

# The Demographic Transition

- ▶ The demographic transition was a major change in population growth and life expectancy driven by changes in mortality and fertility
- ▶ Demographic transition between low population growth rates of preindustrial world, high population growth during the Industrial Revolution, back to low population growth in modern economies despite high incomes
- ▶ If the demographic transition didn't occur, could still be a Malthusian world or at least a world with greater population pressures on income per person

## Fertility patterns in 17th century Britain

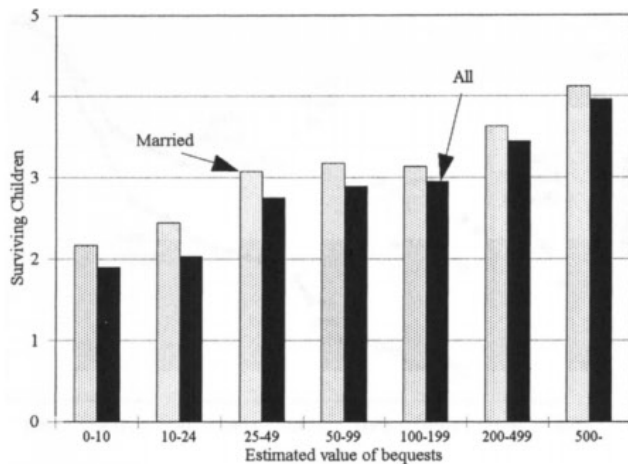
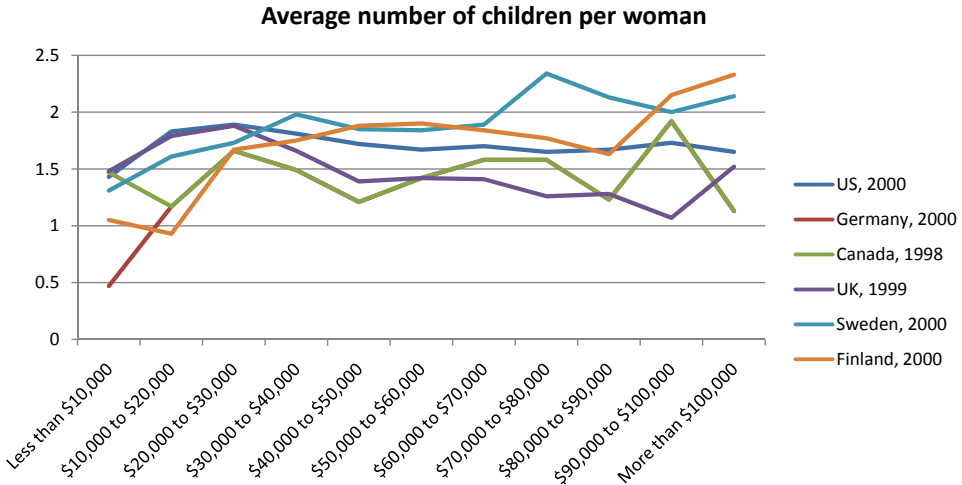


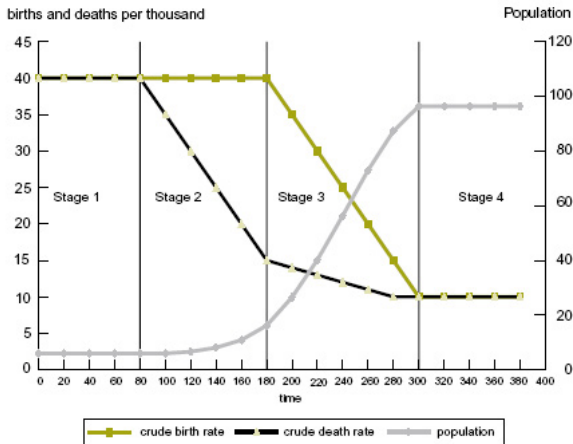
FIGURE 4. Surviving children by assets of Testator, England, 1585–1636. Note: Assets in £. Source: Clark and Hamilton (2004).

# Modern fertility patterns



# A stylized version of a demographic transition

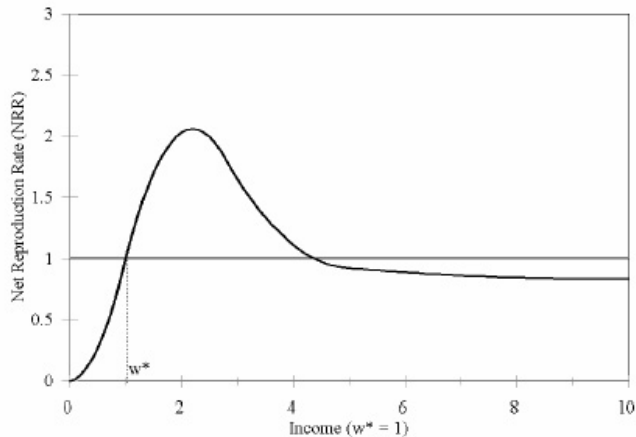
## A Stylized Demographic Transition





## Another stylized version of a demographic transition

**Figure 5: The Fertility Income Relationship**



# The demographic transition across Europe

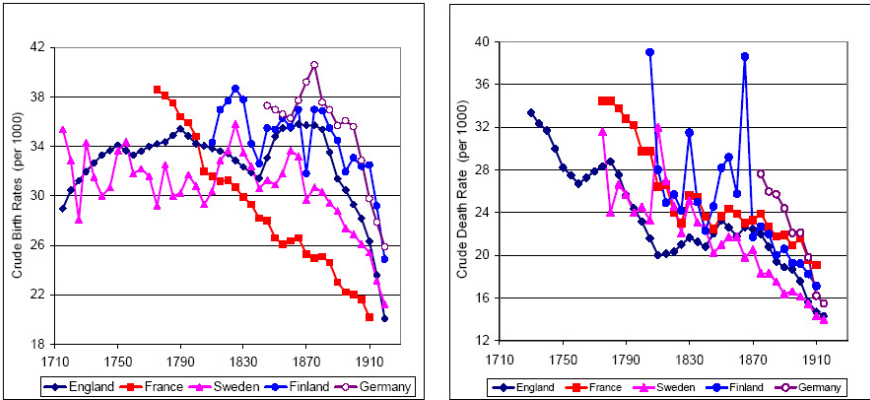
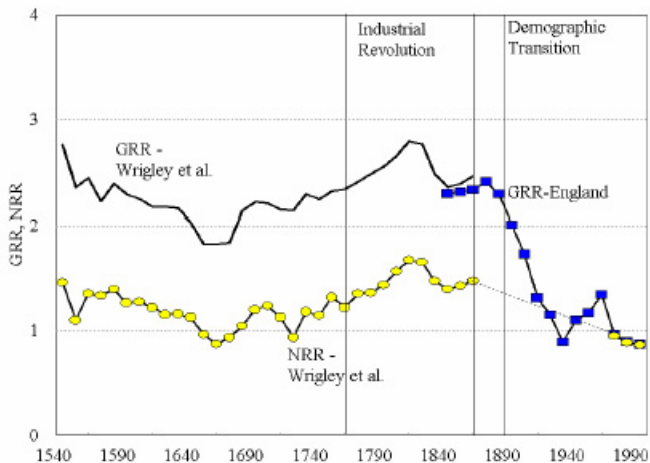


