

# Age and Productivity Differences

Katholieke Universiteit Leuven  
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Vegard Skirbekk  
World Population Program,  
IIASA (International Institute for Applied Systems Analysis)



# Ageing global and inevitable

”A substantial degree of population ageing is expected over the next few decades in all regions of the world

[...] unlikely that policy interventions intended to encourage childbearing in low-fertility countries could substantially alter this expectation.

[...] no plausible assumption about international migration levels would have more than a moderate impact on the expected degree of population ageing that will be experienced in future decades by countries all over the world.”

# EU grows older...

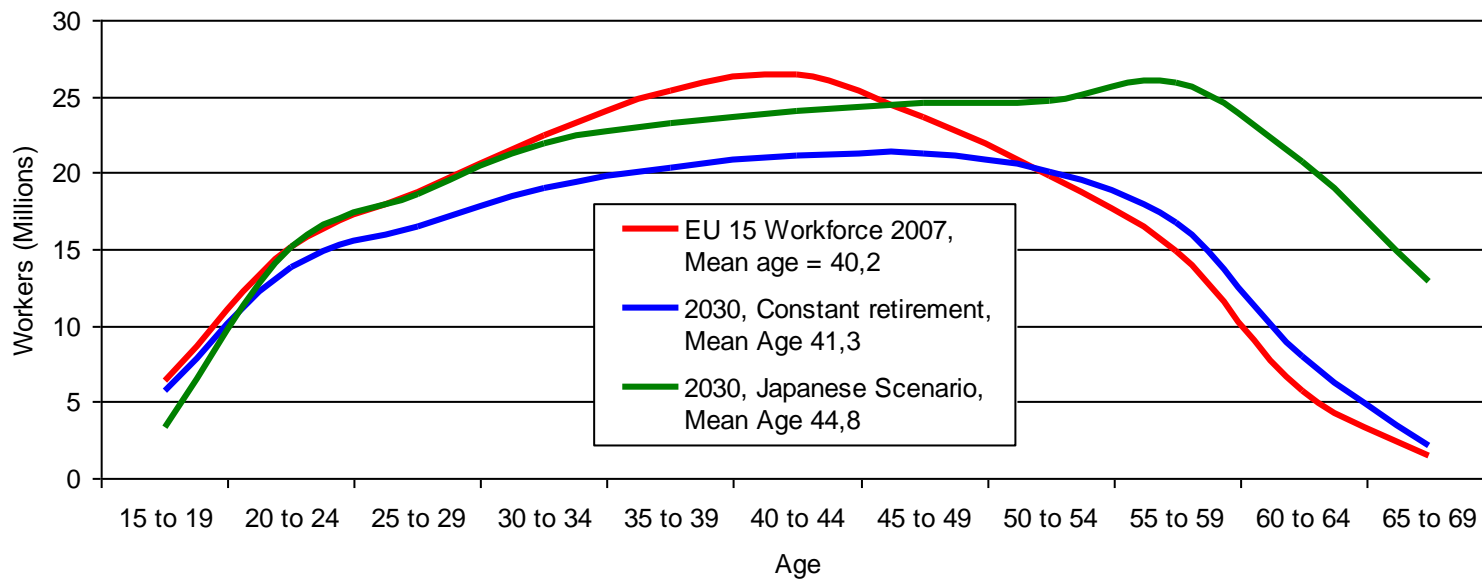
Age composition - EU 27  
(UN medium variant population projections)



Source: UN 2007, Medium variant

... and later retirement ->  
faster workforce ageing

## Age Composition of the Workforce

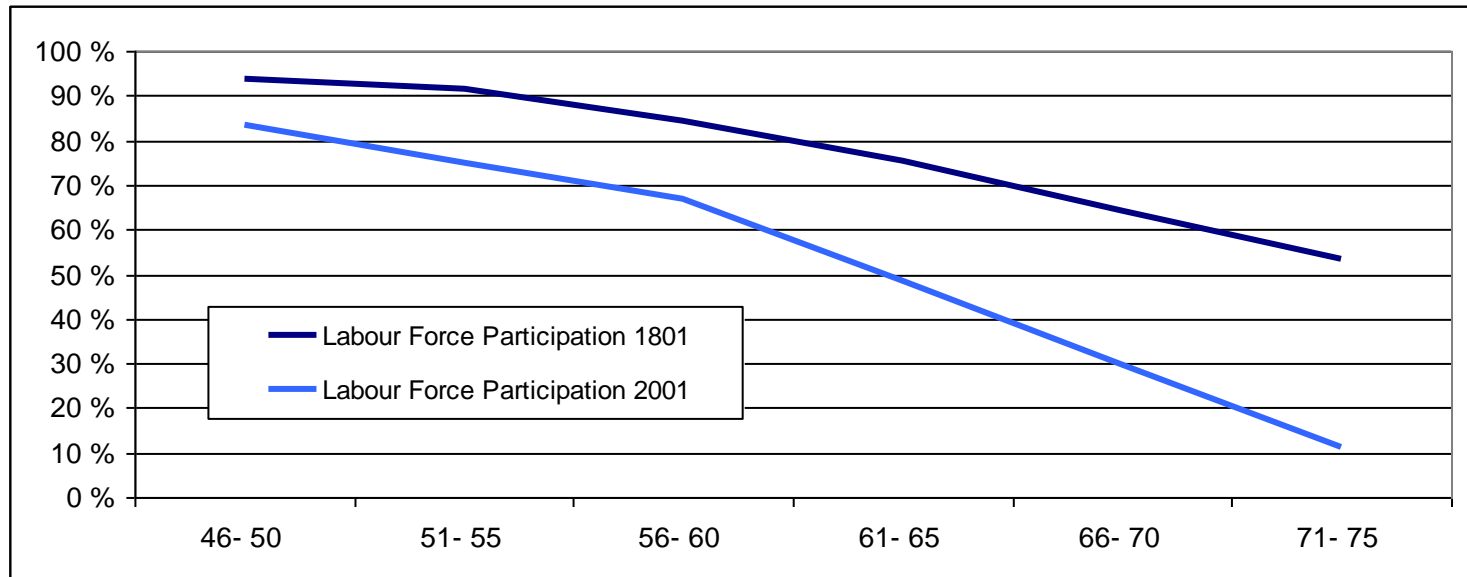


...but higher retirement ages would imply stable dependency ratio...

- Male effective average retirement ages vary from 58 to 73 years across OECD 2000-2005
- In Iceland and Japan it is close to 69 years, while in Belgium and Austria it is close to 59 years

