Population and Economic Growth

Malthus and the Phantom Menace

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A Malthusian model

- Robert Malthus, An Essay on the Principle of Population, 1798.
- Simple yet powerful model of the relation between population and economic growth.
- Good description of the evidence of humanity until around 1800.
- Good description of the natural economy of animals.
- Indeed, Malthus had a strong influence on Darwin.

Growth facts in the very long run

- For most human history, income per capita growth was glacially slow.
- Before 1500, little or no economic growth. Some growth between 1500 to 1800 in Europe.
- Around 1800, the average world income was roughly as high as in the Neolithic.
    1. Income was higher in England or the Netherlands.
    2. But it was probably lower in China or India.
- Moreover:
    1. Hours of work were much longer in the 1800s than in the Neolithic.
    2. There was much more inequality in the 1800s than in the Neolithic.

Some evidence

- Paul Bairoch, Economics and World History: Myths and Paradoxes:
  1. Living standards were roughly equivalent in Rome (1st century CE), Arab Caliphates (10th century CE), China (11th century CE), India (17th century CE), Western Europe (early 18th century CE).
  2. Cross-sectional differences in income were a factor of 1.5 or 2.
- Angus Maddison, The World Economy: A Millennial Perspective calculates 1500-1820 growth rates:
  1. World GDP per capita: 0.05%.
  2. Europe GDP per capita: 0.14%.
- After 1820: great divergence in income per capita.

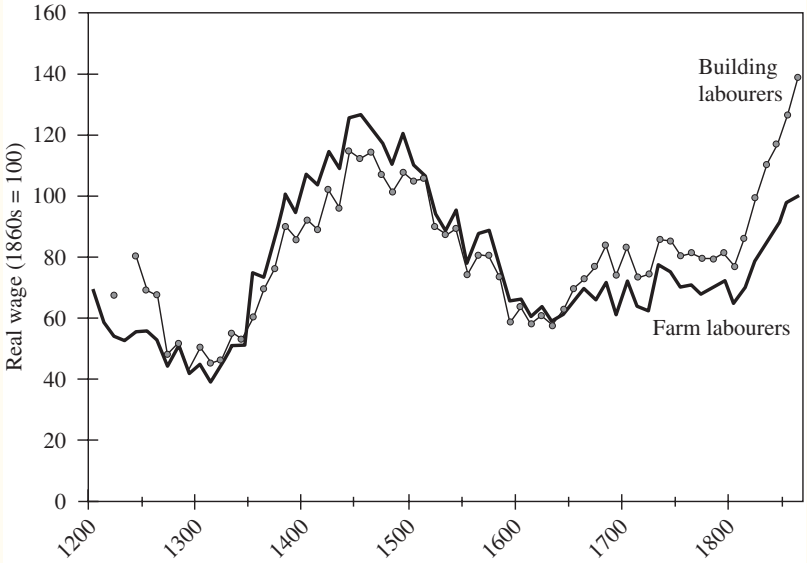
Heights from skeletal remains

Period	Location	Height, cm.
Mesolitich	Europe	168
Neolithic	Europe	167
2500 BCE	Turkey	166
1700 BCE	Greece	166
1600-1800	Holland	167
1700-1800	Norway	165
1700-1850	London	170

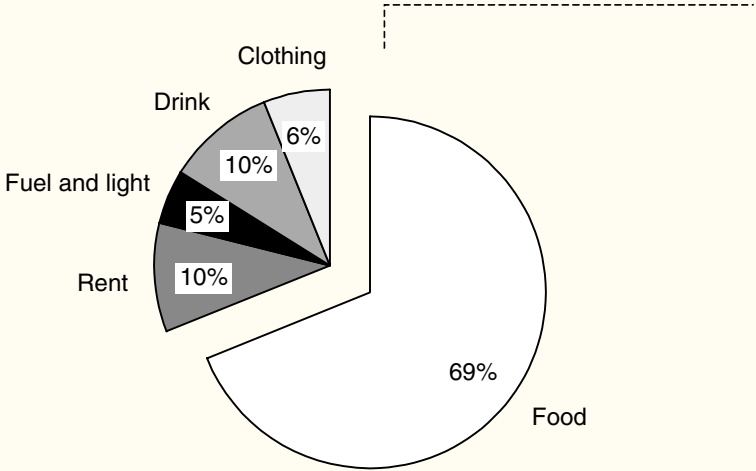
Laborer's wages in wheat equivalent

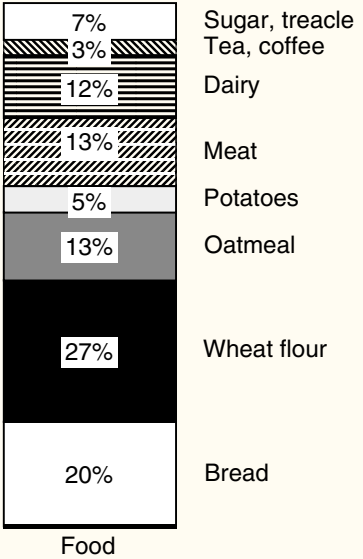
Ancient Babylonia	1800-1600 BC	15
Assyria	1500-1350 BC	10
Neo-Babylonia	900-400 BC	9
Classical Athens	408 BC	30
Roman Egypt	c AD 250	8
England	1780-1800	13