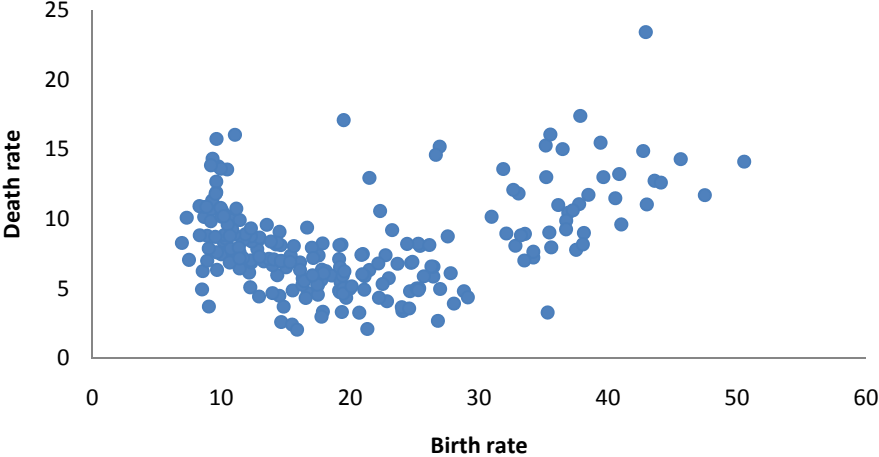
Figure 1. The Decline in Fertility and Mortality in Western Europe:  
Source: Andorka (1978)

# The demographic transition in Britain

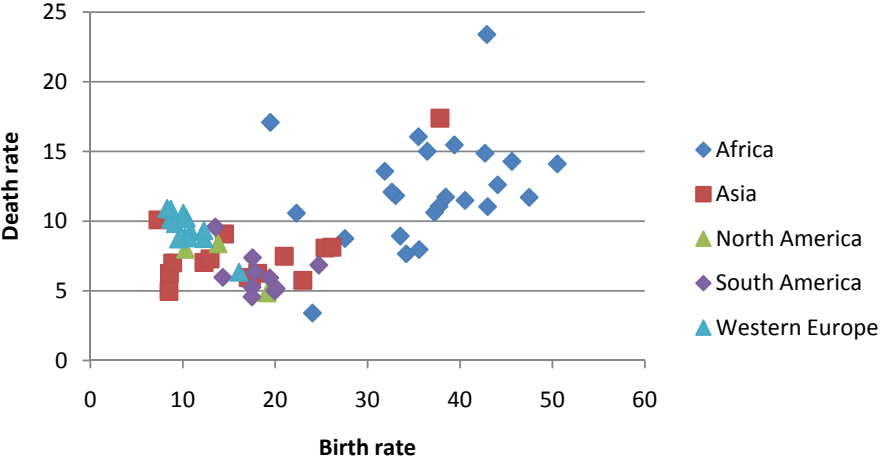
**Figure 1: English Fertility History, 1540-2000**



# Modern birth and death rates



# Modern birth and death rates



## Explanations of the transition

- ▶ Do rising incomes lead to lower fertility rates? Only during transition.
- ▶ Before transition, we have a positive correlation between income and birth rates.
- ▶ No strong correlation between household income and fertility within countries in modern data for US and Europe (there is a negative correlation across countries).
- ▶ Possible explanations: families have one desired size, increased social status of women, change in nature of quantity/quality tradeoff for children

## Explanations of the transition

- ▶ These possible explanations are not mutually exclusive
- ▶ Each is going to draw on slightly different aspects of what we've talked about
  - ▶ Desired family size: mortality declines with rising incomes
  - ▶ Increased social status of women: the Industrious Revolution
  - ▶ Quantity/quality tradeoff: Becker-style household resource allocation



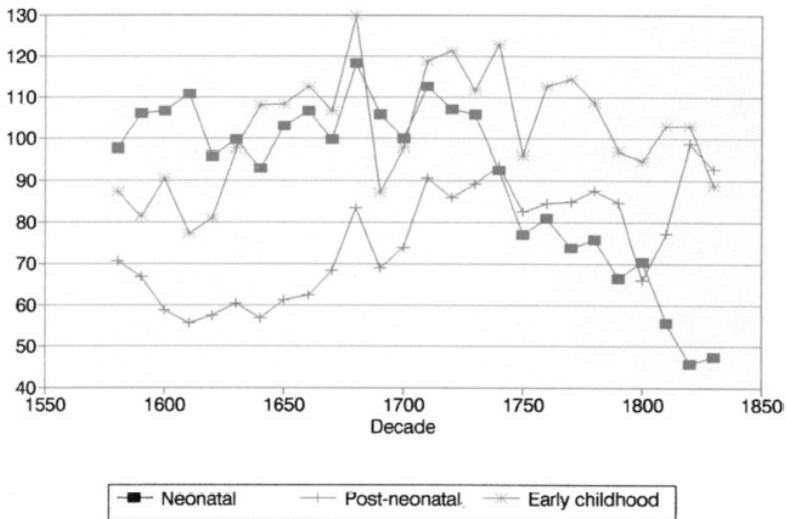


## Desired Family Size Explanation

- ▶ Perhaps couples have a desired family size (for example, they may want to have at least one male heir)
- ▶ These preferences would be over the number of children surviving, not the number of children born
- ▶ If child mortality is high, fertility rates need to be high to achieve desired family size
- ▶ As mortality declines, families can have fewer babies and still achieve the same family size
- ▶ Makes sense in terms of the decline in mortality beginning before the decline in fertility

