

# Population and Health

## Lecture 16. Divergences/convergences in mortality.

### A new approach to health transition

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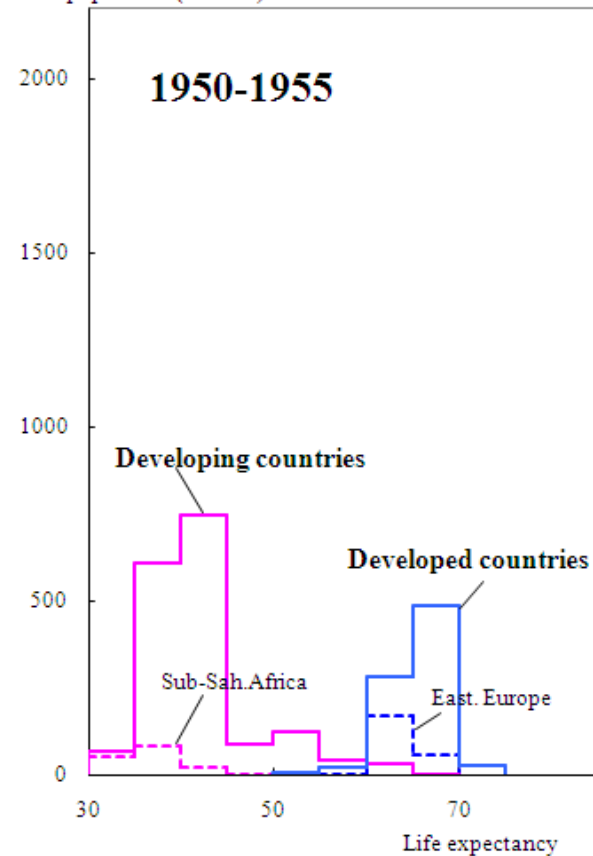
# Health for all!

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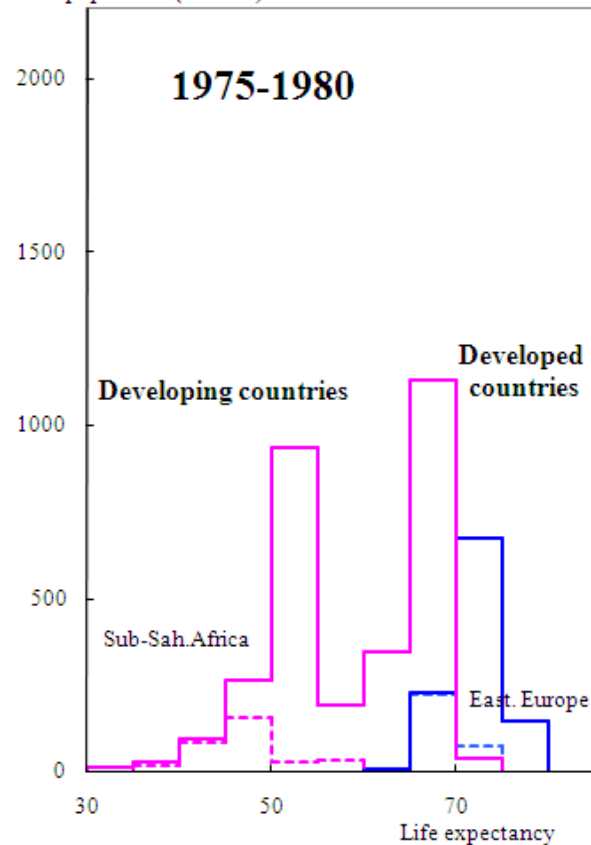
- Social security systems
- WHO target of the 1970s
- UN Population Division scheme of converging life expectancies towards the highest levels
- Far from having been realised, today such objectives seems to be hopeless

# Increasing disparities in life expectancy

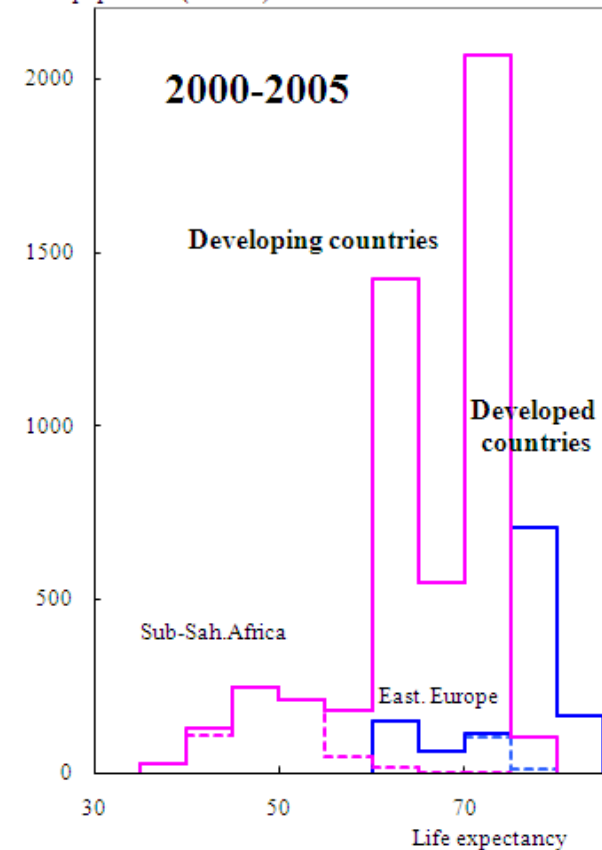
Total population (millions)



Total population (millions)

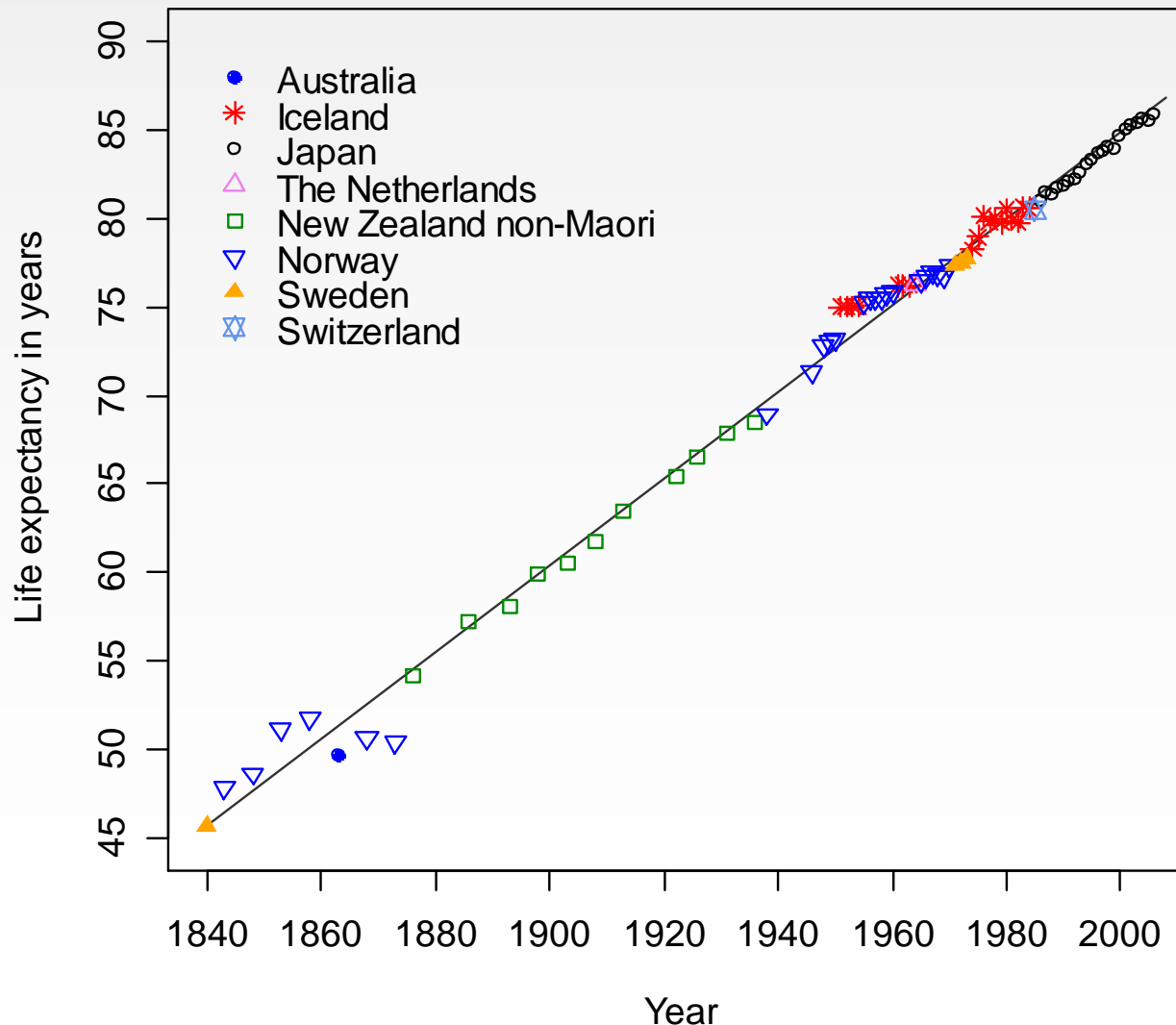


Total population (millions)



# Will life expectancy increase indefinitely ?

## Oeppen-Vaupel straight line

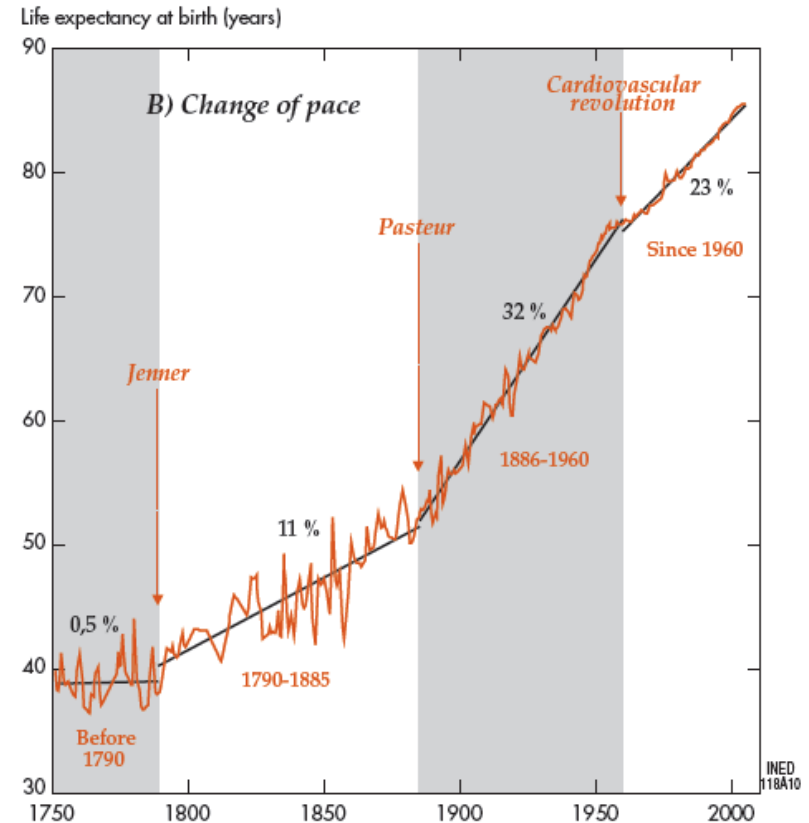
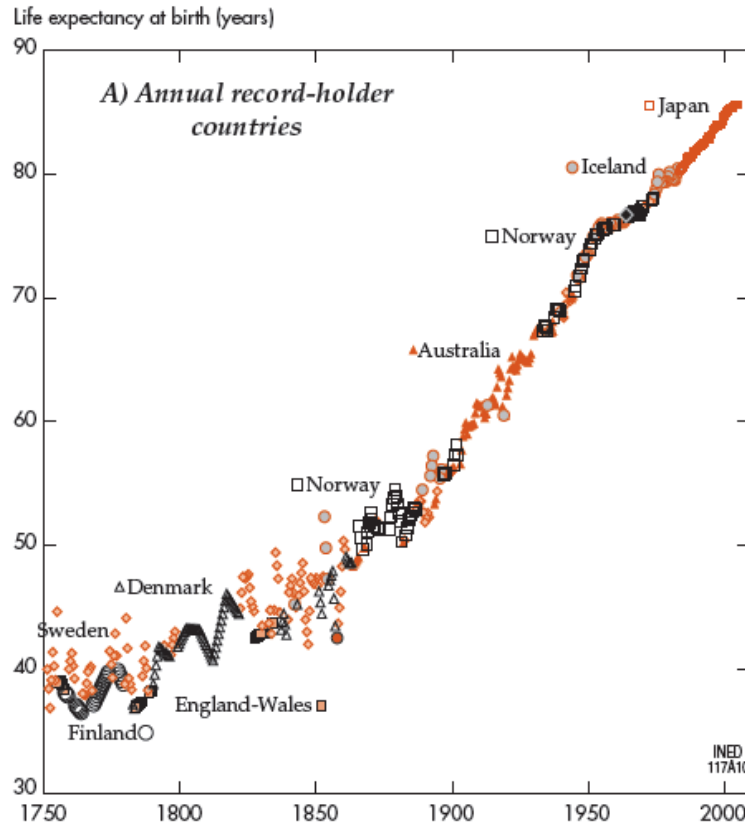


Oeppen Jim and Vaupel James W., 2002. – Broken limits to life expectancy, *Science*, vol. 296, n° 10 May 2002, p. 1029-1031.

