Lecture 5:
2.1. Economic Growth's Absence in the Malthusian Agrarian Age

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for presentation: 2020-02-06

Original course by Melissa Dell (Harvard Econ 1342), revised by Brad DeLong, research assistance by Anish Biligiri

<https://github.com/braddelong/public-files/blob/master/econ-135-lecture-5.pptx>

Roadmap for the Next Week

5. MAA:

- **Read Before:** Jared Diamond (1997): *The Worst Mistake in the History of the Human Race* <https://www.discovermagazine.com/planet-earth/the-worst-mistake-in-the-history-of-the-human-race>
- **Read Before:** *The Man Who Saw the Deep (Gilgamesh)*, selections <https://delong.typepad.com/files/gilgamesh-selections.pdf>
- **Slides**: <https://github.com/braddelong/public-files/blob/master/econ-135-lecture-5.pptx>
- **Assignment:** Malthusian economies paper <https://bcourses.berkeley.edu/courses/1487685/assignments/8065917>

6. Civilizational "Efflorescences" and Imperial Declines:

- **Read Before**: Willem M. Jongman (2007): *Gibbon was Right: The Decline and Fall of the Roman Economy* <https://delong.typepad.com/jongman-gibbon-was-right.pdf>
- **Read Before**: Peter Temin: *The Roman Market Economy*, Roman Growth <https://delong.typepad.com/files/temin-roman-growth.pdf>
- **Finish**: Assignment 4: Malthusian economies paper; due Feb 12

7. Why Was Pre-Industrial Progress so Slow on Average?:

- **Read Before:** Josh Ober (2019): Agamemnon's Cluelessness, selections <https://delong.typepad.com/files/ober-agamemnon-selections.pdf>
- **Read Before:** Moses Finley: Technical Innovation and Economic Progress in the Ancient World <https://delong.typepad.com/finley-technical.pdf> (Links to an external site.)
  Start: Assignment 5: Simulations with the Solow growth model; due Feb 19

“Subsistence”

From Clark: Condition of Working Class in England

- "Manual workers”—70% of median, 50% of average
- 70% spent on food
  - 30-40% grains
  - 20% meat and dairy
- This is a very rich pre-industrial population

TABLE A3
PERCENTAGE OF EXPENDITURES BY CATEGORY, MANUAL WORKERS, 1734–1854

Category	1734 (Vanderlint)	1787–96 (Horrell)	1840–54 (Horrell)	Assumed Here
Food and drink	**54.4**	**75.4**	**61.7**	**67.0**
Bread and flour	12.5	17.5	23.5	18.5
Barley	0	3.6	.0	1.0
Oats and oatmeal	0	9.9	1.5	2.0
Peas	0	. . .	. . .	1.0
Potato	0	6.3	4.0	4.0
Rice	0	.0	.2	.5
Farinaceous	**12.5**	**37.8**	**29.7**	**27.0**
Meat (beef, mutton, pork)	16.7	11.8	9.8	10.0
Fish	0	.1	.2	.5
Bacon	0	.2	1.8	1.0
Eggs	0	.0	.3	.5
Meat	**16.7**	**12.1**	**12.1**	**12.0**
Milk	2.1	5.9	2.7	4.0
Cheese	2.1	2.7	1.9	2.5
Butter	4.2	6.2	4.1	5.0
Dairy	**8.4**	**14.8**	**8.7**	**11.5**
Sugars	. . .	**4.2**	**4.5**	**4.5**
Beer/cider	12.5	2.8	1.7	6.5
Tea	0	3.4	2.2	2.5
Coffee	0	.0	1.0	1.0
Drink	**12.5**	**6.2**	**4.9**	**10.0**
Salt	. . .	. . .	. . .	1.0
Spices (pepper/vinegar)	. . .	. . .	. . .	1.0
Other food	**4.2**	**.6**	**2.1**	**.0**
Housing/housewares	**7.2**	**5.3**	**10.9**	**8.0**
Fuel	**5.6**	**4.4**	**4.8**	**5.0**
Light	2.1	. . .	. . .	4.0
Soap	2.1	. . .	. . .	.5
Light and soap	**4.2**	**3.8**	**5.2**	**4.5**
Services	**8.2**	**.1**	**2.5**	**2.5**
Tobacco	**0**	**.0**	**.7**	**1.0**
Other (clothing, bed linen)	**20.5**	**11.0**	**14.2**	**12.0**

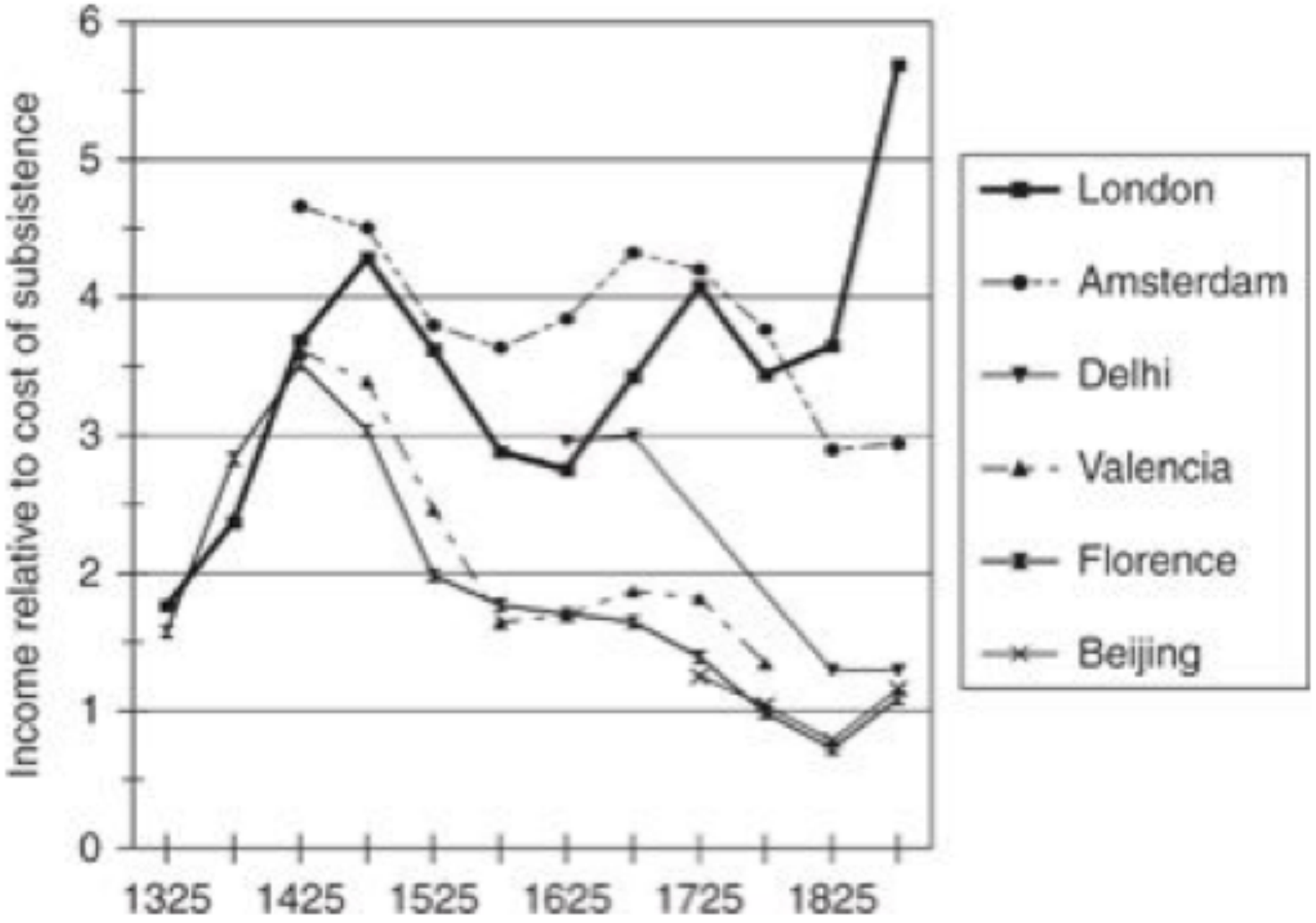
SOURCE.—Vanderlint (1734, 76–77), Horrell (1996, 568–69, 577).
NOTE.—The boldface entries are the sums for each major category of food, such as farinaceous or meat. These groupings of items are the ones whose price levels are reported in table A4.