Real agricultural day wages, England, 1209-1869



Composition working class expenditure, 1788-1792





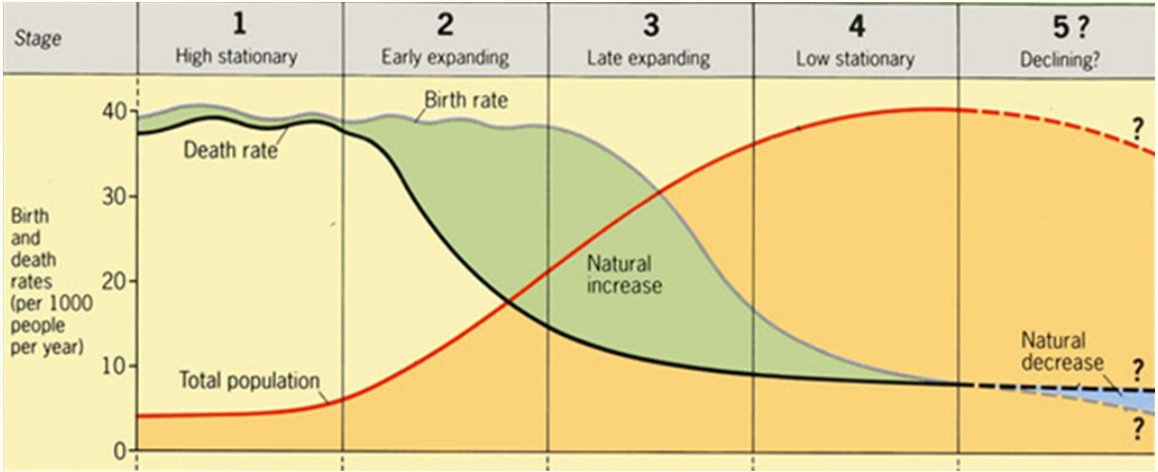
World income and population

- Before the 1800s, the world is in the *Malthusian trap*: improvements in technology only translate in increases in world population.
- In the 1800s the western world moved away from the trap: *demographic transition*.
- In the 1900s, much of the rest of the world went through similar process.
- Countries in Africa and the Middle East still lag.
- We want to understand the *Malthusian trap* and the *demographic transition*.

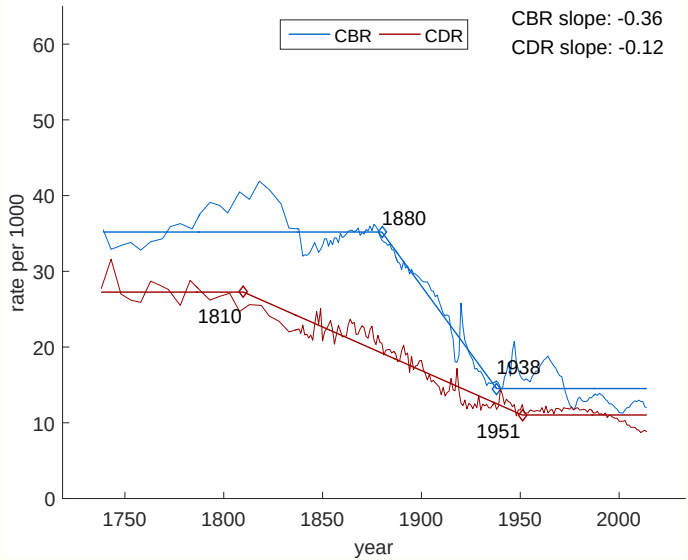
World income and population: data

Year	Population (m.)	GDP per capita ($)
-5000	5	205
-1000	50	240
1	170	210
1000	265	250
1500	425	260
1800	900	375
1900	1625	1275
1950	2515	3050
2000	6120	12262
2015	7300	15000