# Young retirement new phenomenon

## Norwegian labour force participation 1801 and 2001



Source: Norwegian Census data

# Later retirement ages - > Stable dependency ratios

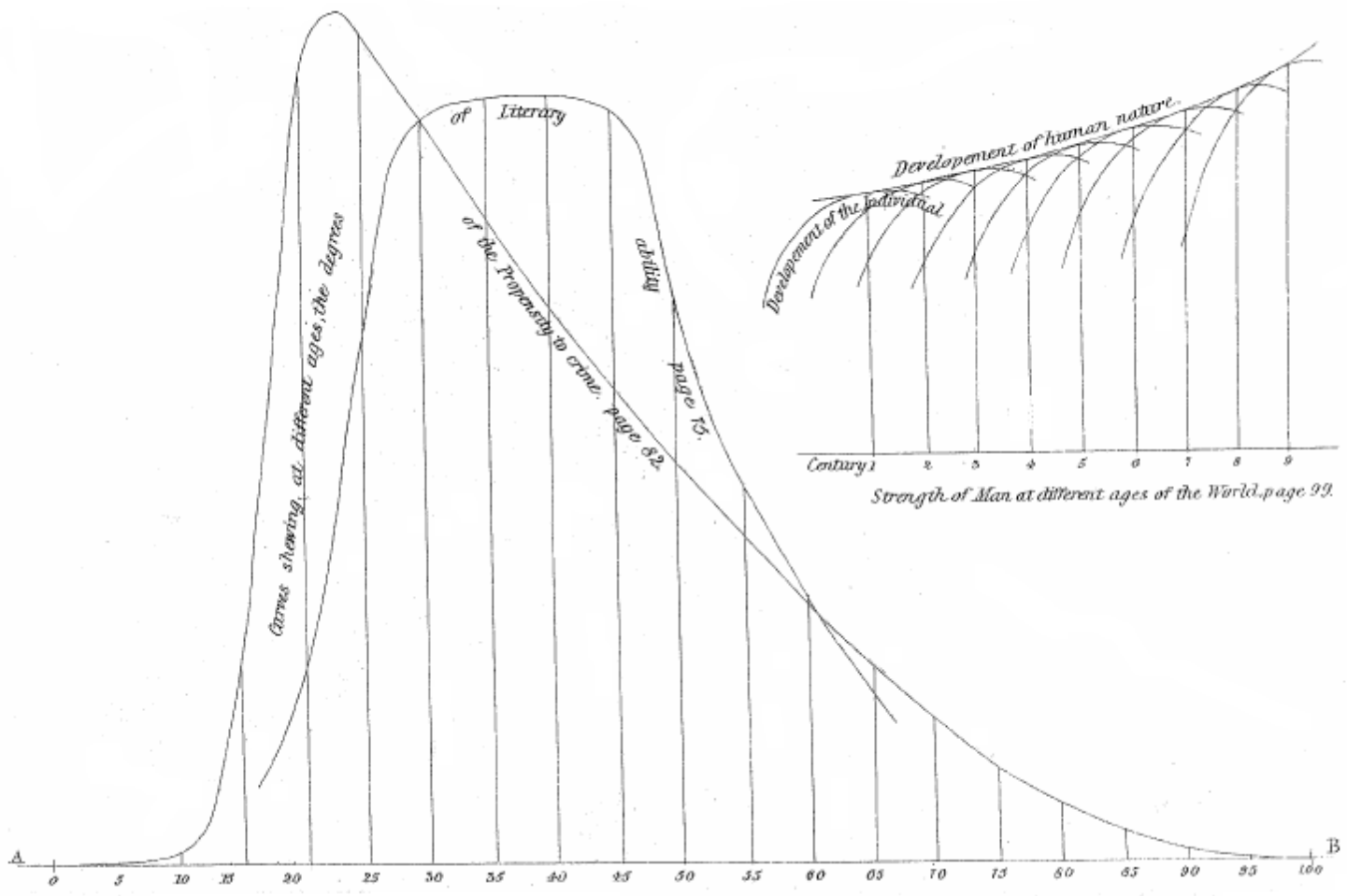
Belgium			
	2010	2030	2050
Ages 15- <b>59</b> years/ [Ages 0-14 + Ages <b>60</b> -]	<b>1.33</b>	1.01	0.88
Ages 15- <b>64</b> years/ [Ages 0-14 + Ages <b>65</b> -]	1.70	<b>1.30</b>	1.10
Ages 15- <b>69</b> years/ [Ages 0-14 + Ages <b>70</b> -]	2.04	1.69	<b>1.35</b>

# Age and productivity

Increasing employment at older ages could depend on age-variation in productivity

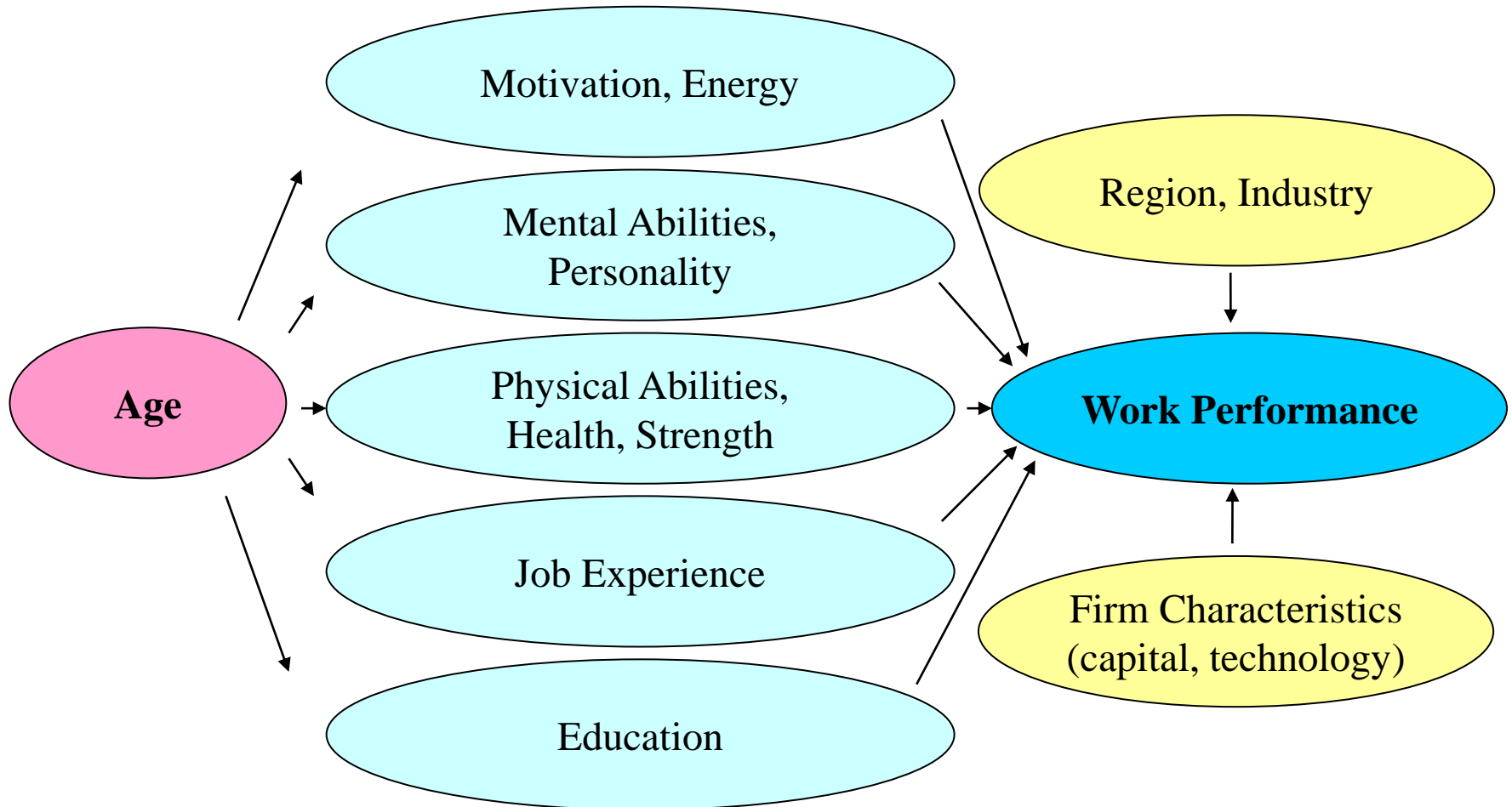


# Age and productivity

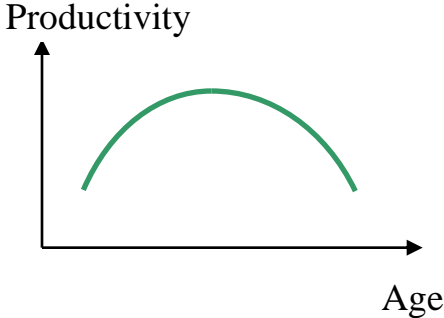
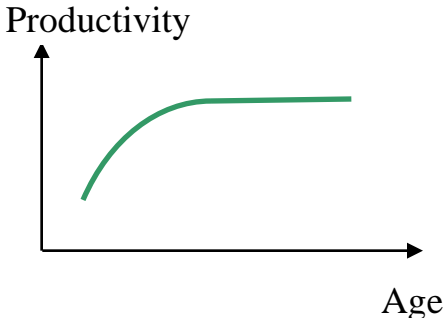
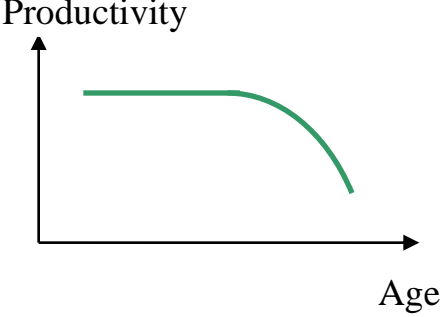
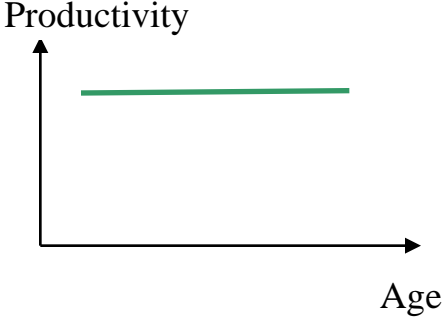


