



TEORIE E MODELLI DEMOGRAFICI

UNIT 1

THE DEMOGRAPHIC TRANSITION THEORY



200 hundreds years that changed the world



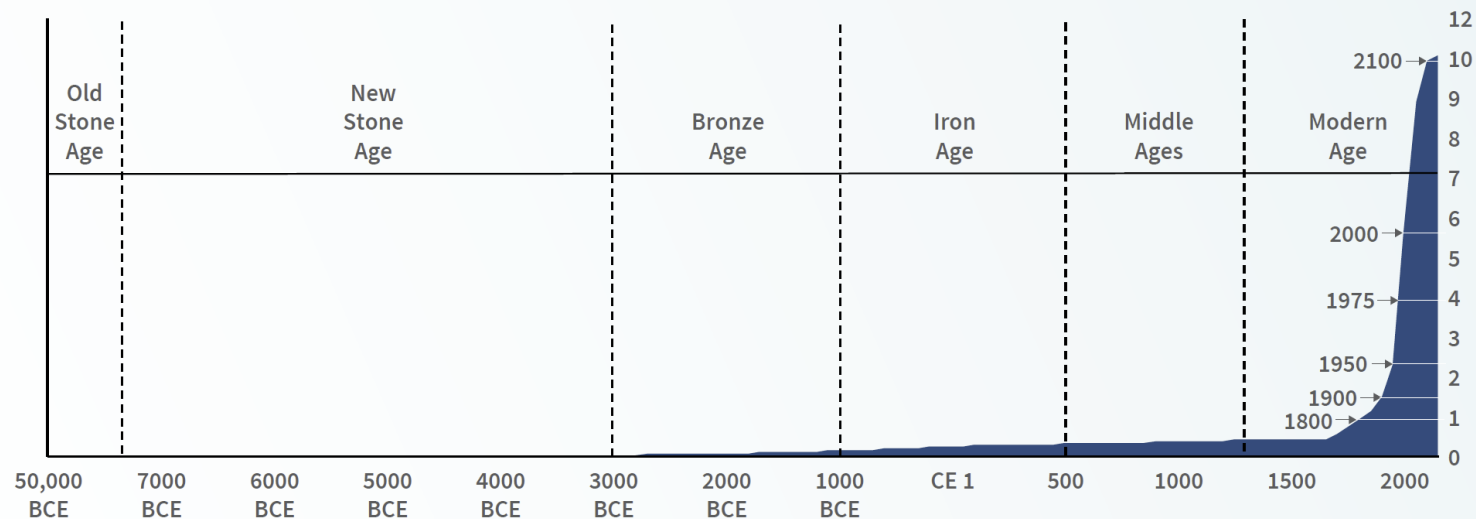
- <https://www.gapminder.org/videos/200-years-that-changed-the-world/>

Rapid population increase is a new phenomenon!

FIGURE 10

RAPID POPULATION GROWTH IS A MODERN-AGE PHENOMENON

World Population Growth Through History in Billions of People



Sources: Toshiko Kaneda and Carl Haub, "How Many People Have Ever Lived on Earth?" Population Reference Bureau (2018); and UN, DESA, *World Population Prospects 2019*.

The mechanism

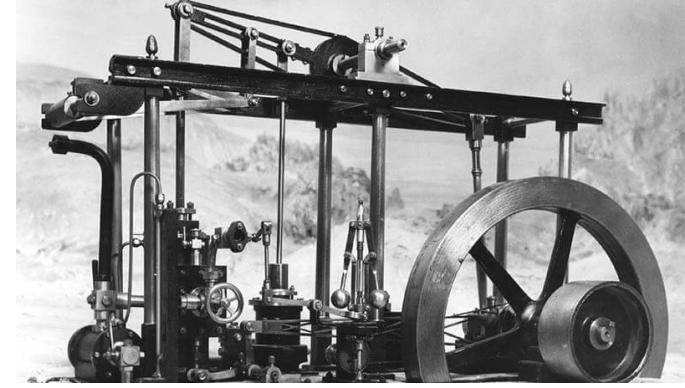
The demographic transition

- It is **the passage** from a **regime**
 - With high mortality and high fertility
 - to a regime**
 - with low mortality and low fertility

It started in XVIII c. in **France** and XIX **in other European countries**

- e_0 (*life expectancy at birth*) from 30-35 to 75-80 year old;
- TFR (*total fertility rate*) from 5 to 2 children
- b (*crude birth rate*) and d (*crude death rate*) from 30/40 per 1000 to 10 per 1000

From waste to economy



➤ **Inefficiency** of old demographic regime:

- in order to maintain a low level of growth, a great deal of fuel (births) was needed and a huge amount of energy was wasted (deaths).
- Women had to bear half a dozen children simply in order to achieve replacement in the following generation.
 - ✓ Between a third and a half of those born perished before reaching reproductive age and procreating.

From disorder to order



➤ **Disorder** of old demographic regime

- The probability that the natural **chronological hierarchy** would be inverted – that a child would die before its parent or grandparent – was considerable.
- High levels of mortality and frequent catastrophes rendered precarious any long-term plans based on individual survival.

