# Population Growth and Economic Development

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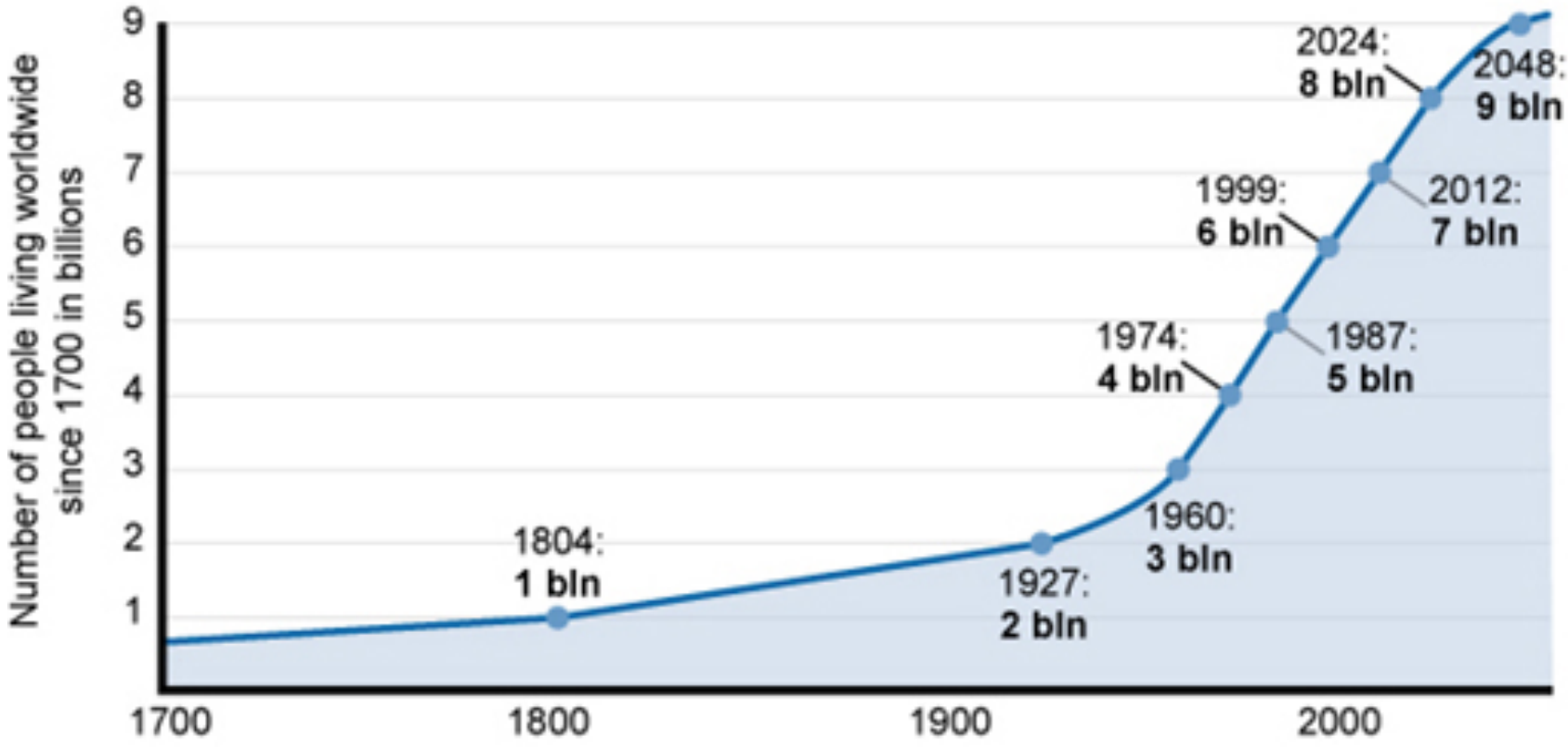
# Introduction

- The world population has been growing very slowly for milennia at rates lower than 0.1% untill 1700.
- Then population growth started to rise in Western Europe and its offshoots in the 18th and 19th centuries, peaking around 1850 at 1 percent and then decreased to 0.5 percent nowadays. In the developing world population growth remained low throughout the 19th century, rose sharply after 1950 to peak at 2 percent in 1970 and has since gradually decreased to about 1 percent today.
- The first billion was reached in 1804, the second in 1927 (123 years later), the third in 1960 (33 years), the fourth in 1974 (14 years), the fifth in 1987 (13 years) and the sixth in 1999 (12 years). Note that the seventh billion has not been reached yet (while 12 years have passed). Realistic scenarios predict a stabilization by 2050 at 10 billion.