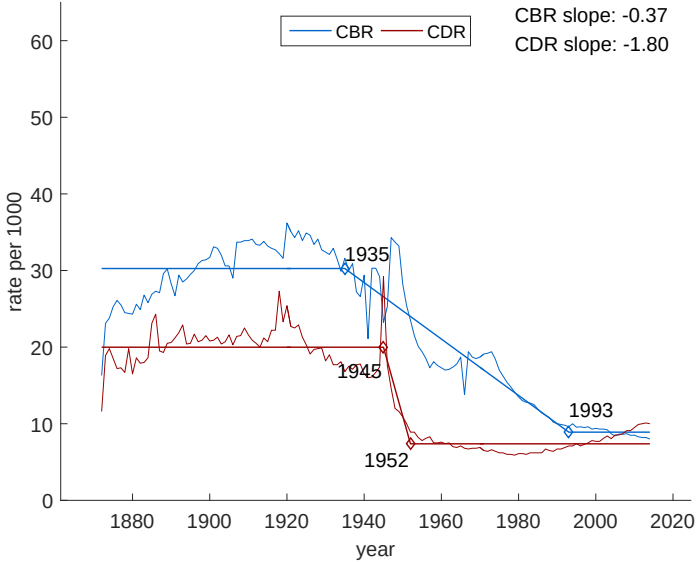
The demographic transition



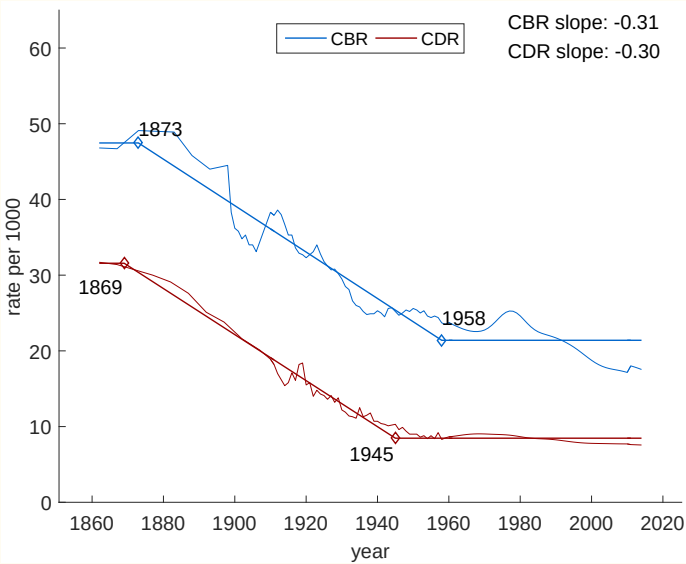
The demographic transition: UK



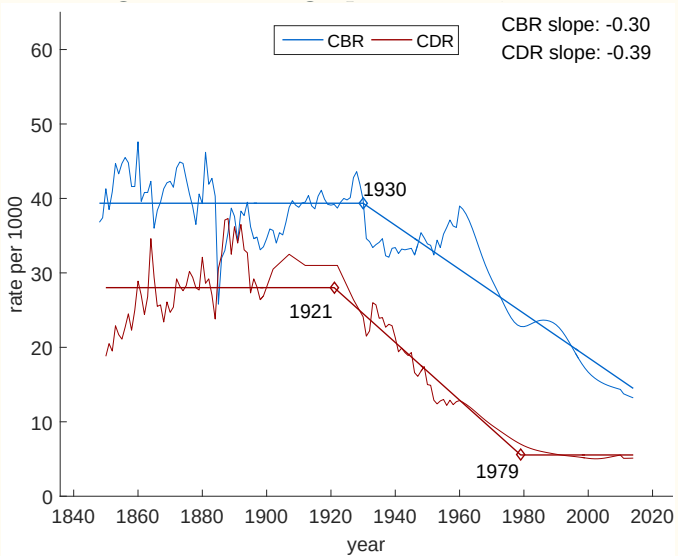
The demographic transition: Japan



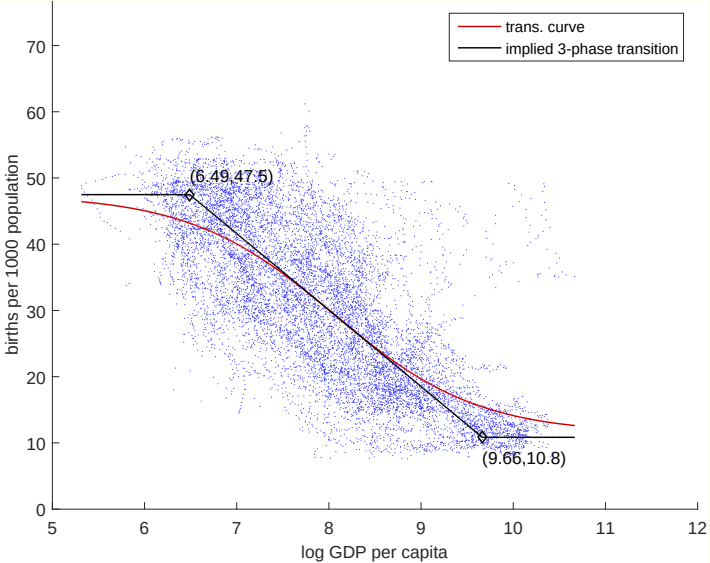