Tie between survival and fertility

➤ **Macro:**

- a **diminishing mortality** **increases** population and pressure on resources (Malthus...).
- A **diminishing fertility** **balances** the relationship between population and resources (with birth control)

➤ **Micro:**

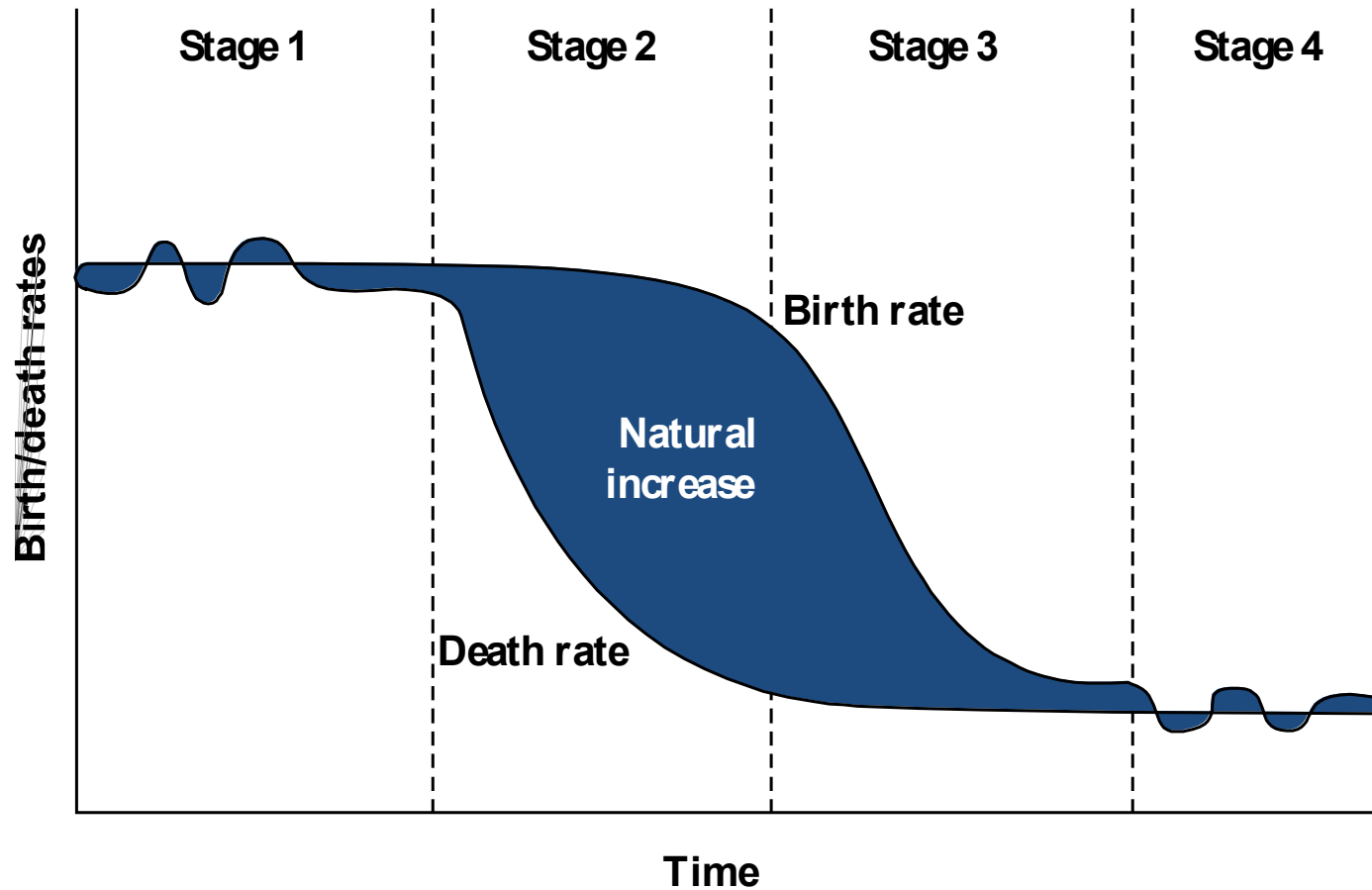
- Wanting to have a given number of “adult” children, it is necessary to give birth to fewer.
- Furthermore: children require more investments