# Will life expectancy increase indefinitely ?

## A broken line

Figure 1 - Highest observed national female life expectancies at a given moment in the world (1750-2005)



Note: Graph A shows the different countries which, in turn, held the life expectancy record for the year. Graph B illustrates the changes of pace as measured by the gradient (in %) of the fitted lines. A 10% gradient signifies that life expectancy increases annually by one-tenth of a year; 20% by one-fifth of a year; 33% by one-third of a year.

(J. Vallin and F. Meslé, *Population & Societies*, no. 473, Ined, december 2010)

**Is there any theory that can explain  
contradictory facts observed to-day?**



# The 3 ages of the *epidemiologic transition theory* according to Abdel Omran (1971)

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- *Age of pestilence and famine*, when mortality was very high and fluctuating, with life expectancy less than 30 years,
- *Age of pandemics receding*, during which life expectancy has steadily increased, from about 30 years to close to 60,
- *Age of degenerative diseases and man made diseases*, when, after some additional reduction, mortality tends to stabilise at a low level.



# The main failures of the theory

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- When life expectancy climbs up again in western industrialized countries (the cardiovascular revolution)
- When Eastern Europe misses this new step
- When AIDS spread in Africa

**Is it enough to expand the theory?  
Or necessary to put its bases in question?**





- Interpretation of the cardiovascular revolution: a 4<sup>th</sup> age?
  - « *Age of delayed degenerative diseases* », Jay Olshansky et Brian Ault (1986)
  - « *the hybristic stage* » (the age of diseases related to behaviour and lifestyle), Richard Rogers and Robert Hackenberg (1987)



- Interpretation of AIDS: a 5<sup>th</sup> age?
  - *The age of reemergence of infectious and parasitic diseases*, Jay Olshansky *et al.* (1998)
  - *The age of aspired quality of life with paradoxical longevity and persistent inequities.* Abdel Omran (1998)
- «and beyond»: a 6<sup>th</sup> age?
  - «*Health for all*» towards equity and quality  
Abdel Omran 1998



# Considering Omran's epidemiologic transition as only a first step of the health transition

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- The health transition (Frenk *et al.*, 1991)
- Several successive epidemiologic transitions (Horiuchi, 1999)
- A succession of phases of divergence-convergence (Vallin et Meslé, 2004, 2005)



# The concept of health transition

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- Julio Frenk, José-Luis Bodabilla, Claudio Stern, Thomas Frejka et Rafael Lozano « Elements for a theory of the health transition » *Health Transition Review*, vol 1 n° 1, 1991
- A concept from M. Lerner (1973), wider than that of epidemiologic transitions since it includes social and behavioural changes
- Combine different levels: « systemic », « societal » « institutional » and « individual »
- However their description is purely theoretical without precise reference to facts



# Successive epidemiological transitions in the History of Mankind

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- Shiro Horiuchi Epidemiological transition in human history *in: Joe Chamie et Robert Cliquet Health and mortality issues of global concern, NU, 1999*
- A link between the type of society and the main causes of death: « hunting and picking »  
« agriculture » « industry » « high technology »  
« future » / « violence » « infection »  
« Cardiovascular diseases » « cancers » « aging »
- Close to the concept of pathocenosis (Mirko Grmek, 1969) but far from the complexity of current situations



# A succession of divergence/ convergence processes (Vallin et Meslé, 2004, 2005)

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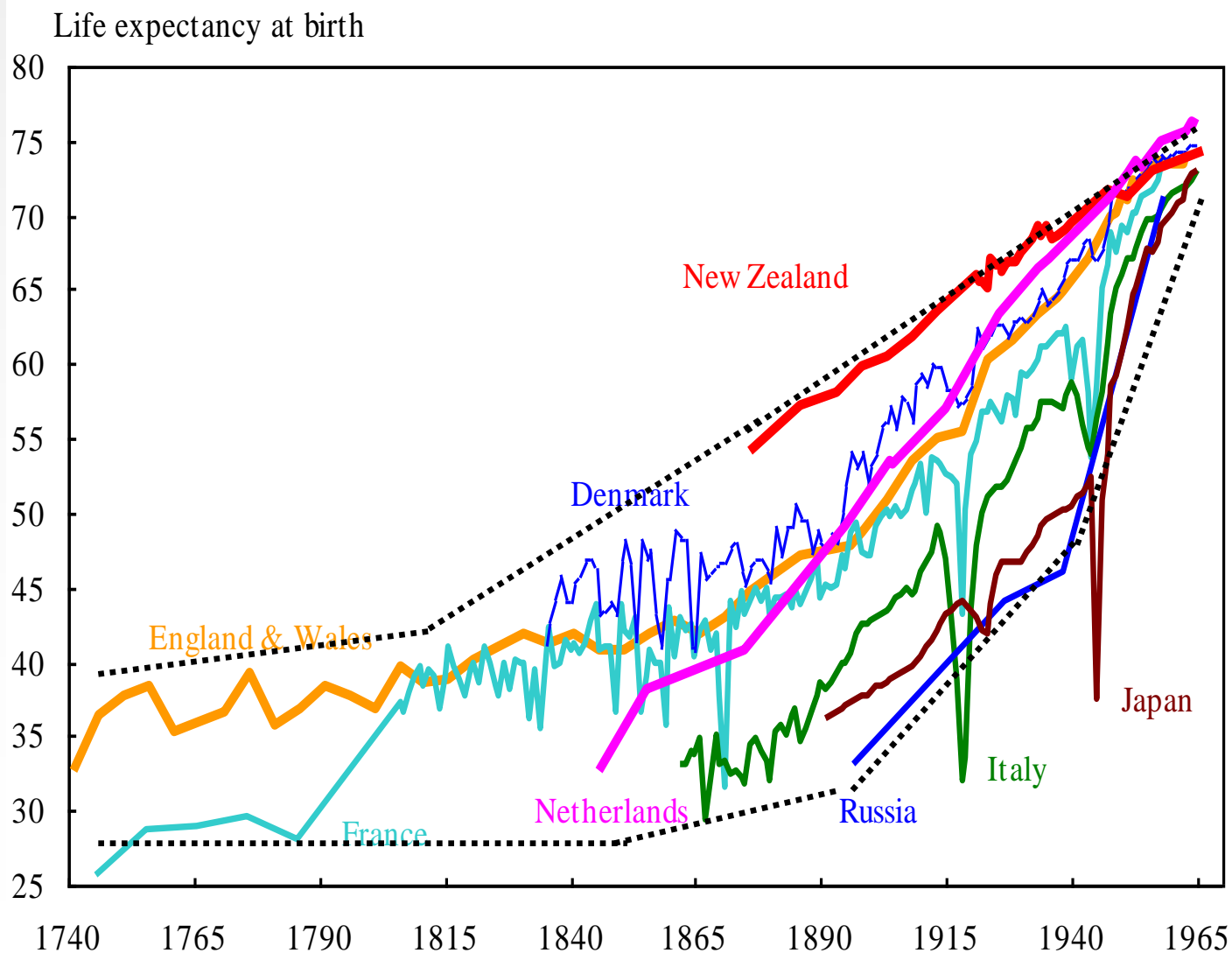
- Any major factor of improvement in life expectancy results in a phase of divergence
- After some time those that were late catch up the pioneers in a convergence phase
- New improvements cause new processes of divergence/convergence
- One on-going process can be interrupted or even contradicted by negative new facts, any time
- A new process can start even if the previous one has not ended
- Sub-national trends may follow the same rule

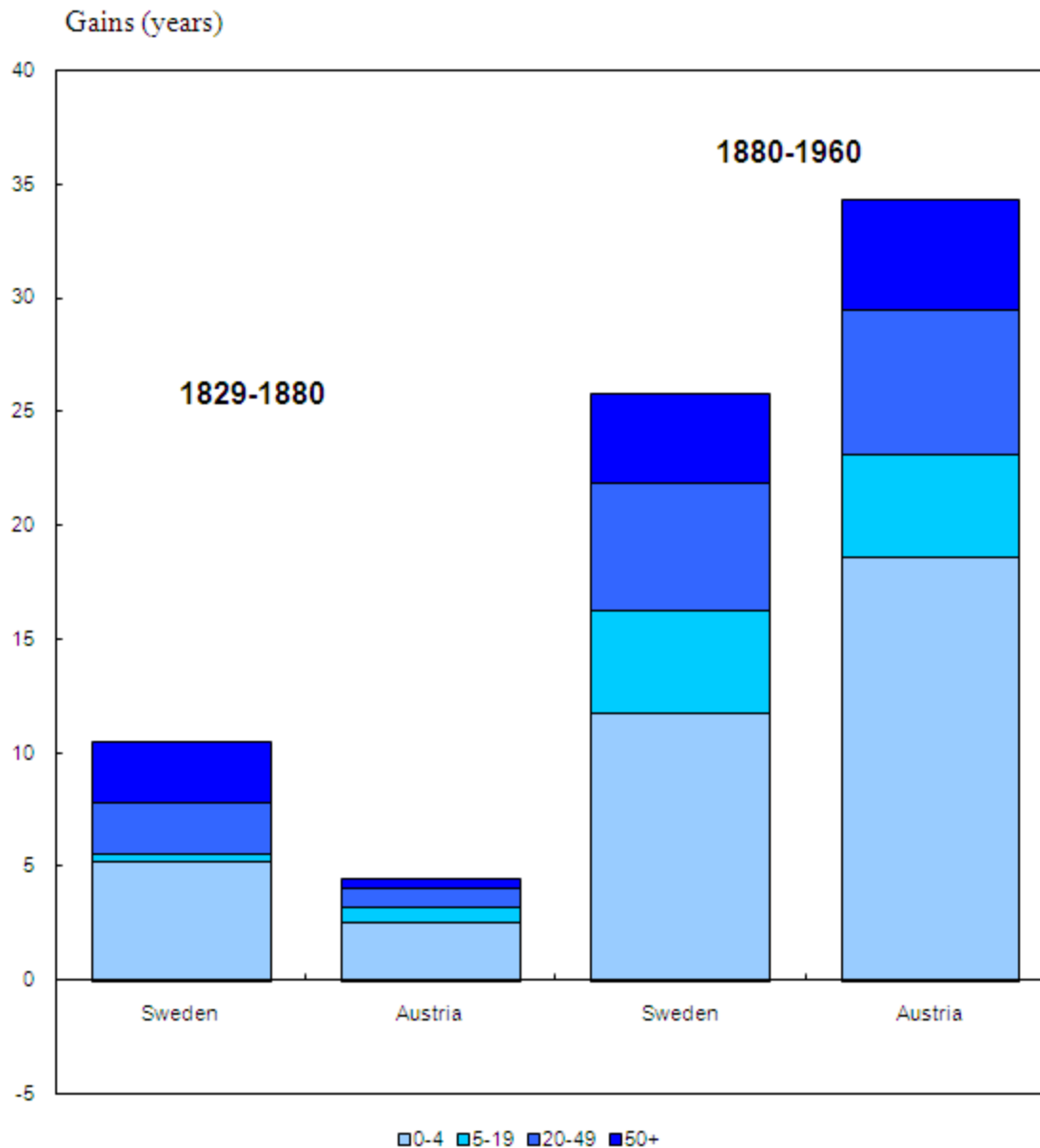
# **Three large historical examples**

**First stage :**  
**Omran's epidemiologic**  
**transition**



# Long-term trends in female life expectancy for selected industrialized countries until the mid-60s

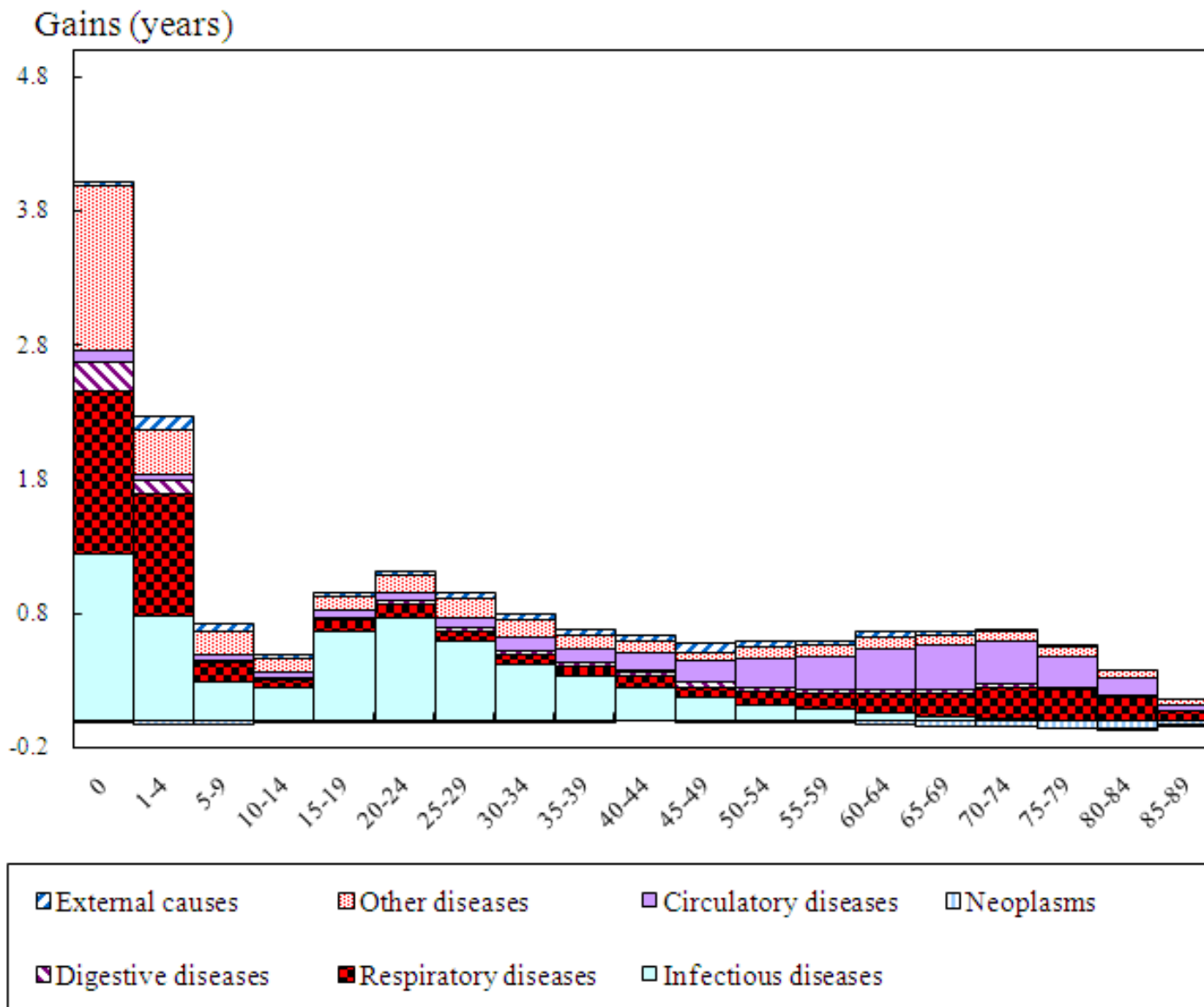




Contribution of mortality decline by age groups to gains in life expectancy in Sweden and Austria:  
1829-1880 and 1880-1960



