.1	86.1
Dependency ratio	32.1	59.9	59.9
Effective retirement age	60.6	62.1	62.0
Low-skill population (% population)	22.9	22.9	24.5
Medium-skill population (% population)	55.7	55.7	57.1
High-skill population (% population)	21.4	21.4	18.4
Employment (yearly hours per worker)	1419	1400	1385
Effective employment (yearly hours per capita)	712	586	567
Pension payment per beneficiary (change in %)	-	-17.9	-18.5
GDP/worker (change in %)	-	3.7	0.8
GDP/capita (change in %)	-	-13.4	-17.8
Consumption/capita (change in %)	-	-11.0	-14.8
Tax ratio (with transfers) (in % GDP)	38.1	48.2	50.7
Tax ratio (with transfers) (change in pp GDP)	-	10.1	12.6
Diff tax ratio (change in pp GDP)	-	-	2.5

Note: per capita pension, GDP and consumption figures are provided relative to the growth trend.

# Simulation results

## Main observations:

- ① Education incentives decrease: the high-skills share in population goes from 21.4 % to 18.4 %
- ② Lower average productivity and participation (low-skilled work less) leads to drops in output: -17.8 % instead of -13.4 % (compared to trend)

Other observation: neglecting education decisions underestimates the public finance cost of population aging (2.5 pp of GDP bias), as health and long-term care expenditures are the same but not productivity (nor production)

# Decomposing the drop in education incentives

Scenario		Change Share High-Skills ( $\Delta$ p.p.)
<i>EDUC</i>	Baseline	- 3.0
A	Non-distorting financing instrument	- 2.2
B	Reduced skill differential in labor supply elasticities and home production value	- 0.4
C	A + B	0.0

Legend:  $\Delta$ p.p. = p.p change in high-skills share of the population from 2010 to 2060

Scenario B: outside value to employment (home production) identical across skill classes  
+ 35 % smaller gap between labor elasticities parameters across-skill classes

# Decomposition results

## Findings:

- Distortive taxation, under partially flat pensions (A): explain 0.8 from 3 pp gap
- Smaller differences in labor supply elasticities across skill classes (B): explain 2.6 from 3 pp
- Jointly (C): explain 3 from 3 pp

## Why (B)? Intuition:

- With (near) constant retirement age, population aging drops capital-labor ratio, increases wages
- As low-skilled are more responsive to increases in wages, they increase labor supply, lifetime earnings and consumption more

# Policy interpretation

To promote education and thus higher average productivity with an aging population...

- A: financing old-age expenditures is better with lower government spending than increases in labor income taxes
- B: look for measures which reduce differences in labor supply constraints
  - Promote work-life balance, targeting high skill employment
  - Eliminate asymmetries in working contracts (e.g. remove free overtime from high-skill resources)

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# Concluding remarks

## Summary:

- Negative *net* impact of population aging and institutions on education incentives in DE: share of high-skills from 21.4% to 18.4% in 2060
- New channel: because low-skill workers are more responsive to wage increases due to aging, their individual labor supply, lifetime earnings and consumption increases more than for educated workers

## Policy implication:

- Remove unattractive features of the labor market for high-skill employees ...
- ... or the education level, average productivity and output may be depressed by population aging

# Concluding remarks

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## Policy implication:

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- ... or the education level, average productivity and output may be depressed by population aging

Thank you for your comments !

# Appendix - Model

Standard Overlapping-Generations (OLG) model with...

- Imperfect labor markets
- Endogenous participation, job search and work hours decisions
- 3 skill levels with endogenous education decisions following Heckman, Lochner and Taber (1998)
  - Households are born with random learning ability  $v$
  - Education is costly (foregone earnings) and painful (disutility costs  $c^M(v)$  and  $c^L(v)$ )
  - With higher education comes higher productivity (wages)
  - Household  $i$  educate (medium level) if and only if expected lifetime utility  $V^{0,M} - c^M(v_i) \geq V^{0,L}$
- Institutions, including flat and earnings-related pensions
- ... as well as (exogenous) health and long-term care expenditures

## Appendix - Household maximization

Given a skill level  $i$ , households maximize expected lifetime utility  $V_0^{0,i}$  in period  $a = 0$ , with:

$$V_t^{a,i} = \max \left[ \left( Q_t^{a,i} \right)^\rho + \gamma^a \beta \left( G V_{t+1}^{a,i} \right)^\rho \right]^{1/\rho},$$

such that the budget constraint (with reverse life-insurance) holds:

$$G \gamma^a A_{t+1}^{a,i} = R_{t+1} \left( A_t^{a,i} + y_t^{a,i} - C_t^{a,i} \right).$$

With effort-adjusted consumption (Greenwood, Hercowitz and Huffman, 1988):

$$Q^{a,i} = C^{a,i} - \bar{\varphi}^{a,i} (\delta^{a,i}, s^{a,i}, l^{a,i}),$$

for total disutility of labor (net of outside option values, with an assumption):

$$\begin{aligned} \bar{\varphi}^{a,i} = & \delta^{a,i} \left[ (1 - u^{a,i}) \varphi^{L,i} (l^{a,i}) + (1 - \varepsilon^{a,i}) \varphi^{S,i} (s^{a,i}) \right] + \\ & \varphi^{P,i} (\delta^{a,i}) - (1 - \delta^{a,i} + \delta^{a,i} u^{a,i}) h^{a,i}. \end{aligned}$$

# Appendix - Calibration Details

Labor supply:

- Evidence that low-skilled workers are more responsive along the extensive margin ...

Elasticity	Low	Medium	High	Interpretation
Participation	0.30	0.20	0.10	% increase in participation rate for 1% increase in labor income

Source: Immervoll, Kleven, Kreiner and Saez (2007) simulations

- ... and to a lesser extent the intensive margin
- Inconclusive evidence along the job search margin
- Choice:

Elasticity	Low	Medium	High	Interpretation
Participation	0.20	0.17	0.10	% increase in participation rate for 1% increase in labor income
Hours worked	0.10	0.09	0.08	% increase in hours for 1% increase in wage rate

## Appendix - Sensitivity Analysis

	Scenario	Share High-Skills (%)	Tax Ratio ( $\Delta$ p.p.)
-	Initial steady state (2010)	21.4	-
<i>EDUC</i>	Baseline	18.4	4.6
D	Smaller education response	18.8	4.2
E	Larger education response	18.1	4.8
F	Multiplicative labor income tax variations	17.6	6.1
G	Health and long-term AWG risk scenario	18.3	5.2
H	Age-neutral health and long-term care costs	18.8	3.0
I	Very low elasticity of job search	18.6	3.2