Demographic transition

The idea of “demographic transition” is the following

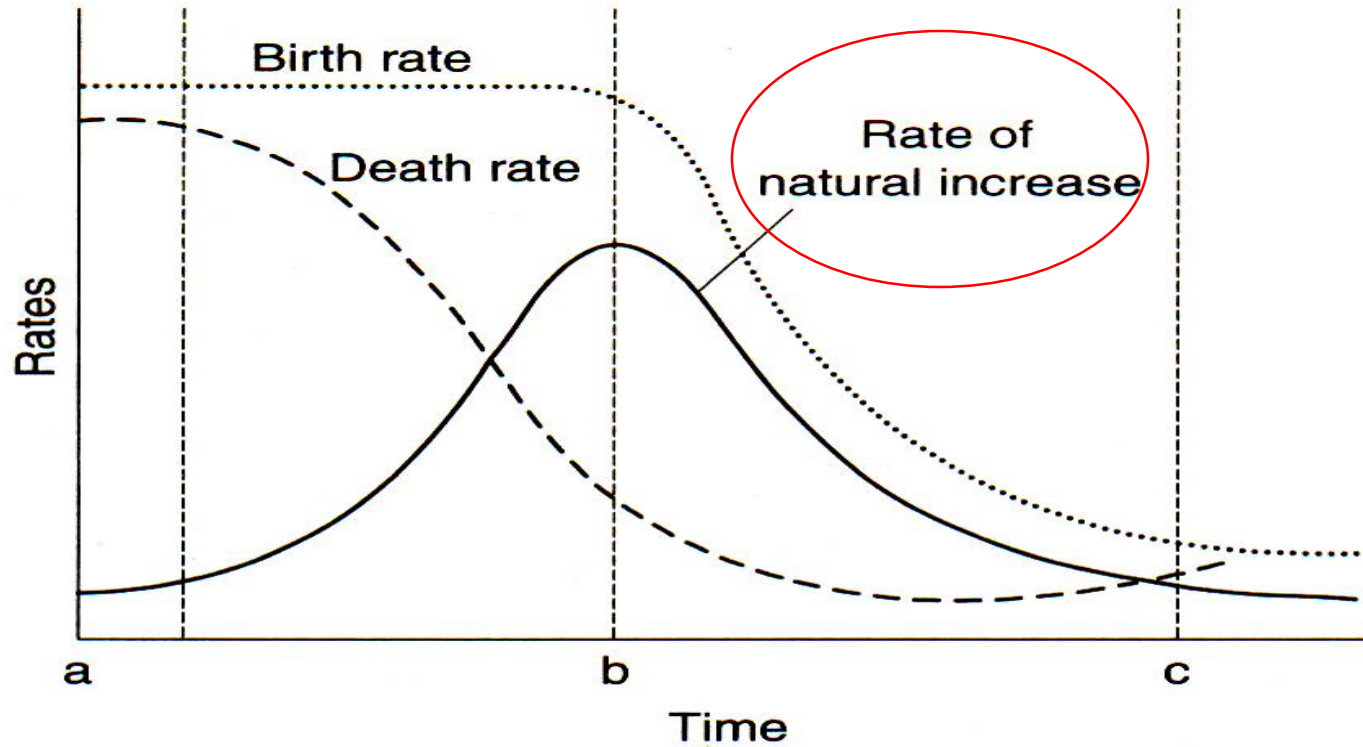
- We **start** from a stage in which $b(t)$ and $d(t)$ oscillate, but they are almost equal on average, so that on average $r(t)=0$
- **$d(t)$ starts decreasing**, so that $r(t)$ grows → “**Mortality transition**”
- **$b(t)$ starts decreasing**, until it reaches $d(t)$ → “**Fertility transition**”

Common phases of the transition



1. Slow growth, b about equal to d in the long term, d oscillates
2. Decline of d , b stays high. Increase of r
3. Further decline of d , decline of b . r still high
4. r almost null, b about equal to d , d is stable over time

Natural change during the transition



- a = beginning of the transition
- b = greatest difference between birth and death rates
- c = end of the transition

From 30 to 80 years of life expectancy

Table 4.3 Life expectancy in several western countries (1750–2002)

<i>Country</i>	<i>1750–9</i>	<i>1800–9^a</i>	<i>1850–9^b</i>	<i>1880^c</i>	<i>1900^d</i>	<i>1930^e</i>	<i>1950</i>	<i>2002</i>
England	36.9	37.3	40.0	43.3	48.2	60.8	69.2	78.3
France	27.9	33.9	39.8	42.1	47.4	56.7	66.5	79.4
Sweden	37.3	36.5	43.3	48.5	54.0	63.3	71.3	80.1
Germany	–	–	–	37.9	44.4	61.3	66.6	78.6
Italy	–	–	–	35.4	42.8	54.9	65.5	80.0
The Netherlands	–	32.2	36.8	41.7	49.9	64.6	71.8	78.3
Russian Federation ^f	–	–	–	27.7	32.4	42.9	64.0	65.4
United States ^g	–	–	41.7	47.2	50.8	61.7	69.4	77.3
Australia	–	–	–	49.0	55.0	65.3	69.6	80.2
Japan	–	–	–	35.1	37.7	45.9	59.1	81.9

From 5 to less than 2 children per woman: fertility adaptation

Table 4.5 Average number of children per woman (*TFR*) for several generations in western countries (1750–1965)^a