# Introduction



# Introduction

- During this class we will go beoynd of the desciption demographics and will try to analyze relation between economic growth and population growth.
- We will focus on the question of demographic transition, i.e. are developing countries going to repeat experience of now-developed countries?
- But before doing that, we should introduce some basic concepts of demography.

# Some basic concepts

- Population dynamics:

$$P_{t+1} = P_t + B_t - D_t + M_t,$$

where

$P_t$ = population at time t

$B_t$ = number of births, hence the birth rate: $b_t = B_t / P_t$

$D_t$ = number of deaths, hence the mortality rate: $d_t = D_t / P_t$ $M_t$ = net migrations, hence the migration rate: $m_t = M_t / P_t$

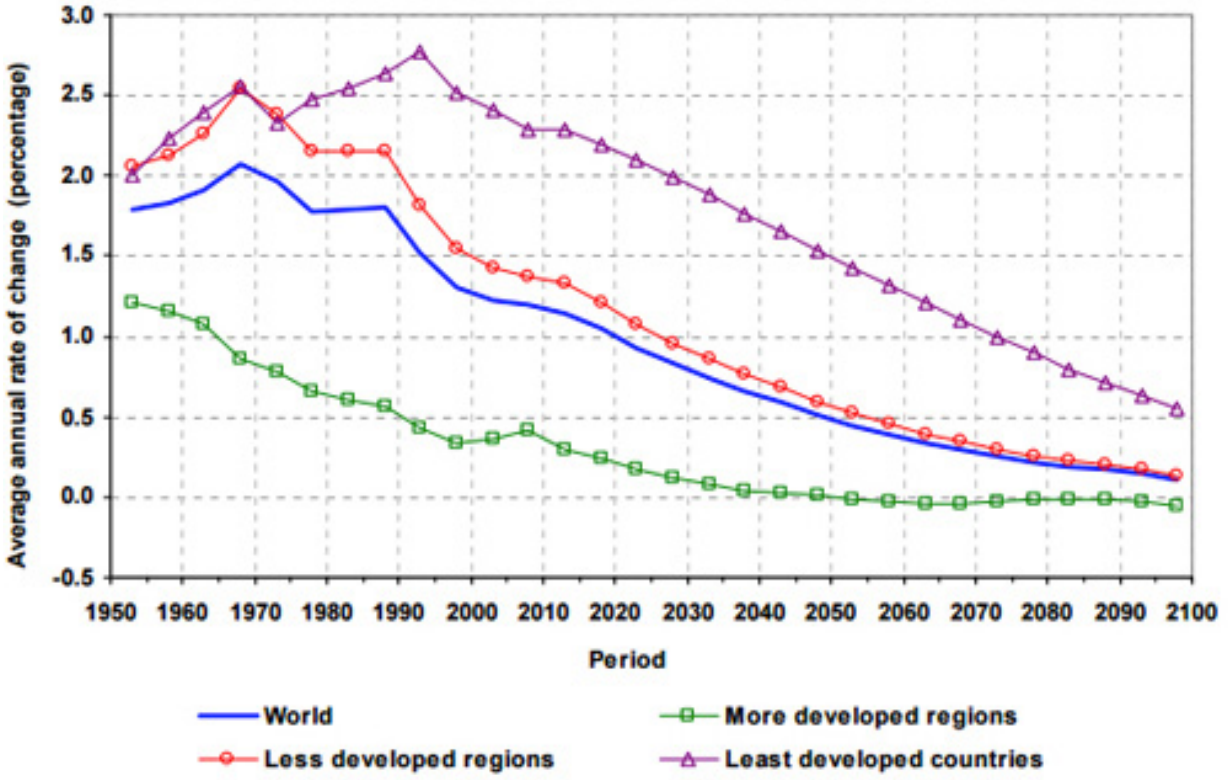
- Growth rate of the population:

$$\frac{P_{t+1}}{P_t} = 1 + n_t,$$

where

$$n_t = b_t - d_t + m_t$$

# Population growth in different regions of the world




*Source:* Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2013). *World Population Prospects: The 2012 Revision*, New York: United Nations.