# Contribution of mortality decline by age and causes to gains in life expectancy in France 1925-1960





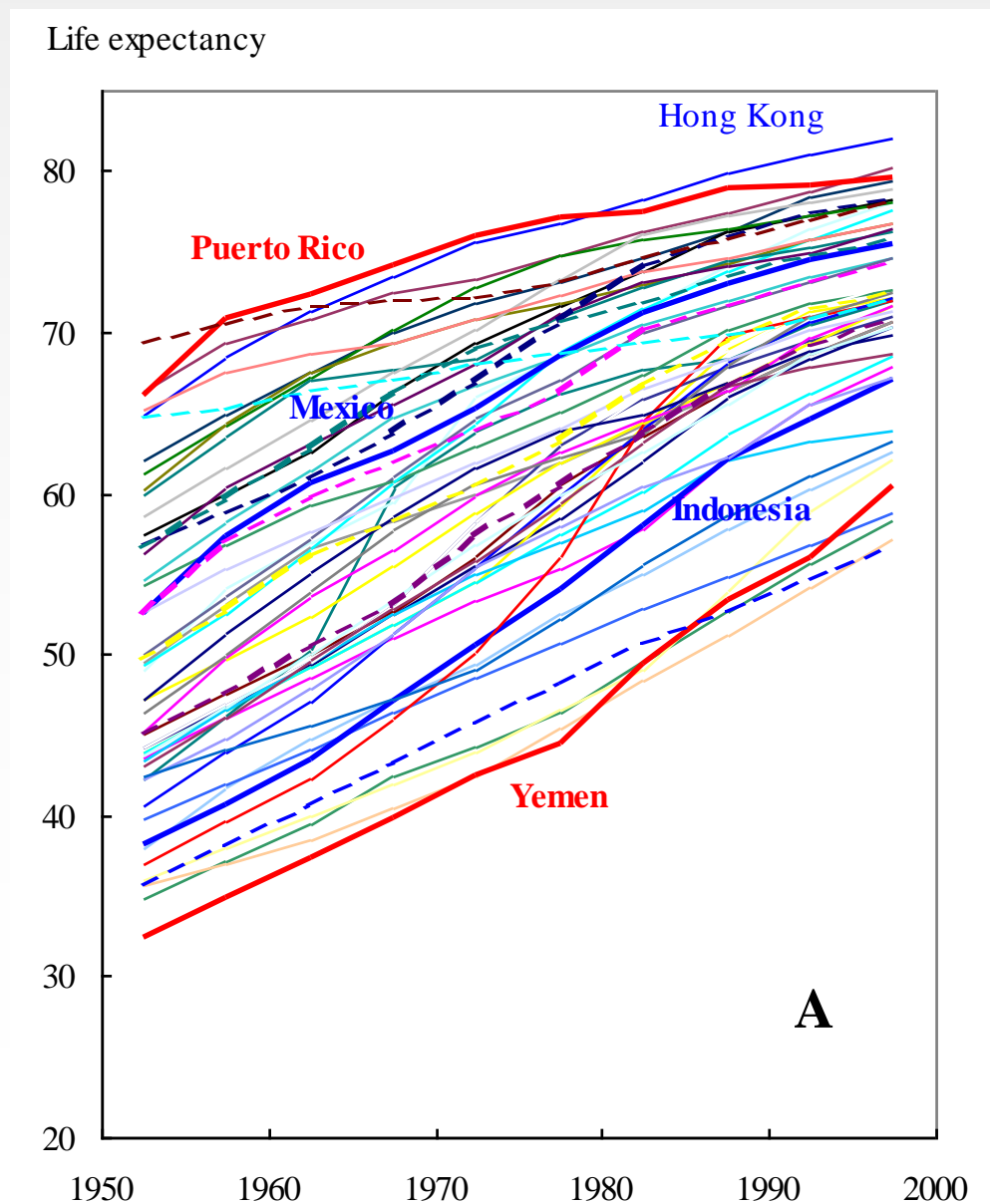
# Major improvement involved

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- New medical tools (Pasteur revolution: aseptic, immunization, antibiotics, etc.)
- Education
- Social security and welfare state

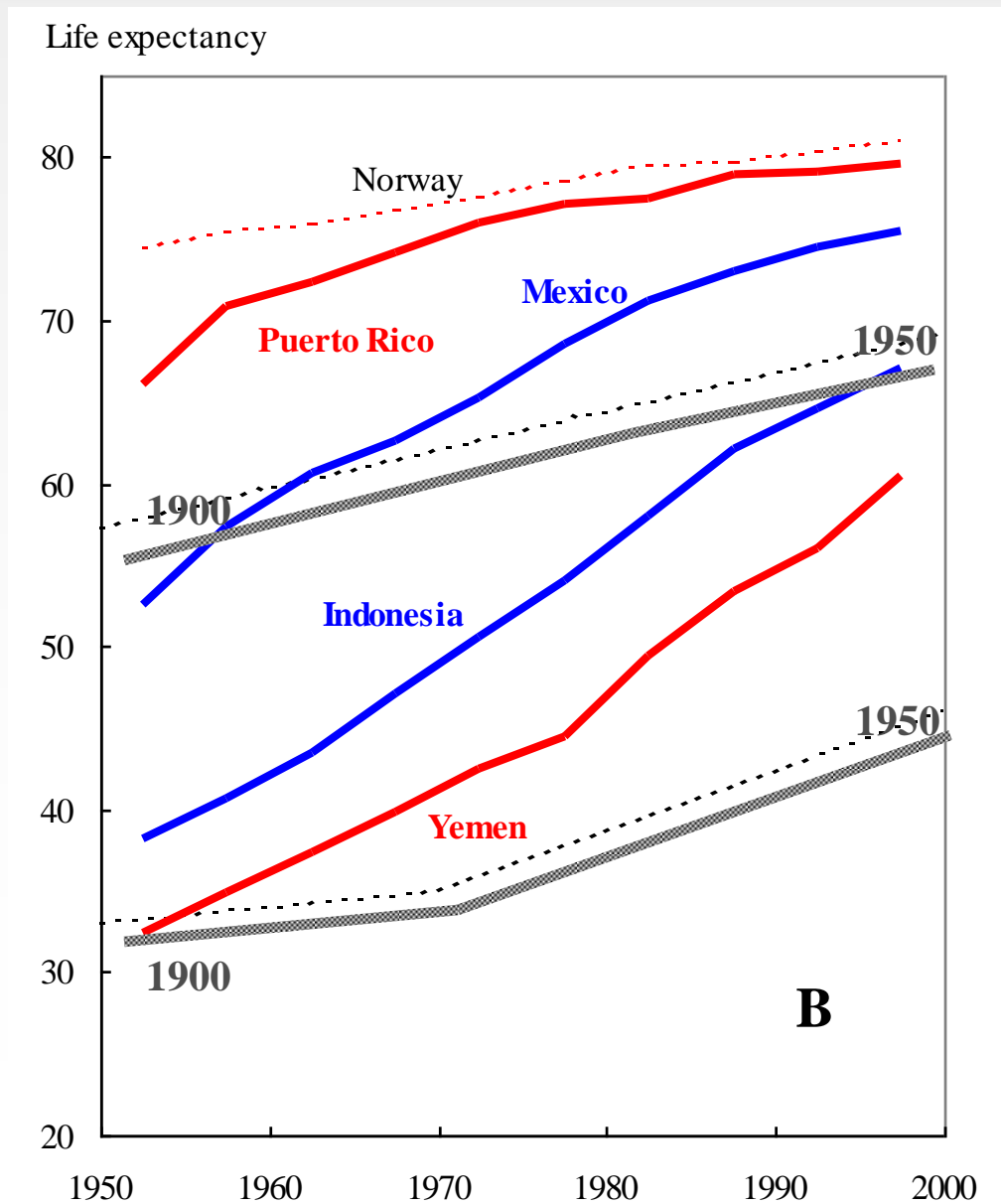


# Long-term trends in female life expectancy for developing countries except Sub-Saharan Africa and countries affected by war