“Bare-Bones”

Table 2. Bare-bones subsistence basket of goods

	quantity per man per year	calories per day	protein (grams) per day
food			
grain	167 kg	1657	72
beans	20 kg	187	14
meat	5 kg	34	3
butter	3 kg	60	0
total		1938	89
non-food			
soap	1.3 kg		
linen/cotton	3 metres		
candles	1.3 kg		
lamp oil	1.3 litres		
fuel	2.0 Million British Thermal Units		

Cities


Income relative to cost of subsistence
0
1
2
3
4
5
6
1325
1425
1525
1625
1725
1825
London
Amsterdam
Delhi
Valencia
Florence
Beijing

Escape

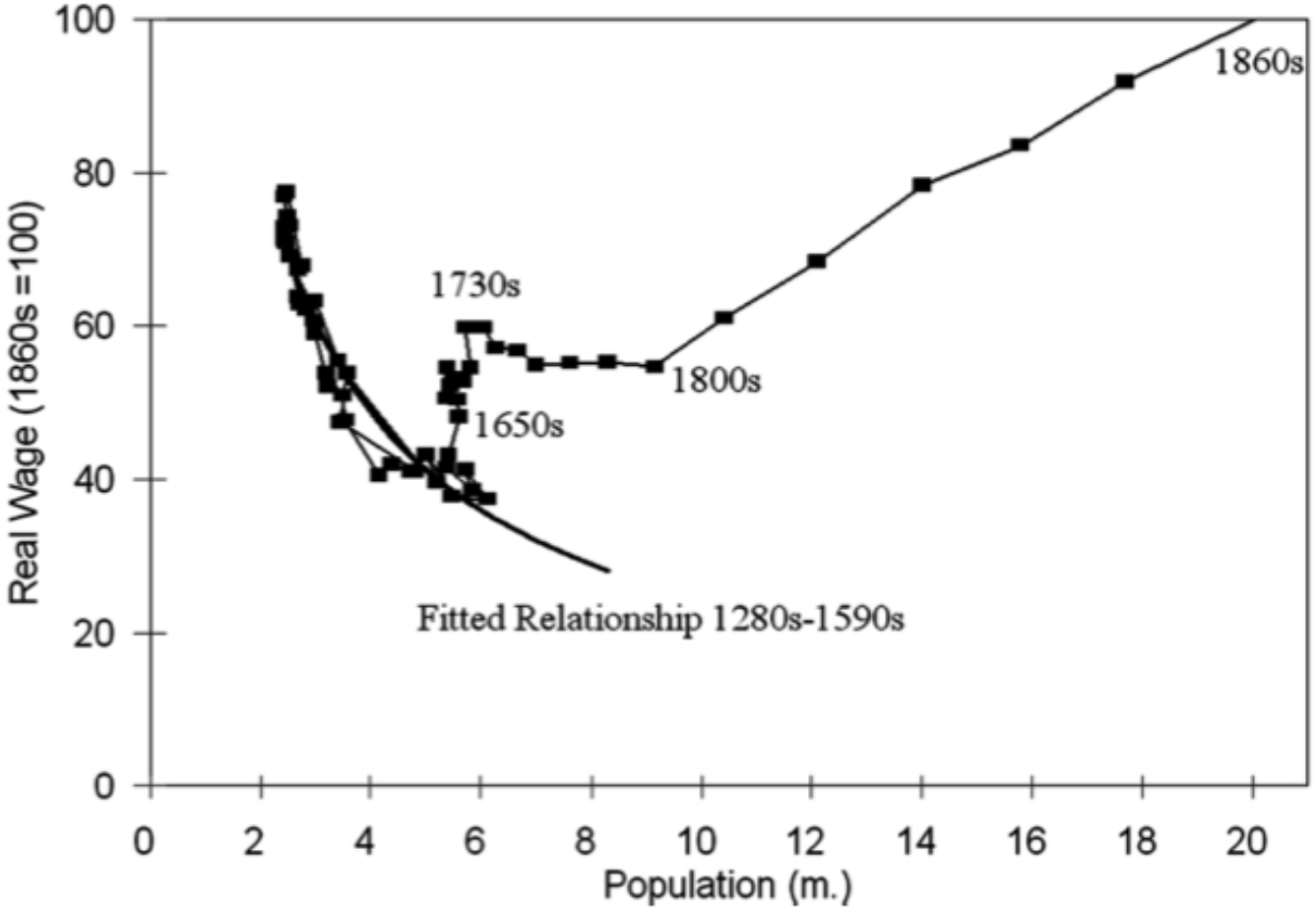


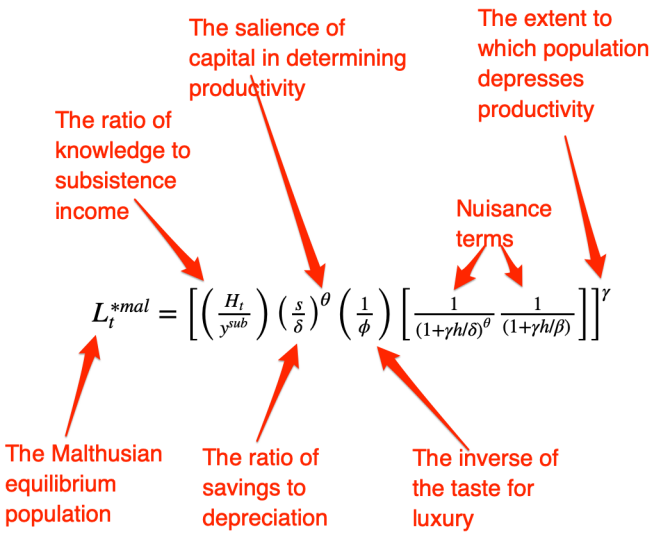
FIG. 5.—Real wages vs. population on the new series, 1280s–1860s. The line summarizing the trade-off between population and real wages for the preindustrial era is fitted using the data from 1260–69 to 1590–99. Sources: population, same as for fig. 3; real wage, table A2.