The demographic transition: Argentina



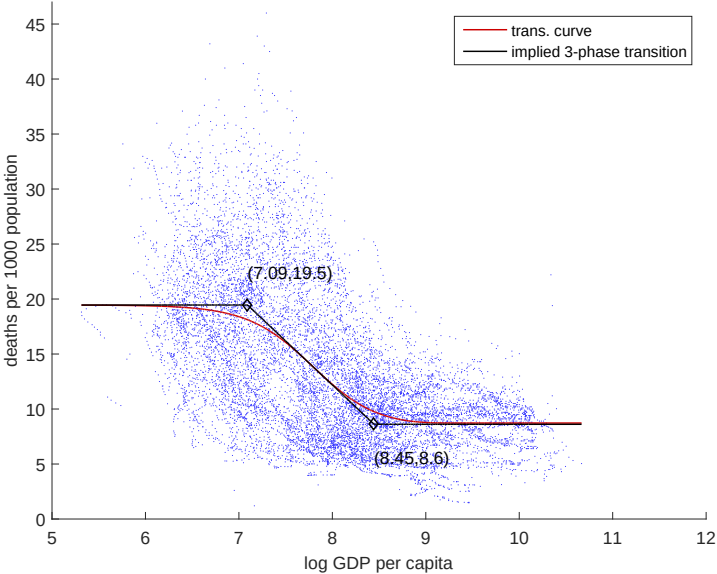
The demographic transition: Chile



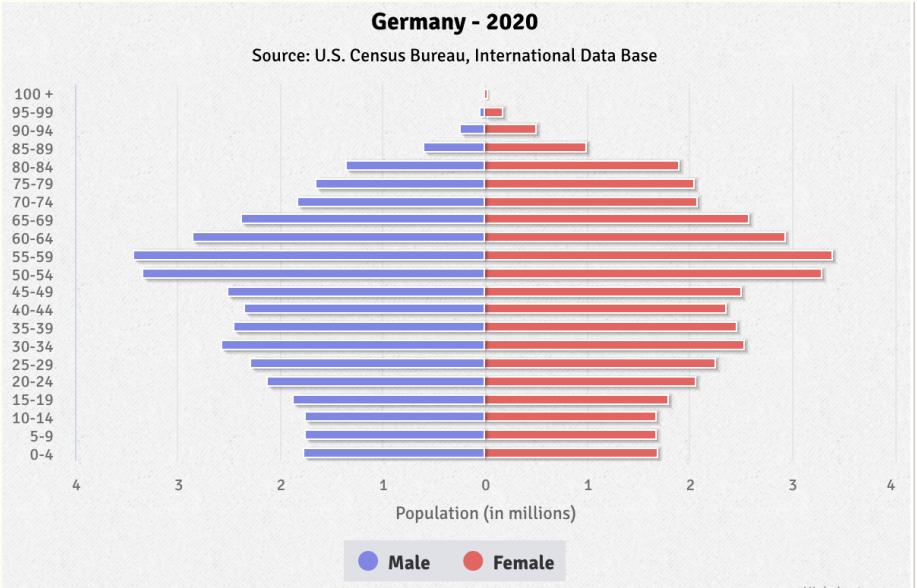
The demographic transition: Average births



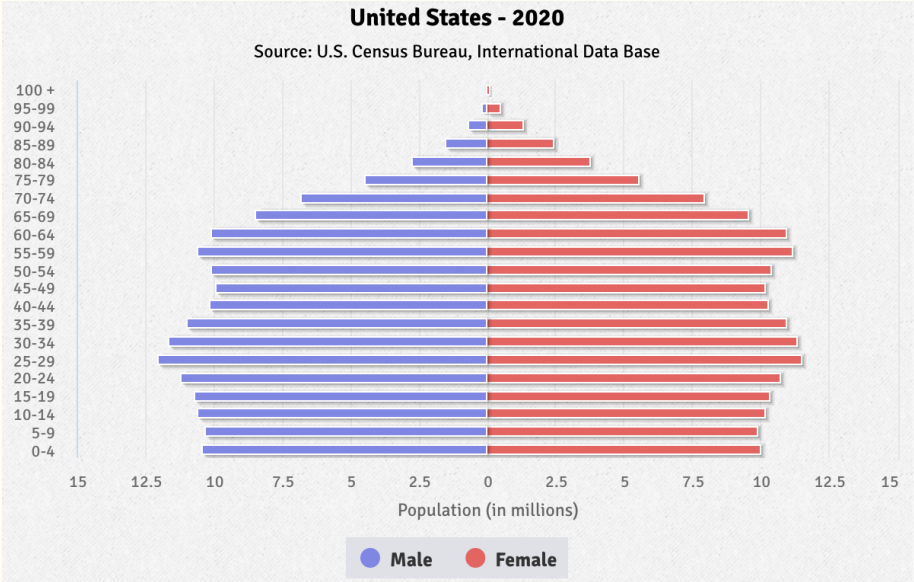
The demographic transition: Average deaths