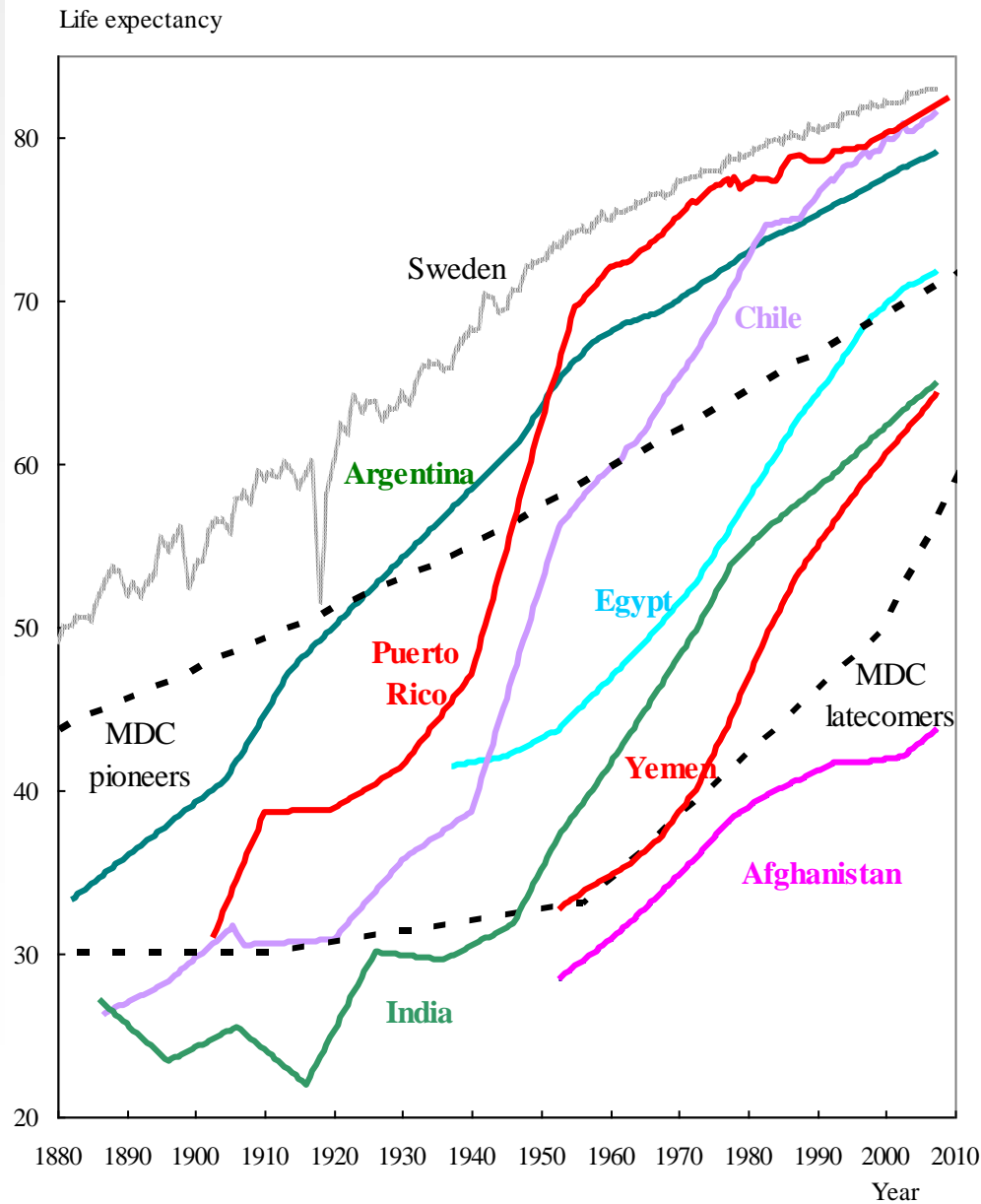




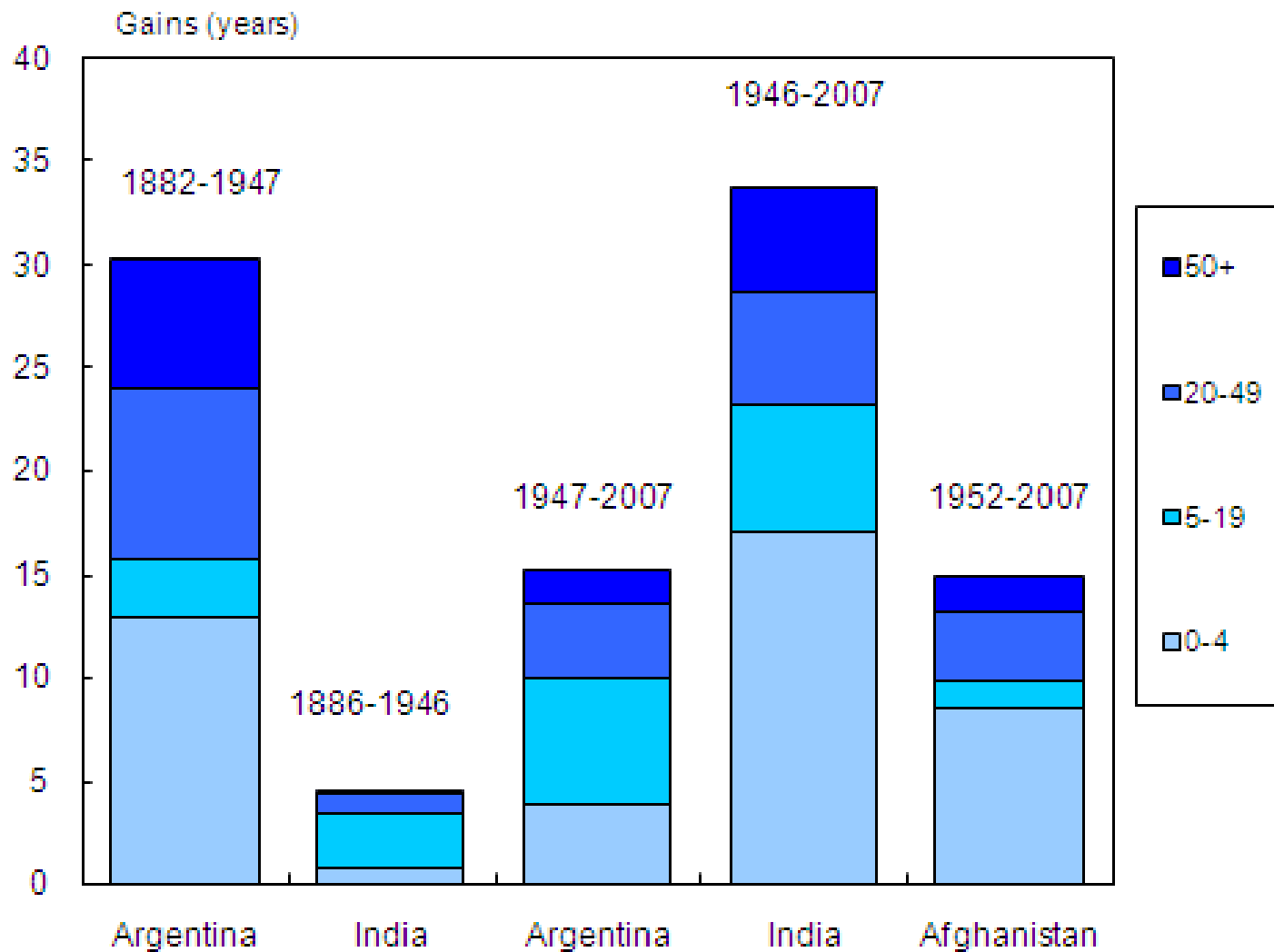
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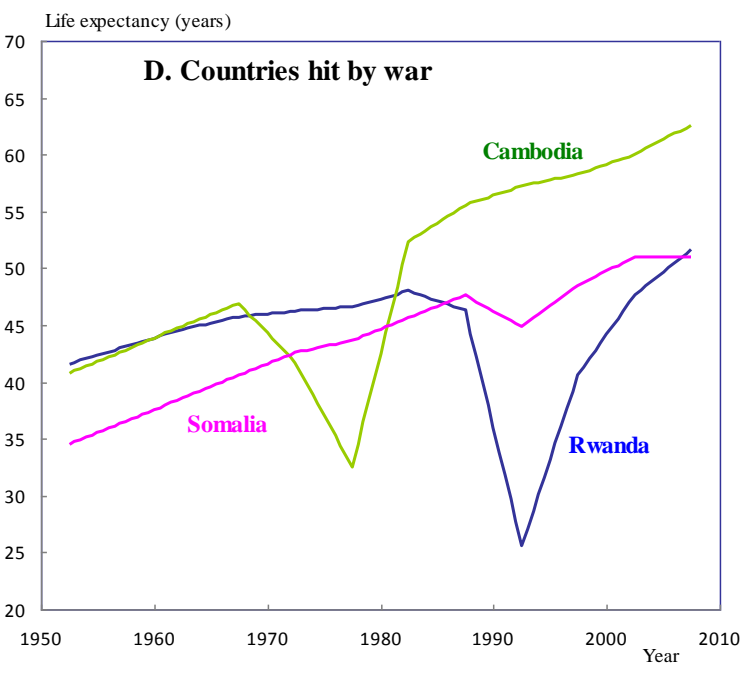
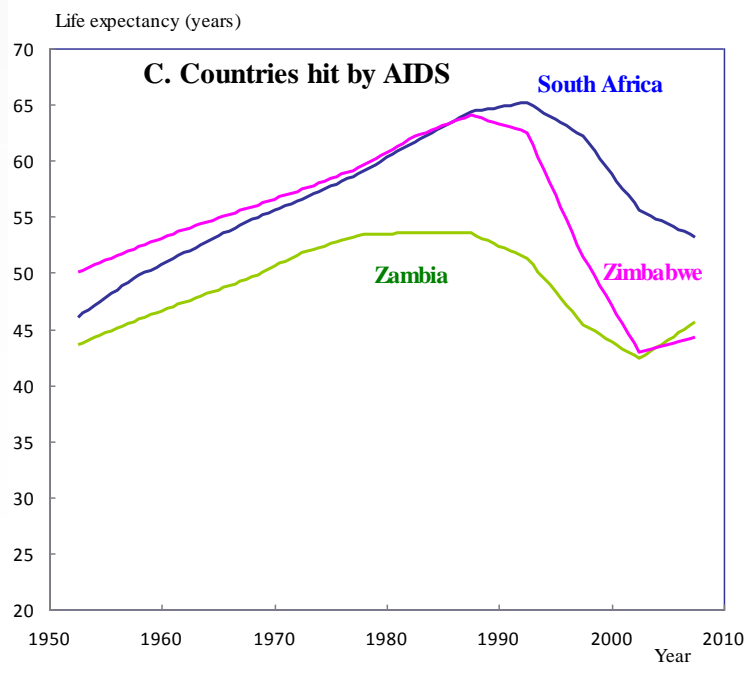
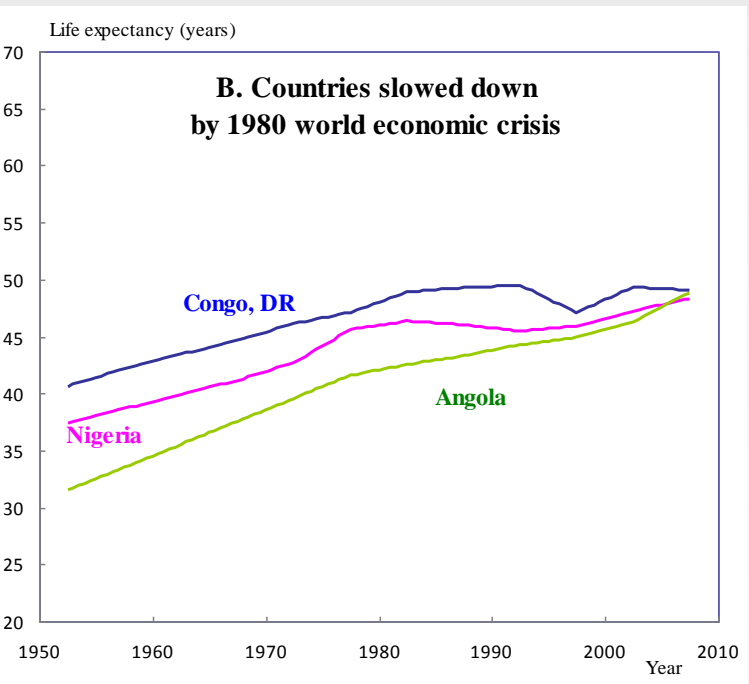
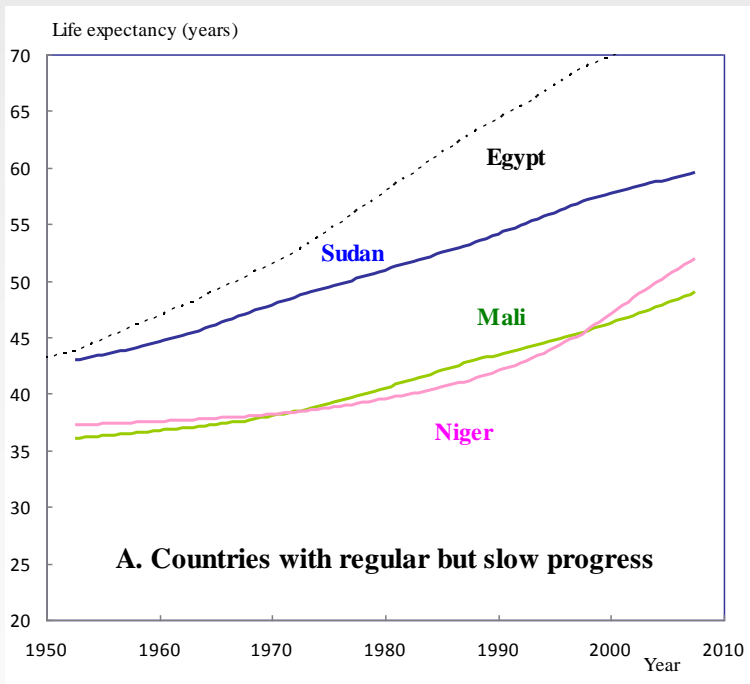
# A longer perspective for some countries



# Contribution of mortality decline by age groups to gains in life expectancy in Argentina, India and Afghanistan before and after WW-2