# Desired Family Size Explanation

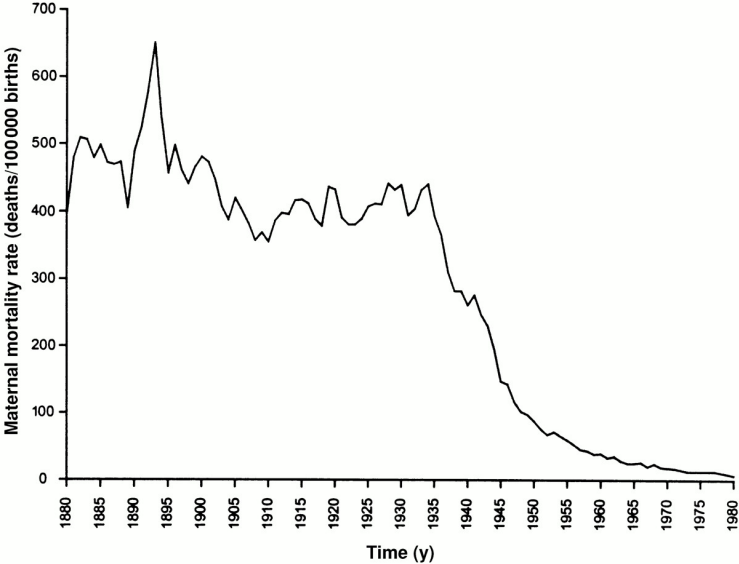
Fig. 3. Neonatal, Post-neonatal and Early Childhood Mortality



## Increased Social Status of Women Explanation

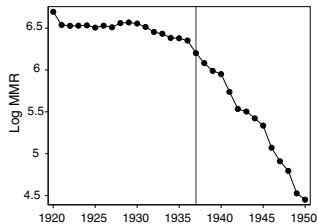
- ▶ The increased social status of women may have also contributed to the demographic transition
- ▶ The costs of additional children were highly asymmetric
- ▶ Women were responsible for the child rearing and bore considerable health risks during child birth
- ▶ It is possible that men desired larger families than women
- ▶ The increased social status of women may have let women have more say in family size

# Increased Social Status of Women Explanation

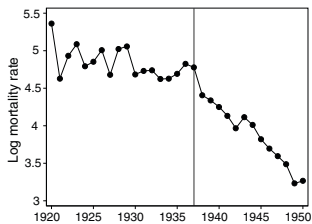


# Increased Social Status of Women Explanation

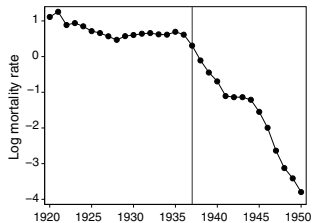
Panel A. Log maternal mortality ratio (deaths per 100,000 live births)



Panel B. Log influenza and pneumonia mortality rate per 100,000



Panel C. Log scarlet fever mortality rate per 100,000



Panel D. Log meningitis mortality rate per 100,000

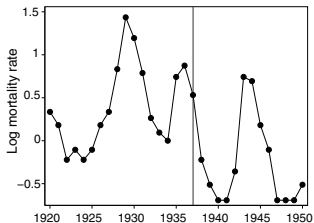


FIGURE 2. MORTALITY TRENDS (*in logs*) FOR TREATED DISEASES, 1920–1950

# Increased Social Status of Women Explanation

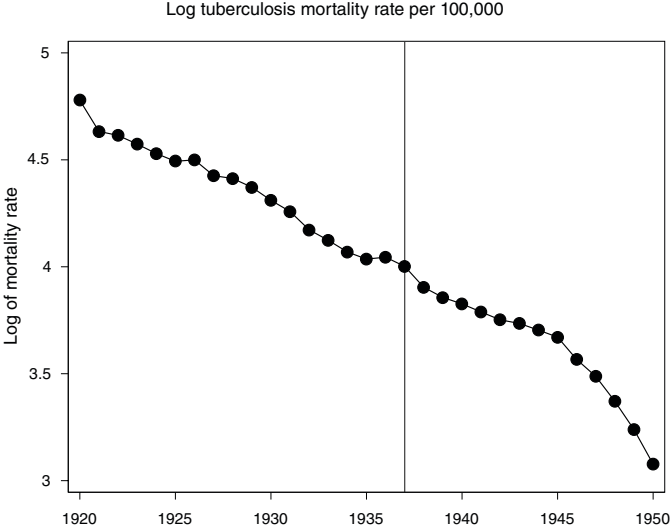


FIGURE 3. MORTALITY TRENDS (in logs) FOR CONTROL DISEASE

# Increased Social Status of Women Explanation

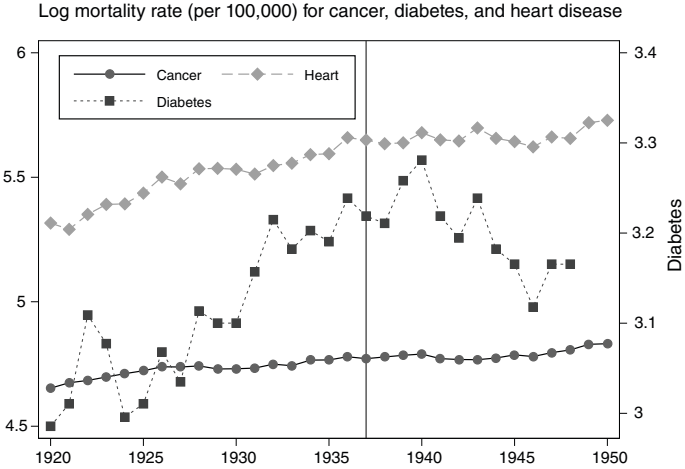


FIGURE 4. MORTALITY TRENDS (in logs) FOR CHRONIC DISEASES

## Quantity/quality tradeoff with children

- ▶ Fewer children with higher income suggests children are an *inferior* good which doesn't seem quite right
- ▶ We can make sense of decrease in number of children if quality of children is considered
- ▶ As income rises, parents can invest more in either additional children or the quality of each child
- ▶ Think of quantity as inferior but quality as a normal good in this scenario
- ▶ Additional children are very time intensive, higher income doesn't buy a longer day (and increases opportunity cost of staying home)
- ▶ Because of time constraints, parents switch to fewer kids with more money invested in each kid (think braces and SAT tutors)