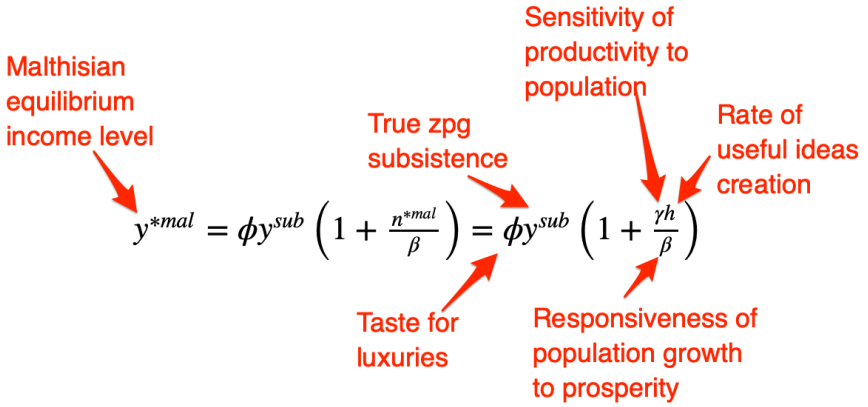
Malthusian Models

$$\frac{dE/dt}{E} = \frac{d\ln(E)}{dt} = g = h - \frac{n}{\gamma}$$

$$\frac{dL/dt}{L} = \frac{d\ln(L)}{dt} = n = \beta\left(\frac{y}{\phi y^{sub}} - 1\right)$$

$$y^{*mal} = \kappa^* E = \left(\frac{s}{n+g+\delta}\right) E$$

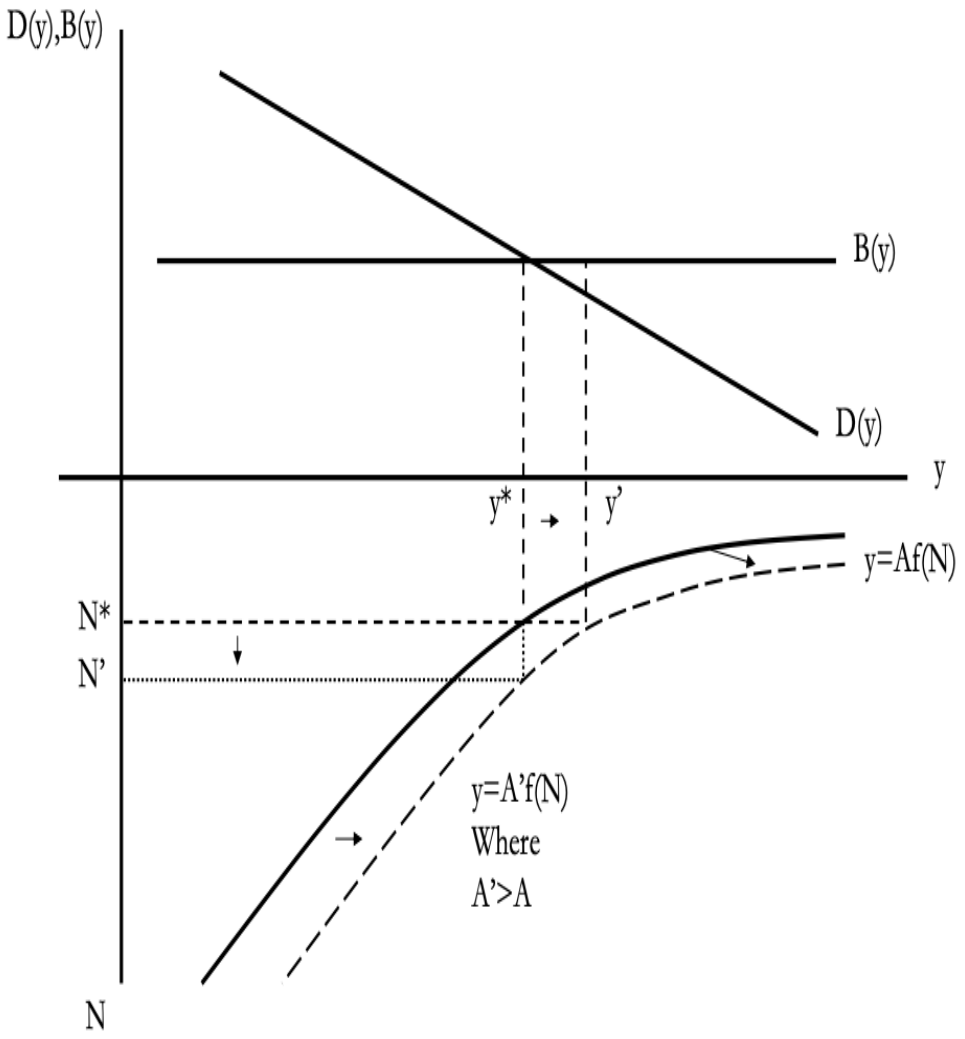




Perhaps Diagrams Are More Intuitive?

Income per-capita always returns to the point where the birth rate is just enough above the death rate to deliver population growth that soaks up technological improvement:

- This is the unique attracting steady-state of the model.
- What happens if there is a one-time permanent jump up in H that improves technology from A to A′ > A?
  - This means more output for any level of population.
  - The initial level of population N∗ now produces an income level y' > y*.
  - This leads to higher incomes and an excess of births over deaths since B > D(y′).
  - In consequence, the population expands from N∗ to N′ until income per-capita is driven back down to where it was before.
- The same is true for other changes which have similar implications for the relationship between population and income, for instance good government.