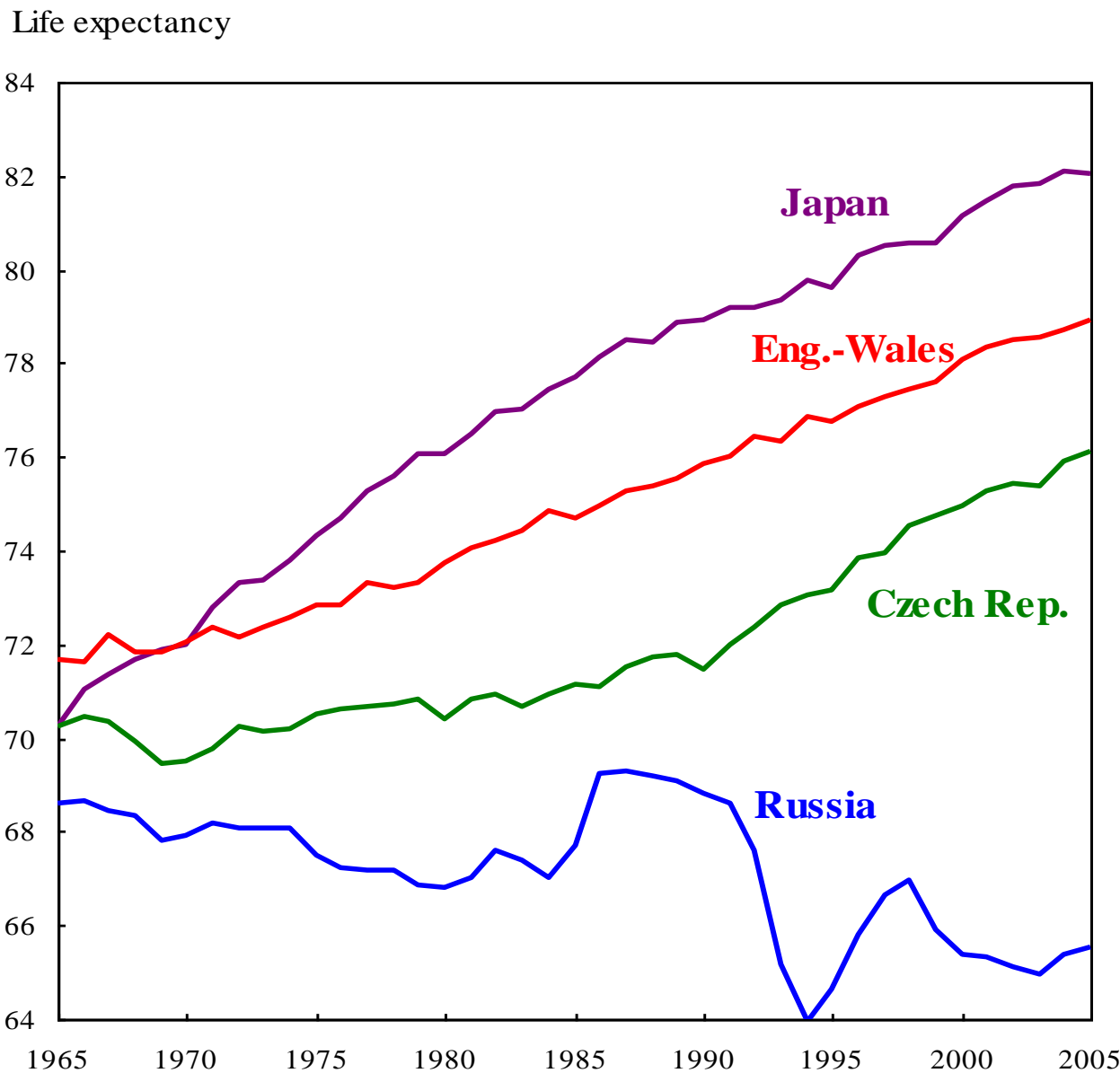




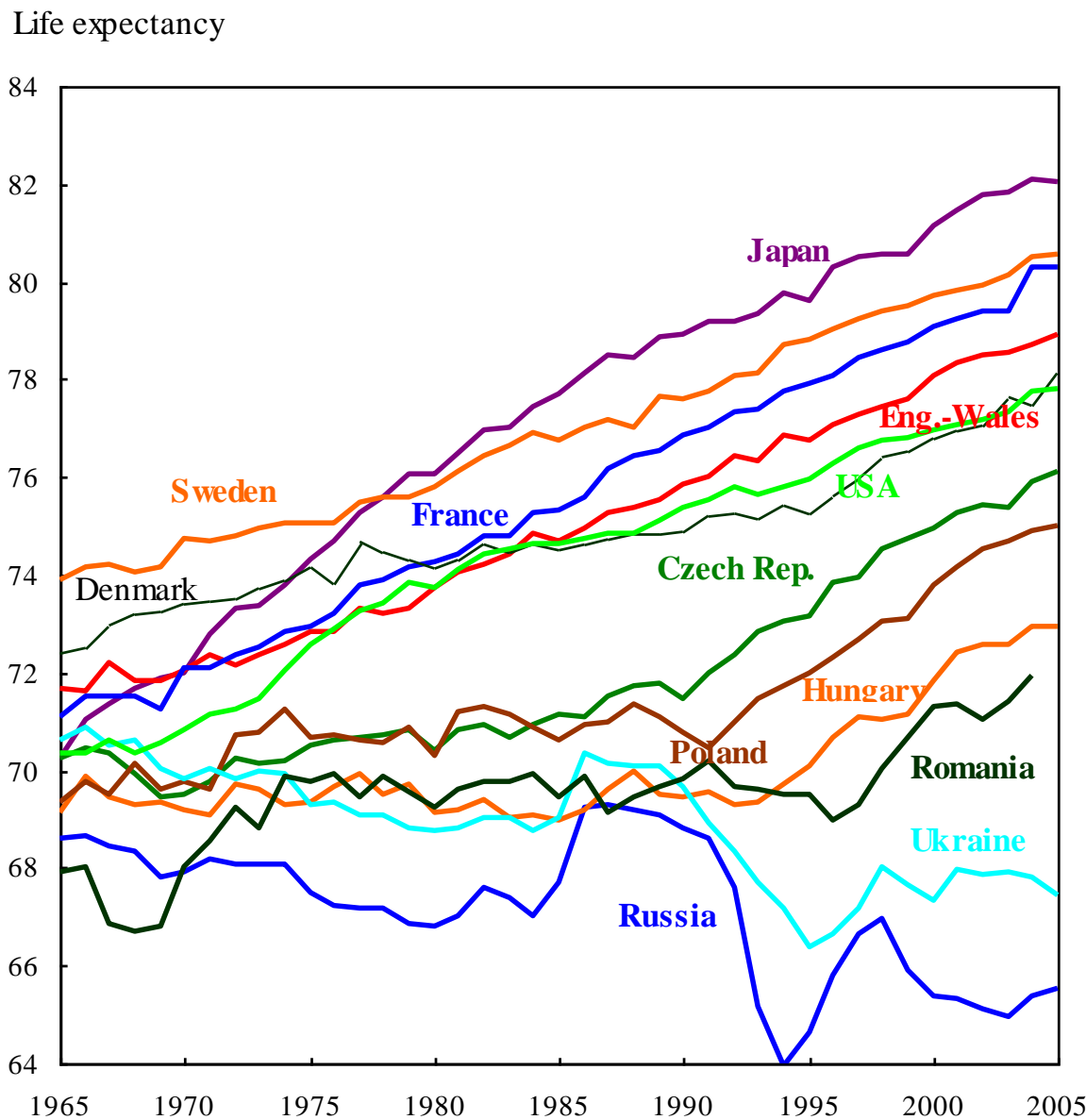


**Second stage:  
the cardiovascular revolution**

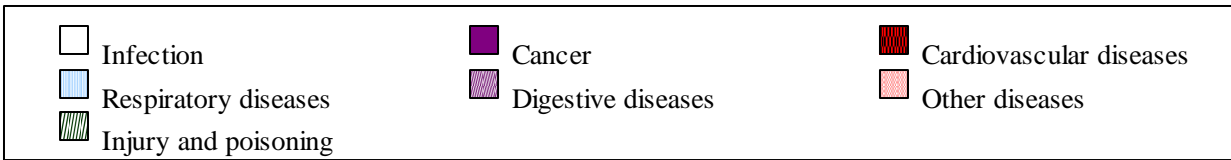
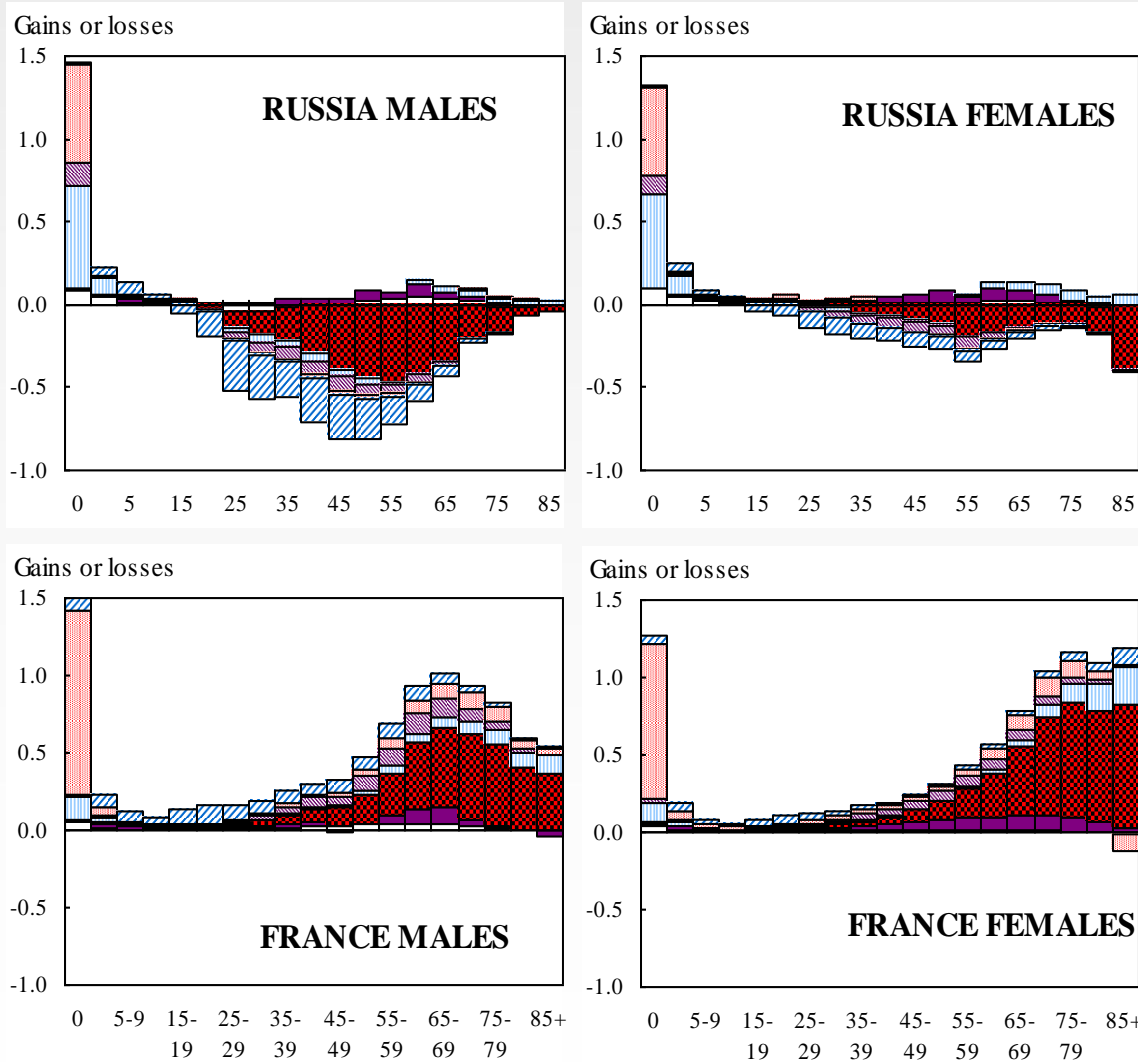
# Trends in life expectancy (both sexes) since 1965 in industrialized countries



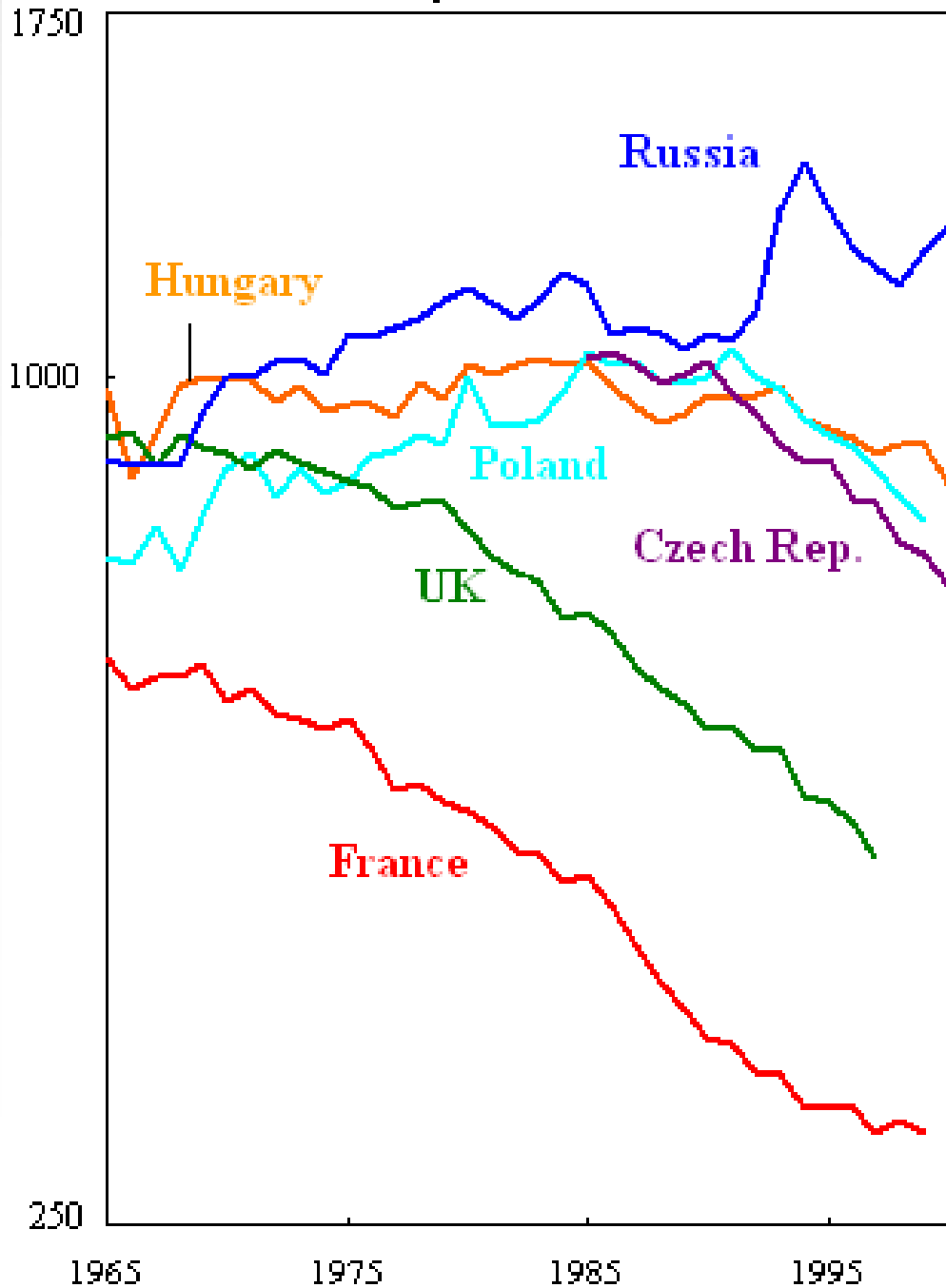
# Trends in life expectancy (both sexes) since 1965 in industrialized countries



# Contribution of trends in age-specific mortality for seven main groups of causes to changes in male life expectancy between 1965 and 2005



# Standardized mortality rate



Trends in male standardized mortality rate from cardiovascular diseases since 1965 in 6 industrialized countries