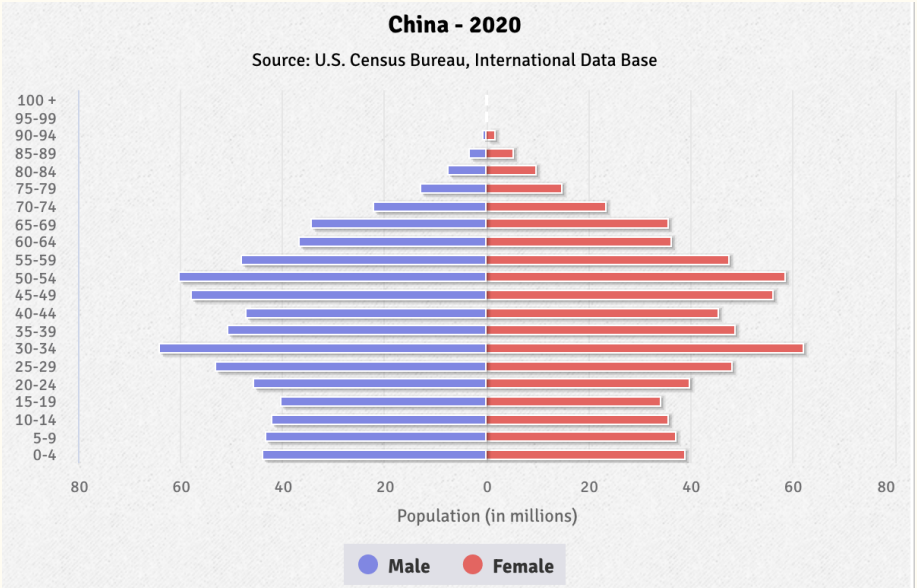
Germany's population pyramid



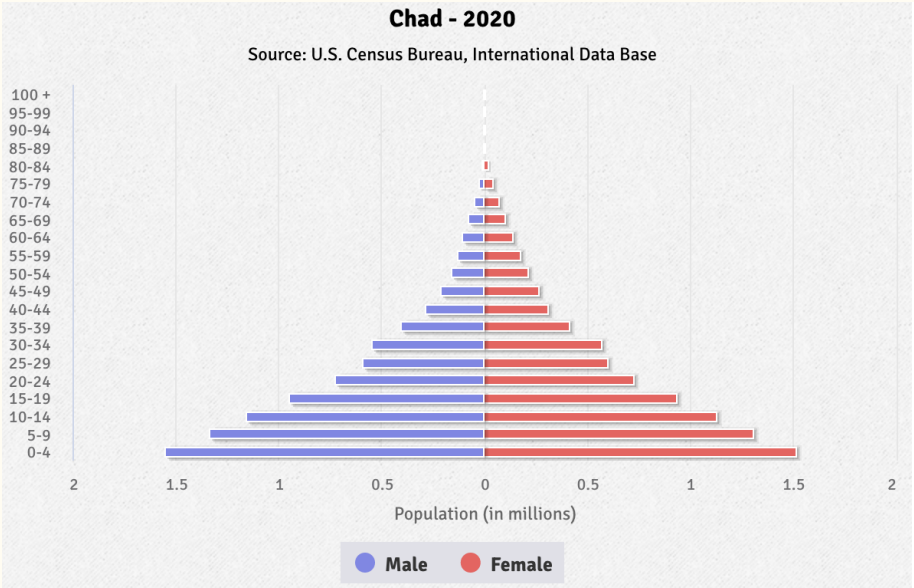
United States' population pyramid



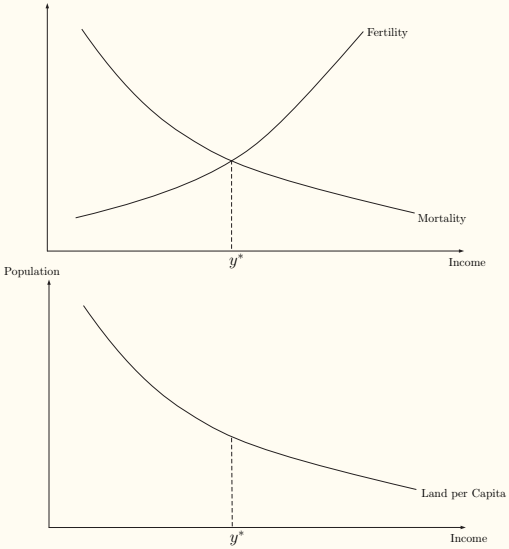
China's population pyramid



Chad's population pyramid



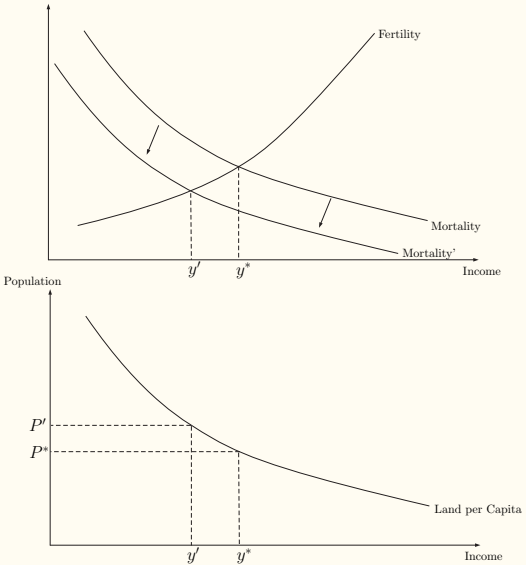
Basic malthusian model



Comparative statics 1

- Let us suppose that in a Malthusian world, we have two countries, the first one with better health conditions (i.e., better medical system, vaccines, or better sanitation).
- The first country will have a lower mortality line.
- From our previous analysis:
  1. Income per capita will be lower in the first country.
  2. Population density will be higher.

Comparative statics 1



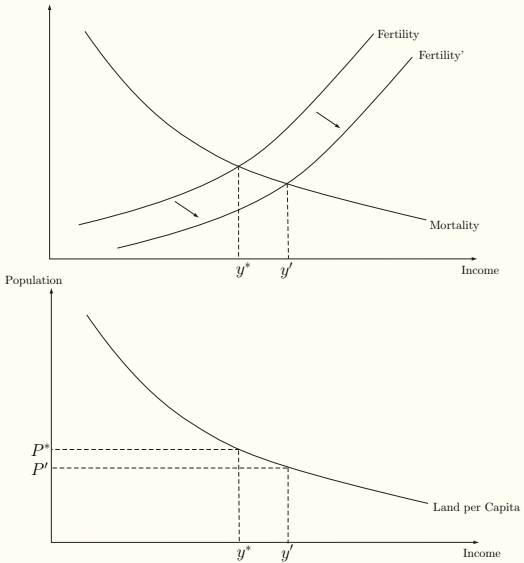
Historical example

- Preindustrial Europe was particularly filthy, especially in comparison with Japan.
- Simultaneously, Japan was poorer and had a higher population density.
- Evidence:
  1. Cleanliness of Japanese was emphasized by European travelers between 1543 and 1811.
  2. Toilets in Japan were built at some distance from living quarters, in England even the upper classes built their toilets adjacent to the bedrooms.