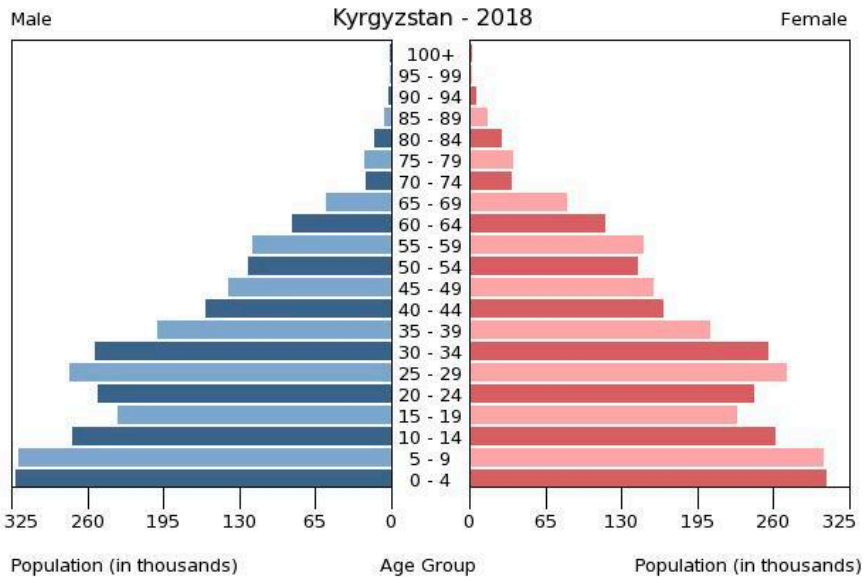
# Birth and death rates (1992), population growth rates for selected countries

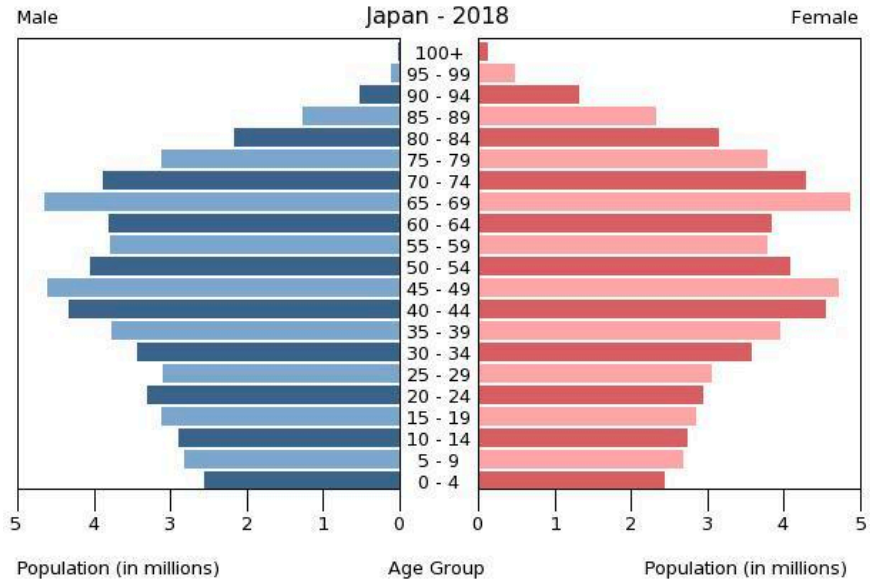
| Country | her capita income | Birth rate | Death rate | growth rate (%) |
|---|---|---|---|---|
| I. | | | | |
| Mali | 520 | 51 | 20 | 3.1 |
| Malawi | 690 | 51 | 20 | 3.1 |
| Sierra Leone | 750 | 49 | 25 | 2.4 |
| Guinea-Bissau | 840 | 43 | 21 | 2.2 |
| II. | | | | |
| Kenya | 1,290 | 45 | 12 | 3.3 |
| Nigeria | 1,400 | 45 | 15 | 3.0 |
| Ghana | 1,970 | 42 | 12 | 3.0 |
| Pakistan | 2.170 | 41 | 9 | 3.2 |
| III. | | | | |
| India | t,220 | 29 | 10 | 19 |
| Bangladesh | t,290 | 36 | 12 | 2.4 |
| IV. | | | | |
| China | 2,330 | 18 | 7 | 1.1 |
| Sri Lanka | 2,990 | 21 | 6 | 1.5 |
| V. | | | | |
| Nicaragua | 1,900 | 41 | 7 | 3.4 |
| Peru | 3,220 | 27 | 7 | 2.0 |
| Guatemala | 3,350 | 39 | 8 | 3.1 |
| Brazil | 5,370 | 25 | 8 | 1.7 |
| Colombia | 5,490 | 24 | 6 | 1.8 |
| VI. | | | | |
| Thailand | 6,260 | 19 | 6 | 1.3 |
| Malaysia | 7,930 | 29 | 5 | 2.4 |
| Republic of Korea | 9,630 | 16 | 6 | 1.0 |

Source: World Development *Report* (World Bank [1995]) and Human Development *Report* (United Nations Development Programme [1995]).

# Age distribution

- The age distribution of a population is given by proportions of different age groups.
- Usually, the less developed country the younger population is.