# Major improvement involved

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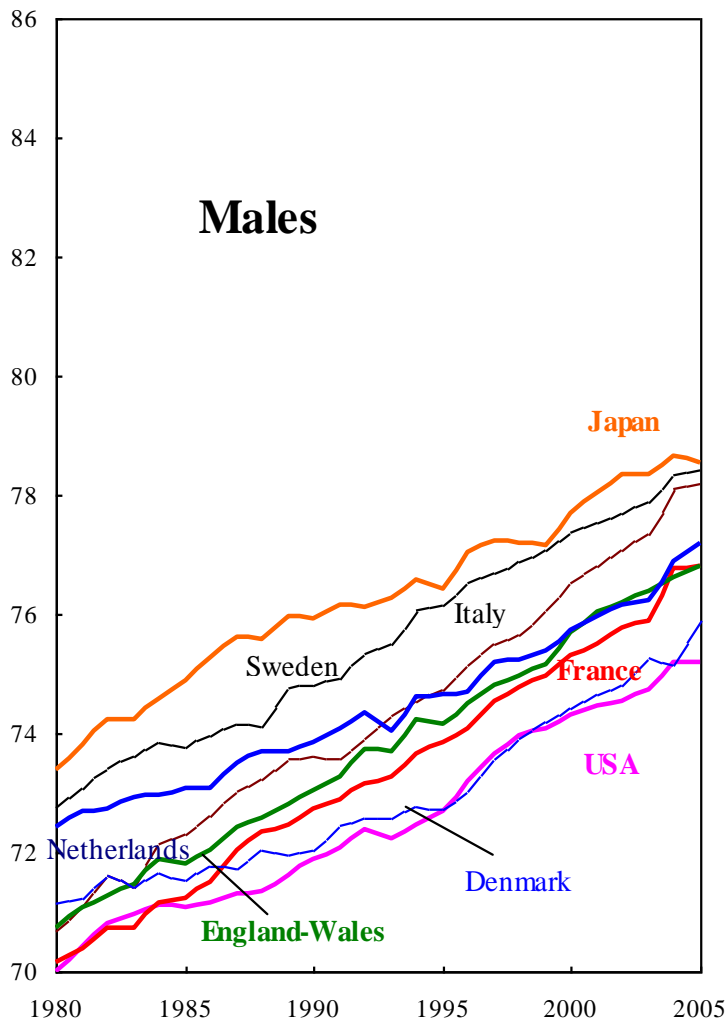
- New medical tools (heart surgery and drugs, emergency services, etc.)
- Behavioural changes (diet, stop smoking, exercise)
- Economical and financial aspects

**Third stage:  
the fight against ageing**

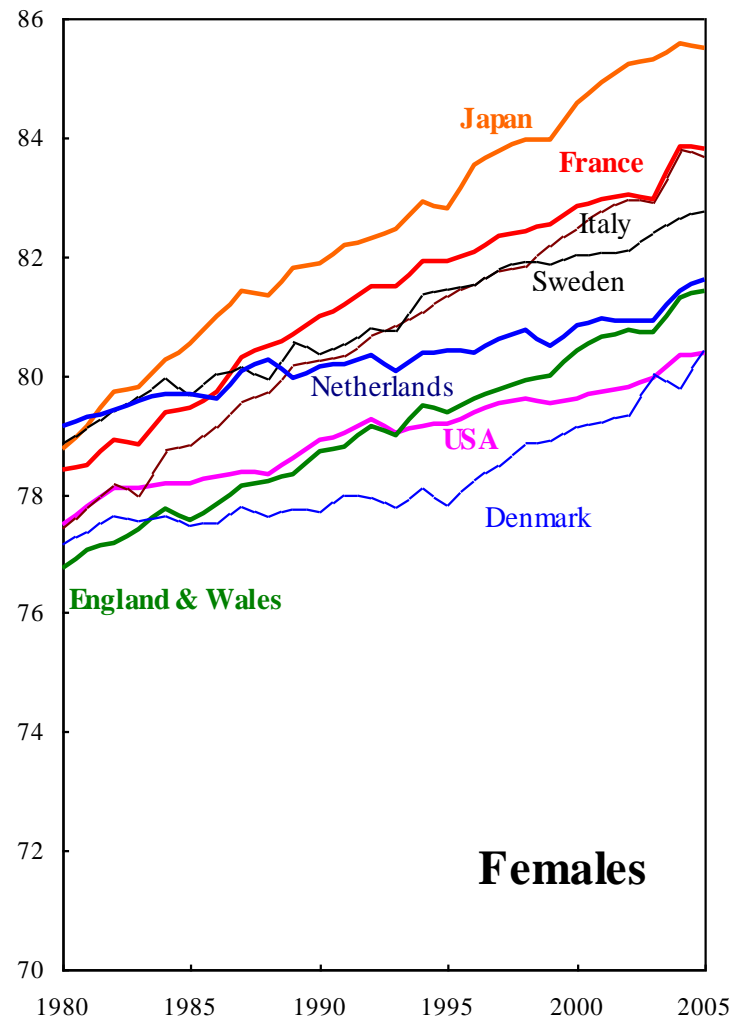


# Trends in life expectancy since 1980 in some Western industrialized countries

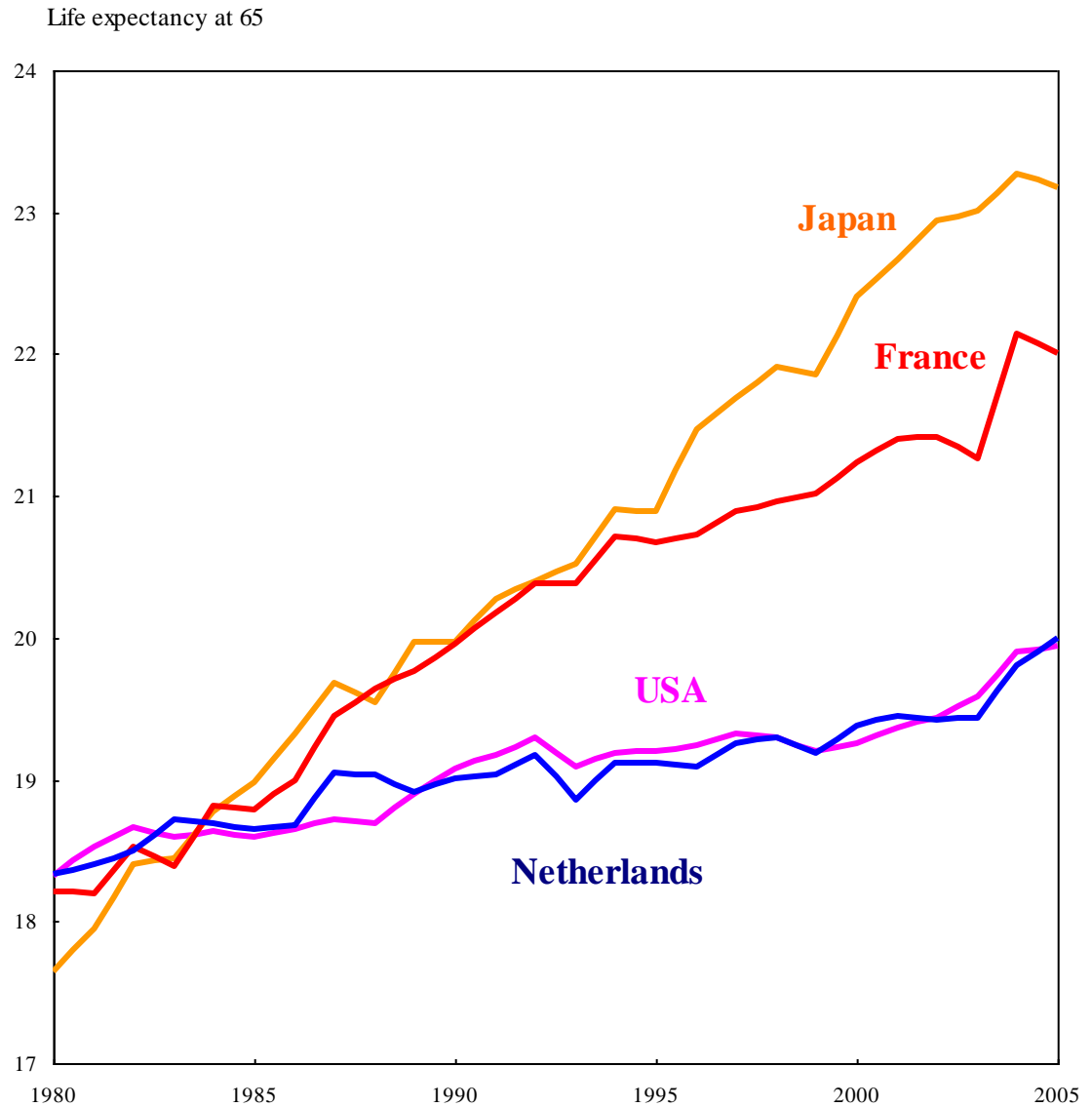
Life expectancy

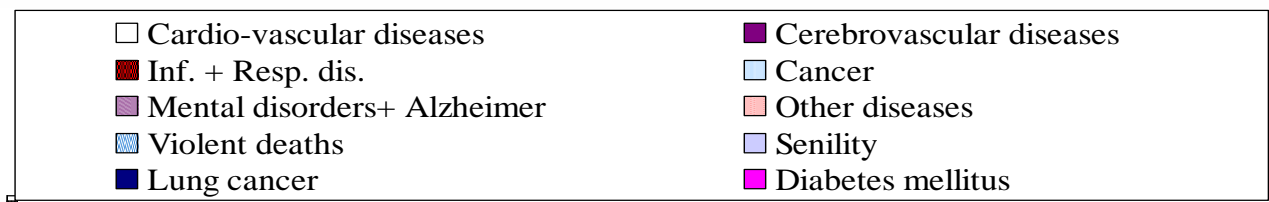
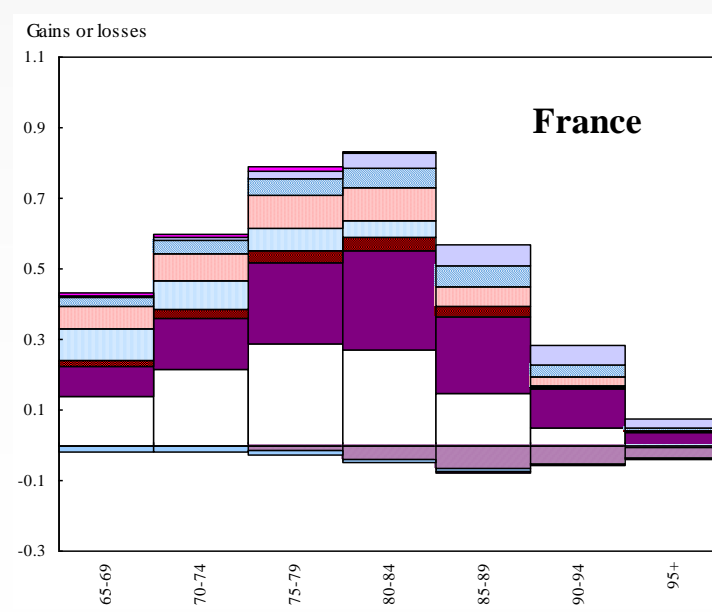
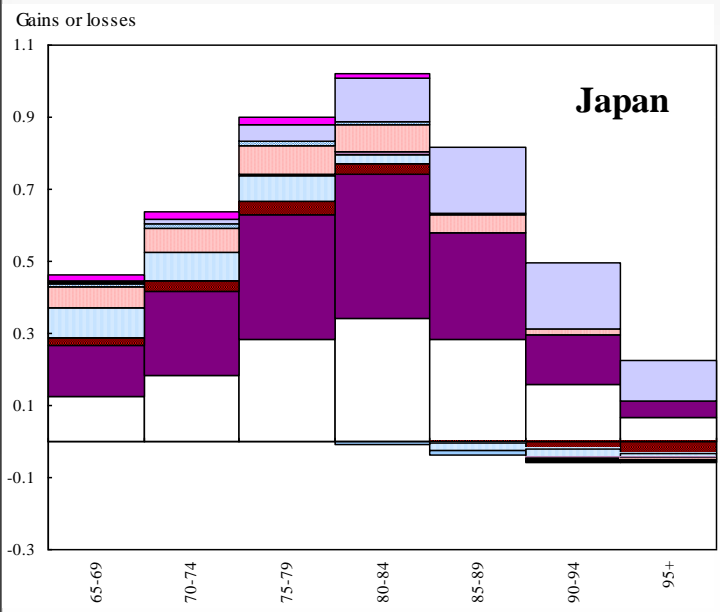
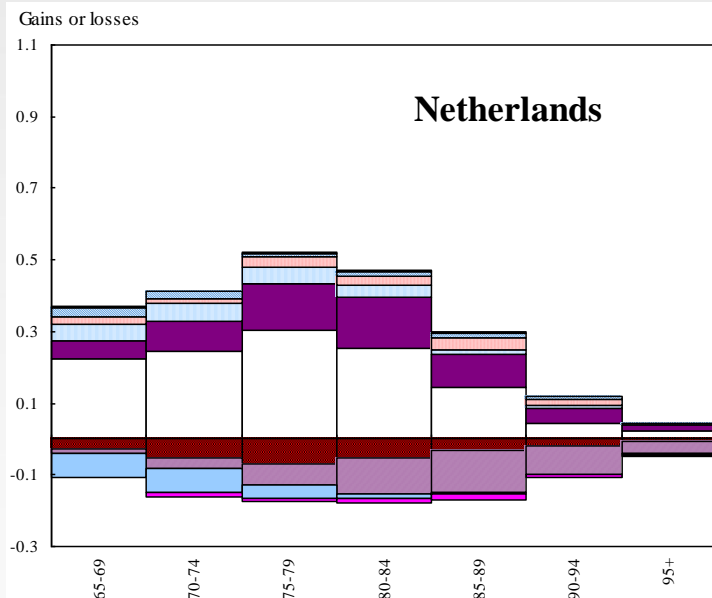
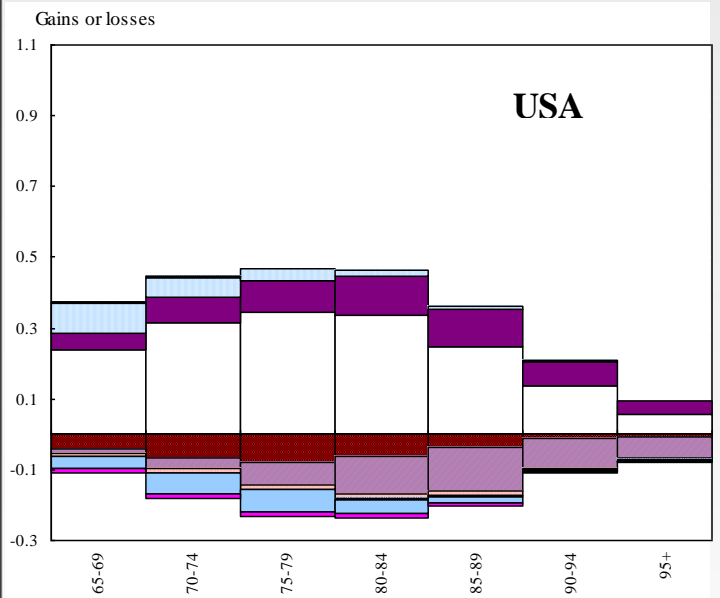