Source: Quetelet (1842)

# Determinants of job performance



# Age and productivity

	Ability requirements affected by age reductions	Ability requirements not affected by age reductions
Experience improves productivity	 <p>A graph with 'Productivity' on the vertical axis and 'Age' on the horizontal axis. A green curve starts at a low point, rises to a peak, and then falls as age increases.</p>	 <p>A graph with 'Productivity' on the vertical axis and 'Age' on the horizontal axis. A green curve starts at a low point, rises steeply, and then levels off to a constant horizontal line as age increases.</p>
Experience does not improve productivity	 <p>A graph with 'Productivity' on the vertical axis and 'Age' on the horizontal axis. A green curve starts at a constant level, remains flat for a short period, and then declines as age increases.</p>	 <p>A graph with 'Productivity' on the vertical axis and 'Age' on the horizontal axis. A green curve is a constant horizontal line, indicating that productivity does not change with age.</p>

# Measuring age and productivity

- Supervisor's ratings  
Finding: Age-productivity profile relative flat or declining (Dalton and Thompson 1971, Remery et al. 2003, Waldman and Avolio 1986, Warr 1994).  
  
Problem: Surveys subjective which can bias findings (Salthouse and Maurer 1996)  
  
General problem: Occupational sorting increases with age (bad workers exit, promotion implies increased selection)
- Work samples  
Finding: Quality compensates for quantity in mid-working life, but overall performance declines by ages 55-60 (Mark 1957, Kutscher and Walker 1960).  
  
Problem: Time limits, selection issues (Kate and Perloff 1992, Siemen 1976)

# Measuring age and productivity

- Employer-employee datasets

Of 14 E-E studies presented in Skirbekk (2008), 10 find a productivity decline from age 50, 2 have inconsistent results, while 1 finds that productivity peaks among the oldest workers.

Problem: To correctly adjust for all other influences on firms' output

- Age-earnings schedules

Age-earnings peak around 50 in the majority of OECD countries (OECD 2006). When wages reflect productivity, as for the self-employed, age-earnings tend to be flat. 19th century British earnings peak in the 30s (Boot 1995, Johnson 2001, Lazear and Moore 1984).

Problem: Earnings profiles probably not reflecting productivity curves, as incentives and age-discrimination play a role.

# Measuring age and productivity

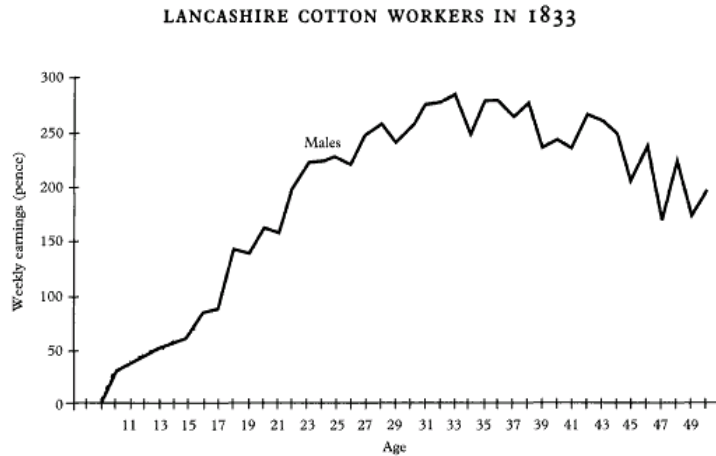
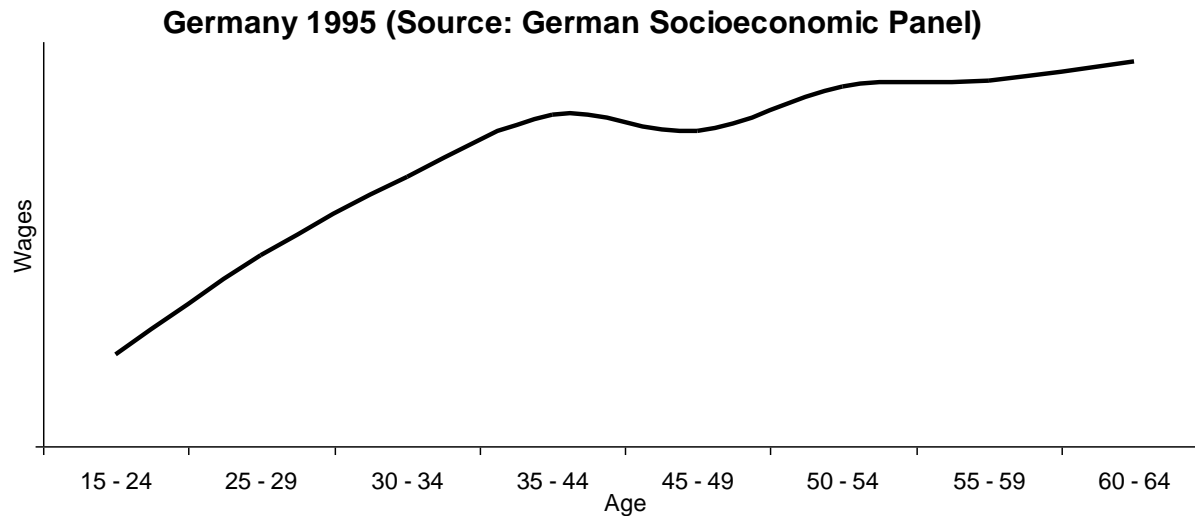


Figure 1. Average weekly earnings, Lancashire cotton industry, 1833  
Source: D.C. on children in factories (D.D. 1834. XX)



# Measuring age and productivity

- Science and Innovations

Biochemistry, economics, geology, physics, physiology most productive from their twenties to their forties (Stephan and Levin 1988, Oster and Hamermesh 1998). Inventors and Nobel Prize laureates peak in early 30s in 1900 and late 30s in 2000 (Jones 2004)

- Arts

Best average ages for creative output (musicians, writers, painters) the 30s and 40s (although female authors write slightly more in their 50s) (Miller 1999). However, variation is high.

