

Population: an Exogeneous or Endogeneous variable for Sustainable Development?

*Conference on “Social sciences and humanities facing the
climate challenge”*

Paris, September 22-23, 2008

Henri Leridon, INED and Collège de France

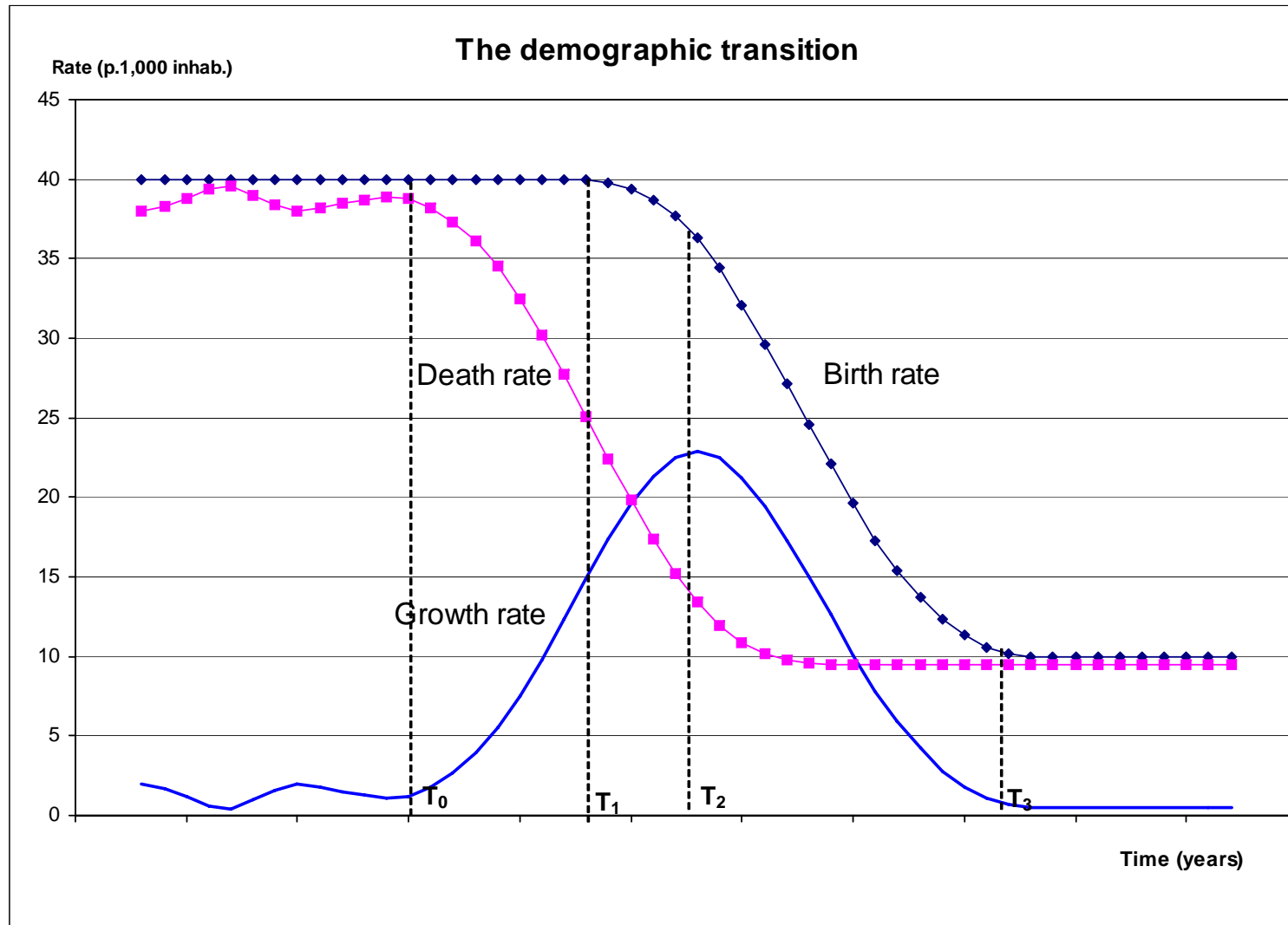
Summary

- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - Migrations
- 3. Models with population as an endogeneous variable