Life expectancy



# Trends in female life expectancy at age 65, since 1980





**Age and cause components of life expectancy changes 1984-2005: increasing weight of lung cancers and mental disorders in the USA and the Netherlands**



# Major improvement involved

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- The way to take care of elderly



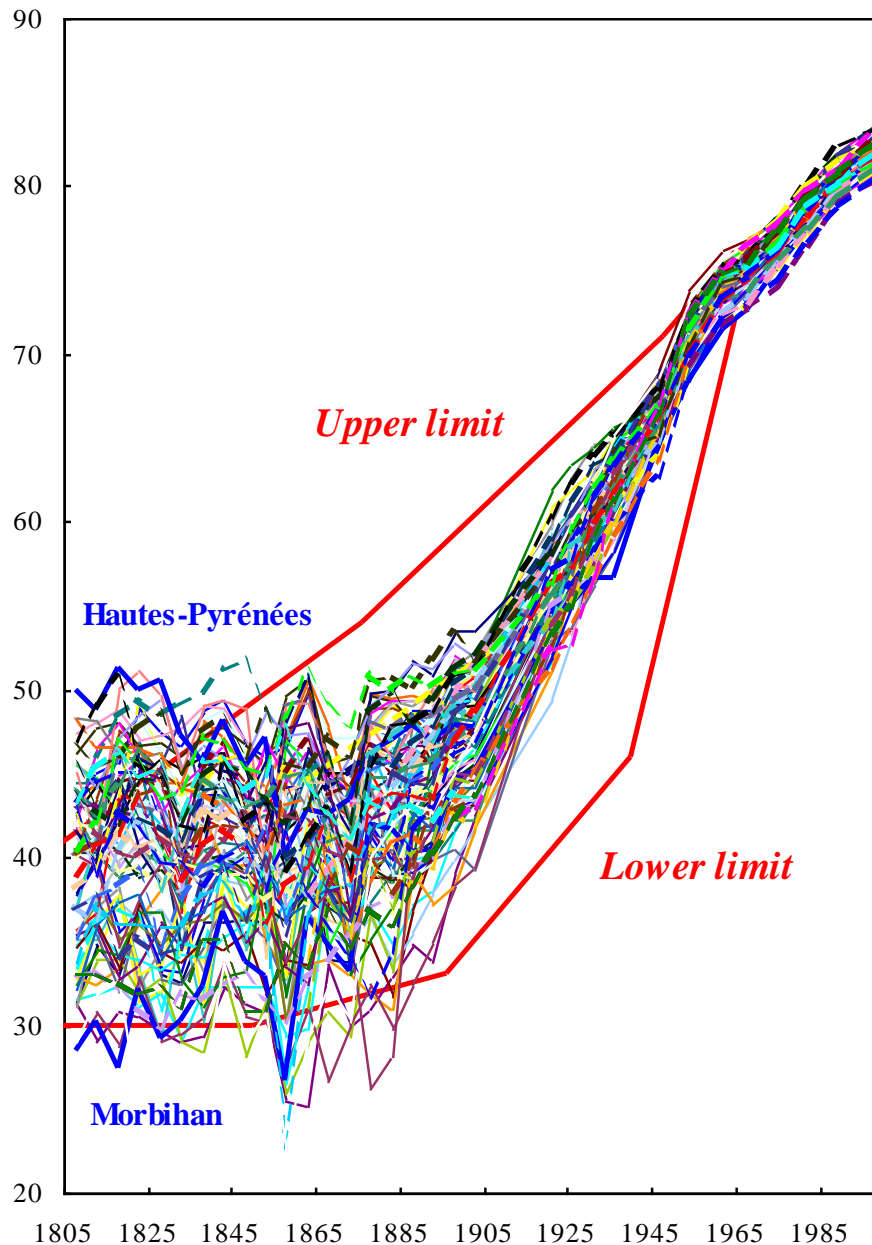
# The improbable generalised convergence

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- Each major improvement induces new divergence
- No hope for general convergence except if no more progress can be done...

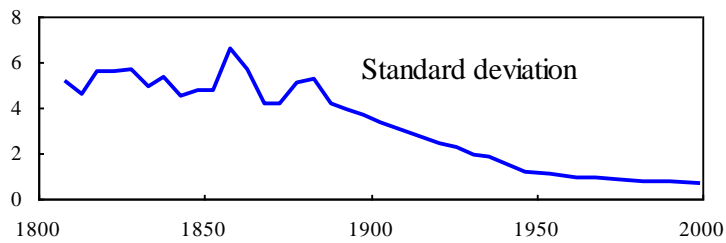
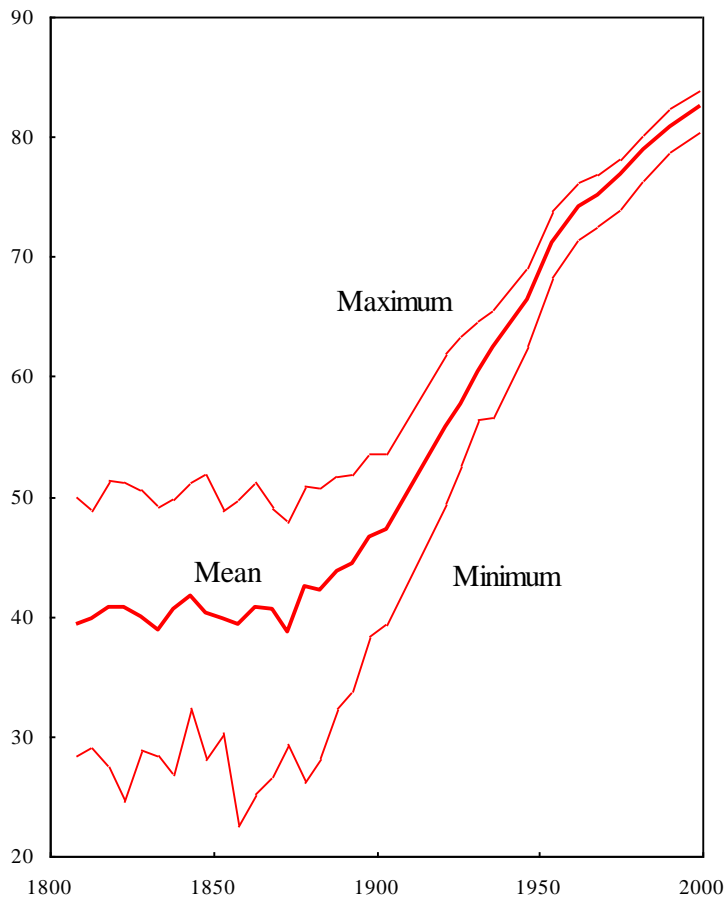
What about sub-national differences ?

Life expectancy at birth



Trends in female life expectancy by French *Départements* as compared to the upper and lower limits of national trends in industrialized countries

Life expectancy

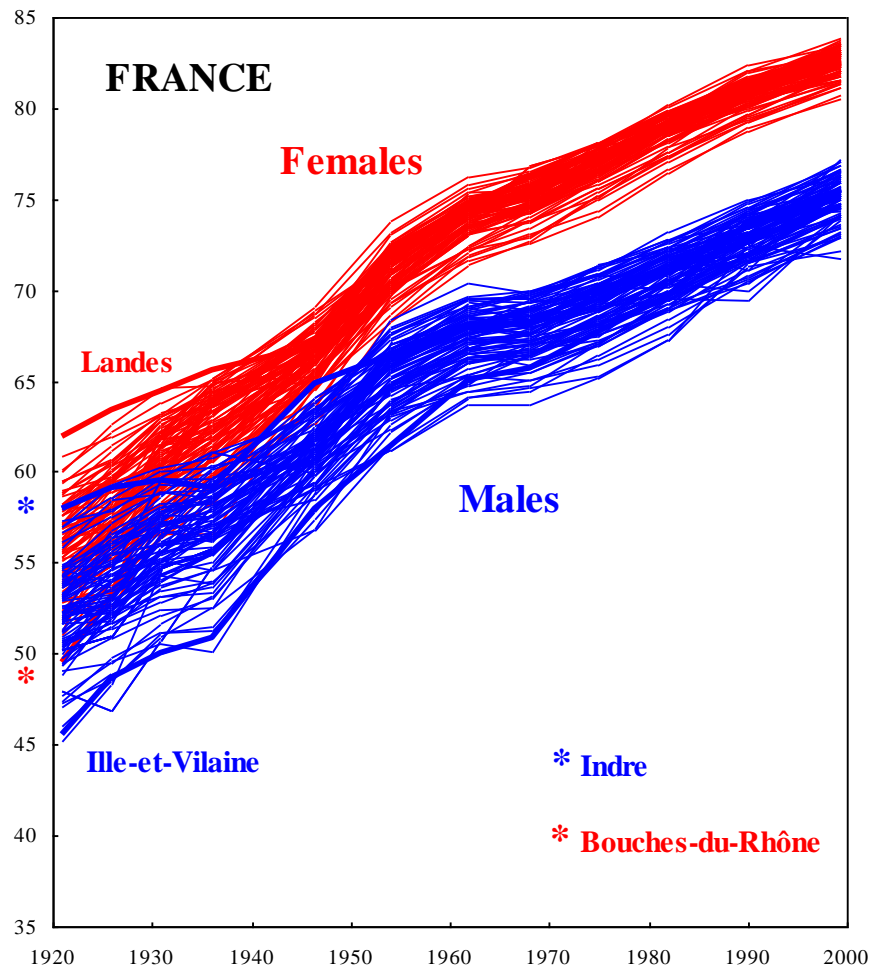


Historical trends in maximum, minimum, mean and standard déviation of female life expectancy by French *Départements*

