5. The Demographic Transition.

Reference: Weil, Chapter 4.3-4.4

What happened around 1800?

- 1. The demographic Transition
- 2. The industrial revolution $\rightarrow$ later

- Before 1800
    - ► life was short
    - ► births were many
    - ► growth was slow
    - ► and the population was young.

    Then (in the Western World)
    - ► first Mortality declined,
    - ► then fertility,
    - ► causing temporarily high population growth.
- Eventually mortality, fertility, and population growth stabilized / will stabilize (?) at low rates.

Global Population Trends Over the Transition: Estimates, Guesstimates and Forecasts, 1700–2100

	Life Expectancy (Years at Birth)	Total Fertility Rate (Births per Woman)	Pop Size (Billions)	Pop Growth Rate (%/Year)	Pop < 15 (% of Total Pop)	Pop > 65 (% of Total Pop)
1700	27	6.0	.68	0.50	36	4
1800	27	6.0	.98	0.51	36	4
1900	30	5.2	1.65	0.56	35	4
1950	47	5.0	2.52	1.80	34	5
2000	65	2.7	6.07	1.22	30	7
2050	74	2.0	8.92	0.33	20	16
2100	81	2.0	9.46	0.04	18	21

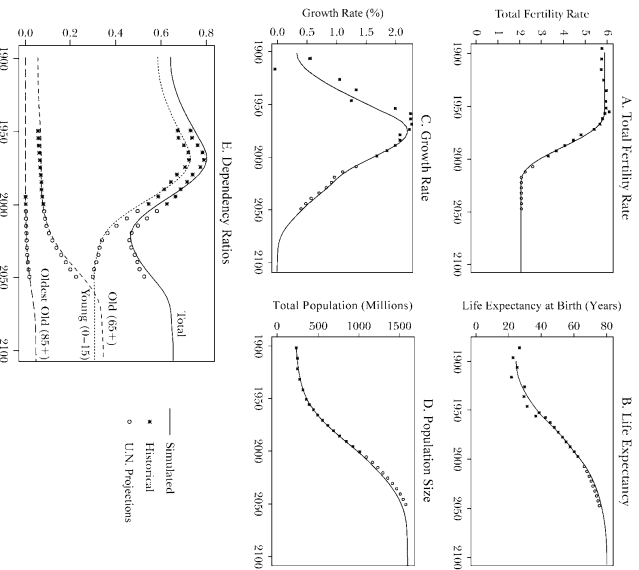Although the demographic transition is a global phenomenon there are tremendous cross-country differences.

Reher (2004) divides the world's countries by their onset of fertility decline into

- forerunners
- followers and trailers
- latecomers

Indicator	Forerunners	Followers	Trailers	Latecomers	Total
Onset fertility decline	1905	1950–60	1965–75	1980–2000	
Pre-decline birth rates	33–35	36–40	41–44	46–47	
CBR decline (in 10 years)	0.92	0.79	0.84	0.89	
CBR decline (in 20 years)	0.84	0.63	0.74	?	
Time to 50% decline	75	30	?	?	
Time to 10 point decline	30	15	15	?	
Onset of mortality decline (CDR)	1895	1925	1930	1945–50±	
Pre-decline death rates	22–25	26–29	27–30±	33–34±	
CDR decline (in 10 years)	0.88	0.78	0.90	0.87	
CDR decline (in 20 years)	0.77	0.66	0.66	0.74	
Time to 50% decline	50	30	30	45	
Time to 10 point decline	45	20	20	30	
Gap mortality–fertility decline	5–10	30	30	40–45±	
Onset of infant mortality decline	1895	1920	1935	?	
Pre-decline IMRs	170–190	200–220	180–220	180–220+	
IMR decline (in 10 years)	0.91	0.83	0.87	?	
IMR decline (in 20 years)	0.81	0.73	0.73	?	
Time to 50% decline	40	30	35	?	
Time to 50 point decline	30	25	25	?	
Natural growth rates: pre-decline	9–11	7–11	10–13	15	
Natural growth rates: peak	12–13	26–27	26–27	27–29	
Natural growth rates: 1995–2000	2.8	12.6	16.1	25.6	
Countries (by continent)	**24**	**17**	**48**	**56**	**145**
Africa	0	2	11	39	**52**
North America	4	4	10	4	**22**
South America	2	1	8	1	**12**
Asia	0	10	18	12	**40**
Europe	18	0	1	0	**19**

Note: Underlined estimates are only approximations. '?' means that no estimation is possible.