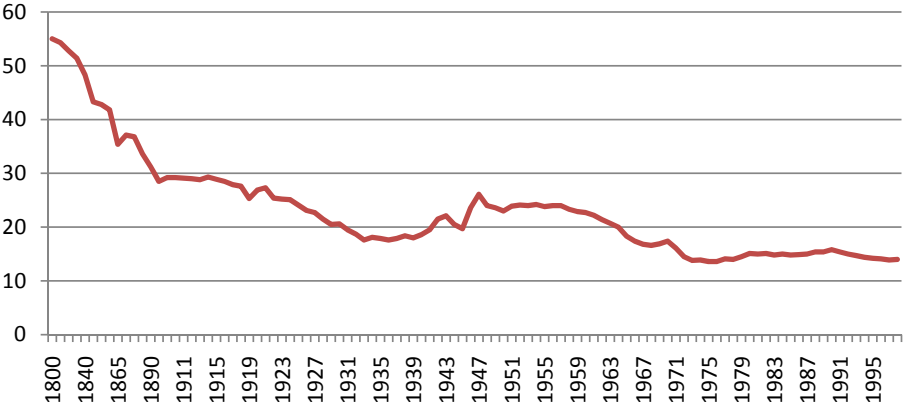


# The Demographic Transition Across the Atlantic

- ▶ It's worth taking a moment to think about how the US experience compares to Europe
- ▶ America had a very different demographic transition that can help highlight some additional dimensions of fertility and mortality
- ▶ Two big differences for the US compared to Europe:
  - ▶ Mortality didn't initially decline with rising incomes as it did for Europe
  - ▶ The drop in fertility preceded the decline in mortality

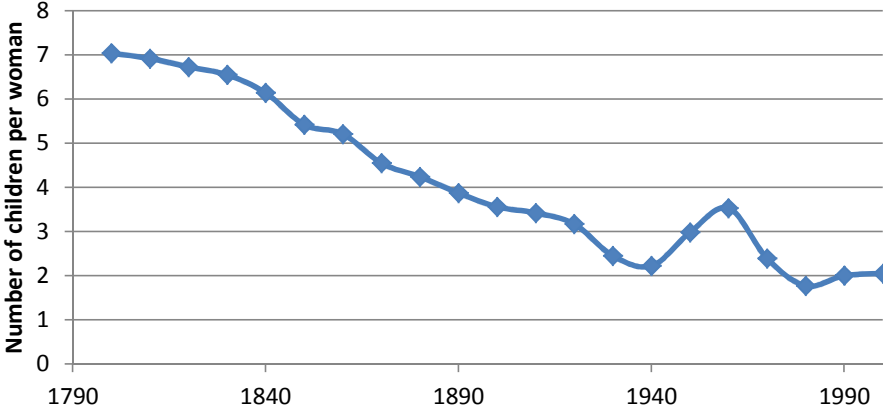
# The American Birthrate

## US Birthrate per 1,000, 1800-1999

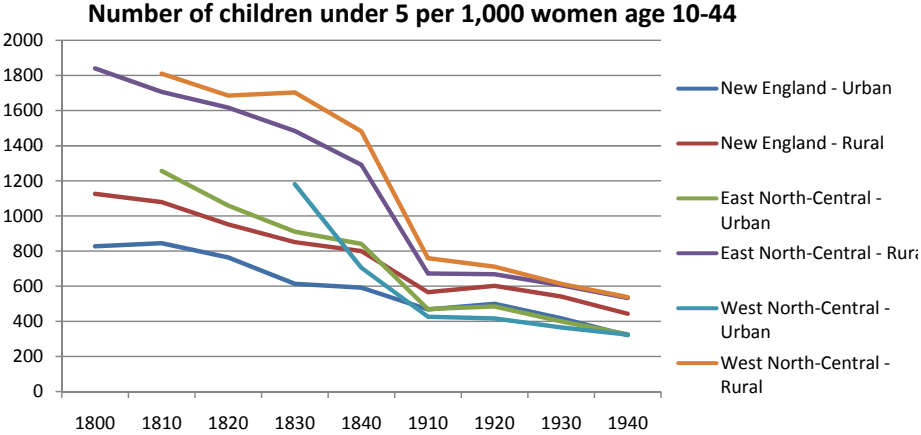


# The American Fertility Rate

## Total fertility rate, 1800-2000



# The American Fertility Rate - Regional Differences



## Why are fertility rates higher in rural areas and the frontier?

- ▶ A common explanation is that on the expanding frontier, the abundance of land meant that there was plenty of economic opportunity if you could provide enough labor
- ▶ Children could provide valuable labor on the farm
- ▶ In addition, the greater land wealth of farmers made them more likely to have several children if providing inheritances matters to parents (target bequest model)
- ▶ An alternative to this idea of a target bequest model is a strategic bequest model in which parents want their children to take care of them when they are older

# Children as a Source of Labor



## Were children valuable on the farm?

### Contributions to Farm Family Income, 1860

Family Group	Northeast	Midwest	Frontier
Children, 0-6	(\$20.82)	\$8.59	(\$6.41)
Children, 7-12	\$22.81	\$27.76	\$27.12
Teenage females	\$22.95	\$39.75	\$17.53
Teenage males	\$111.03	\$47.45	\$49.03
Adult women	\$154.08	\$70.25	\$147.28
Adult men	\$294.77	\$186.44	\$193.66

# Children and the Target Bequest Model

## ESTATE PROPORTIONS BY BIRTH ORDER

Two-children families ( $N = 31$ )		
First born	Mean	Standard deviation
$X_1/W_1$	0.491	0.052
$X_2/W_2$	0.498	0.048
$X_3/W_3$	0.495	0.047

Three-children families ( $N = 30$ ) Complete ordering ( $N = 19$ )		
First born	Mean	Standard deviation
$X_1/W_1$	0.329	0.127
$X_2/W_2$	0.342	0.090
$X_3/W_3$	0.339	0.091
<u>Second born</u>		
$X_1/W_1$	0.317	0.069
$X_2/W_2$	0.312	0.067
$X_3/W_3$	0.310	0.066



# Children and the Strategic Bequest Model

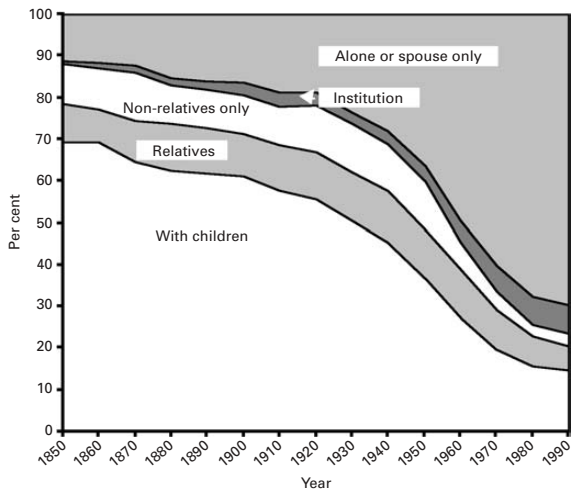


FIGURE 1. Distribution of living arrangements of white individuals and couples aged 65 or older, United States, 1850–1990. (Source: S. Ruggles, M. Sobek et al., *Integrated Public Use Microdata Series: Version 2.0*, Minneapolis, Historical Census Projects, University of Minnesota, 1997, hereafter IPUMS [available at <http://ipums.org>].)