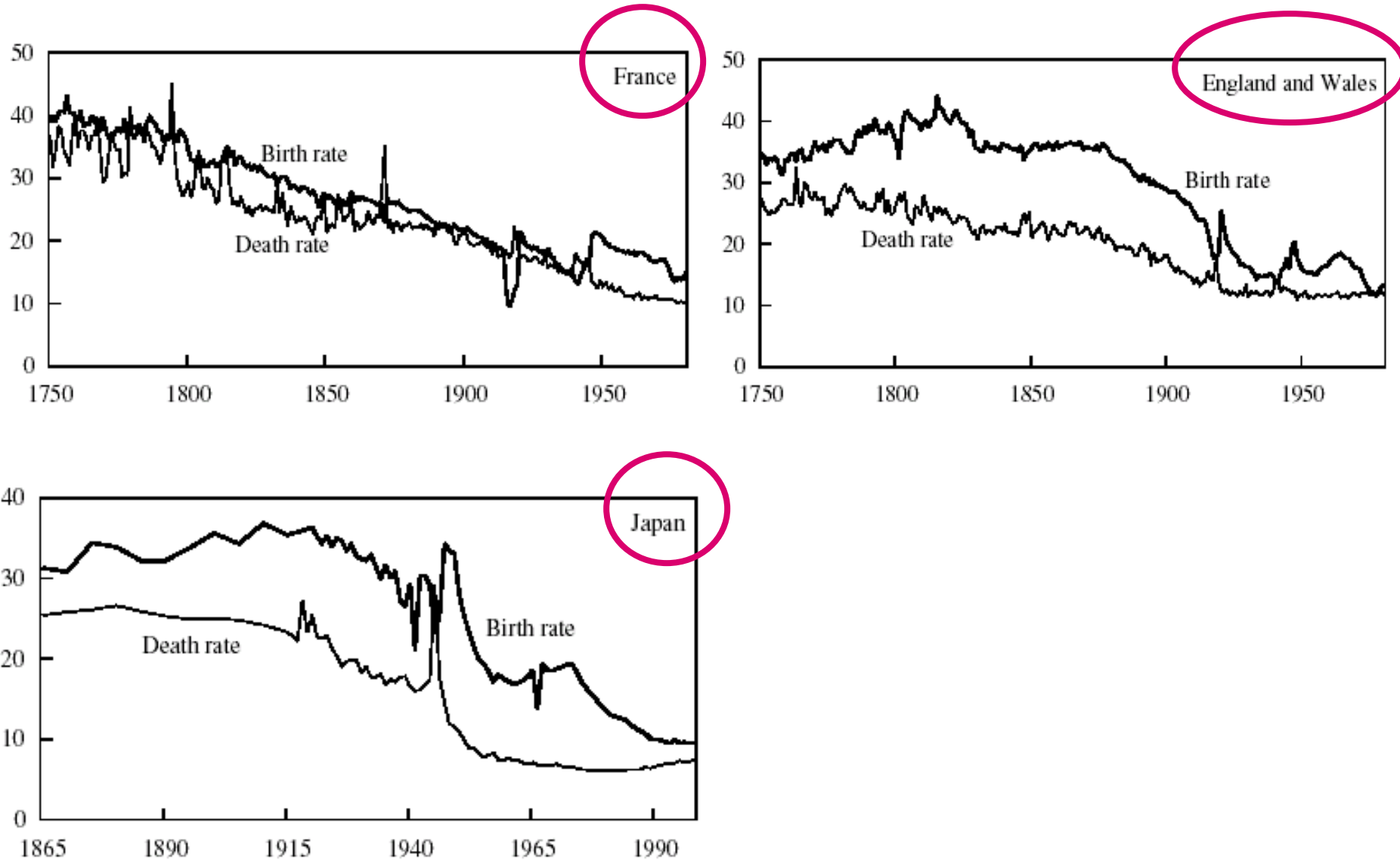
<i>Country</i>	<i>1750</i>	<i>1775</i>	<i>1800</i>	<i>1825</i>	<i>1850</i>	<i>1875</i>	<i>1900</i>	<i>1925</i>	<i>1950</i>	<i>1965</i>
Sweden	4.21	4.34	4.68	4.4	4.28	3.51	1.9	2.05	1.98	1.98
England and Wales	5.28	5.87	5.54	5.05	4.56	3.35	1.96	2.15	2.06	1.90
Germany ^b					5.17	3.98	2.08	2.06	1.72	1.53
France				3.42	3.27	2.6	2.14	2.59	2.11	2.02
The Netherlands					4.98	3.98	2.86	2.76	1.85	1.77
Spain						4.64	3.38	2.51	2.15	1.61
Italy ^c					4.67	4.5	3.14	2.27	1.88	1.49
United States					4.48	3.53	2.48	2.94	1.96	2.01
Australia						3.22	2.44	2.98	2.30	2.05