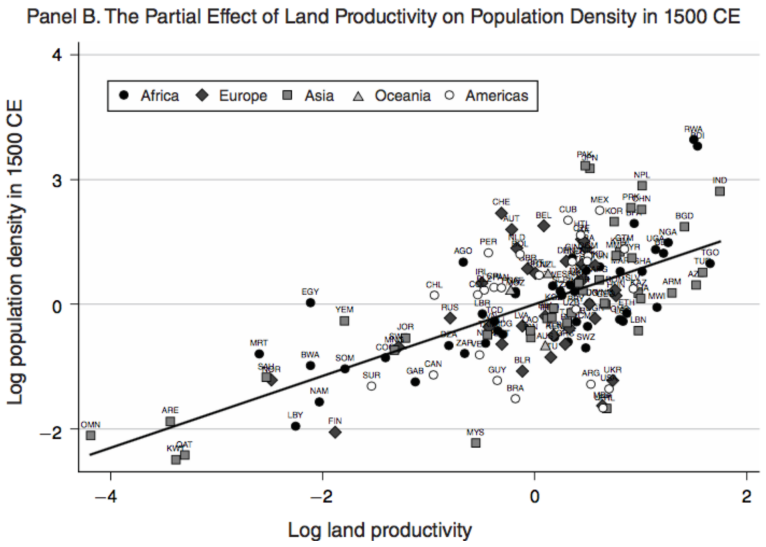


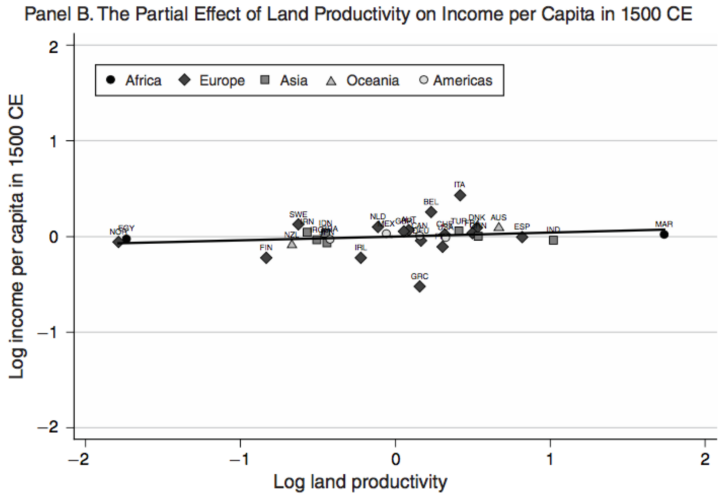
Slide taken from Melissa Dell

Is Malthus Right?

At the macro level, yes; but there are lots of interesting meso- and small-scale puzzles:

- Malthusian model implies that even though the Spanish might have had better technology than the Inca, there income per-capita ought to have differed only according to their fertility and mortality schedules.
- But population density in the pre-modern era is positively correlated with proxies for per-capita income, such as urbanization or Maddison's income estimates.





Slide taken from Melissa Dell

Is Malthus Right? II

At the macro level, yes; but there are lots of interesting meso- and small-scale puzzles:

- In addition, measures of good government, such as proxies for constraints on the executive, are correlated with urbanization in this period.
- For example, DeLong and Shleifer (1993) showed there was a strong correlation between form of government and urbanization in the pre-modern world
    - Charles Wilson (1967): *Trade, Society, and the State*: "The two areas which in 1500 represented the richest and most advanced concentrations of trade, industry and wealth were the quadrilateral formed by the Italian cities Milan, Venice, Florence and Genoa; and the strip of the Netherlands that ran from Ypres north-east past Ghent and Bruges up to Antwerp. It was not merely coincidence that these were the areas where the tradesmen of the cities had been most successful in emancipating themselves from feudal interference and in keeping at bay the newer threat of more centralized political control offered by the new monarchies. In the fleeting intervals between the storms of politics and war, men here glimpsed the material advance that was possible when tradesmen were left in peace unflattered by the attentions of strategists who regarded their activities as the sinews of war…"

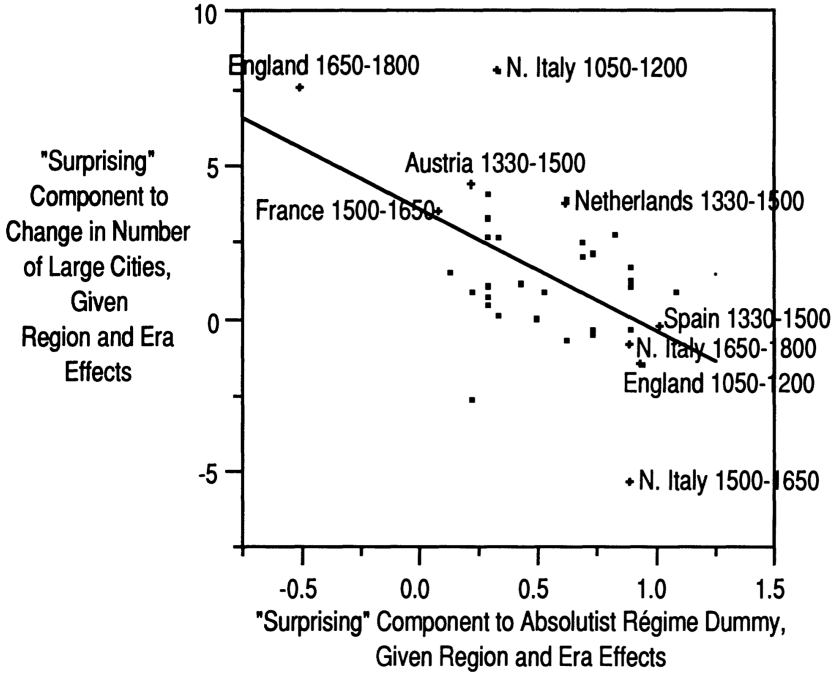


FIGURE 1.—Partial scatter of change in number of cities against absolutist regime