  3. Houses in Japan had raised wooden floors and outside shoes were taken off at the entrance. In England, the dwelling had beaten earth follors covered by rushers that were only infrequently renewed.
  4. In the 1710s, English per capita soap consumption was less than 0.2 ounces per day. Convicts transported to Australia around 1850 got a ration of 0.5 ounces per day.

Comparative statics 2

- Let us suppose that in a Malthusian world, we have two countries, the first one where women marry late (perhaps because of religious reasons) and one where women marry early.
- The first country will have a lower fertility line.
- From our previous analysis:
    1. Income per capita will be higher in the first country.
    2. Population density will be lower.

Comparative statics 2



Historical example

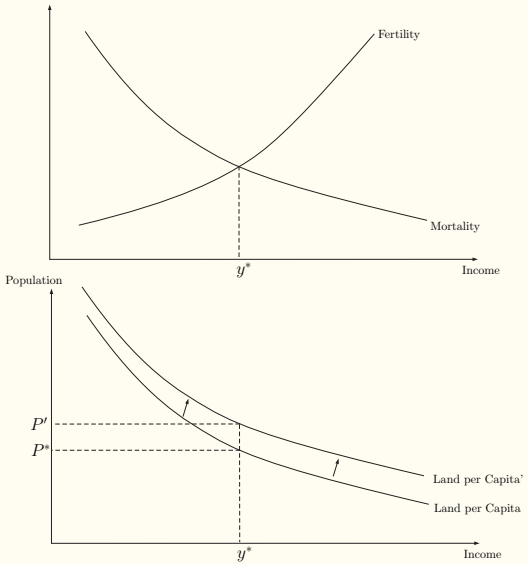
- Hajnal line between Saint Petersburg to Trieste.
- European Marriage pattern:
  1. High marriage age of women (around 25-26).
  2. A substantial proportion of women remained celibate (around 25%).
- It seems to appear in the later Middle ages.
- Why?
- Alternative mechanisms for fertility control: abortion, infanticide, extended lactancy.