## Children and the Strategic Bequest Model



FDR signing the Social Security Act of 1935

## Children and the Strategic Bequest Model



Ernest Ackerman, received 17 cents in Social Security benefits

# Children and the Strategic Bequest Model

## AGRARIAN JUSTICE,

OPPOSED TO

AGRARIAN LAW,

AND TO

AGRARIAN MONOPOLY

BEING A PLAN FOR

MELIORATING THE CONDITION OF MAN,

*By Creating in every Nation,*

A NATIONAL FUND,

To Pay to every Person, when arrived at the Age of TWENTY-ONE YEARS, the Sum of FIFTEEN POUNDS Sterling, to enable HIM or HER to begin the World!

AND £ L50,

Ten Pounds Sterling per Annum during life to every Person now living of the Age of FIFTY YEARS, and to all others when they shall arrive at that Age, to enable them to live in Old Age without Wretchedness, and go decently out of the World.

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By THOMAS PAINE,

AUTHOR OF COMMON SENSE, RIGHTS OF MAN,  
AGE OF REASON, &c. &c.

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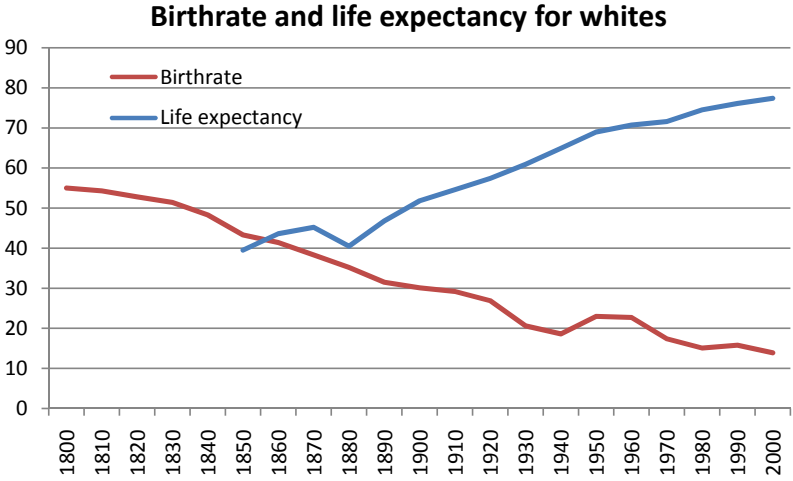
FOR

BENJAMIN FRANKLIN BACHE

# Explaining the American Fertility Decline

- ▶ Falling fertility levels in the US may be less about mortality rates and desired family size and more about rural to urban migration
- ▶ Urbanization and industrialization did a variety of things:
  - ▶ Larger families became more costly with rising population density
  - ▶ Decline in need for children as farmhands
  - ▶ Decline in wealth (issue for target bequest model)
  - ▶ Increased outside opportunities for kids (issue for strategic bequest model)

# The Decline in American Death Rates

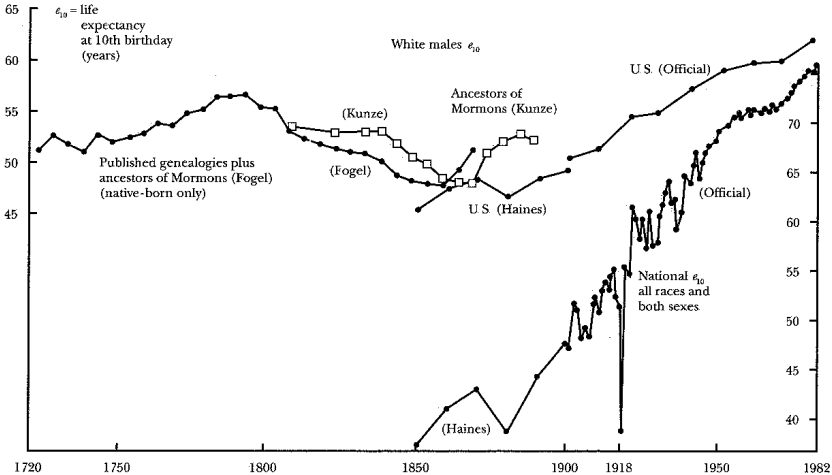


## The Decline in American Death Rates

- ▶ Despite rising incomes in the early 1800s, life expectancies were actually falling
- ▶ The drop in birthrates was a result of decisions over family size, the drop in death rates was not a result of preferences over deaths
- ▶ Death rates are a function of health, nutrition, disease, and the likelihood of dying an unnatural death
- ▶ Medical science was improving, basic hygiene practices were spreading, sanitation was improving
- ▶ All of these factors above increased life expectancies (as we predicted in our Malthusian model)
- ▶ However, working in the opposite direction was urbanization

# The Decline in American Death Rates

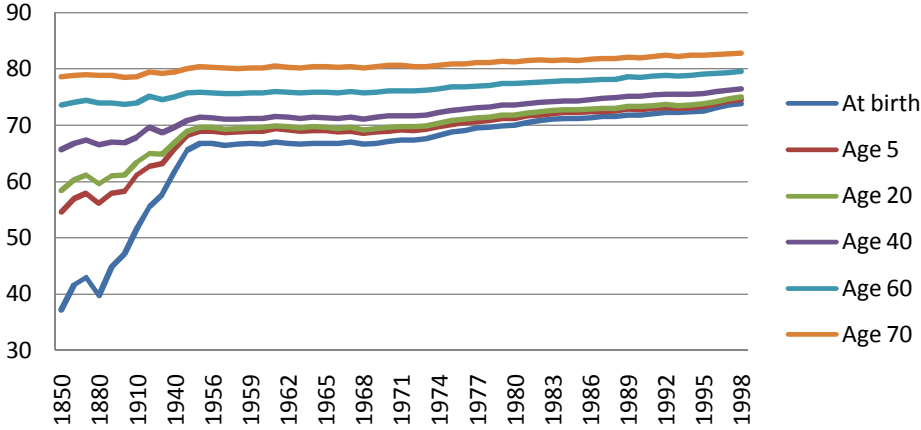
Life Expectancy in America, 1720–1982



Source: Peter Lindert, "Comment," in National Bureau of Economic Research, *Long Term Factors in American Economic Growth*, vol 51, ed Stanley I. Engerman and Robert E. Gallman (Chicago: University of Chicago Press, 1986): 530