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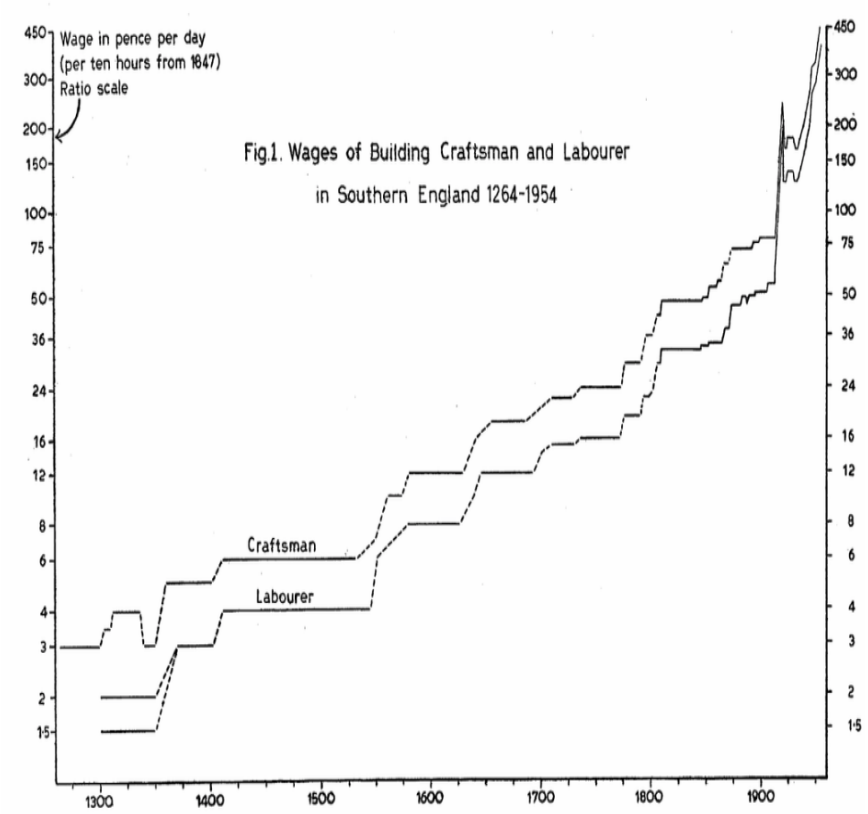
Malthus and the Black Death

The 1346-48 Bubonic Plague killed off about 1/3 of the population of Europe

- A basic premise of the Malthusian model is that when population falls, incomes should rise. Is that true?
- One important event used to support the Malthusian model is the Black Death.
- As the data for Western Europe shows, after the population collapse, real wages eventually increased. However, the reality is more complex than is conveyed by the Malthusian model.
- After the Black Death, the government of Edward III tried to stop wages from rising by passing the Statute of Labourers.
- They were only partially able to enforce this, however, and after the Peasants Revolt of 1381, they mostly gave up.

Real Wages and the Black Death



Source: E. H. Phelps Brown, E.H. and Sheila V. Hopkins (1955) Seven Centuries of Building Wages," *Economica*, 22,195-206.

Slide taken from Melissa Dell

The Statute of Laborers

Rosemary Horrox ed. (1994) *The Black Death*, Manchester University Press:

- Because a great part of the people and especially of the, workmen and servants has now died in that pestilence, some, seeing the straights of the masters and the scarcity of servants, are not willing to serve unless they receive excessive wages ... We, considering the grave inconveniences which might come from the lack especially of ploughmen and such labourers, have ... seen fit to ordain: that every man and woman of our kingdom of England ... shall be bound to serve him who has seen fit so to seek after him; and he shall take only the wages liveries, meed or salary which, in the places where he sought to serve, were accustomed to be paid in the twentieth year of our reign of England, or the five or six common years next preceding [1347]…

"Enticement"

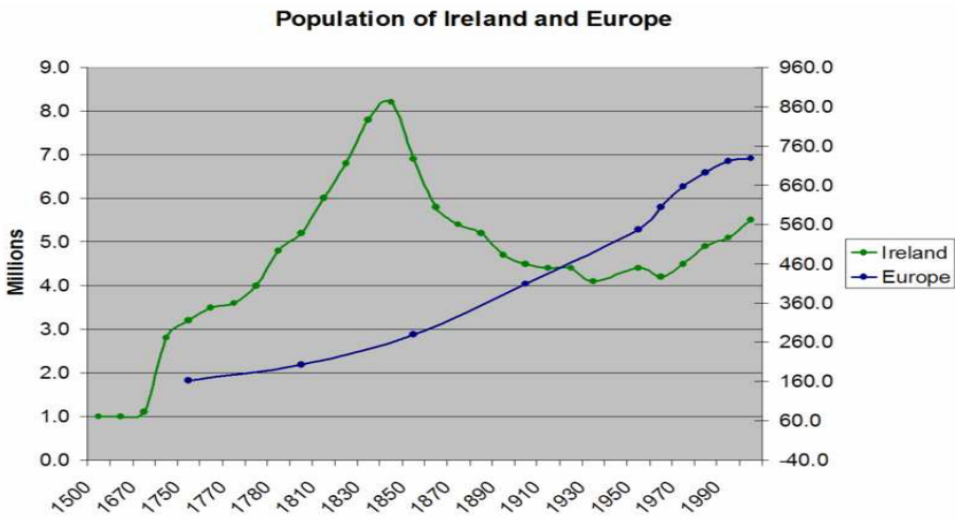
- And if a reaper or mower, or other workman or servant, of whatever standing or condition he be, who is retained in the service of any one, do depart from the said service before the end of the term agreed, without permission or reasonable cause, he shall undergo the penalty of imprisonment, and let no one ... moreover, pay or permit to be paid to any one more wages, livery, meed or salary than was customary as has been said…

Slide taken from Melissa Dell

Do Real Wages Increase After Negative Population Shocks?

Not always:

- After the conquest of Mexico the indigenous population fell by around 90%.
- This ought to have led to a huge increase in real wages, but it did not.



But sometimes:

- After the Great Potato Famine in Ireland between 1846 and 1849, when probably 20% of the population died or left, real wages increased substantially afterwards

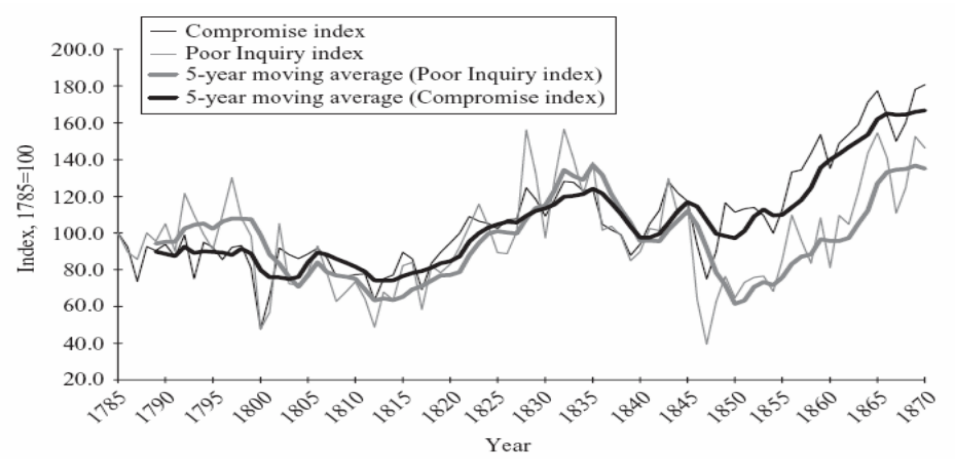


Figure 3. *Real earnings of Irish agricultural labourers assuming uniform employment, 1785-1870*
Source: app. IV