Hajnal line

Comparative statics 3

- Let us suppose that in a Malthusian world, we have two countries, the first one with higher productivity than the second.
- From our previous analysis:
  1. Income per capita will be the same in both countries.
  2. Population density will be higher in the first country.

Comparative statics 3



Historical example

- Historical Example: China versus Europe.
  1. Rice delivers more units of calories per unit of land than wheat: $\text{productivity}_{rice} > \text{productivity}_{wheat}$.

     18th century, one hectare produced if 7.5 million calories if Rice, 1.5 if wheat, 0.34 if meat.
  2. Hence, income per capita will be roughly the same, but China will be denser.
- Cultivation of different cereals may have many important consequences for economic growth and social organization (Wittfogel, *Hydraulic Despotism*).

Comparative statics 4

- Let us suppose that in a Malthusian world, we have two countries, the first with an Emperor that taxes τ of agricultural production to finance his private consumption, for example, a grand palace.
- We have that the after-tax income is then $\widetilde{y} = (1 - \tau)\, y$.
- With this new technology level, the analysis goes through unchanged with respect to the previous case:
  1. Income per capita will be the same in both countries.
  2. Population density will be lower in the first country.

Political economy consequences

- Hence, the cost of the palace is less population, not a lower income for the existing population.
- Similarly, having a landed gentry obtaining a huge rent from farmers only implies lower population, not higher income:
    1. Elites may live much better if productivity increases (and hence taxes), even if the average person does not improve.
    2. Strong limit to the effects of redistribution.
- Historical example: land reform in France during the revolution.

Dynamics of the model I

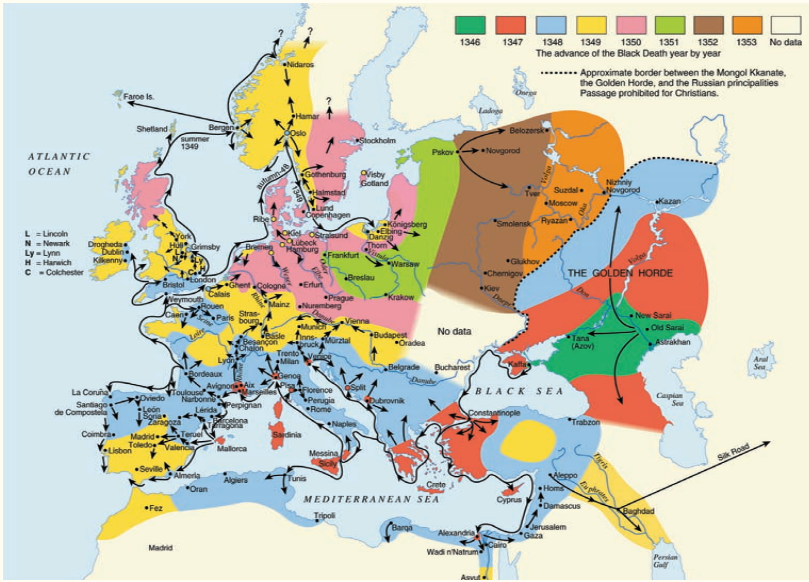
The waves of population

"What has changed entirely is the rhythm of the population increase. At present it registers a continuous rise, more or less rapid according to society and economy but always continuous. Previously it rose and then fell like a series of tides. This alternate demographic ebb and flow characterised life in former times, which was a succession of downward and upward movements, the first almost but not completely cancelling out the second. These basic facts make almost everything else seem secondary." Fernand Braudel, *Civilization and Capitalism, 15th-18th Century: The structure of everyday life*, p. 30.