*Source:* CIA World Factbook, 2019. Available at: https://www.indexmundi.com/

# Fertility rates

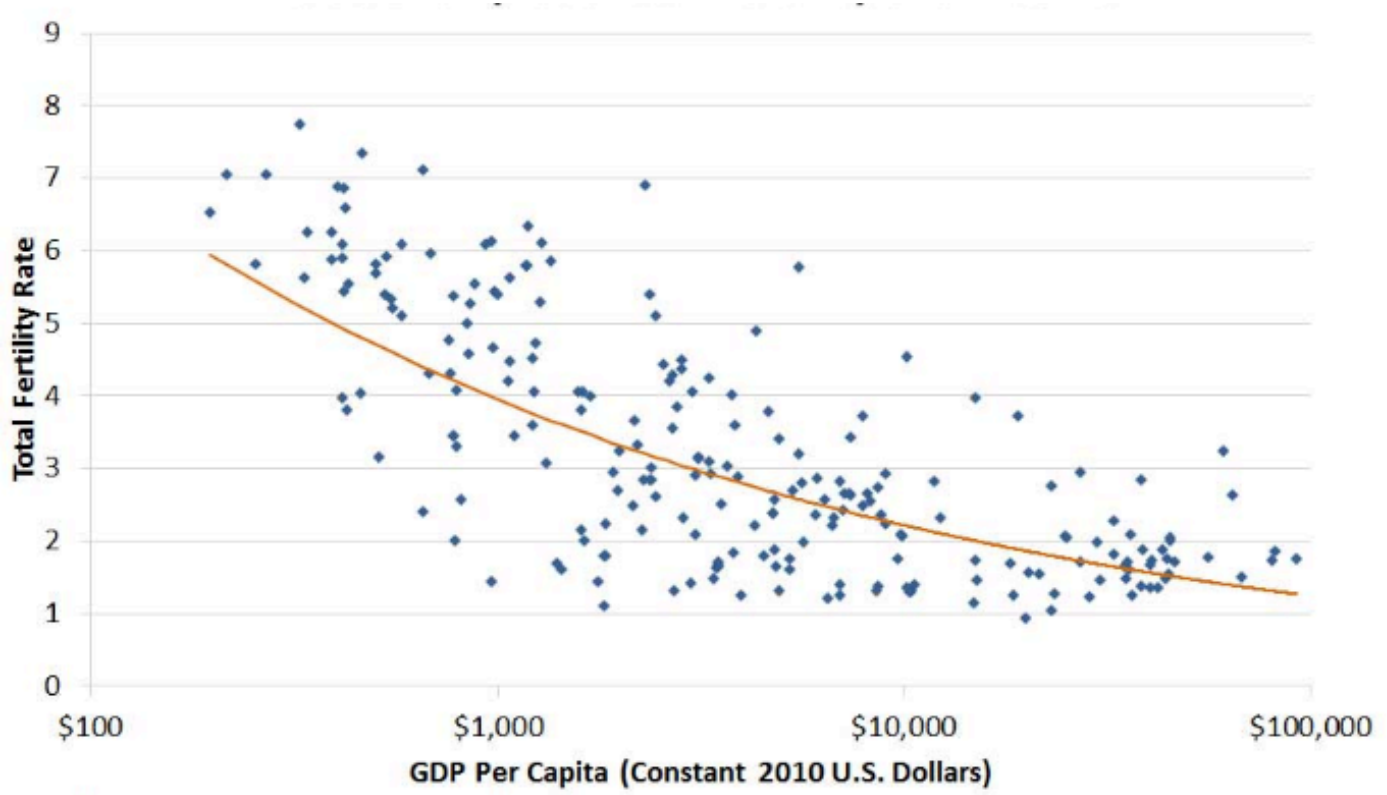
- Age Specific Fertility Rate (ASFR) is the average number of children per year born to women in a particular age group:

$$ASFR_i = \frac{births\ to\ a\ woman\ of\ i-th\ age\ group\ in\ a\ stated\ period}{number\ of\ women\ of\ i-th\ age\ group\ in\ a\ stated\ period}$$

- Total Fertility Rate (TFR) is found by adding up all the age-specific fertility rates over different age groups:

$$TFR = \sum_{i=1}^{n} ASFR * age\ group\ width$$

# Relationship between Fertility and Income

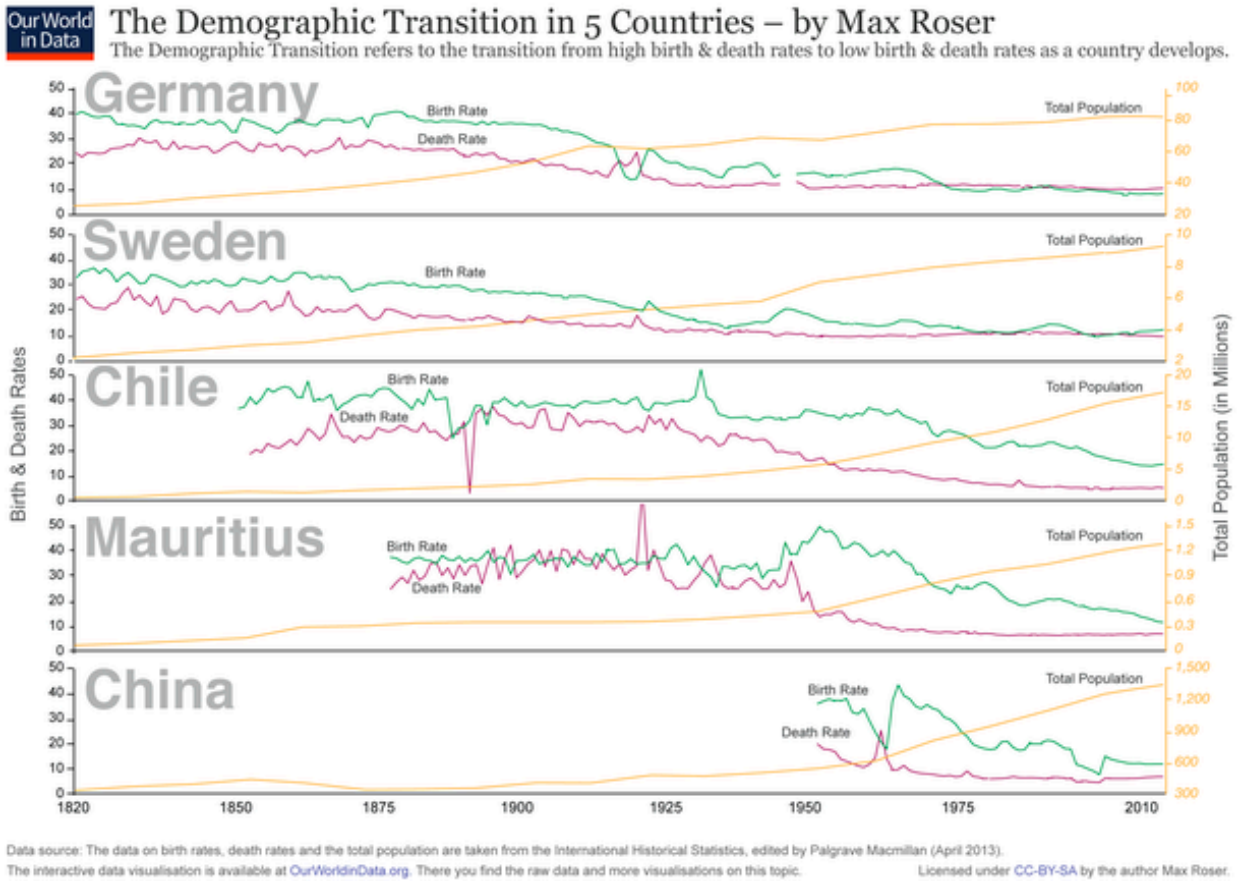



NOTES: Each point represents a country. Data are from 2000.
SOURCES: United Nations Population Division, U.S. Census Bureau, Eurostat, United Nations Statistical Division, World Bank and Organization for Economic Cooperation and Development.

# Demographic transition

- First phase: for millennia, birth and deaths rates have been very high and of similar magnitudes, yielding extremely low population growth.
- Second phase: death rates started declining thanks to better health practices and increases in agricultural and industrial productivity; with first steady birth rates and then demographic inertia due to the age structure, this caused population to explode in Europe in the 19th century and in the developing world in the mid-20th century.
- Third phase: with declining birth rates and an aging population, birth and death rates again converge to a low-level equilibrium already reached by developed countries while developing countries are either in the second or at the beginning of the third phase.

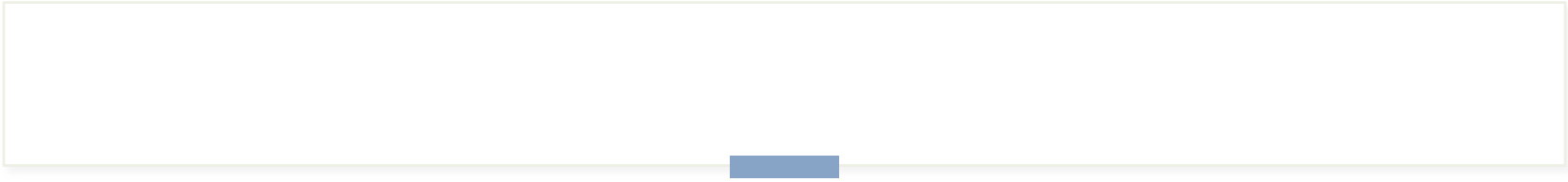
# Examples of demographic transitions




Available at: https://en.wikipedia.org/wiki/File:Demographic-Transition-5-countries.png