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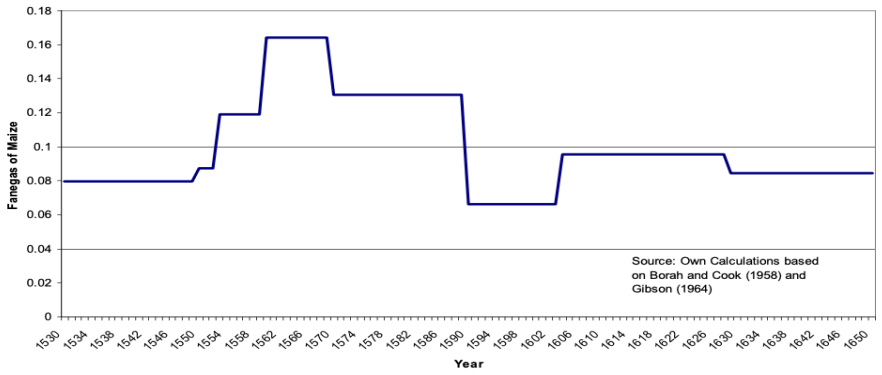
Why Didn't Real Wages Rise in Post-Conquest Mexico?

"Institutions":

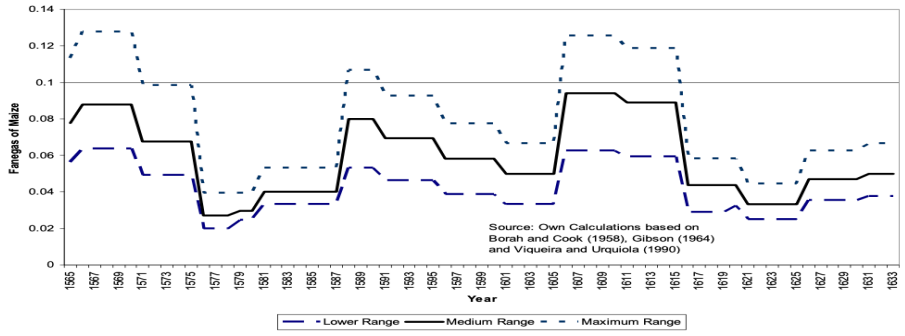
- Data are from the *Repartimiento*, which was a system of central labor allocation. Spaniards who wanted labor had to petition the Viceroy who would allocate Amerindian workers and determine the nominal wage they would be paid. There are also data from labor contracts in textile *obrajes*.
- In both cases, coercion was used to repress wages and at least in the case of the *repartimiento*, the centralized nature of the system possibly stopped the type of 'enticement' which undermined the intent of the Statute of Labourers in England.
- Meanwhile in South America, a massive forced labor system called the *mita* system was instituted.
- The relative advantage of the Spanish state was higher than that of the English state in the 14th century.

Average Real Daily Wages for Unskilled Workers



Source: Acemoglu, Daron, Pablo Querubín and James A. Robinson (2008) "Supply≠Demand: Population Decline and Real Wages in Mexico, 1530-1650," Work in Progress.

Average Real Daily Wages in Obrajes



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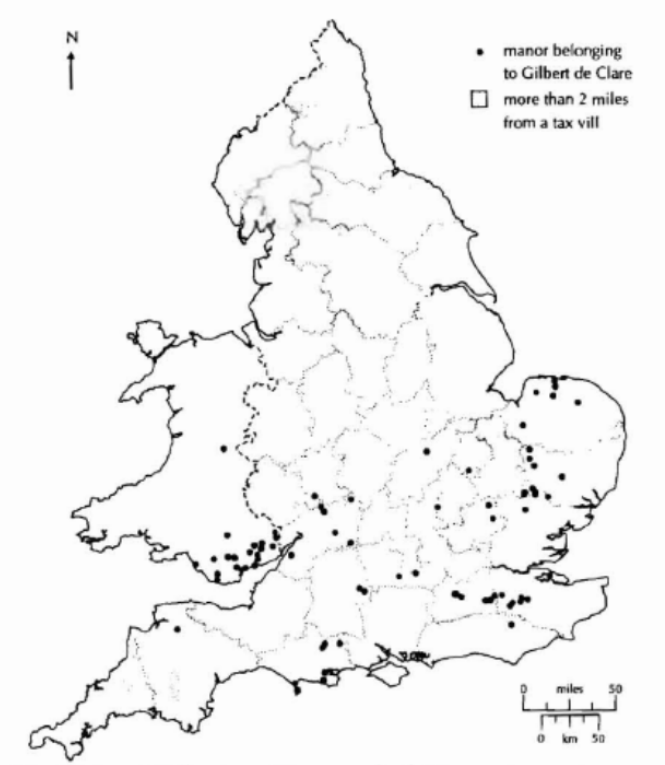
Feudal Power and Lordly Competition in England After the Black Death

What kept English lords from being able to keep a lid on wages post-1348?

- What was it that allowed the Spanish settlers in Mexico to keep wages so low, when in England after the Black Death the state had been incapable of enforcing the Statue of Laborers and stopping wages from rising?
- The economic historian Bruce Campbell has proposed that this may have been because of the differential organization of landholdings in Britain, which increased competition between landowners for workers after the Black Death.
- After invading England, William the Conqueror rewarded his army by providing them with feudal landholdings.
- In an effort to prevent these nobles from becoming powerful regional warlords who could challenge the king's power, each noble received landholdings scattered across the country
- (The exception was along the Scottish and Welsh borders), where nobles were given large plots for defensive purposes
- This division of landholdings meant that in a given region, there were many landholders in close proximity.
- This created intense competitive pressures for labor, particularly in the wake of the Black Death
- This contrasts to Mexico, where conquistadors were granted vast contiguous tracks of land called encomiendas

The Manors of Lord Gilbert de Clare (1314)



(a) Estate of Gilbert de Clare, earl of Gloucester and Hertford, 1314.

Slide taken from Melissa Dell

Malthus: Summing Up

On the broadest scale only:

- The simple Malthusian model may indeed capture some realities.
- If labor markets are competitive, population growth may indeed induce a decline in wages.
- Or if there is a fixed amount of land and few opportunities for labor intensive cultivation systems, a population increase may lead to a decline in output per worker.
- However, the reality is typically much more messy.
  - How wages respond to changes in income will depend on *institutions*.
  - Thus the overwhelming likelihood that institutional or cultural factors also shaped pre-modern growth
  - It was not simply being dictated by the Malthusian relationship between births, deaths, and income.

Slide taken from Melissa Dell

Class and Conflict at the End of the Middle Ages

What was "feudalism" and how did it end?