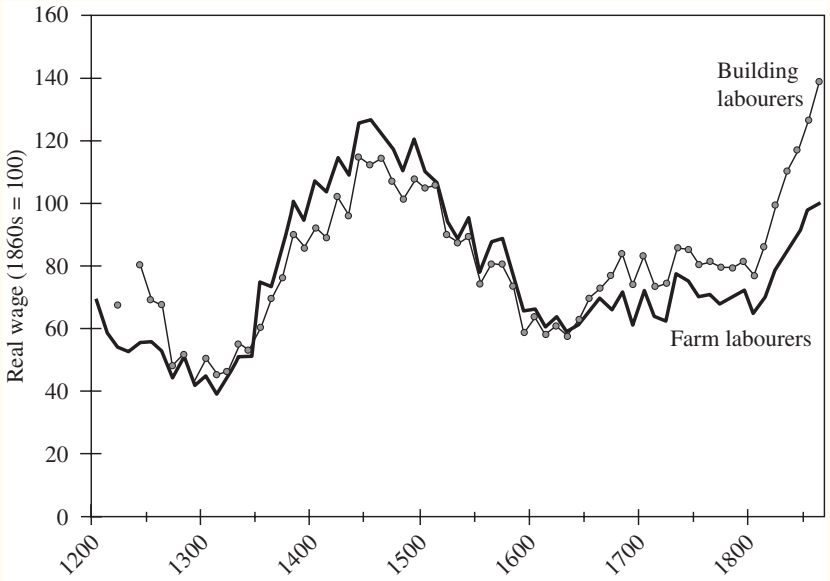
Dynamics of the model II

- Population grows when density is low and income per capita is high.
- Let us suppose we are at the steady state and that an epidemic wipes out 50 percent of the population:
  1. Income per capita will immediately rise by.
  2. Population will begin to increase (lower mortality and higher fertility).
  3. Eventually, we will end up in the same steady state as before.
- Historical example: Black Death in Europe in 1348.
- Robert Brenner's view: economic transformation in Europe.

Spread of the black death, 1346-1353



Real agricultural day wages, England, 1209-1869



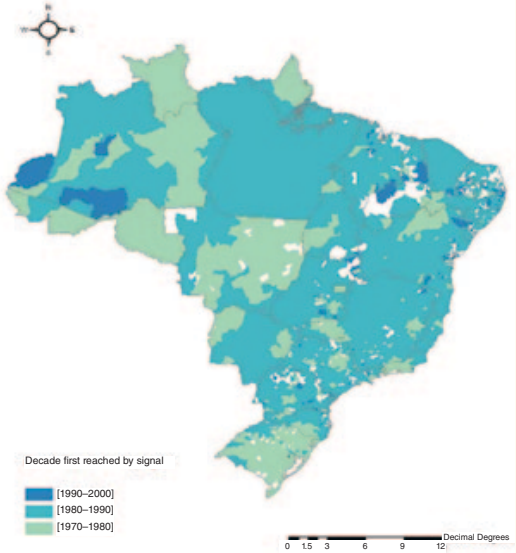
Mechanisms for change

- Farming vs. manufacturing/services economy.
- Child labor.
- Survival rates.
- Modern financial markets and social security.
- Quantity-quality trade-off.
- Contraceptive technologies.
- Cultural norms (including gender roles).

Italy's pension reform

	Unaffected (up to - 1 year)	Affected (up to +1 year)
Number of children (up to 1993)	1.3831	1.3788
	(0.0742)	(0.0802)
Number of children (after 1993)	0.3134	0.4899***
	(0.0421)	(0.0468)
Number of children (up to 1996)	1.4627	1.5101
	(0.0730)	(0.0800)
Number of children (after 1996)	0.2338	0.3586**
	(0.0360)	(0.0410)
Total number of children (up to 2006)	1.6965	1.8687*
	(0.0699)	(0.0772)
N	*201*	*198*

Expansion of Rede Globo



Fertility drop

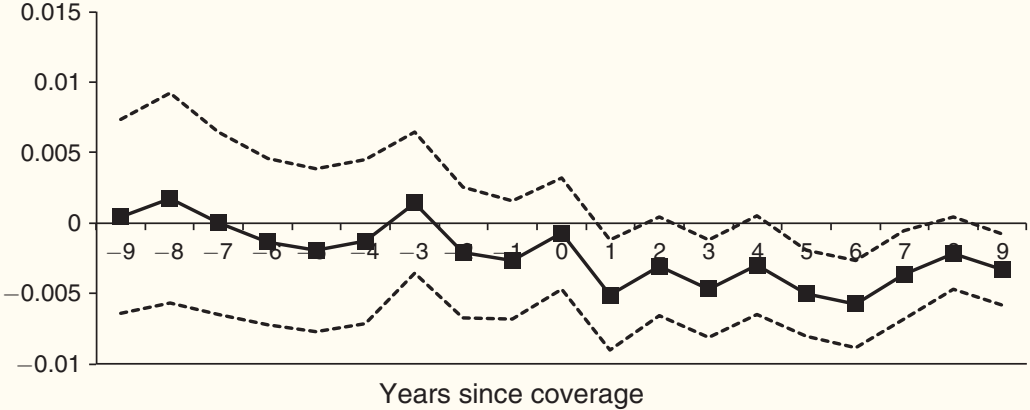


FIGURE 4. TIMING OF FERTILITY DECLINE AROUND YEAR OF GLOBO ENTRY