# Measuring age and productivity

- Quality of production may also decrease by age

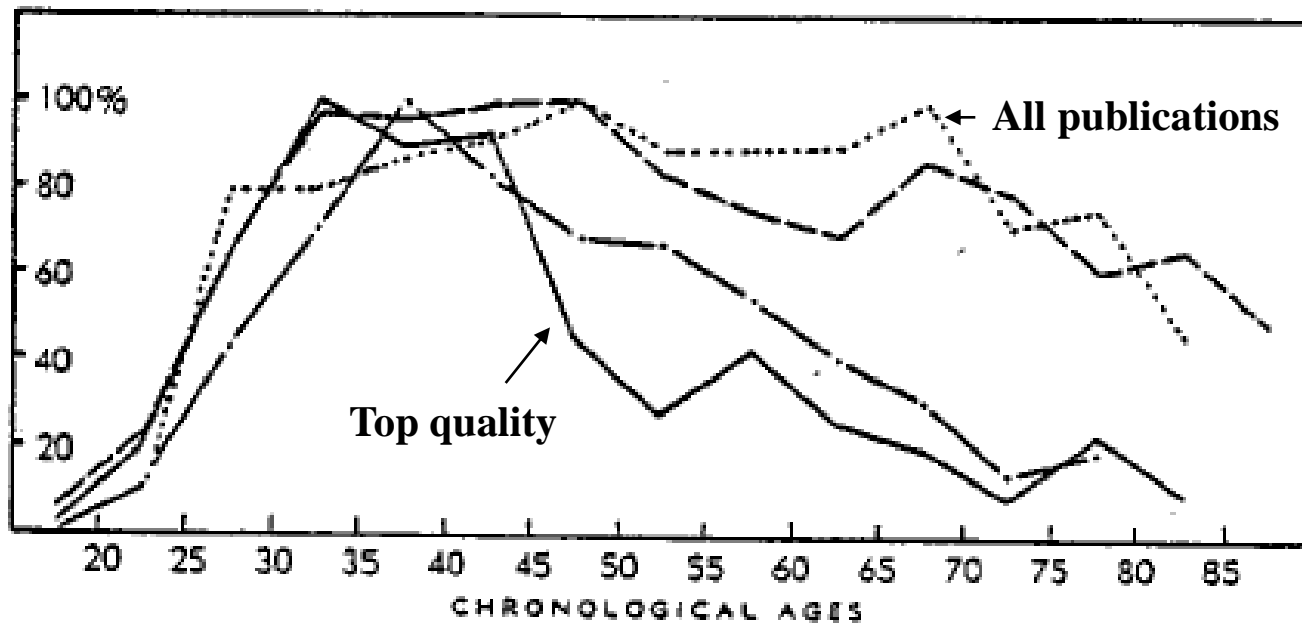


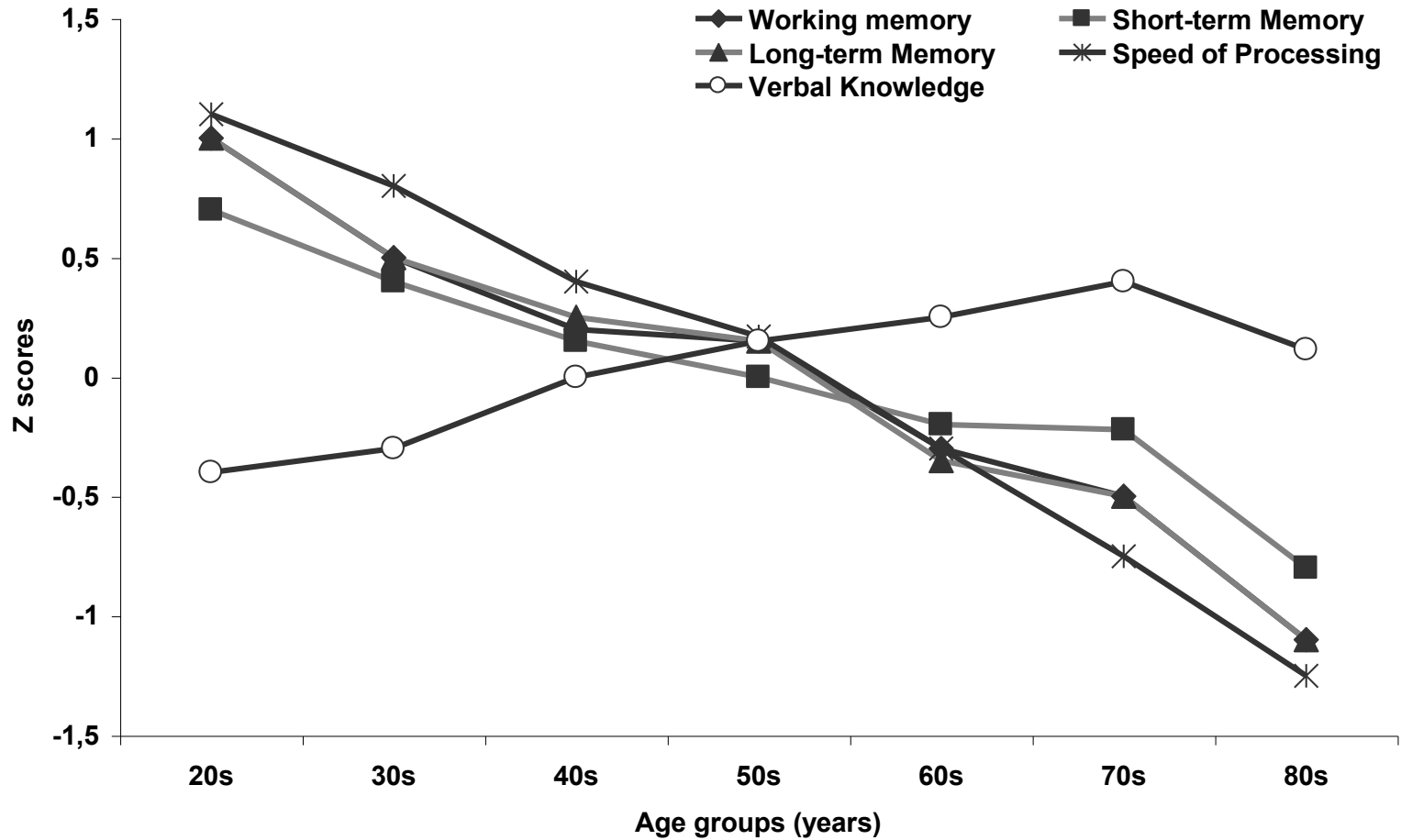
FIG. 89. Age versus production of literary works of varying degrees of merit. *Solid line*, 461 works by 152 authors. *Broken line*, 673 works by 122 authors. *Dash line*, 1,157 works by 134 authors. *Dotted line*, 2,191 works by 118 authors.



# Causes of productivity differences: Cognitive abilities and experience

- Ability measures possibly best predictor of individual productivity (Jenkins 2001, Schmidt and Hunter 1998)
- Fluid abilities (learning, perceptual speed and reasoning abilities) decline considerably over life cycle, while crystallized abilities (vocabulary size and semantic meaning) remain stable (Schaie 1994)