| | 1650 | 1800 | 1933 | 1995 | 2010 |
|---|---|---|---|---|---|
| World Population | 545 | 906 | 2057 | 5716 | 6909 |
| Europe | 18.3 | 20.7 | 25.2 | 12.7 | 10.6 |
| North America | 0.2 | 0.7 | 6.7 | 5.1 | 5.1 |
| Oceania | 0.4 | 0.2 | 0.5 | 0.5 | 0.5 |
| Latin America | 2.2 | 2.1 | 6.1 | 8.4 | 8.5 |
| Africa | 18.3 | 9.9 | 7.0 | 12.8 | 15.0 |
| Asia | 60.6 | 66.4 | 54.4 | 60.5 | 60.3 |

# Geographic Distribution of the Global Population



# Micro inertia of fertility

- Overall probability of having a given child look after is "p".
- Treshhold probability of receiving support from at least one child – "q".
- The number of offsprings – "n" must be enough to meet:

$$1 - (1 - p)^n > q$$

- Let's imagine p = ½ and q = 9/10 then n = 4.
- For p = ½ and q = 95/100 n=5
- q is generally referred as parental risk aversion rate.

# Micro inertia of fertility

- Not only age structure, fertility rate and other macro level factors define fertility rate;
- There are number of factor which should be considered on a HH level:
  - Fertility Choice and missing markets
  - Relationship between mortality and fertility
  - Gender bias
  - Information, income, and fertility
  - Hoarding versus Targeting
  - The cost of Children

# Gender Bias

- What if old age support provided by a son.
  - Then n may refer to the number of birth of boys.
  - So instead of four births, now need eight births.
  - Explains consequence of preferences, not reason for gender preferences. Son preference sometimes supported by legal rights and land ownership. E.g., only males can hold property. Widow needs to have a son.
  - Fertility decline slower in societies with son preference (East Asia, Latin America).

# Information, Income and Fertility

Fertility response to mortality decline likely to be slow:

- Takes time to recognize mortality has fallen. Ray: likely across generations.
- Offspring needs to earn sufficient income to support parents when old. Likely related to mortality decline.
- Separation of offspring and parents (e.g., emigration) not related to mortality rates.
- Gender bias. And intrinsic low valuation of women compounds gender bias.

# Hoarding and Targeting

- Hoarding – children before we know which of them will support. Yet, may not realize child's income or willingness to support parents until relatively late. If so \inventory" children.

- Targeting – children are attained sequentially. Infant/child mortality likely woman may bear additional children. Sequential decision making. May “replace" child who dies.

# Cost of Children

Must also recognize that children are costly.

- Direct costs: food, clothing, housing, schooled, watched, . . .
- Indirect costs: Opportunity cost, foregone income of child raising.

Time spent at home with kid is time spent not earning income, so

indirect cost infinite  w * hours in childcare

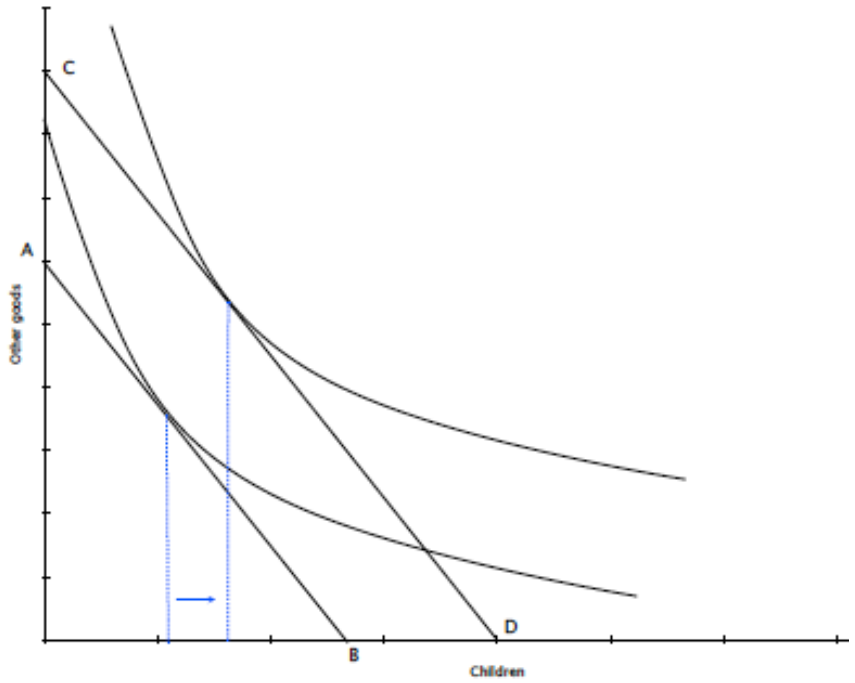
Societies in which the opportunity cost of time is low, fertility rates tend to be high.