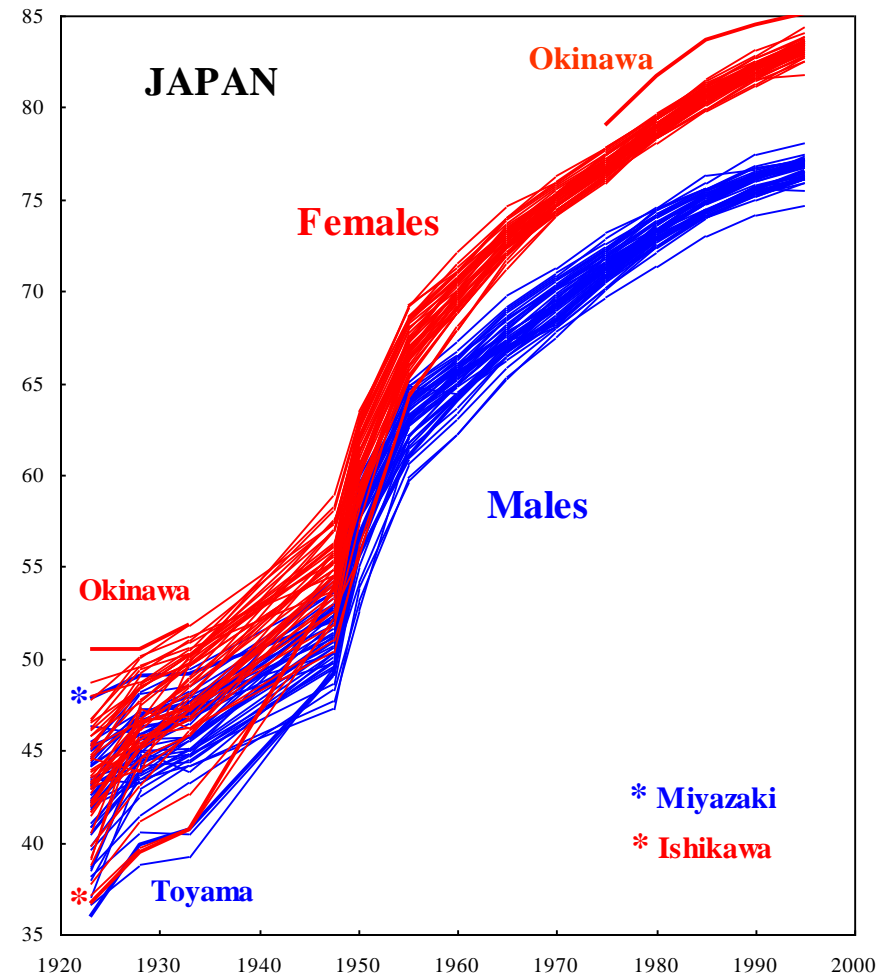


# Geographical variations in life expectancy in France and Japan since the 1920s

Life expectancy



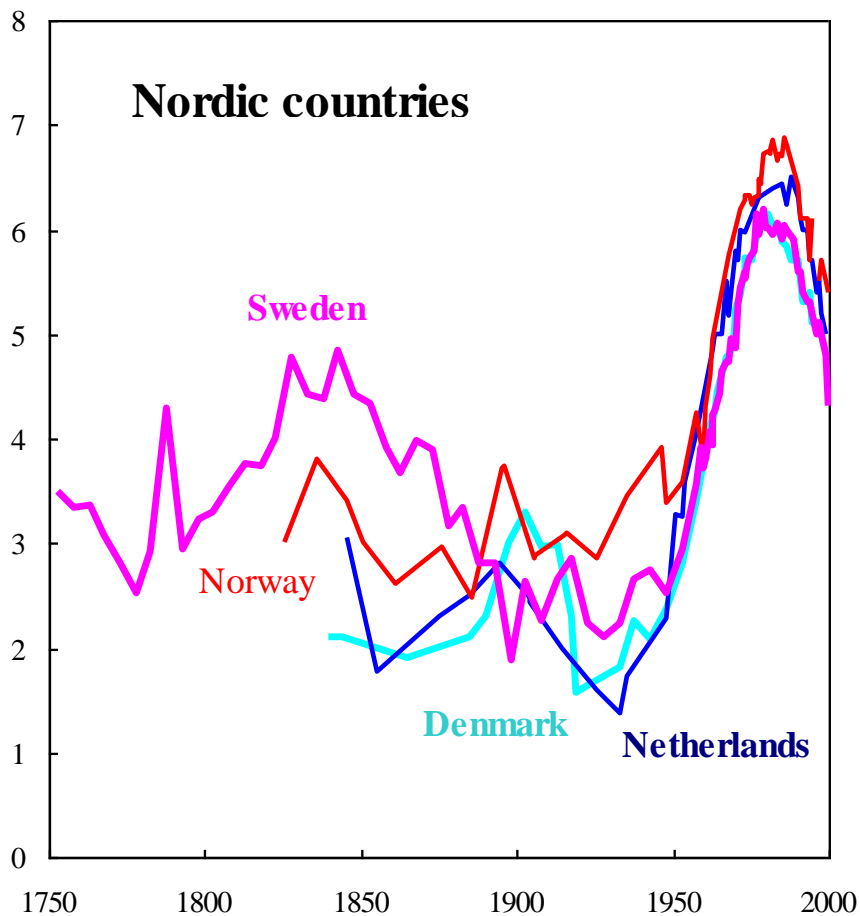
Life expectancy



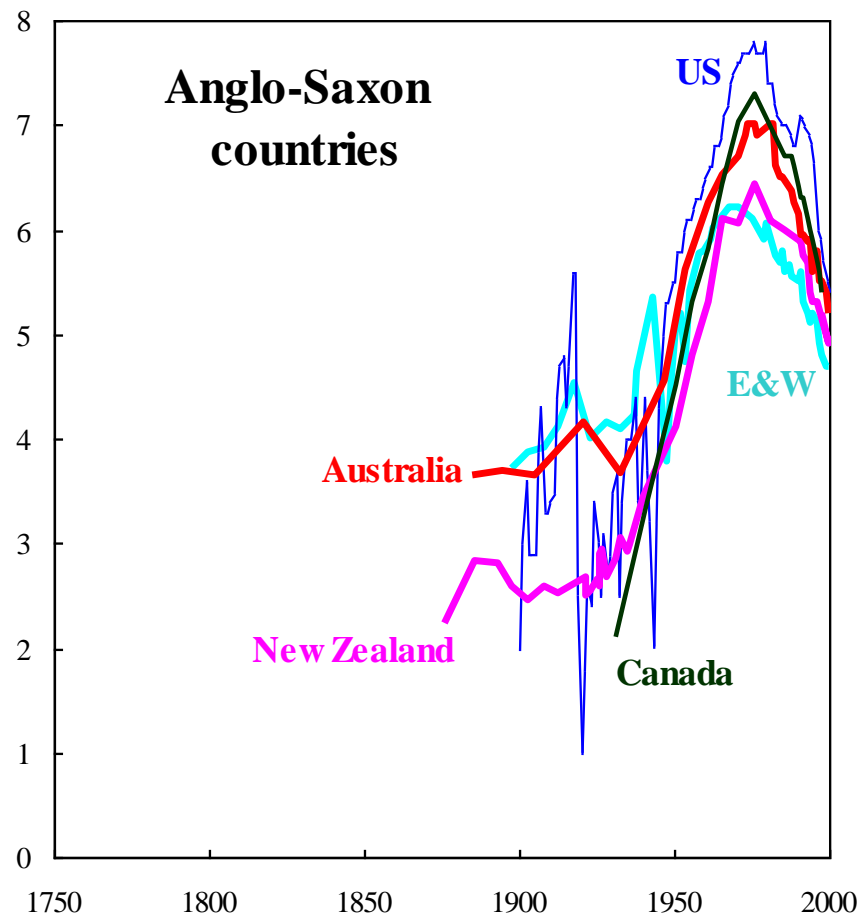


# Trends in sex differences in life expectancy

Difference

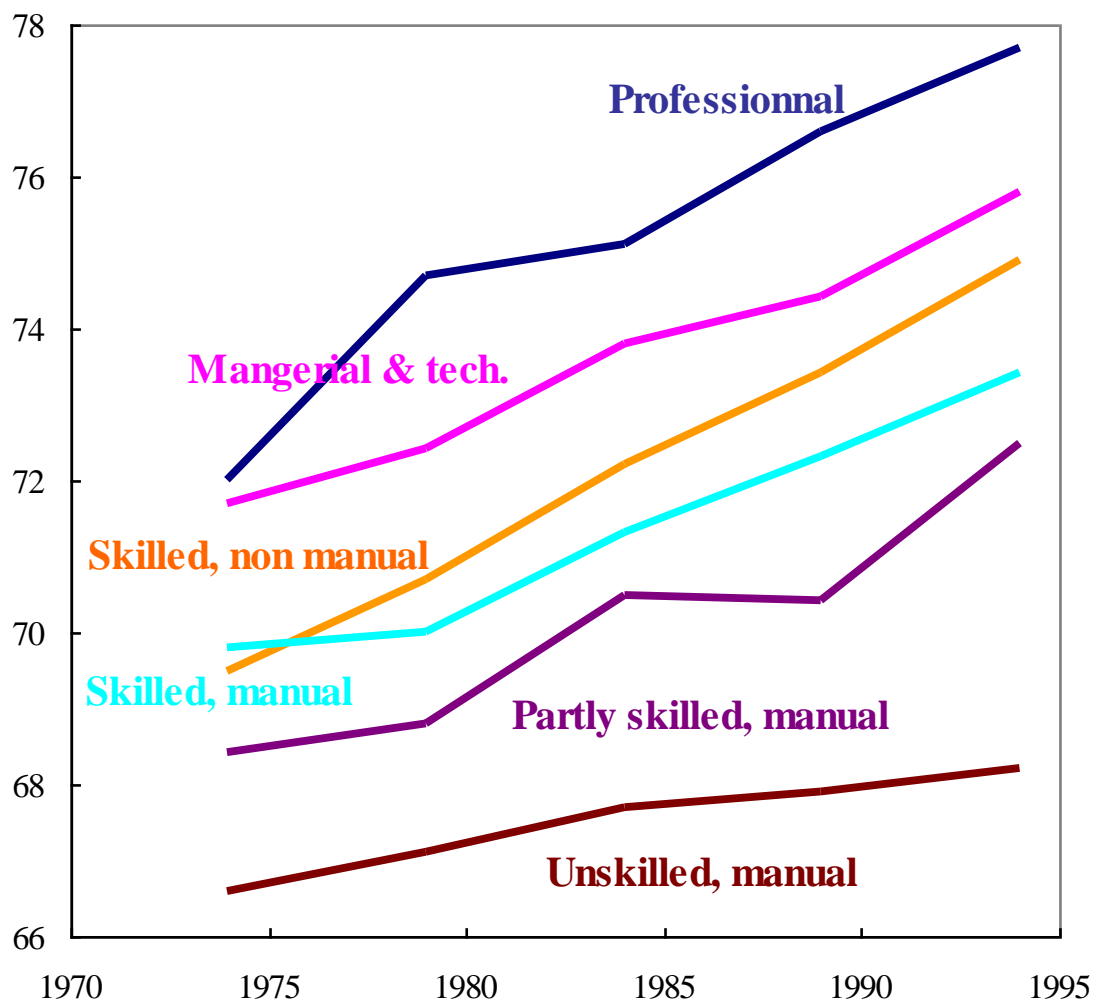


Difference





# Trends in life expectancy at birth in England and Wales by social classes





# Conclusion

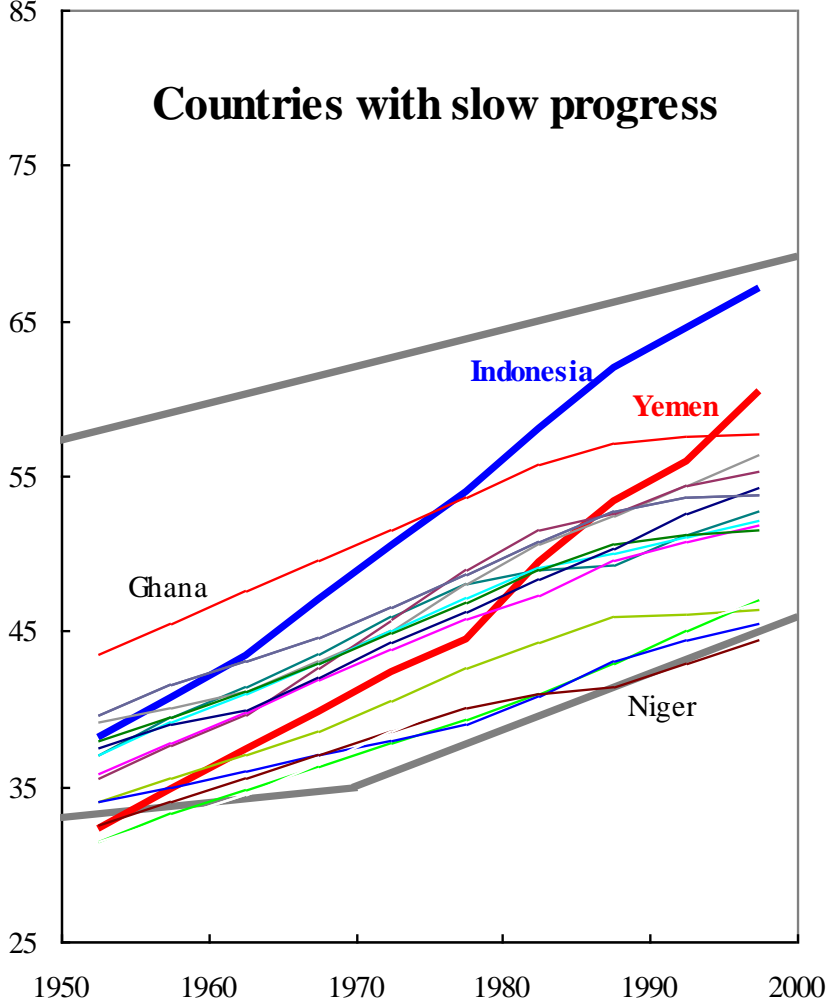
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- Health transition is not running smoothly
- Successions of diverging/converging moves: an explanatory theory which
  - helps understanding the diversity of cases existing to-day in the world
  - but makes quite pessimistic about a possible future reduction of inequalities

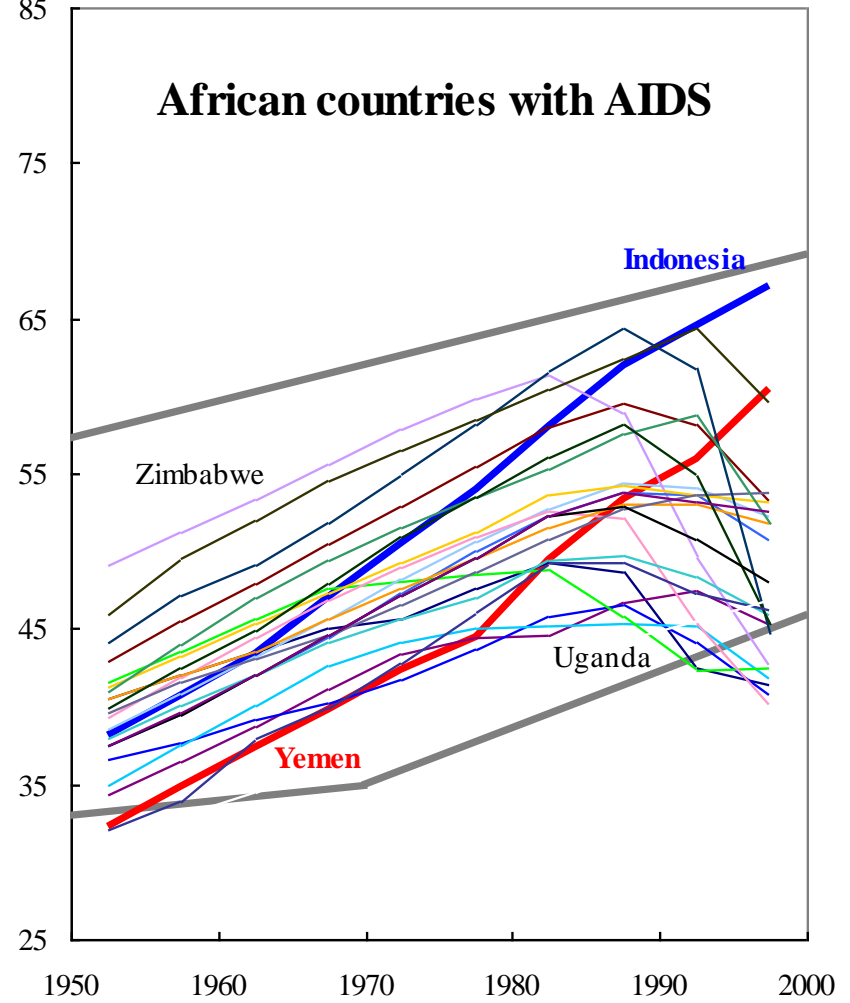
**The end**

# Long-term trends in female life expectancy for Sub-Saharan Africa

Life expectancy



Life expectancy



1900