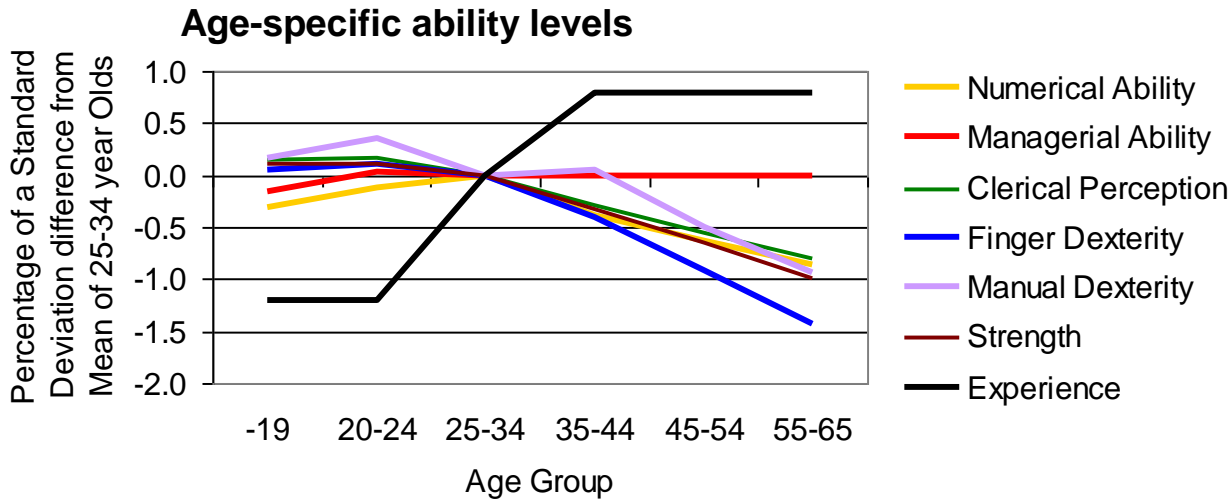
# Age and cognitive skills



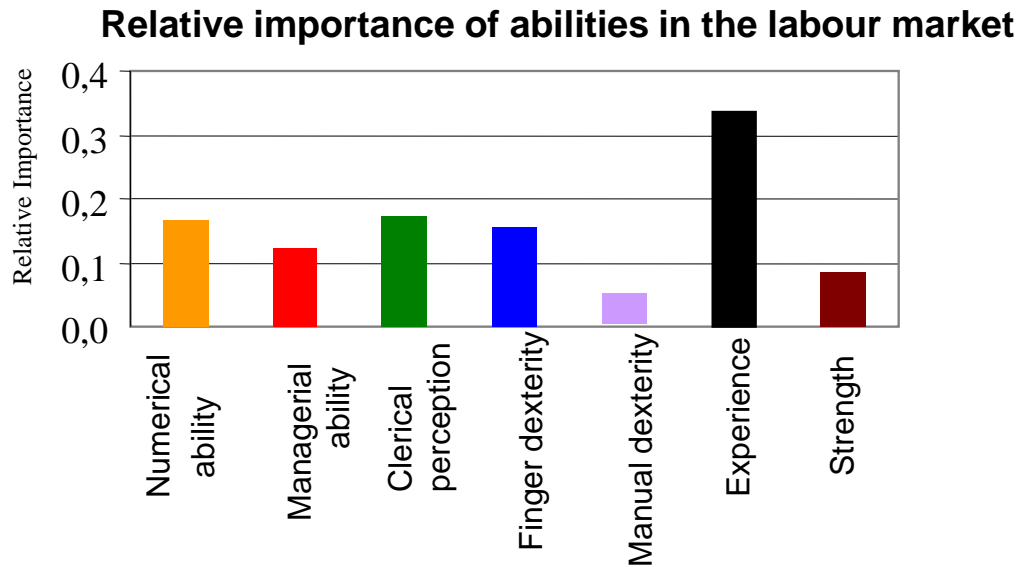
# Experience

- Job experience possibly most important job performance determinant. However, additional experience likely to benefit productivity only up to a given point
- Several studies suggest it takes roughly 10 years to reach *expert performance* in strategic and analytic work.
  - 10-year “rule” found in X-ray analysis, chess playing, medical/natural science research performance and livestock evaluation (Ericsson and Lehmann 1996, Phelps and Shanteau 1978; Lehman 1953; Lesgold 1984; Raskin 1936).
  - Only 0.6% of Norwegian employers prefer workers with more than 10 years of experience (Econ 1998).

# Determinants of variation in productivity



Some cognitive and physical abilities decline from young adulthood.

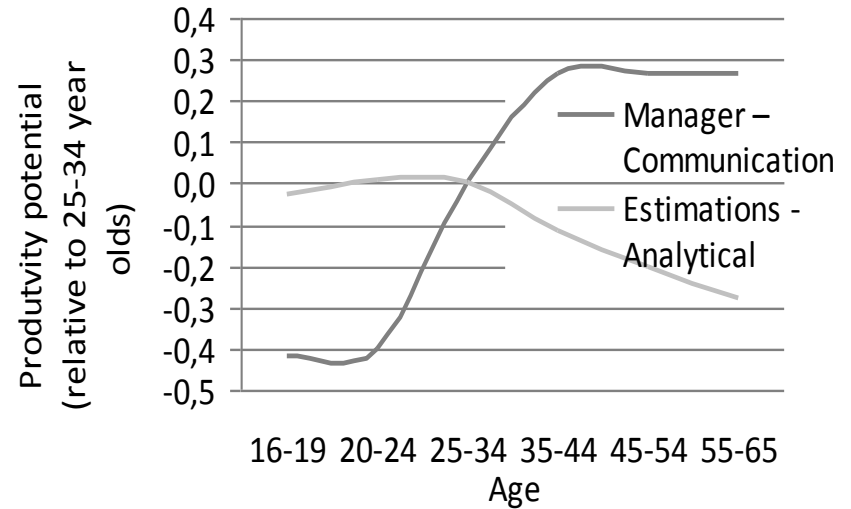
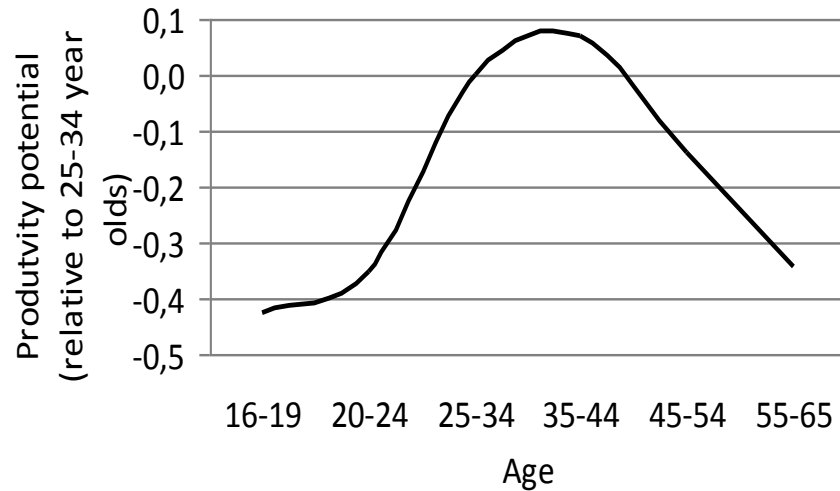


Large variation in labour market relevance of different abilities

# Estimates of the age-productivity curve

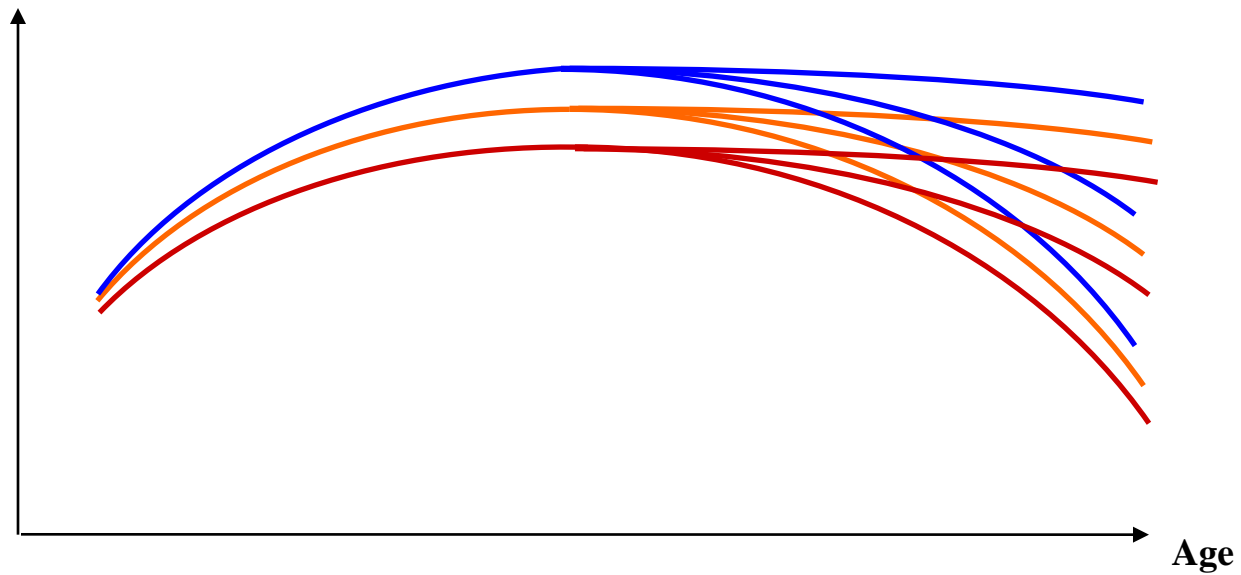
Weighting abilities by their labor market relevance produces a hump-shaped age productivity curve...