# Cost Benefit of Childbearing

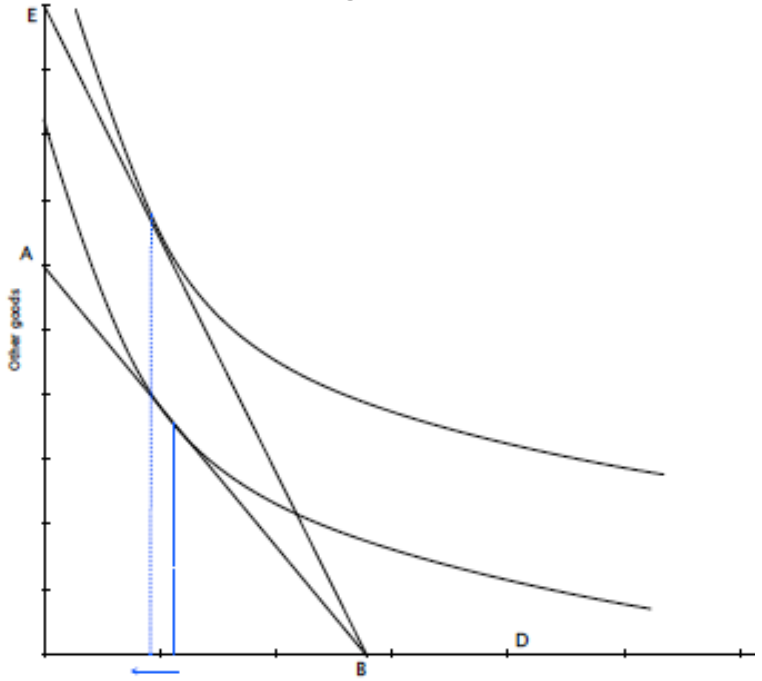
- Cost/Benefit Approach. But to be meaningful, must make benefits and costs specific and tied to the connect.
- Presumption: Benet of child | old age support.
- So with costs, must recognize implications of different kinds of cost on fertility.

# Cost Benefit of Childbearing

Increase in HH income




Increase in Wage



# Is Fertility too high?

- High fertility does not imply that behavior is suboptimal.
- At individual level, if freely chosen, then private welfare optimal. What about social level? Maybe not optimal:
  - Incomplete information and uncertainty.
  - Ex ante versus ex post perspectives.
  - Externalities.

# Information and Uncertainty

- Risk aversion and uncertainty may lead a couple to more children than otherwise.

- May obtain a discrepancy between ex-ante beliefs and ex-post consequences. “Unwanted pregnancies" but no “unwanted births”.
- While households learn and internalize new (lower) mortality regime. Fertility too high.

# Externalities

- Largest wedge between private and social value due to externalities.
- Childbearing may have consequences (costs) on others within family or upon other families.
- Externality need not be negative (e.g., grandparents), but negative externalities lead to excess fertility.