# The Decline in American Death Rates



Life expectancy for American males

# The Decline in American Death Rates

## Leading Causes of Death in the United States, 1900

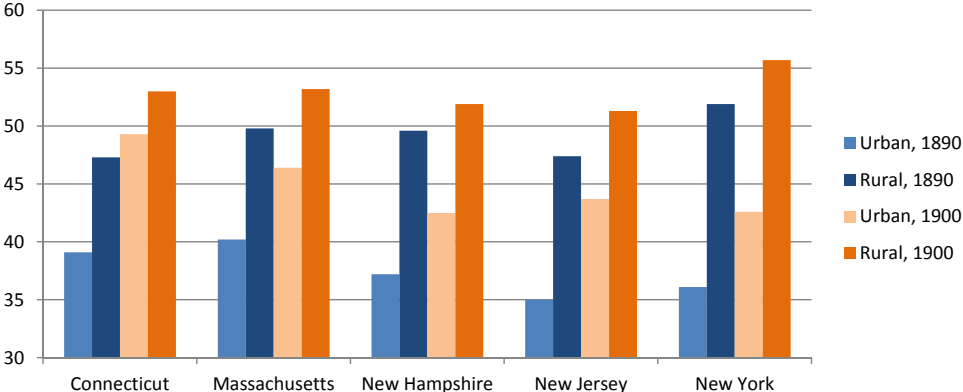
Rank	Cause	Rate per 100,000 people
1	Pneumonia and influenza	202.2
2	Tuberculosis	194.4
3	Diarrhea, enteritis, and ulceration of the intestines	142.7
4	Diseases of the heart	137.4
5	Intracranial lesions of vascular origin	106.9
6	Nephritis	88.6
7	Accidents	72.3
8	Cancer and other malignant tumors	64
9	Senility	50.2
10	Diphtheria	40.3

# The Decline in American Death Rates

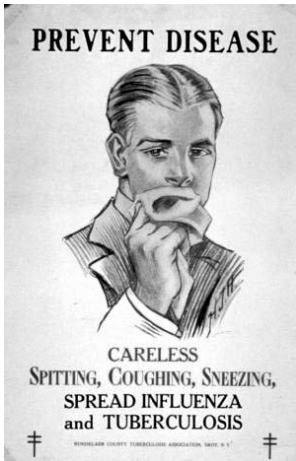
## Leading Causes of Death in the United States, 1998

Rank	Cause	Rate per 100,000 people
1	Diseases of heart	268.2
2	Malignant neoplasms	200.3
3	Cerebrovascular diseases	58.6
4	Chronic obstructive pulmonary diases	41.7
5	Accidents	36.2
6	Pneumonia and influenza	34
7	Diabetes	24
8	Suicide	11.3
9	Nephritis	9.7
10	Chronic liver disease	9.3

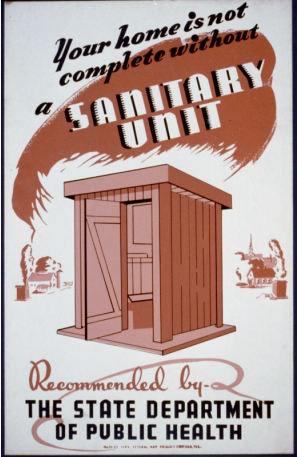
# Urban-Rural Differences in Life Expectancy



# Improvements in Public Health



# Improvements in Public Health



## Improvements in Public Health

Slogans promoted by the Ohio State Board of Health:

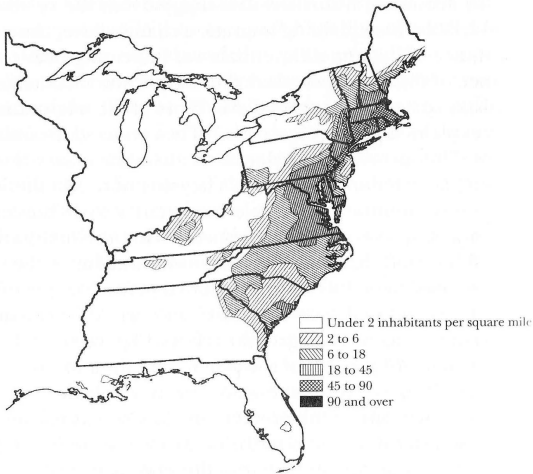
- ▶ “Treat your body to an occasional bath. It may not be entitled to it, but it will repay you with better service.”
- ▶ “A fly in the milk may mean a member of the family in the grave.”
- ▶ “There is less danger in vaccinating a person than in cutting his corn.”

## The Role of the Frontier

- ▶ If scientific knowledge crosses borders, shouldn't the US and Europe have similar mortality declines?
- ▶ Yes, if they are starting from the same point
- ▶ However, just like with fertility rates the frontier plays a big role
- ▶ There is an American frontier throughout industrialization
- ▶ This isn't the case for Europe

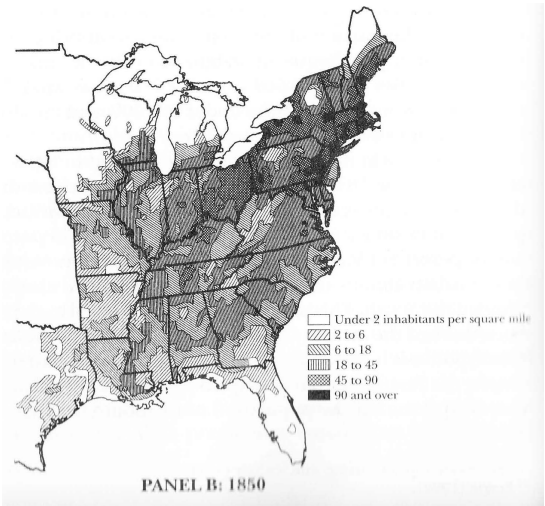


# The Role of the Frontier



PANEL A: 1790

# The Role of the Frontier



# The Role of the Frontier

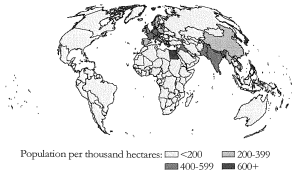


Figure 7.5 World population densities, circa 1500. The figure is drawn using the admittedly wildly speculative numbers of McEvedy and Jones, 1978, for population. Farmland areas are those for modern times as reported by the Food and Agriculture Organization (FAO).