...however, heterogeneity is high



# Age and Heterogeneity

Age-Productivity Profile



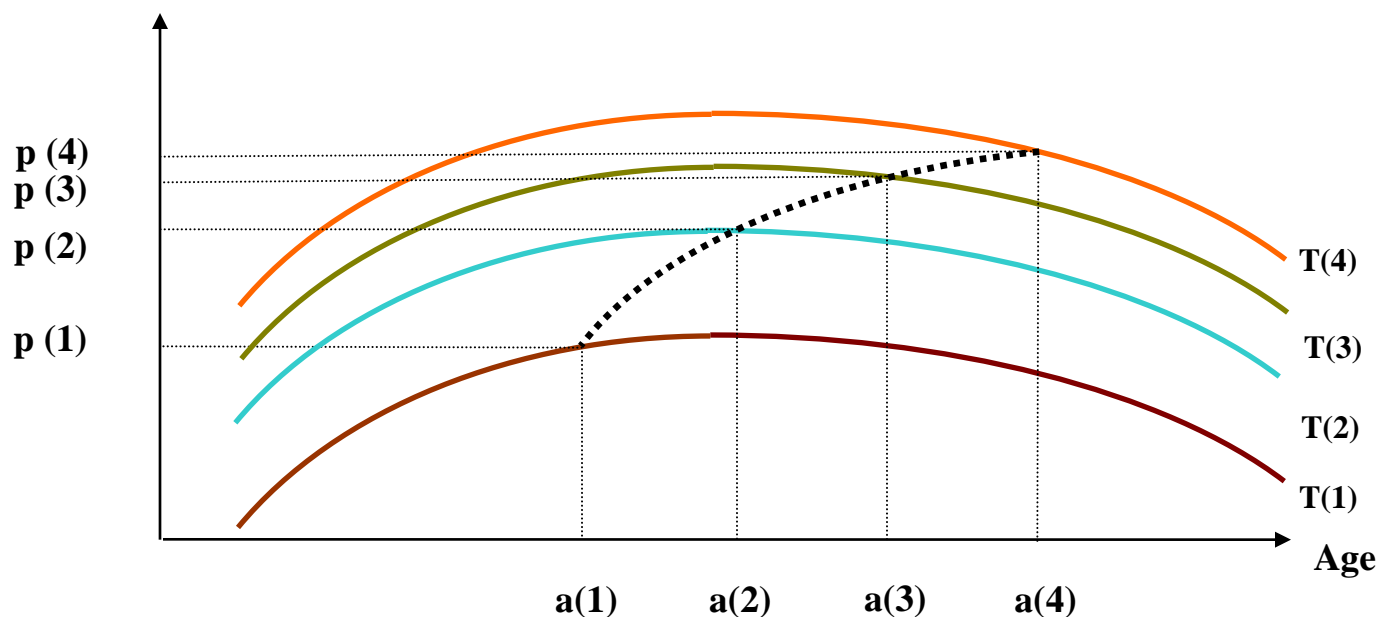
# Improving productivity along cohort lines

Ancient Romans described old age as *Mala Aetas* (*Bad Age*) and Young Age as *Bono Aetas* (*Good Age*) (Parkin 2003).

However, improvements in health, cognition and technologies imply that *Mala Aetas* is an increasingly poor description of seniority in contemporary societies

# Productivity growth benefits all age groups

Age-Productivity Profile



Increased education, more capital, better technologies imply that both younger and older individuals are increasingly productive over time.

Hence, individuals could experience productivity increase throughout life cycle in spite of hump-shaped cross-sectional age-productivity profiles

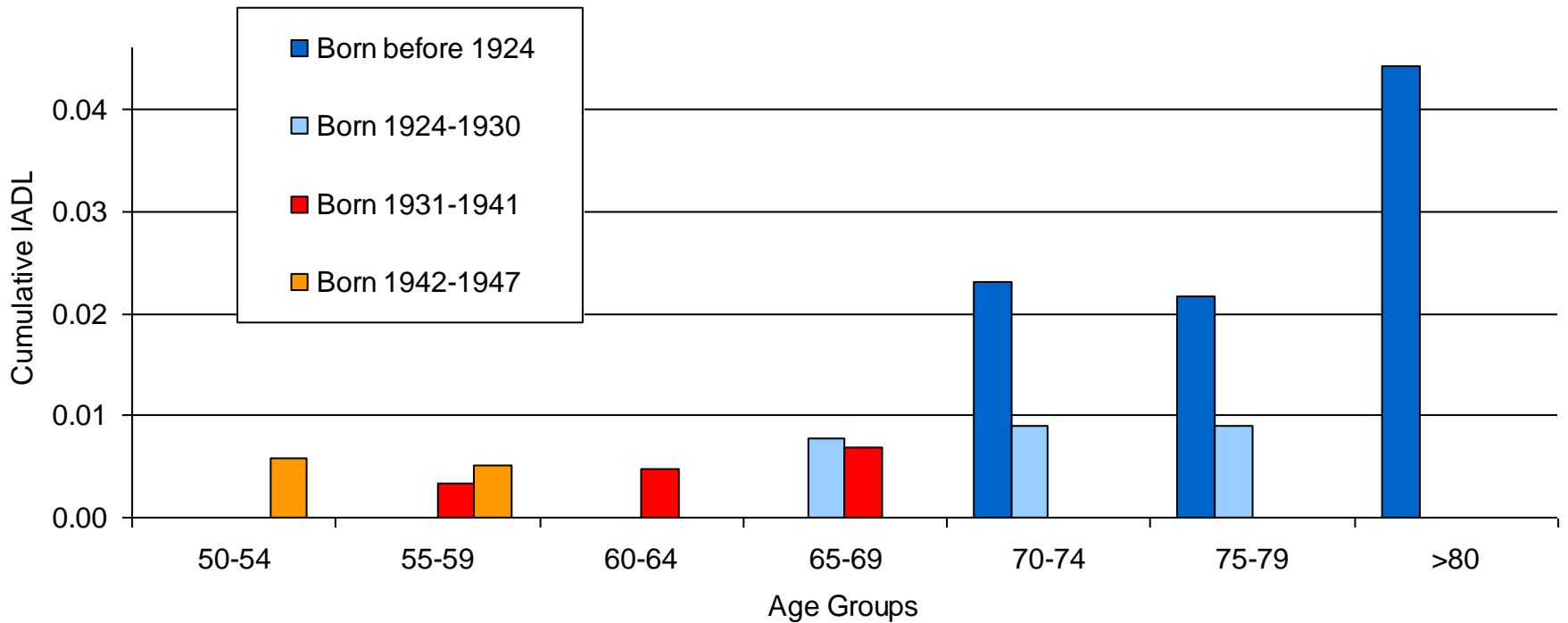


# Disability free life expectancy increase in parallel with longer life expectancy?

- Costa (2000) finds a decrease in chronic disease rates by 66% from the early 1900s to the 1970s and 1980s among men aged 50 -74
  - 75% of decline in back problems in 20<sup>th</sup> century caused by a shift away from non-manual labour and reduction in physical load
- During the 20th century, British male life expectancy increased from about 45 years to 75 years (Hicks and Allen 1999). Disability free life expectancy increases similarly (Manton et al. 1997; Romeu Gordo 2006)
- Only 15% of 65 year old Canadians have a health condition that justifies their exit from the workforce (Michaud et al. 1996)

# Improvements in health

## Functional Disabilities by Cohort

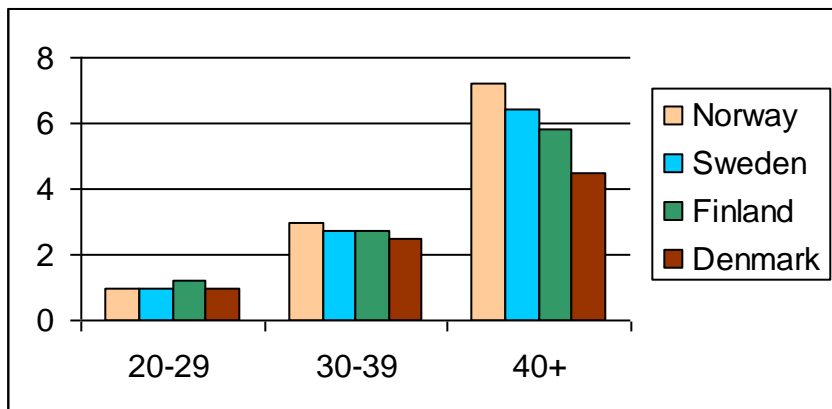


Source: Romeu-Gordo (2006)

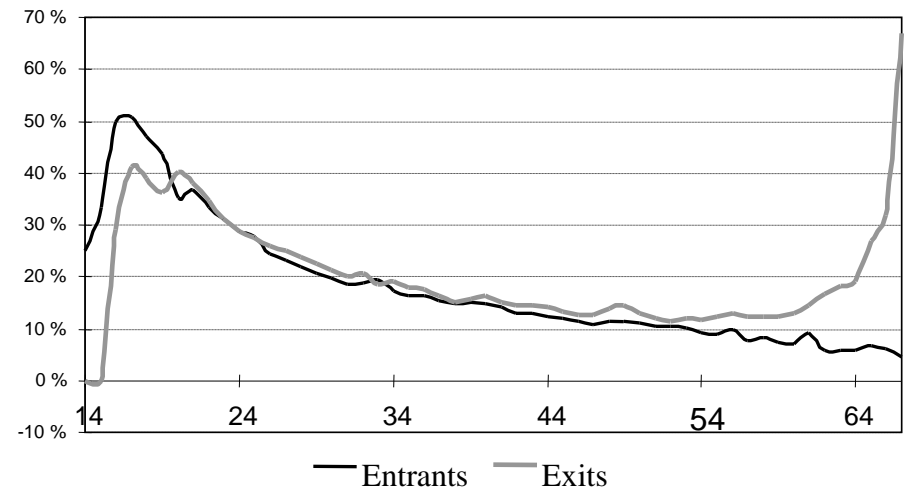
# Other Influences on Work Performance

- Health problems, as reflected in disability levels, increase by age
- Job stability increasing up to around age 60