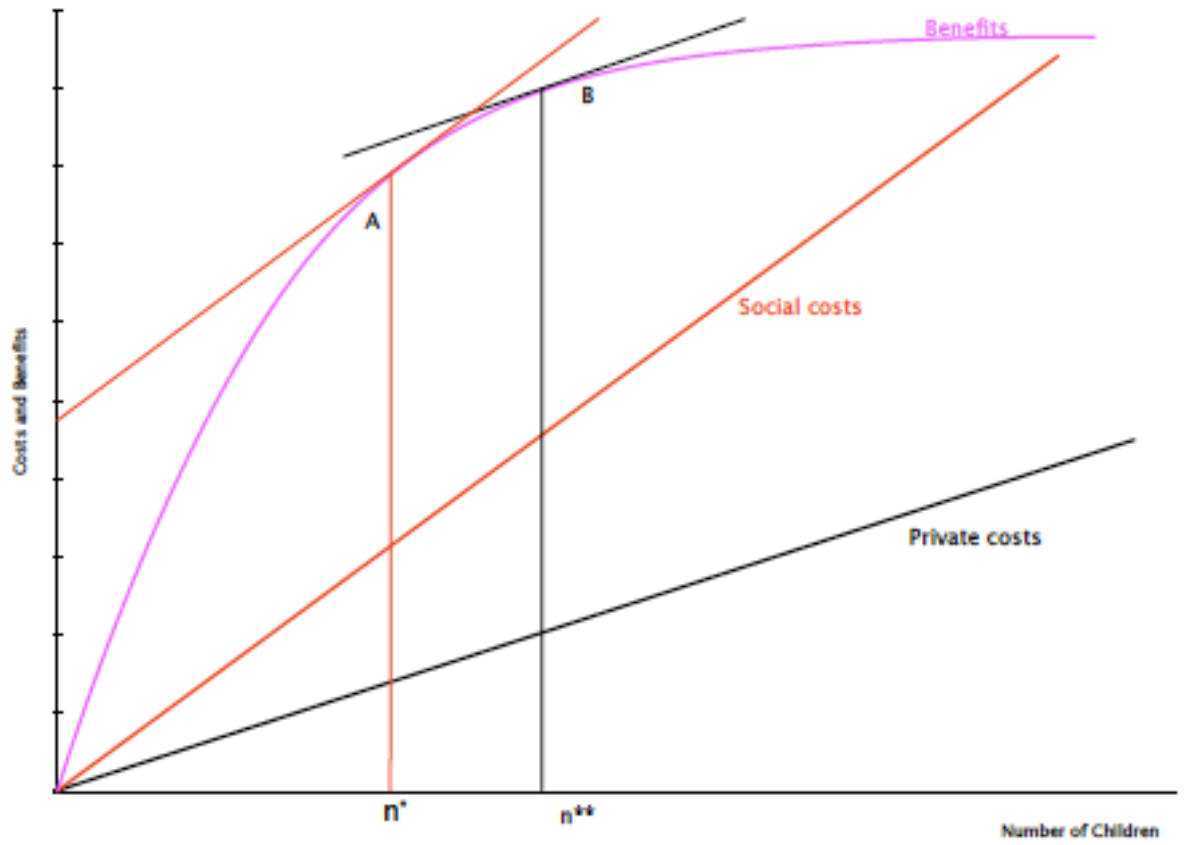
Example: Public subsidies that lower the direct cost of fertility

(e.g., public education).

Example: Subsidized housing or health service not valued (by HH)

at true marginal cost.

# Private, Social Costs and Fertility



# Social Norms

- Social norms: informal institutions that assure stability; social glue
- Strength of social norms likely inhibit adjustment to new environment.
- Norms may be supported by religious or cultural practice.
- In new environment, must coordinate on new norm. Takes time (if occurs at all).
- Example of Family Planning intervention. Pgms can serve as social legitimization. Tipping point as women adopt contraceptives.
- Changed by mass media.

# Matlab - Bangladesh

- Most studied family planning intervention in 1977.
- Treatment and control villages.
- Within three years, fertility within treatment villages declined to 2/3 that of controls.
- Mechanism: people constrained pre{program? Perhaps. More likely, program signaled that lower desired fertility is a good thing; tolerated and indeed encouraged.

# From Population Growth to Economic Development

- Some negative effects coming from two primary sources:
- Malthusian view. Not bizarre, but not useful in developing countries. Fertility behavior largely unrelated (exogenous) to per capita income. In most developing and developed countries relationship between income per capita and fertility is endogenous but negative, and not positive as Malthus concluded.
- Population growth on Economic Development.

# Growth Models

- Can be brief, we covered this in our discussion of the
- Harrod-Domar and Solow models.
- Key points:
  - In Harrod-Domar population growth reduces the growth rate, as there is no substitution between labor and capital. More labor requires capital be spread more thinly.

$$\boldsymbol{g(1+n) = (s/v - n)}$$

  - In Solow, population growth reduces the capital per capita and hence the level of income, but not the growth rate of output or income.

$$\Delta k_t = sf(k_t) - nk_{t+1} - \delta k_t$$

At steady state: $\Delta k = sf(k) - k(n+\delta)$

  - Population and Savings. Faster population growth makes population younger, lower savings rate. Increase dependency ratio in families.

# Population and Economic Development

- Population and savings. Faster population growth lowers the aggregate rate of savings.
- Population, inequality, and poverty. Faster population growth will exacerbate poverty and will increase inequality. For several reasons, the poor more likely to have more children.
- Population growth and environment. Overpopulation puts pressure on renewal resources (grazing, land, fish stocks, groundwater). More people do not “produce" more forests, fish, etc. Thus expect effects on renewal resources to be immediate.

# Some positive effects

- Increased population density may give incentive to innovate. May increase growth rate of productivity.
- Population growth concomitant with increase in share of urban population. Take advantage of agglomeration economics that reduce cost. E.g., Cities attract skilled labor, large pool of skilled labor attract rms.
- Order statistics Large population has a larger pool of potential innovators, larger stock of ideas and innovations that can be put to use. China has 4 times the population of USA so 4 times the number of geniuses. Top 1% is 12-13m China versus 3-4m USA.