1. Demographic projections, as a basis for most models with population as an exogeneous variable

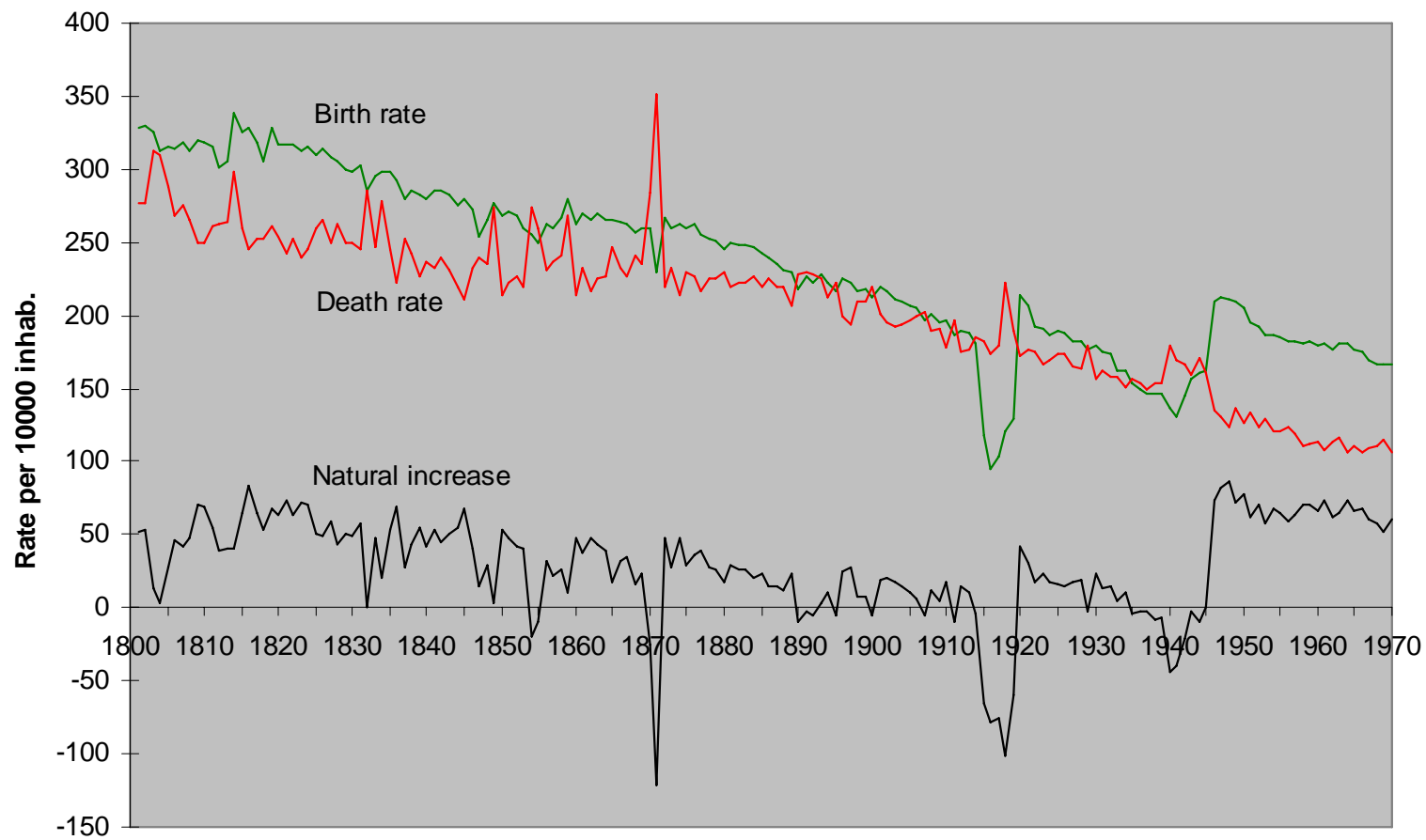
- The principle of demographic projections
 - *Performed for each individual country, then aggregated*
 - *Components are projected, not the total population: mortality, fertility, migrations*
 - *The guiding principle: the « demographic transition »*
 - *Usually, one central hypothesis and variants*