Disability Levels Nordic Countries

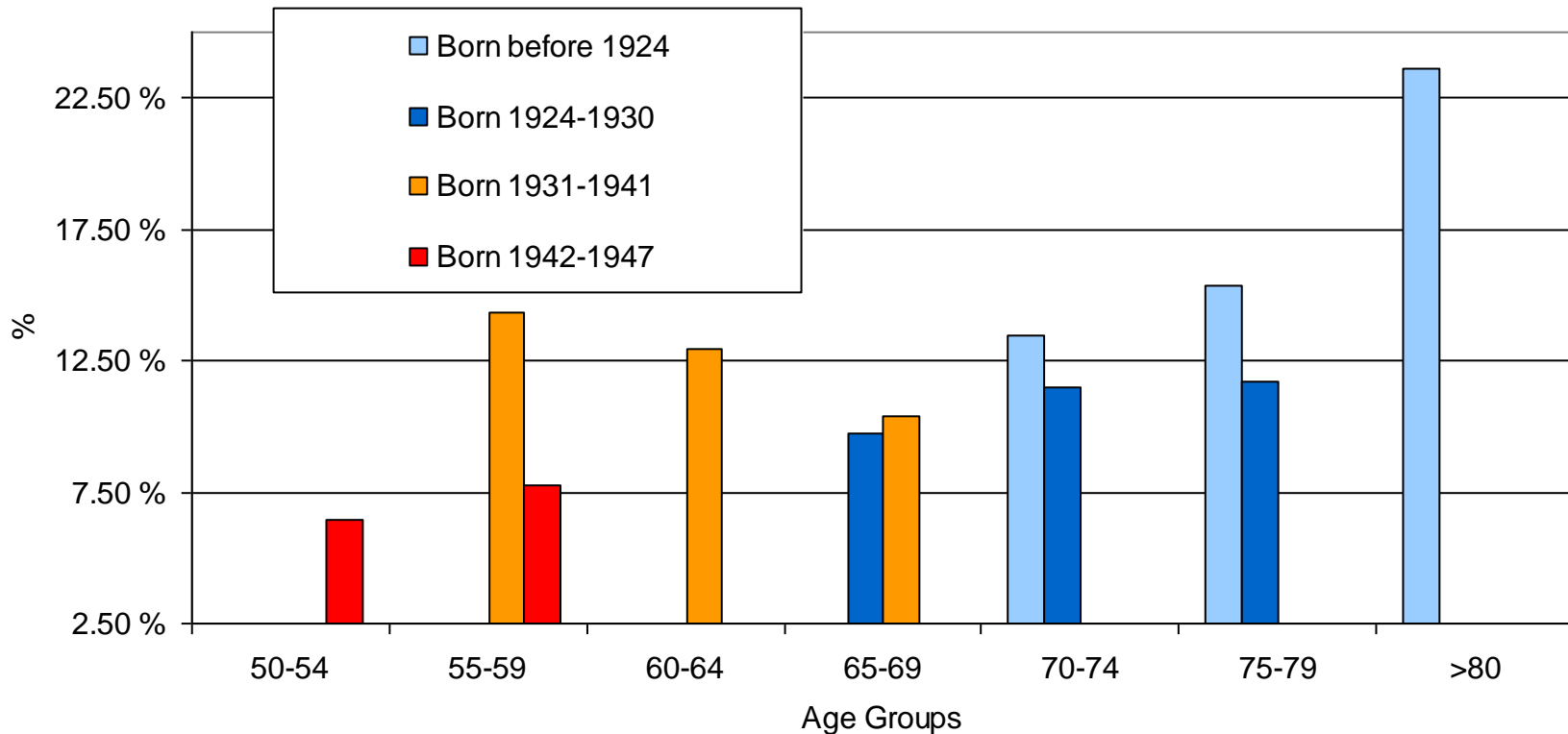


Job Flows, Norway



# A “Flynn effect”, improved mental performance among the elderly?

## Difficulties in Using a Map by Cohort



Source: HRS (US), Romeu-Gordo (2006)

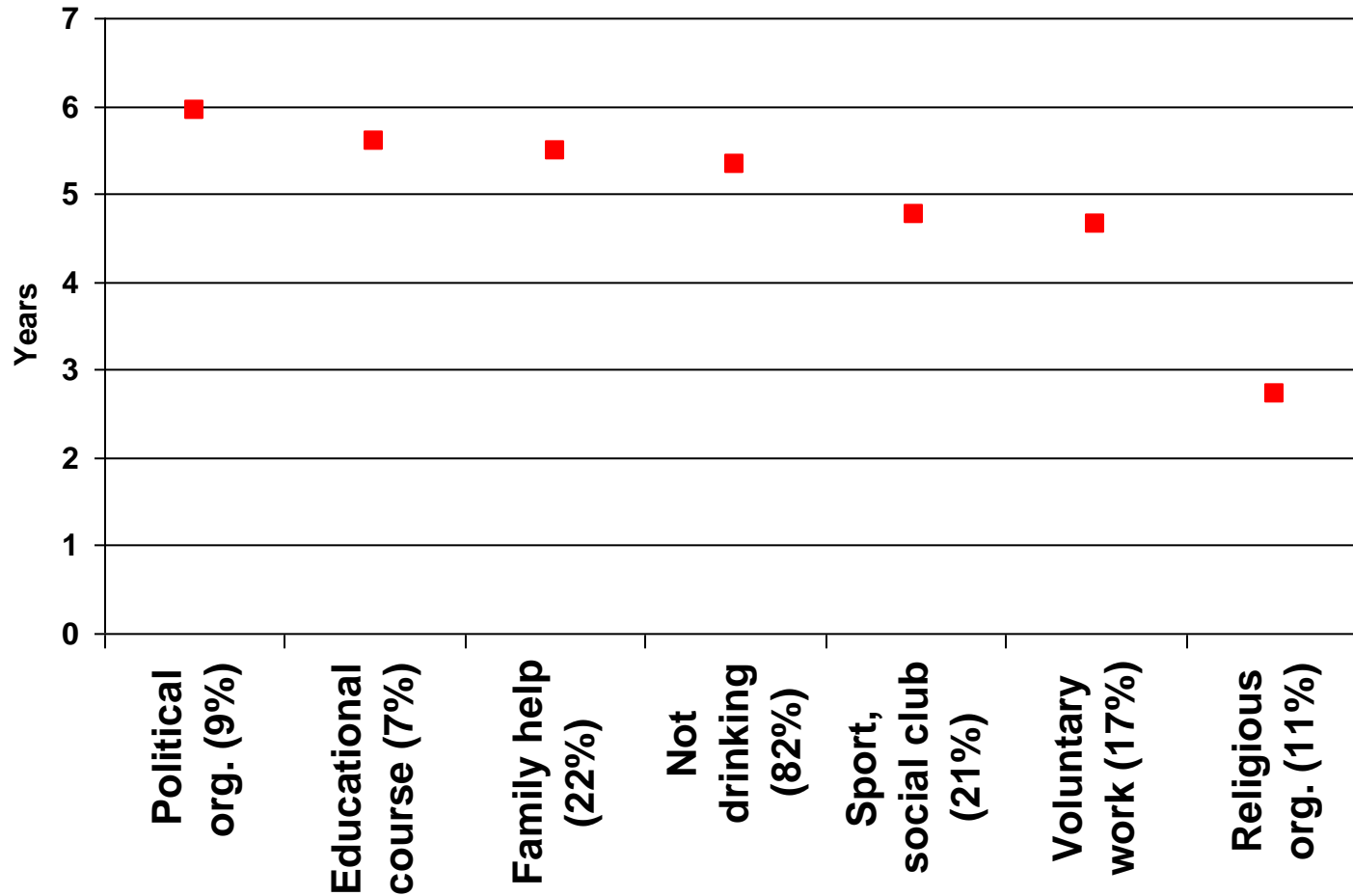
# Work at older ages

Individuals who are/were engaged in complex work perform better at older ages (Salokangas and Joukamaa 1991).