Abstract model of transition

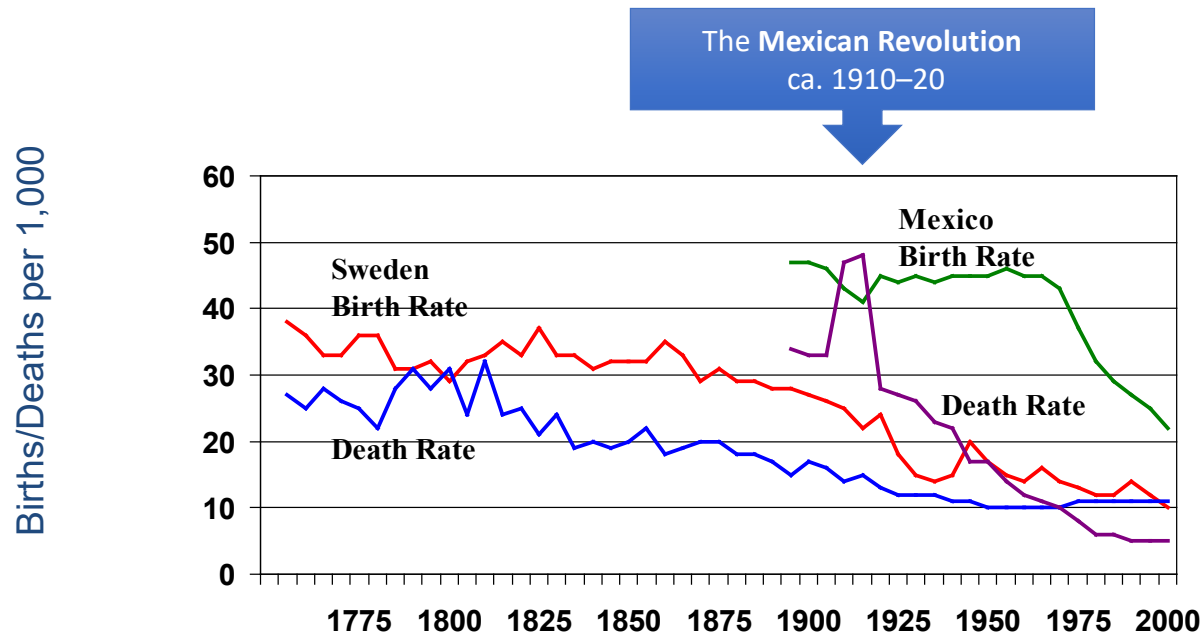
1. The beginning of *mortality decline* generally precedes that of *fertility*;
2. during this phase the separation between the two components (the **rate of natural increase**) reaches a **maximum**;
3. as fertility decline accelerates and that of mortality slows down, the two curves approach one another again and the natural **rate of increase** returns to a **low level** (similar to that at which it began the transition).

Empirical evidence

Empirical evidence

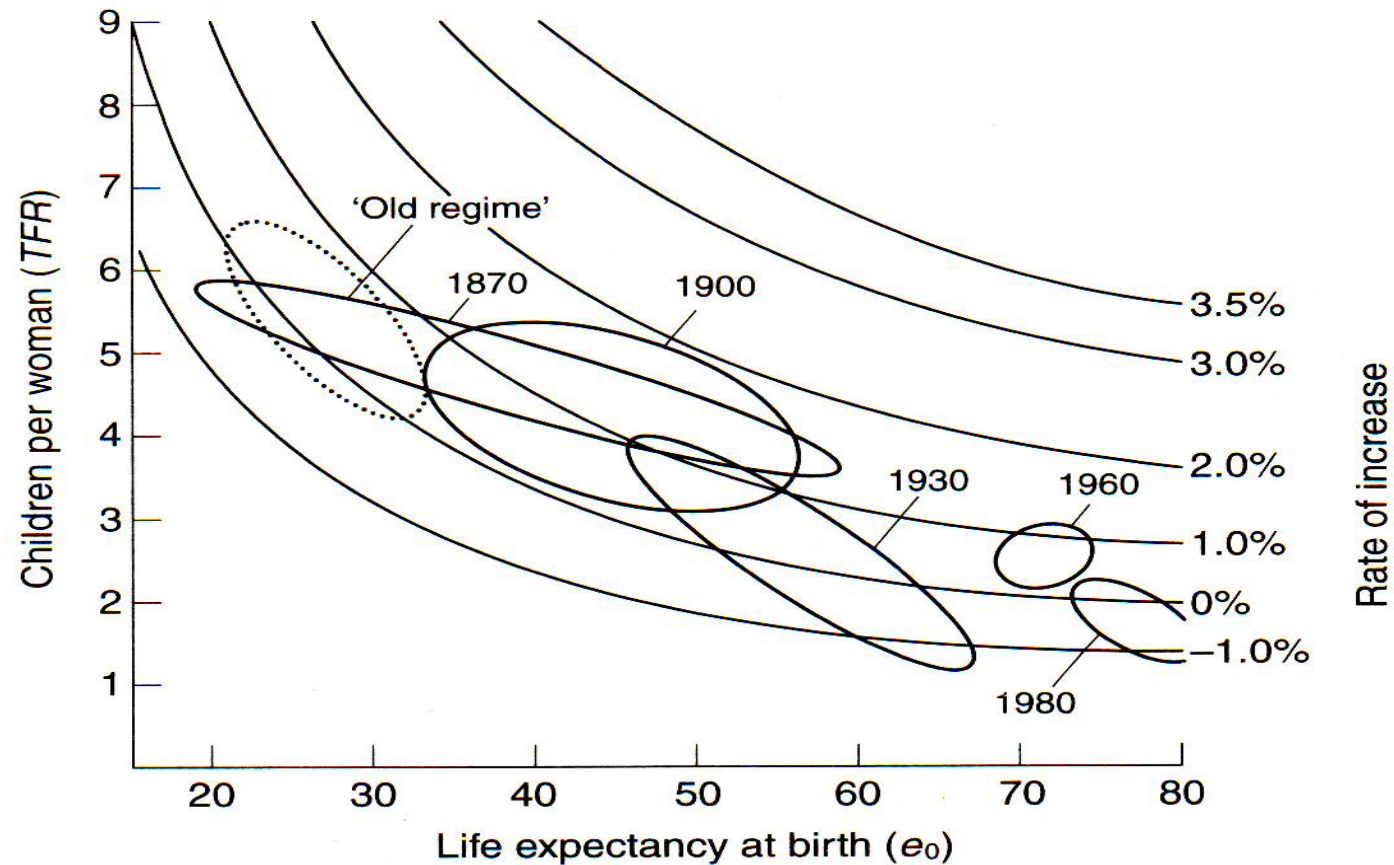


Demographic Transition in Sweden and Mexico



Sources: B.R. Mitchell, *European Historical Statistics 1750-1970* (1976): table B6; Council of Europe, *Recent Demographic Developments in Europe 2001* (2001): tables T3.1 and T4.1; CELADE, *Boletín demográfico* 69 (2002): tables 4 and 7; Francisco Alba-Hernandez, *La población de México* (1976): 14; and UN Population Division, *World Population Prospects: The 2002 Revision* (2003): 326.