The scheme of demographic transition

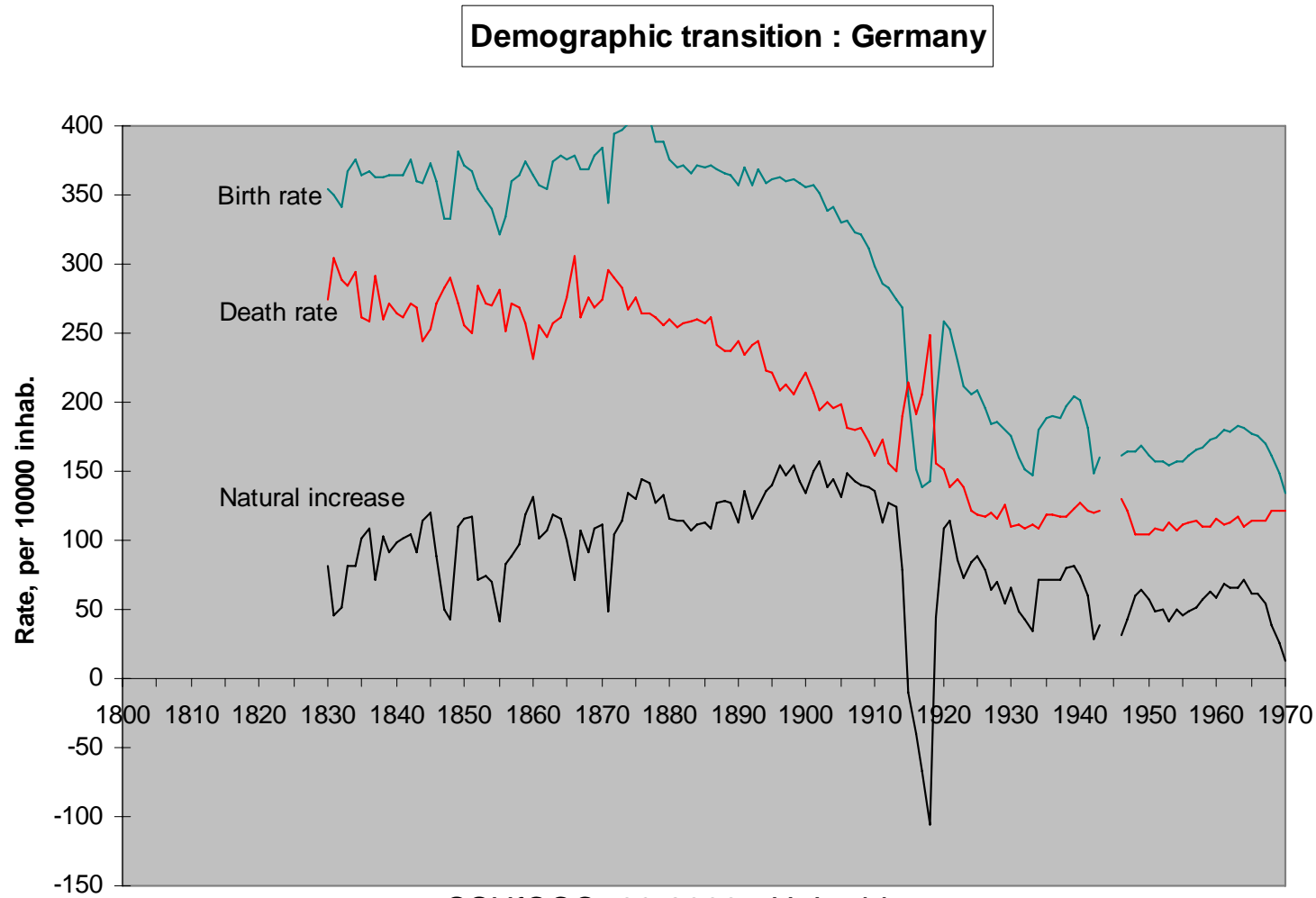


The demographic transition: France, 1800-1970

Demographic transition : France



The demographic transition: Germany, 1800-1970



SSHfCCC- 09-2008 - H. Leridon

- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - Migrations
- 3. Models with population as an endogeneous variable

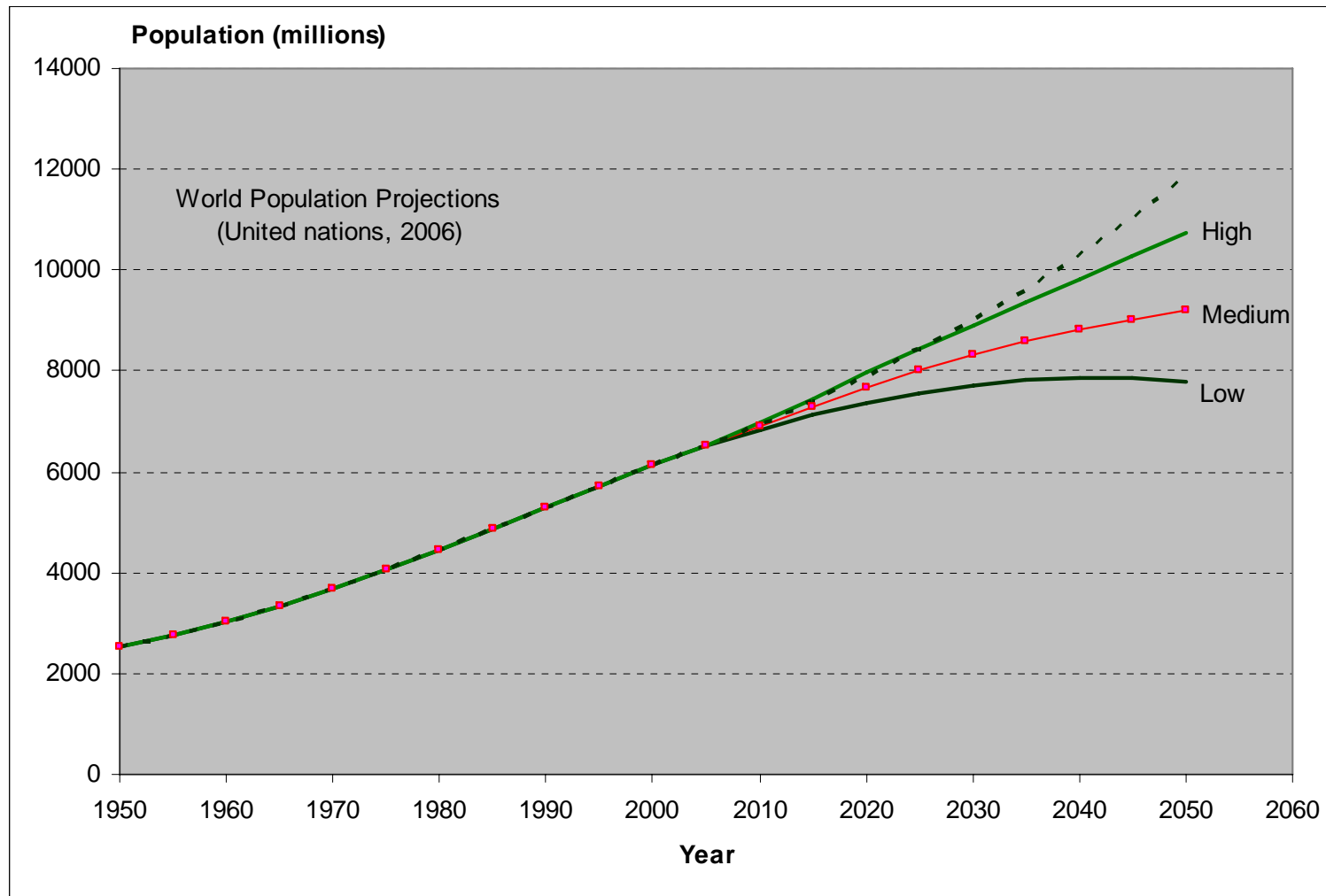
- World population: Towards stabilization?