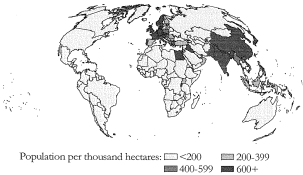


Figure 7.6 World population densities, circa 1800.

*1,000 hectares equals 3.86 square miles.*

# The Role of the Frontier

- ▶ The lack of a frontier in England is going to matter for additional reasons
- ▶ Leading up to and during the Industrial Revolution, Europe was facing natural resource constraints
- ▶ A big part of revolution was figuring out how to get around those constraints
- ▶ This leads to our next two topics:
  - ▶ The agricultural revolution
  - ▶ Our first attempt to explain the when and where of the Industrial Revolution

# Agricultural Revolution



*Jethro Tull, 1967-present*

# Agricultural Revolution



*Jethro Tull, 1674-1741*



# Agricultural Revolution

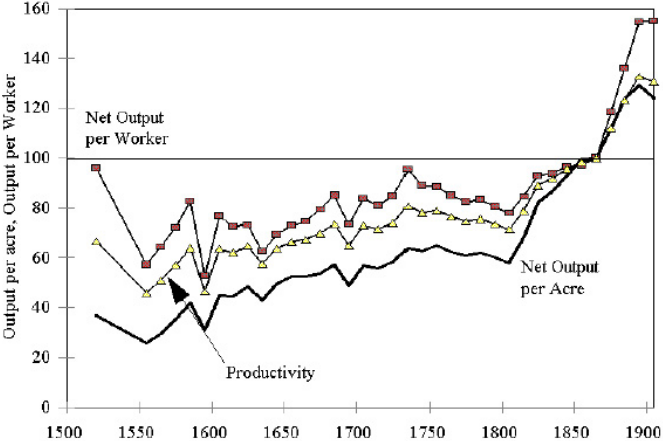
The traditional view:

- ▶ Agricultural yields were low in medieval England compared to their levels by 1850: net output per acre tripled in southern England between 1300 and 1850
- ▶ This increase in productivity is even more dramatic if the share of the population employed in agriculture was significantly declining
- ▶ Traditional accounts of agricultural revolution suggest large efficiency gains in agriculture concurrent with the Industrial Revolution (e.g. Jethro Tull)
- ▶ The motivation behind this traditional view is that the Industrial Revolution brought with it a population that was quickly getting larger and wealthier implying a substantial increase in demand for food



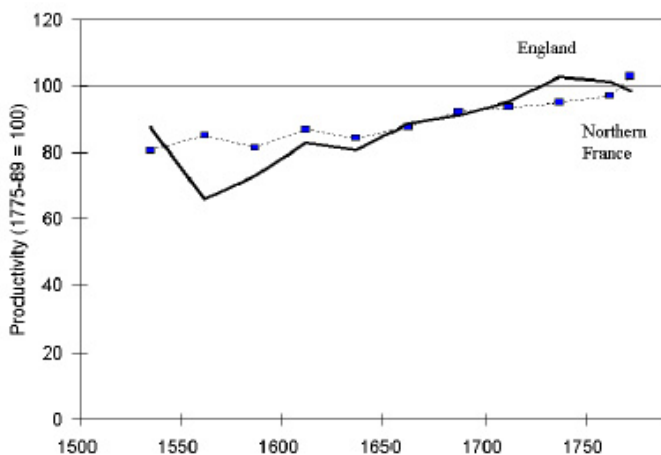
# Growth in agricultural productivity in Britain

Figure 2: Net Output per Acre and per Male Farm Worker, Preferred Labor Estimates



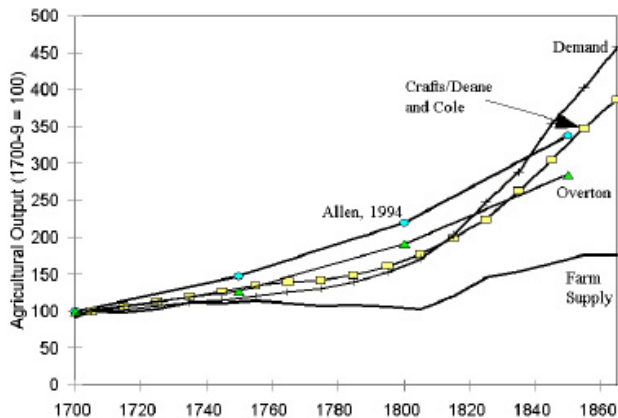
# Growth in agricultural productivity in Britain relative to France

Figure 5: Productivity Growth, England Compared to Northern France, 1520-1789



# Supply and demand of agricultural products

Figure 7: Alternative Estimates of Farm Product Demand and Supply in England/Britain, 1700-1860.



## Agricultural consumption in England

<b>Agricultural Consumption per Person in England</b>			
	1700	1760	1860
Population (millions)	5.16	6.25	19.97
English farm net output	64.7	71.4	114.3
Net food imports	1.7	3.2	79.8
New raw material imports	-2.1	-4.6	61.4
Domestic coal consumption	1.7	7.9	48.3
Total food, energy and raw material consumption	66	79.3	303.8
Consumption per person	12.8	12.7	15.2

All numbers except population and consumption per person are in millions of 1860 pounds. Consumption per person is in 1860 pounds.