- Task: find 5 significant differences between forerunners and latecomers.

- Note: average absolute latitudes: • forerunners 47.8° • followers and trailers 21.1°
  • latecomers 13.8° • tropics 23°

A Classic Demographic Transition: Actual and Projected for India and Simulated, 1900–2100

A. Total Fertility Rate

B. Life Expectancy

C. Growth Rate

D. Population Size

E. Dependency Ratios

Legend:
— Simulated
× Historical
○ U.N. Projections

Notes: The simulation is based on a fertility transition in which the total fertility rate follows a quintic path declining from 5.9 in 1953 to 2.1 in 2025 and a mortality transition in which the mortality index follows a sinusoidal path as $e(0)$ increases from 24.7 in 1900 to 80.0 in 2100.
Sources: Actual India data for the period 1891–1901 to 1941–1951 are taken from Bhat (1989). Actual and projected data are taken from United Nations (2003).

Yet, mortality and fertility are *not* functions of t.

What triggered the mortality decline?

- innovations in preventive medicine (smallpox, measles, rabies, ...), antibiotics
- improvements in nutrition (technological progress in agriculture): $A \uparrow$ big time
- improvements in public health (water supply, sewage), personal hygiene

Note: 2 countervailing trends

- HIV / AIDS (mainly SSA)
- Alcoholism (mainly former USSR)

What triggered the fertility decline?

Here is the answer somewhat less clear. 2 "schools":

- 1. Mortality decline preceded fertility decline (almost everywhere) $\rightarrow$ mortality declined *caused* fertility decline (adjustment to optimal family size)
- 2. Something else

What triggered the fertility decline: a selection of answers:

- Opportunity costs (Becker, 1965): childbearing and -rearing is a time-intensive activity. $y \uparrow$:
    - ▶ income effect: child demand $\uparrow$ (normal good)
    - ▶ substitution effect: children become relatively more expensive (compared to a car, for example): child demand $\downarrow$
    - ▶ the substitution effect dominates.

- Gender gap (Galor and Weil, 1996): $K \uparrow \rightarrow$ female $w \uparrow \rightarrow$ opp. cost of children $\uparrow$

- Quantity-Quality Substitution (Becker, 1960): parents maximize child-services, a function of the number of children and expenditure per child (on education, health etc.) $y \uparrow$:
    - ▶ income effect: more children AND higher child expenditure.
    - ▶ thus the price per child rises $\rightarrow$ substitution effect.
    - ▶ the substitution effect dominates.

- Old age security (Willis, 1980): access to capital markets $\uparrow$, (compulsory) old age insurance, family values $\downarrow$.

- Child labor (Strulik, 2004): tech. progress $\rightarrow$ child relative wage $\downarrow\rightarrow$ monetary importance of children $\downarrow\rightarrow$ quantity-quality substitution.
- Empowerment of Women (Eswaran, 2002): (female) education $\uparrow\rightarrow$ bargaining power of mothers $\uparrow\rightarrow$ quantity-quality substitution.
- ...

Yet, there is one 1 item on which fertility depends surprisingly little: contraceptive costs / available birth control techniques.