- Marc Bloch's definitions:
  - A subject peasantry
  - Widespread use of the service tenement (i.e., the fief) instead of a salary (or of private property plus taxation and then purchase)
  - The supremacy of a caste of specialized warriors
  - Ties of obedience and protection which bind man to man
  - Within the warrior class, these ties assume the distinctive form called vassalage
    - Fragmentation of authority
    - Disorder and private war
  - But also, other forms of association, family, and state surviving…
- By the late Middle Ages feudalism was a stable system
- Trade and population expanded
- What data we have shows the number and size of cities increasing

The Population of England

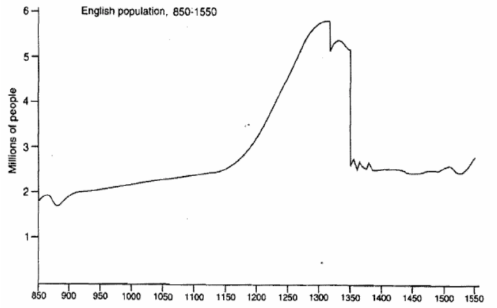


Figure 2. English population, 850–1550. A speculative reconstruction. The figures from 850 to 1086 are pure speculation. The subsequent figures are based on Domesday (1086), the Poll Tax (1377), the subsidies (1524–5) and the military survey (1522), and by extrapolation from manorial records of tenant deaths and payments of headpennies and common fines.

Sources: J. Hatcher, *Plague, Population and the English Economy, 1348–1530* (1977); R. M. Smith, 'Human Resources', in G. Astill and A. Grant (eds), *The Countryside of Medieval England* (Oxford, 1988); E. A. Wrigley and R. S. Schofield, *The Population History of England,*

Source: Dyer, Christopher (2002) *Making a Living in the Middle Ages*, Yale University Press. p. 235.

English Wool and Cloth Exports

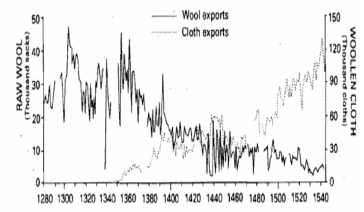


Figure 4. English exports of wool and cloth, 1279–1544 (cloth exports are only consistently recorded from the mid-fourteenth century).

Sources: E. M. Carus-Wilson and O. Coleman, *England's Export Trade 1275–1547* (Oxford, 1963); E. M. Carus-Wilson, *Medieval Merchant Ventures* (1954).

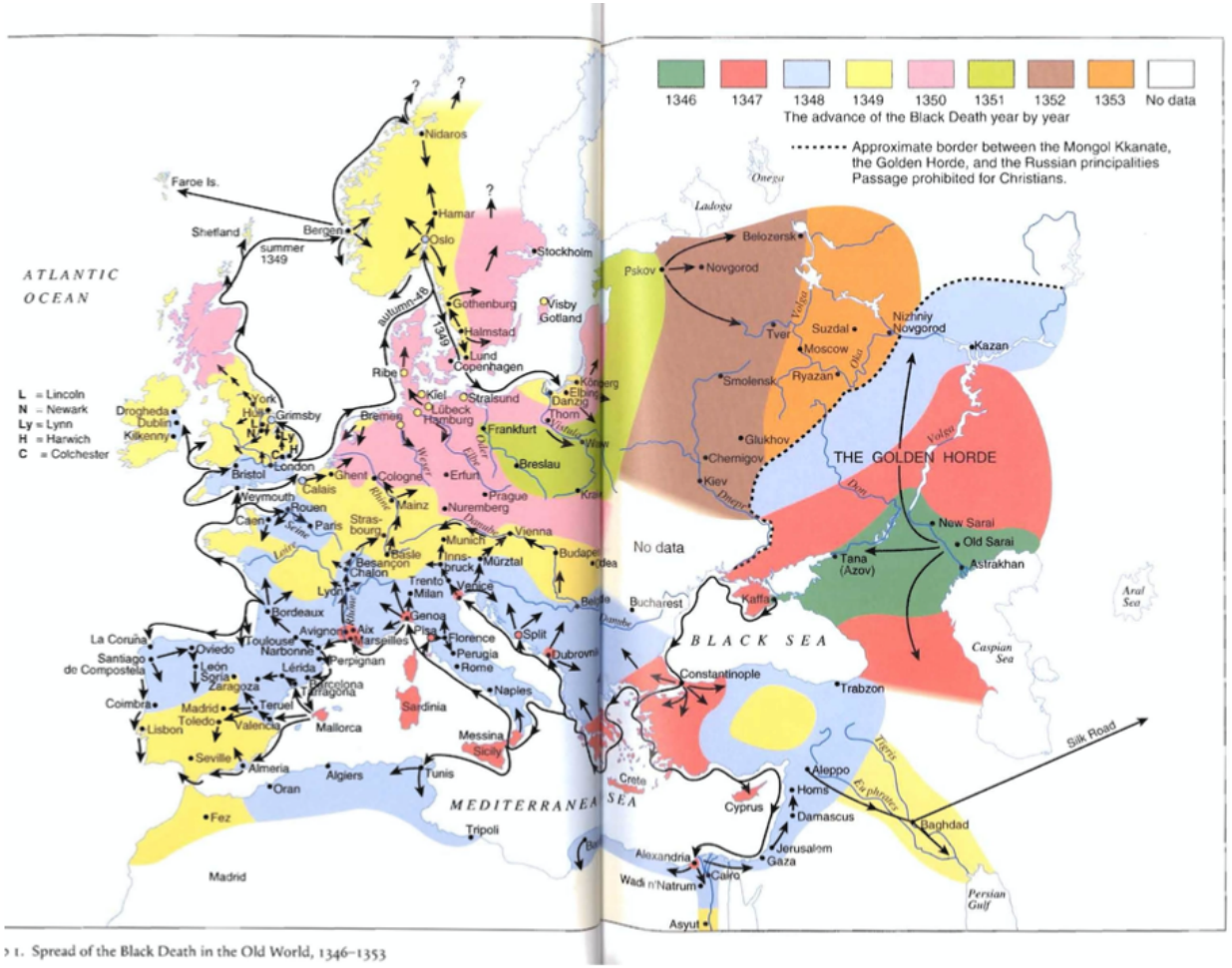
Source: Dyer, Christopher (2002) *Making a Living in the Middle Ages*, Yale University Press. p. 244.