- 2006 UN projections: 9.2 billions in 2050

- [7.8 – 10.8]

- Suggesting a possible stabilization round 10 billions in 2100

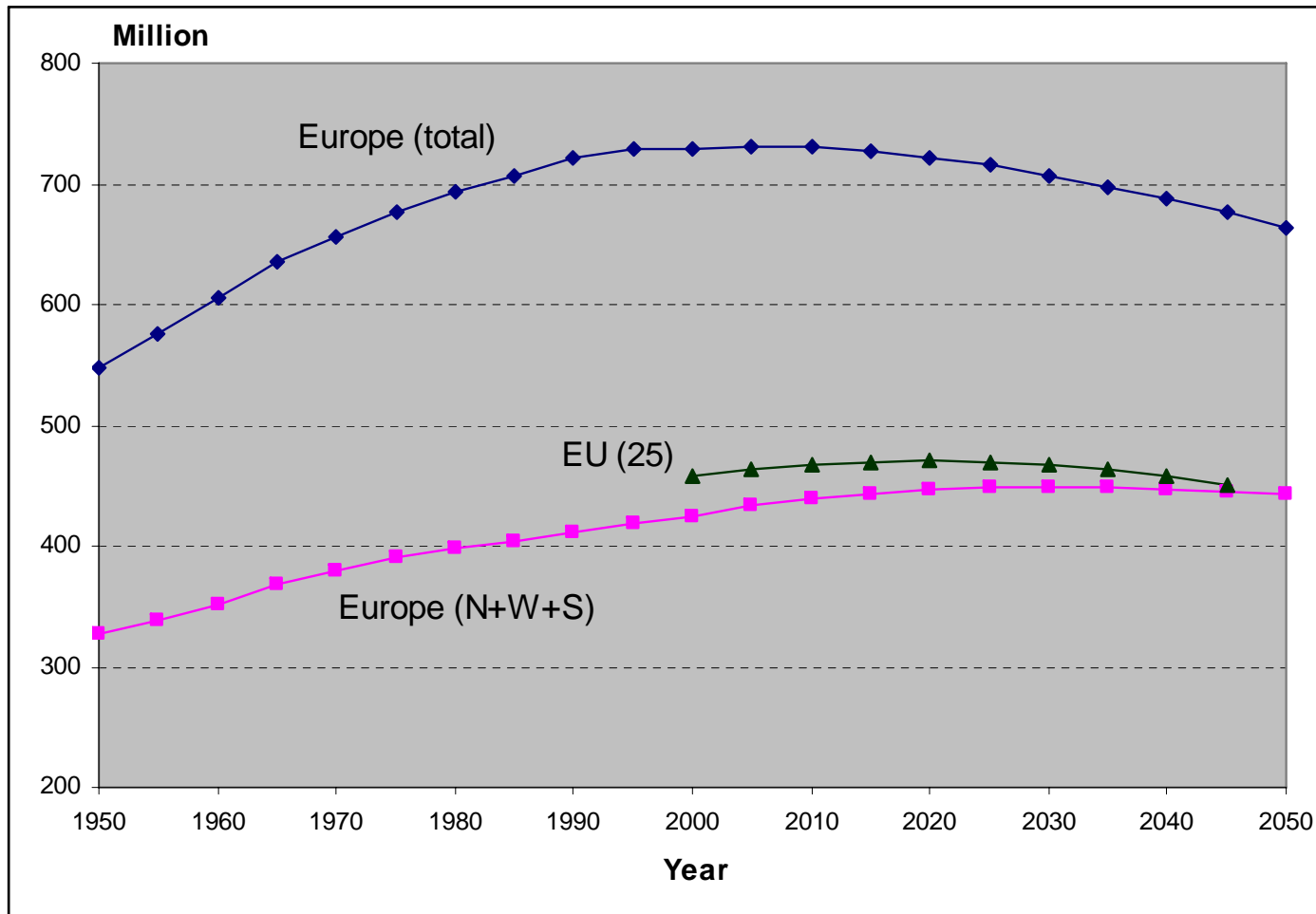
UN World population projections, 2006



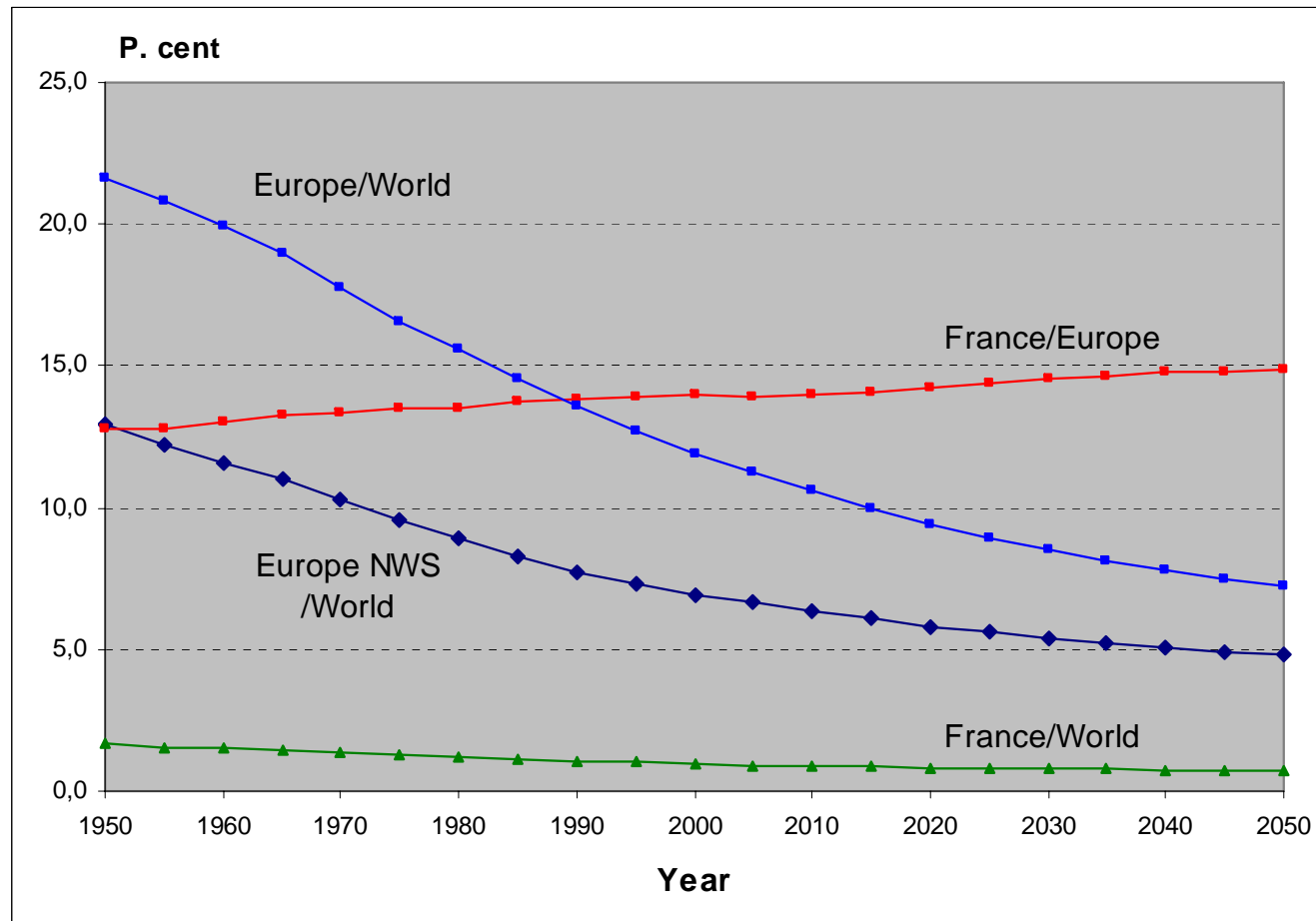
- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - Migrations
- 3. Models with population as an endogeneous variable

- *Several definitions of Europe:*
 - The 'geographical definition' of the UN: includes Russia, Ukraine and Belarus
 - The 'Northern+Western+Southern' parts of Europe: approximately same size as...
 - The European Union (with 25 members)