- We had birth control at all times
  - ▶ oldest written reference to birth control: 1850 BC
  - ▶ ancient Greece and medieval methods of exposure
  - ▶ late marriage / prolonged breast-feeding
  - ▶ ...
- in Europe fertility declined before the invention of rubber (and of course the contraceptive pill)
- and today we observe ...

$$TFR = 1.36 + .89 \times DTFR$$
$$N = 66, \; R^2 = .91$$
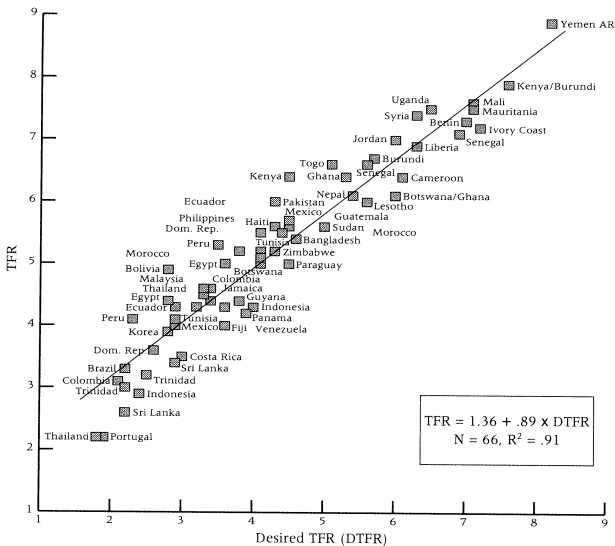
[From: Pritchett (1994): Desired Fertility and the Impact of Population Policies]

Conclusions:

- "Woman know what they want."
- People roughly achieve their fertility targets.
- Our economic models of optimal fertility / child demand make sense.
- Why ? → The decision to have another child is simply too important and too costly for contraceptive costs to play a major role.

- If we think population growth is "too high", the challenge is to reduce fertility desires (not to reduce "unwanted" fertility).

- Development is the best contraceptive.
- Take care of the people and population takes care of itself.

(2 relatively recent insights)

Summary:

- $y \uparrow$ fertility $\downarrow$
- $y \uparrow$ mortality $\downarrow$

$\Rightarrow$ we get a "Modified Theory of Demographic Transition" (Strulik, 1997):
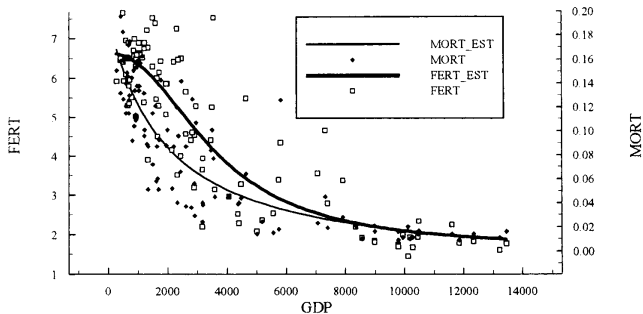
Fig. 1. Actual and estimated total fertility rate and infant mortality in relation to income
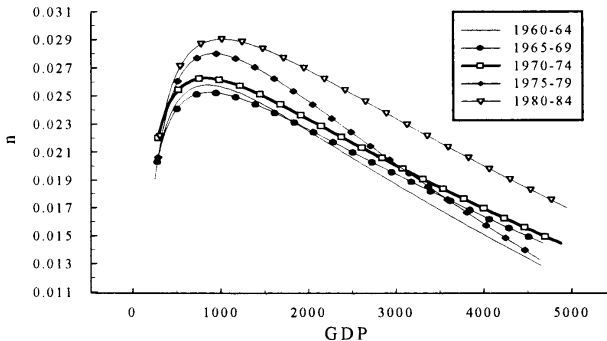
Fig. 2. Estimated population growth rate in relation to income

Note 1 crucial difference to the Original Theory of Demographic Transition:

- A society must not *necessarily* run through the complete transition path as time proceeds.
- It may get stuck in a "population trap".
- Anyway, the speed of transition does not directly depend on g but on g_y

$\Rightarrow$ How does g_L determine g_y taking into account the feedbacks of y on fertility and mortality (and thus g_L)?