## Agricultural consumption in England

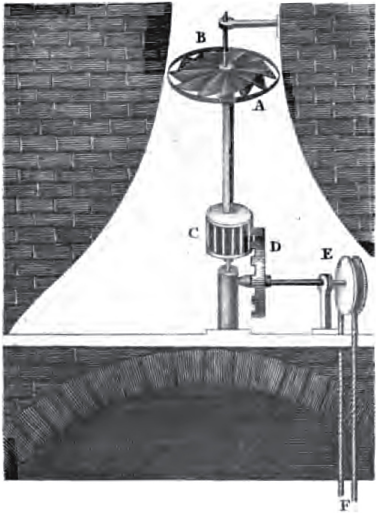


## Agricultural consumption in England



# Agricultural consumption in England

*Fig. 2.*



## A revised view of the Agricultural Revolution

- ▶ Productivity and output did grow significantly: between 1500 and 1869 output tripled and total factor productivity increased by 50%
- ▶ But these changes were slow and steady: the productivity gains translate into an average annual productivity growth of 0.15% (not much of a revolution)
- ▶ British agricultural labor productivity was better than other European nations but that was true since medieval times
- ▶ Growing demand for food consumption was met by importing and using less of agricultural production for energy (in 1700, 1/3 of agricultural output was used for horses, firewood and raw materials)



# A true Agricultural Revolution



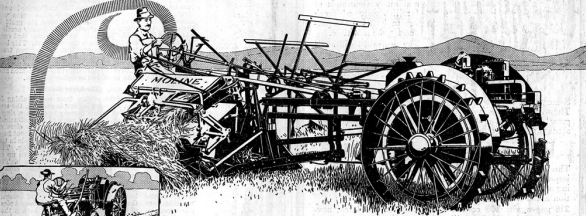
*Fritz Haber*

## A true Agricultural Revolution




# A true Agricultural Revolution


**ONE MAN CAN FARM  
MORE LAND** *with the*



**MOLINE**  
**UNIVERSAL TRACTOR**  
*"It Solves the Farm Help Problem"*



*Plowing*



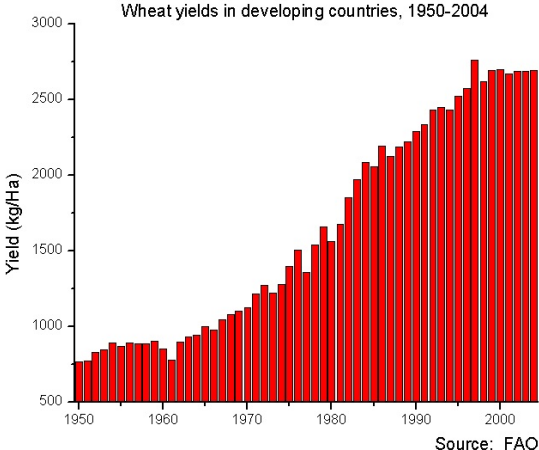
*Harrowing*

# The Green Revolution

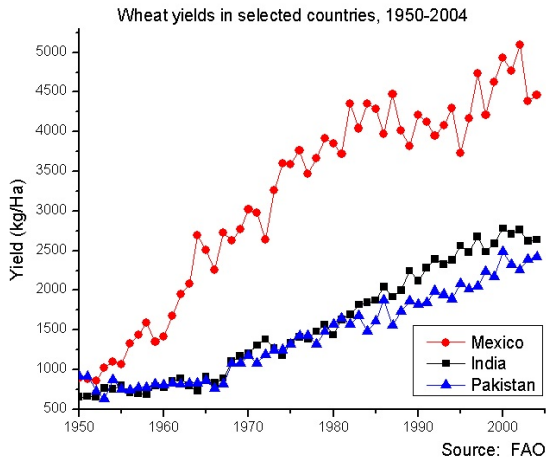


*Norman Borlaug*

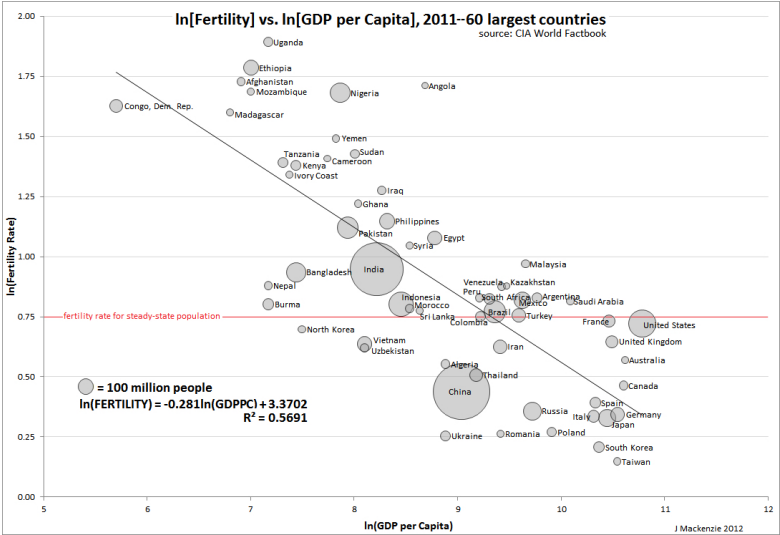
# The Green Revolution



# The Green Revolution



# Mixed Blessings



## Mixed Blessings

Country	Population growth rate	GDP per capita (PPP)
Central African Republic	2.12	\$700
Burundi	3.25	\$800
Democratic Republic of the Congo	2.37	\$800
Liberia	2.5	\$900
Tokelau	-0.01	\$1,000
Malawi	3.31	\$1,200
Niger	3.19	\$1,200
Mozambique	2.46	\$1,300
Eritrea	0.85	\$1,400
South Sudan	3.83	\$1,500
United Kingdom	0.52	\$43,600
United States	0.81	\$59,500
Liechtenstein	0.8	\$139,100



## Announcements

- ▶ Today we'll wrap up the Demographic Transition and the Agricultural Revolution
- ▶ Next week we'll start in on explanations for the Industrial Revolution
- ▶ Required readings:
  - ▶ North and Thomas (1970) "An economic theory of the growth of the Western World." *Economic History Review* (next two weeks)
  - ▶ Acemoglu, Johnson and Robinson (2001) "The colonial origins of comparative development." *American Economic Review* (next two weeks)
- ▶ Make certain you're wrapping up the second assignment, due today at 5pm (I'm expecting you to use a different variable than either one you used on the first assignment)

## Announcements

- ▶ The midterm is on February 29th in class
- ▶ While we'll get to new readings before then, the set of readings covered on the midterm will be the readings from the preindustrial economy lectures and the Industrial Revolution readings
- ▶ The exam will cover lecture material up to and including today's lecture
- ▶ When looking at past midterms, keep in mind that they might cover some material that we haven't reached yet and might cover papers that I've cut
- ▶ You will be allowed to bring hard copies of anything you want (readings, notes, slides) but they must be hard copies
- ▶ You will not be allowed to access any electronic devices