Freedom to to organize one's working day associated with reduced cognitive decline (Dave et al. 2006).

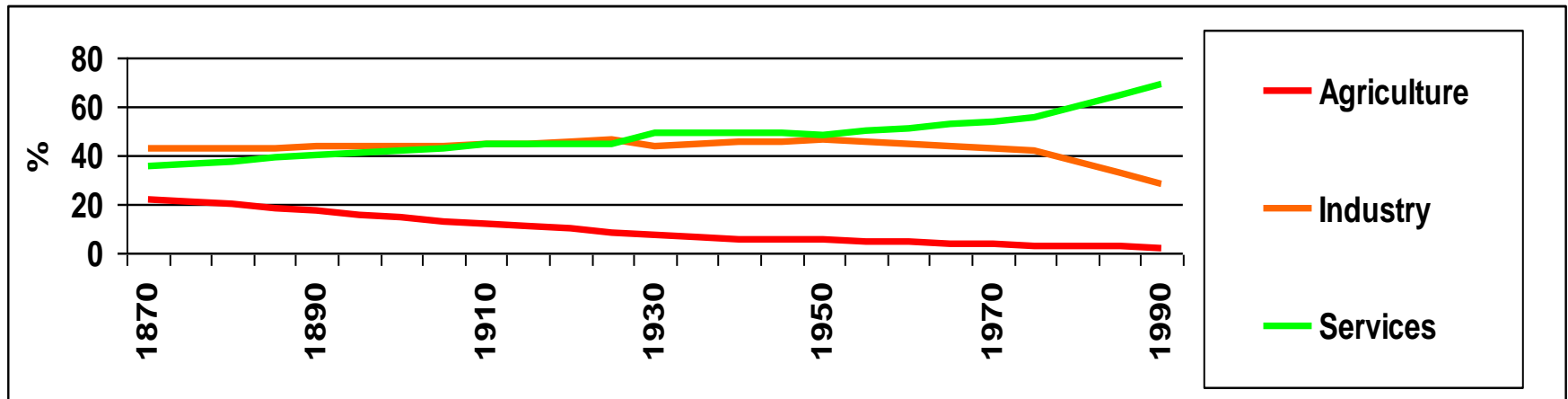
# Healthy, active lifestyles may boost mental performance

Years of Cognitive Functional Level “Gained” by Activity



Source: Buber et al. (2006)

# A productive future for older workers?



Industrial Composition (Great Britain)

- Health problems may be less of a concern in the workplace (reduced strength and physical impairments less of a hinder to job performance)
- Workers are of increasingly better health and have better cognitive skills
- Annual hours worked declined by a third or more 1850-1987 in Japan, US, France, Germany, UK from (Ausubel and Grubler 1995)

# Increasing productivity of seniors

A range of policies can boost work performance among elderly workers



# Exercise & education -> Mentally fit ?

- Exercise good for mental and physical functioning, while overweight accelerates cognitive decline
- Education could lead to a more healthy lifestyle (in terms of nutrition, exercise, tobacco consumption), which in turn could improve cognitive functioning.
- “Brain work” stimulate neuronal growth. Katzman (1993) argues that schooling increases synaptic density in neocortical cortex, could delay onset of Dementia by 4-5 years.

# Engagement, social interaction

- That married individuals (men, in particular) live longer and healthier lives, could be due partly to “the protective” effects of marriage (Murray 2000; Ribar 2004; Waite 1995).
- Socialising with others has been found to benefit mental health levels (Cohen 2004; Cole et al. 2002; Glass et al. 1999; Melchior et al. 2003; Sugisawa et al. 1997).

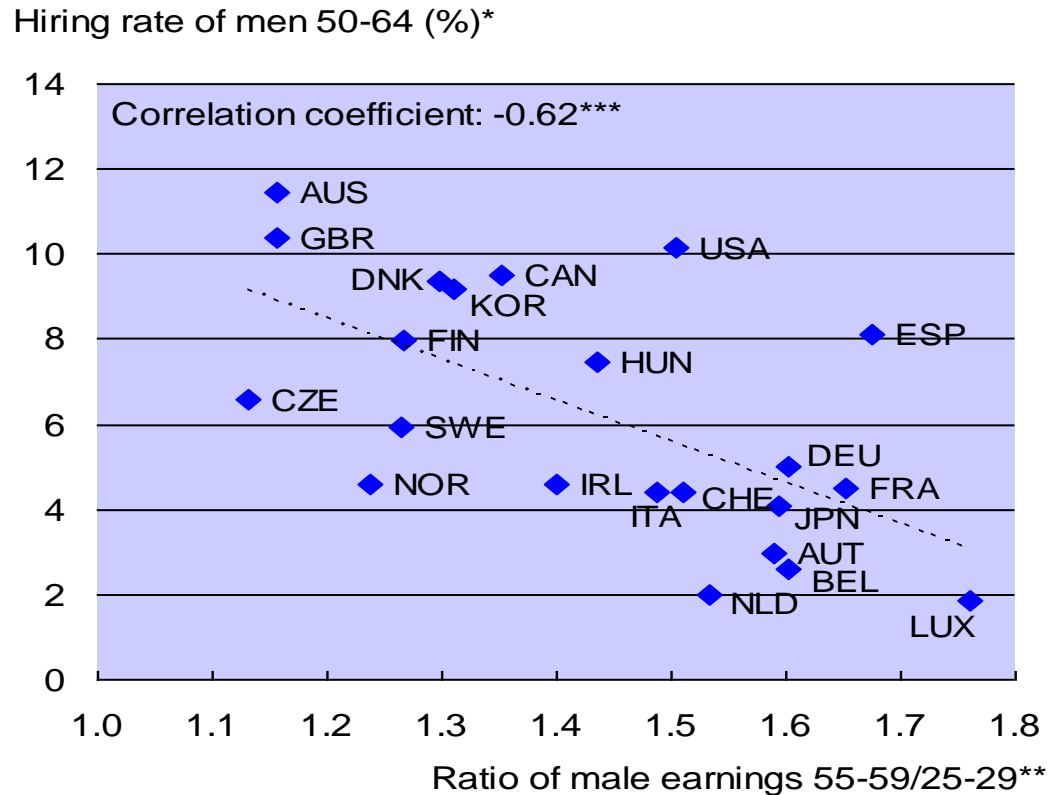
# Improving mental health and cognitive performance

- Perspectives of longer working lives increases incentives to maintain productivity
- Targeted training can raise mental capacities and work performance (Ball et al. 2002, Zwick (2002)
- Complex work/tasks with high degree of self-decision
- Social & political engagement
- Computer design for elderly can be beneficial (Czaja and Lee 2007)
- Improving eye sight, preventive measures particularly important (Eva 2002)
- Healthy lifestyle
  - Smoking (e.g., Deary et al. 2003 find that smoking lowers IQ by a fifth of a standard deviation, net of initial IQ)
  - Fish, cereals, red wine, aspirin found to raise mental ability (Nilsson et al. 2003, Solfrizzi et al. 2003).

# Flexible wage levels - > later retirement

- Japanese high status-low wage “secondary career” related to late retirement (Clark et al. 2006)
- Icelandic long working lives related to low pensions (Herbertsson 2004)
- In Austria, reemployment probability of elderly displaced workers equals that of displaced prime age workers when elderly accept lower wages (Ichino et al. 2006)
- Firm level data from the US, Hong Kong, the UK -> elderly employment low when wage profiles are steep (Daniel and Heywood 2007)

# Flexible wage levels - > later retirement



# Policy suggestions

- Create incentives and opportunities for a longer working life, with later labour market withdrawal
- Norms:
  - Accept lower salaries at the end of the working life
  - End seeing 60s as the age one should retire
  - End seeing senior employment as a cause of youth unemployment
- Encourage healthy life styles, exercise and education in order to increase productive output
- More part time positions, better career planning, preventive measures, occupational health programmes, elderly friendly computer systems

# Summing up

- Estimates of productivity suggest age-productivity curve is hump shaped or sometimes flat
- Coming decades likely to see less physical demands and better health. Workers increasingly better educated and healthier
- Promoting physical & mental fitness results in more mentally able and productive workers
- Increased wage flexibility at higher ages could increase elderly employment