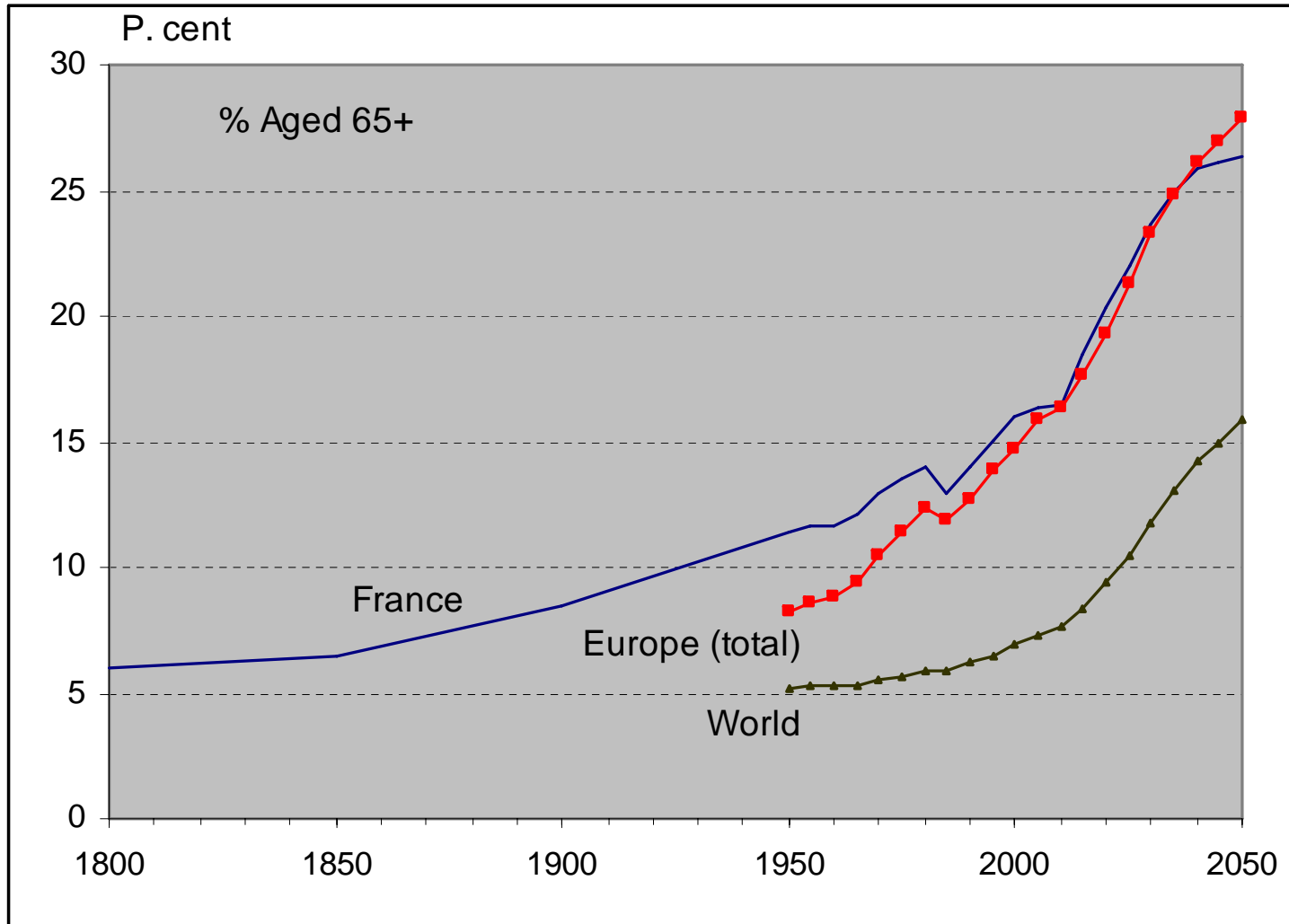
The population of Europe : 1950-2050



Ratios of populations: World, Europe, France



The ageing of populations

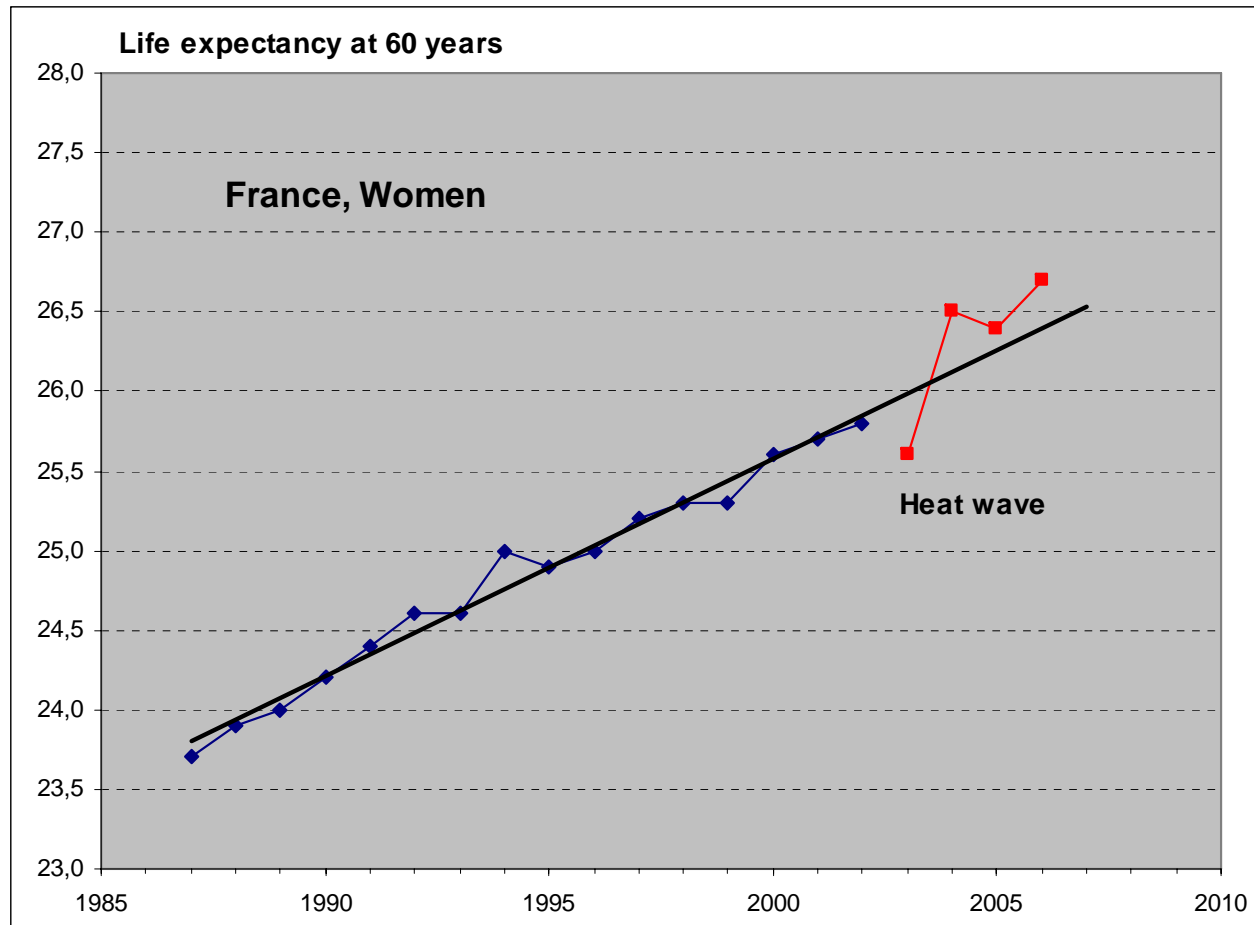


- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - Migrations
- 3. Models with population as an endogeneous variable