The strategic space of growth for 17 European countries (nineteenth through twentieth centuries)



Same graph, but with Italy in evidence

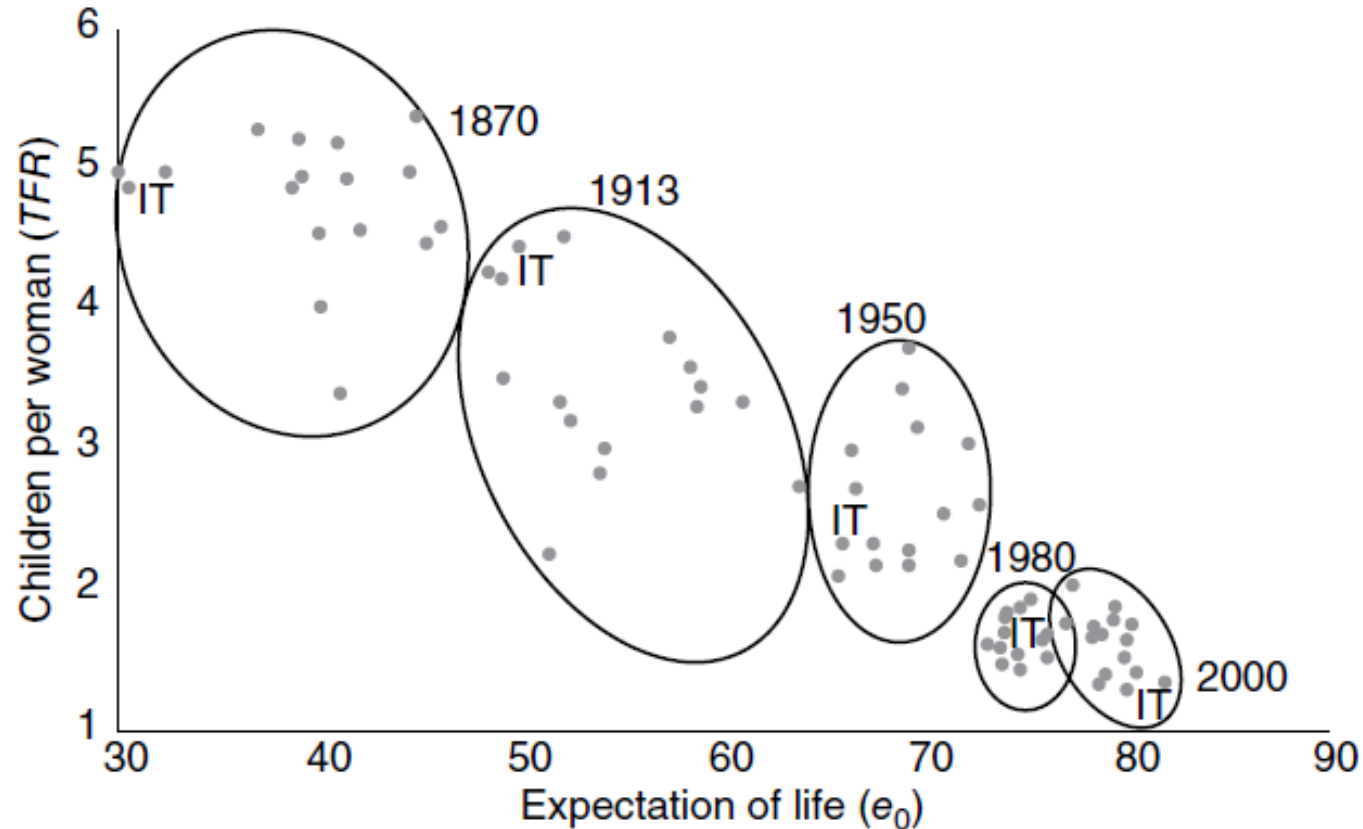


Figure 4.11 Relation between life expectancy (e_0) and children per woman (TFR) in 16 European countries (1870, 1913, 1950, 1980, 2000).

Transition multiplier

- Population increase depends on:
 - **Duration** of the transition
 - **Speed** of decrease of mortality and birth rate
 - The **difference** between the two



- The ratio of the two populations before and after the transition:

 ***transition multiplier***

Beginning, end, duration, and “multiplier” of the demographic transition for several countries

<i>Country</i>	<i>Beginning and end of the transition</i>	<i>Duration in years</i>	<i>Multiplier</i>
Sweden	1810–1960	150	3.83
Germany	1876–1965	90	2.11
Italy	1876–1965	90	2.26
USSR	1896–1965	70	2.05
France	1785–1970	185	1.62
China	1930–2000	70	2.46
Taiwan	1920–1990	70	4.35
Mexico	1920–2000	80	7.02

The ratio between population size at the beginning and the end of the transition may be called the transition “**multiplier**.”