- *Mortality:*

- Rates by sex and age are extrapolated
- The only factor that is explicitly taken into account in the UN projections: HIV-AIDS
- Catastrophes are not considered... because they are difficult to forecast at a country level

France, 2003 : effects of the heat wave on female life expectancy at 60 years

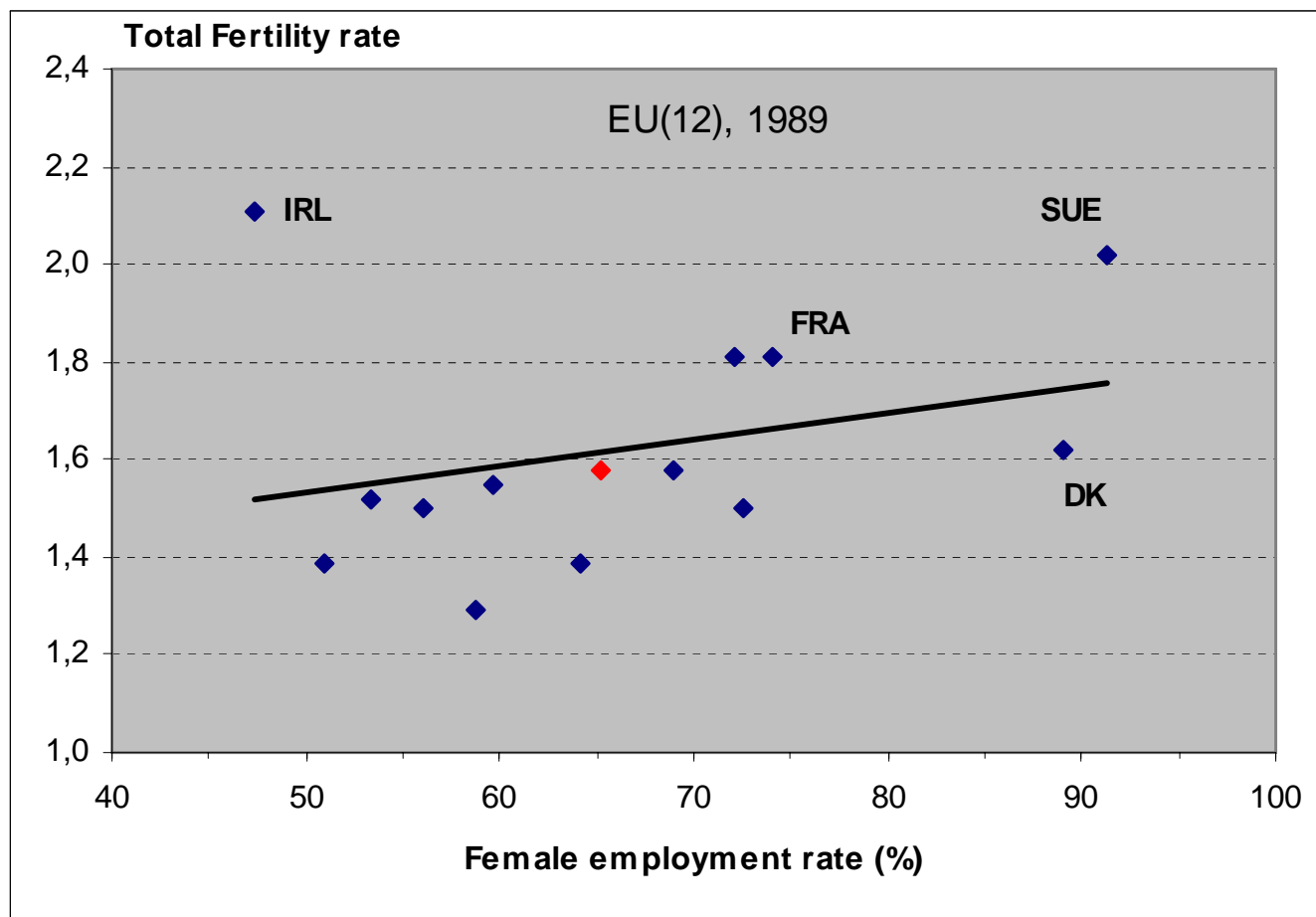


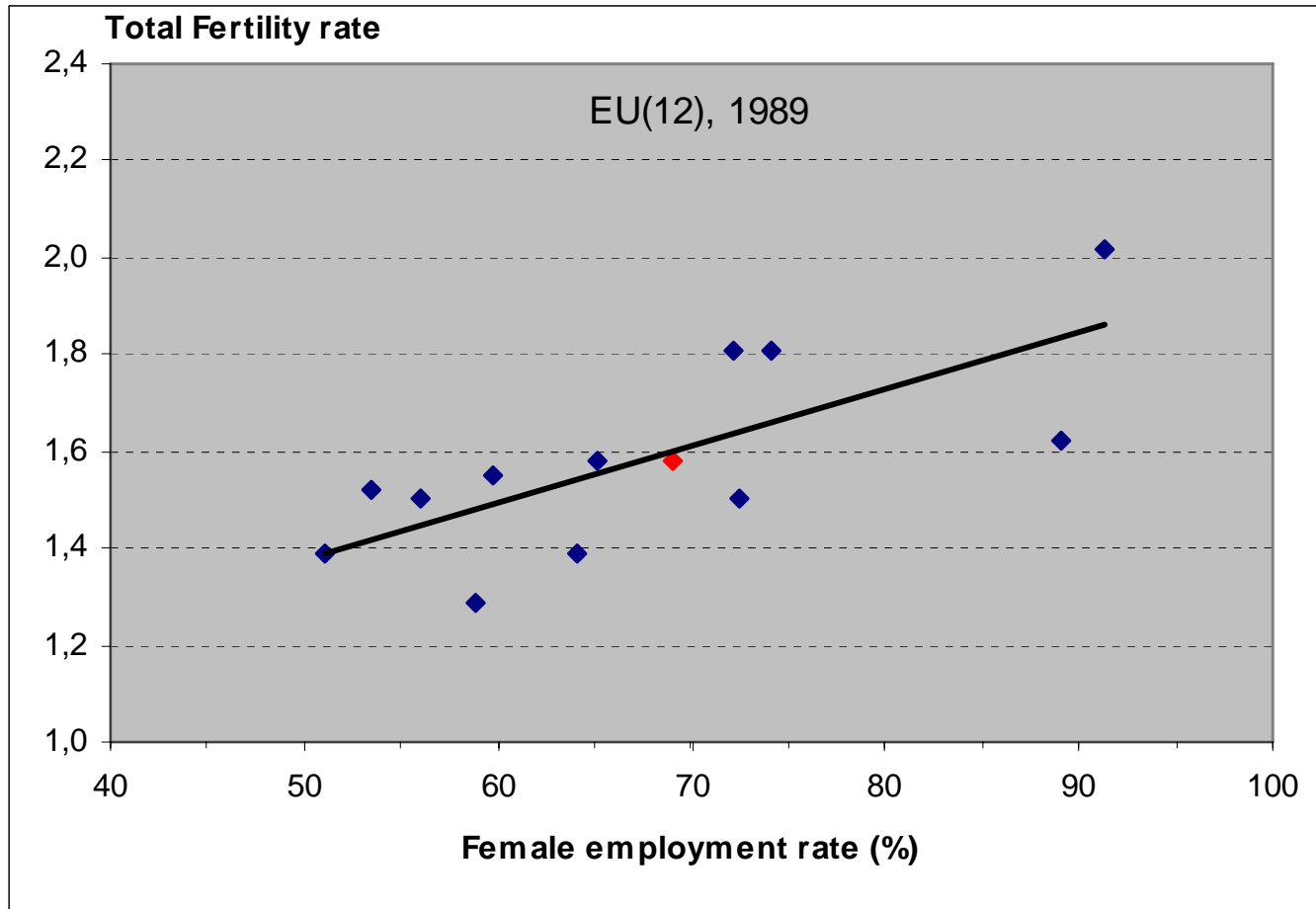
- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - Migrations
- 3. Models with population as an endogeneous variable

- *Fertility:*

- A large number of determinants: biological and behavioral
- A key variable: women education (+ employment and social status)
- Contraception must be available... and used
- Risks of decline in *fecundity*?

Female employment and fertility





Risks of a decline in fecundity?

Possible effects on fertility of a decline in fecundity

| | | |
|--|-----------|-------------|
| Reduction in sperm concentration | 21% | 47% |
| <i>Resulting in a...</i> | | |
| Reduction in fecundability of: | 7% | 15% |
| Initial Total Fertility Rate (children per woman) | 2.00 | 2.00 |
| Possible decline of TFR (absolute) | 0.02 | 0.04-0.08 |
| Decline (per cent) | 1% | 2-4% |

- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - **Migrations**
- 3. Models with population as an endogeneous variable

- *Migrations:*
 - No effect at the world level...
 - At the country level, the annual net rate of migration is rarely above 0.5% per year
 - Round year 2000, the annual net rate for the more developed regions was 0.2%
For LDC's : -0.05%
 - In UN projections, the migration rates are usually lesser in 2040-50 than in 2000

- 1. Demographic projections, as a basis for most models with population as an exogeneous variable
 - Making projections
 - Prospects for the World population
 - Prospects for the European population
- 2. How Population can be treated as an endogeneous variable
 - Taking mortality into account
 - Taking fertility into account
 - Migrations
- 3. Models with population as an endogeneous variable

'The limits to Growth' model

- *Five key variables:*
 - Food production
 - Natural resources (gas, coal, metals...)
 - Industrial production, and capital
 - Pollution and impact on environment
 - World population
- ... *Plus about 80 intermediate variables*

'The limits to Growth' model

- The main conclusion: a long-term equilibrium is impossible, if the demographic growth is not stopped
- A number of criticisms
- And no further attempt to build such a global 'world model'
- But many 'sub-models' relating population and economy, or economy and pollution, or population and climate....

Conclusions

- Population is likely to remain an exogeneous variable in most cases
- Because long term population projections are available, and are reasonably reliable
- And because the links between population and other variables are still badly known, or too country-specific

- Thank you.