Consequences of mortality and birth decline

Table 3.7 Characteristics of populations during and after the demographic transition

	Pre- Transition	Mid- Transition	Post- Transition	Future Declining ¹
Crude birth rate ²	50.0	45.7	12.9	9.8
Crude death rate ³	50.0	15.7	12.9	14.8
Annual growth rate %	0.0	3.0	0.0	-0.5
Age structure %				
0-14	36.2	45.4	19.2	15.6
15-64	60.9	52.0	62.3	52.7
65+	2.9	2.6	18.5	31.7
total	100.0	100.0	100.0	100.0
Dependency ratios				
Child ⁴	59.0	87.0	31.0	29.6
Aged ⁵	5.0	5.0	30.0	60.0
total	64.0	92.0	61.0	89.6
Percentage surviving (females)				
to age 5	46.8	81.7	98.2	99.6
to age 65	7.8	43.3	83.1	94.2
Life expectancy (females)				
at birth	20.0	50.0	75.0	85.0
at age 5	36.6	55.9	71.4	80.3
at age 65	7.5	11.9	15.7	22.2

(1) I dati sono riferiti al previsto sviluppo della popolazione italiana tra il 2025 e il 2050

To wrap up:

Consequences of mortality and birth decline

➤ Natural increase

- has an increasing phase until it reaches a maximum and then decreases when the rate of fall in birth rate exceeds the rate of fall in death rate

➤ Amount of population

- Undergoes a significant increase, the more conspicuous the greater the lag of the fall in birth rate relative to the fall in mortality rate

➤ Age structure:

- During the first phase, there is a noticeable rejuvenation of the population (due to the reduction in infant mortality)
- During the second phase:ageing

Theory or a model?

Theory or model?

Demography is the discipline that has produced one of the most successful generalizations in the Social Sciences: the Demographic Transition." (Kirk 2006)

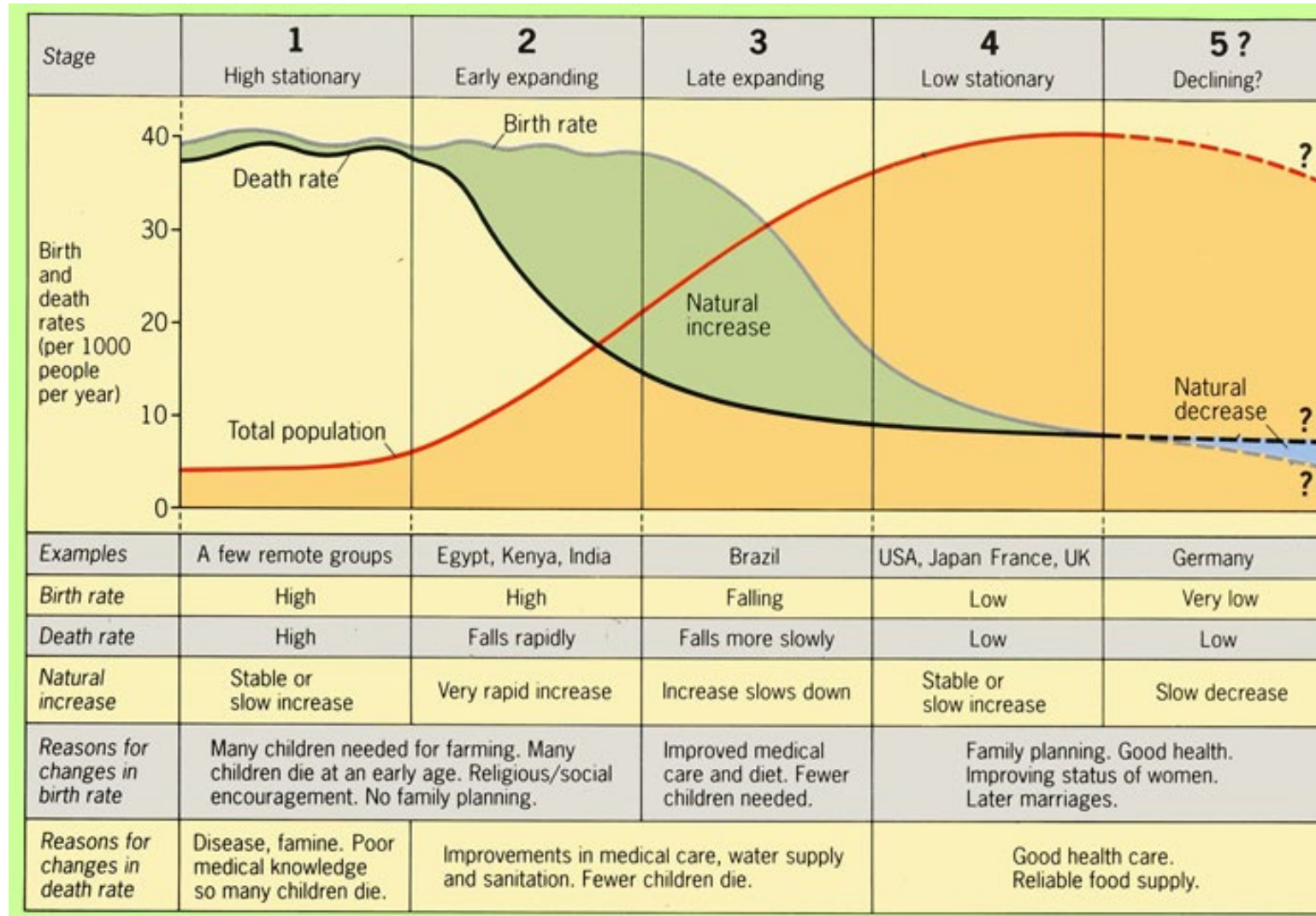
Looking for regularities...

- The search for a common path of development has always been present in demographic research:
 - poor of theory and
 - rich in empirical observations and quantification (Thornton 2001)

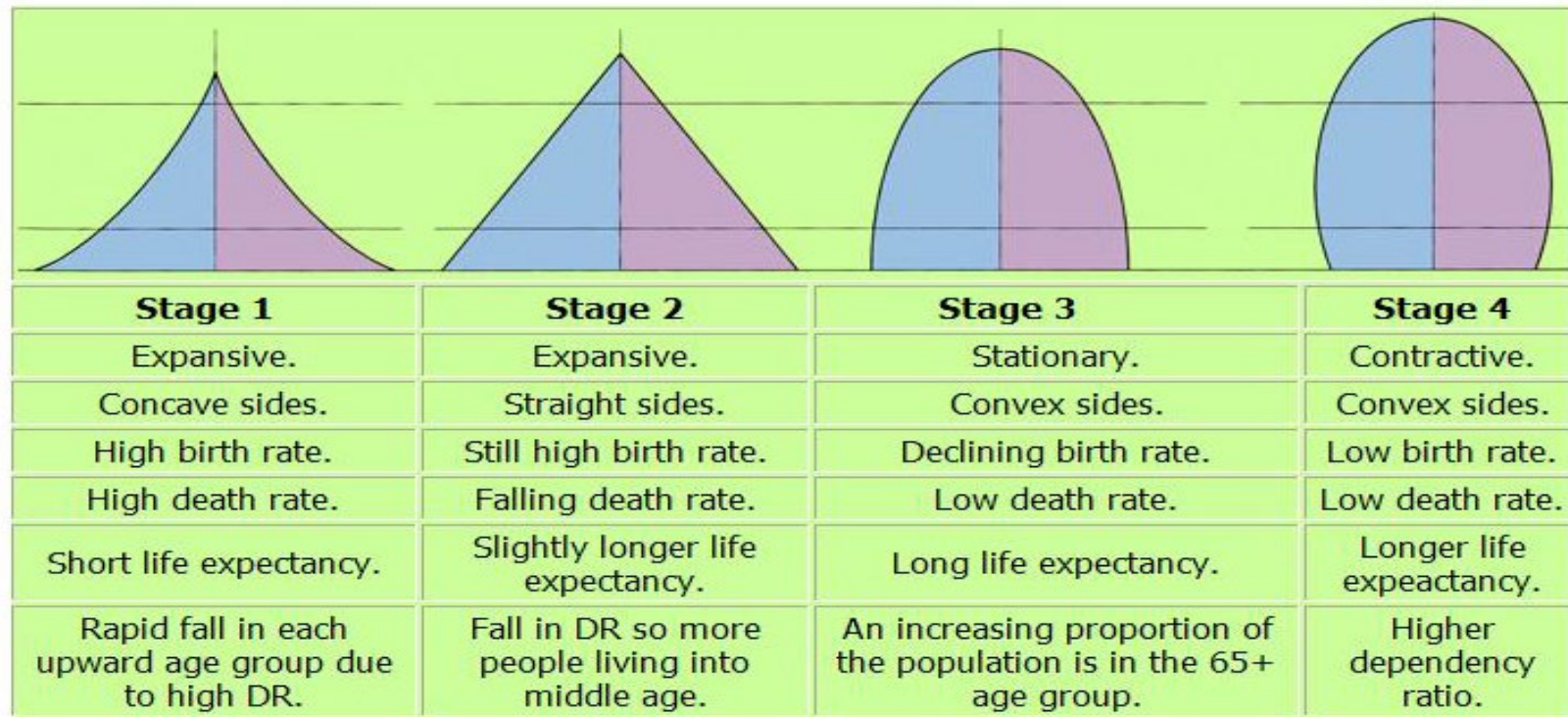
A data-drive theory

- This **data-driven theory** predicts a **common path for all societies**, which they all experience a modernization progress:
 - from an inefficient **pre-modern regime** of **high mortality** and **high fertility**
 - to a **post-modern equilibrium** characterized by both **low fertility** and **mortality** (Reher 2011, Livi-Bacci, 2012).

The transition as a model



Age structure at different steps of DT



Common features of the process of the demographic transition

➤ Necessity:

- the lowering of mortality (whether due to factors exogenous or endogenous to the demographic system) also determines with greater or lesser delay, the progressive containment of fertility.

➤ Irreversibility:

- process of fertility reduction has slowdowns and pauses, but never returns except accidentally to higher levels. The same can be said-but with less force-of mortality (e.g., former USSR, or Southern Africa, Covid?).

➤ Universality:

- All populations of the modern era seem destined to undergo the transition process.