Slide taken from Melissa Dell

The Black Death and the Collapse of the FMP

The Black Death in Florence: Giovanni Boccaccio:

- In the face of its onrush, all the wisdom and ingenuity of man were unavailing .. the plague began, in a terrifying and extraordinary manner, to make its disastrous effects apparent.
- It did not take the form it had assumed in the East, where if anyone bled from the nose it was an obvious portent of certain death. On the contrary, its earliest symptom . . . was the appearance of certain swellings in the groin or armpit, some of which were egg-shaped whilst others were roughly the size of a common apple.…
- Later on the symptoms of the disease changed, and many people began to find dark blotches and bruises on their arms, thighs and other parts of their bodies ...
- Against these maladies .. all the advice of physicians and all the power of medicine were profitless and unavailing .. and in most cases death occurred within three days from the appearance of the symptoms we have described…



1. Spread of the Black Death in the Old World, 1346–1353

Slide taken from Melissa Dell

The Black Death and the Collapse of the FMP

1/3 of Europe's population dropped dead over 1346-8:

- Some time around the middle of 1346 the bubonic plague reached the city of Tana at the mouth of the River Don on the Black Sea. It traveled from China brought by traders along the Silk Road.
- The plague was transmitted by fleas that lived on rats.
- Tana was a port and the rats were soon spreading the fleas and devastation around the Mediterranean through Genoese ships.
- By early 1347 it had reached Constantinople.
- In the spring of 1348 it spread through France and North Africa and up the boot of Italy.
- Acemoglu and Robinson argue that in Western Europe, feudalism and the Medieval Boom collapsed with the Black Death, ultimately leading to a new set of institutions that sustained economic growth.
- The collapse of institutions in Western Europe came with a great deal of disorganization and chaos - for instance the 100 Years War between 1337 and 1453 between England and France.
- We saw that Jongmans' idea about the collapse of the Roman Empire was that the Antonine Plague tipped institutions in a direction that emphasized labor coercion. The Black Death did that in Eastern Europe. In Western Europe, it did not. However, a new political model needed to develop before the economic benefits of the decline of feudalism could be experienced

Slide taken from Melissa Dell

Eastern Europe and the "Second Serfdom"

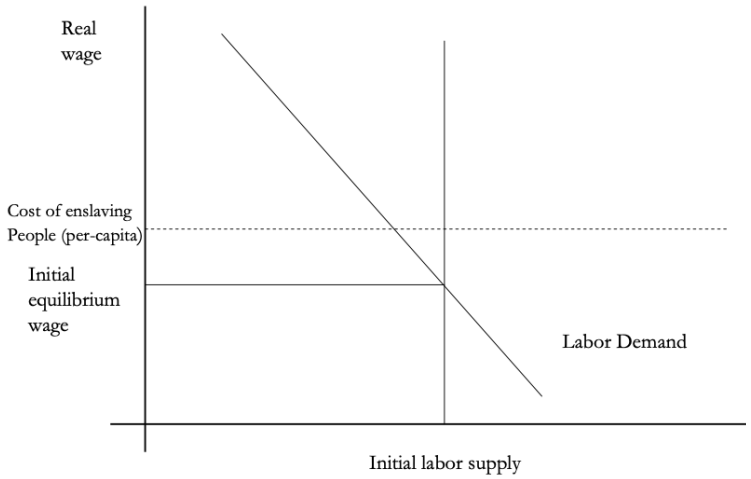
Eastern Europe after 1348 is very different:

- The plague seems to have hit most of Europe, and the percentage of people killed was similar across space.
- After the plague, landlords in Eastern Europe started to take over large tracts of land and expand their holdings, which were already larger than those in Western Europe.
- Towns were weaker and less populous and rather than becoming freer, workers began to see their already existing freedoms encroached on: the Domar hypothesis at work.
- This contrasts with the English case, and with Western Europe more generally.
- This phenomenon is known as the Second Serfdom, to distinguish it from the original serfdom which had happened in the early Middle Ages.
- The effects became especially pronounced after 1500, when Western Europe began to demand the agricultural goods which the East produced such as wheat, rye and livestock.
- 80 percent of the imports of rye into Amsterdam came east from the Elbe, Vistula and Oder river valleys. Soon half of the Netherlands' booming trade was with Eastern Europe.
- Eastern landlords ratcheted up their control over the labor force to expand their production.
- The historical literature emphasizes that the Second Serfdom was distinct and more intense than the original
- Lords increased the taxes they levied on their tenants. In Mecklenberg in Eastern Germany in 1500, peasants owed only a few days unpaid labor services a year to landowners. By 1550 this was one day a week and by 1600 three days per week. Workers' children had to work for the lord for free for several years.
- In Hungary, landlords legislated one day a week of unpaid labor services for each worker. In 1550 this was raised to 2 days per week. By the end of the century it was 3 days. Serfs subject to these rules made up 90% of the rural population by this time.

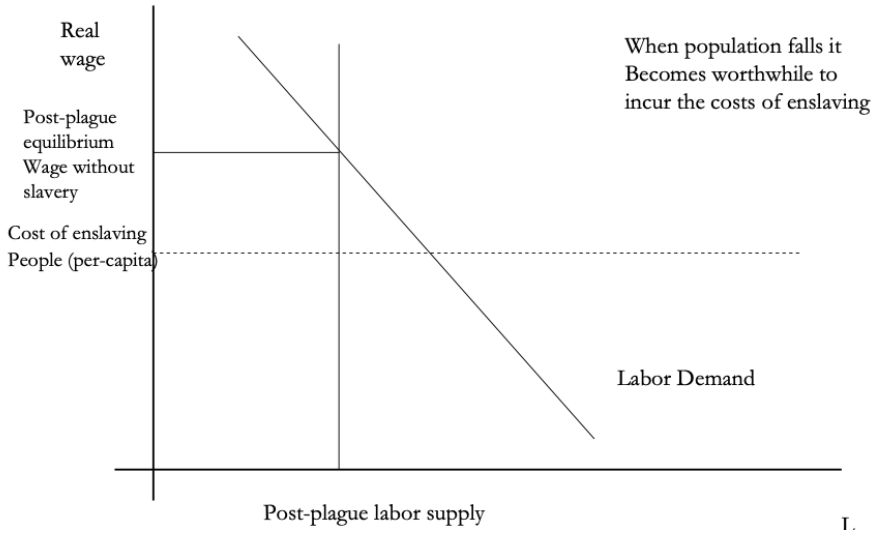
Slide taken from Melissa Dell

Domar's Analysis and the Second Serfdom

The Incentive to Enslave - The Domar Hypothesis



Consequences of a Plague



Jongmans explicitly compares the decline of Rome to the Second Serfdom

- His argument is that the most important potential impact of population collapse is on institutions. His argument is that the Antonine plague pushed economic institutions into a much more extractive mode and this is why the Empire collapsed.
- This is outside the scope of the Domar model. Clearly, the model needs not just to be amended by introducing power but also the fact that when the labor market 'power' of workers is high this can not only avoid slavery or serfdom but can induce other institutional changes in society.

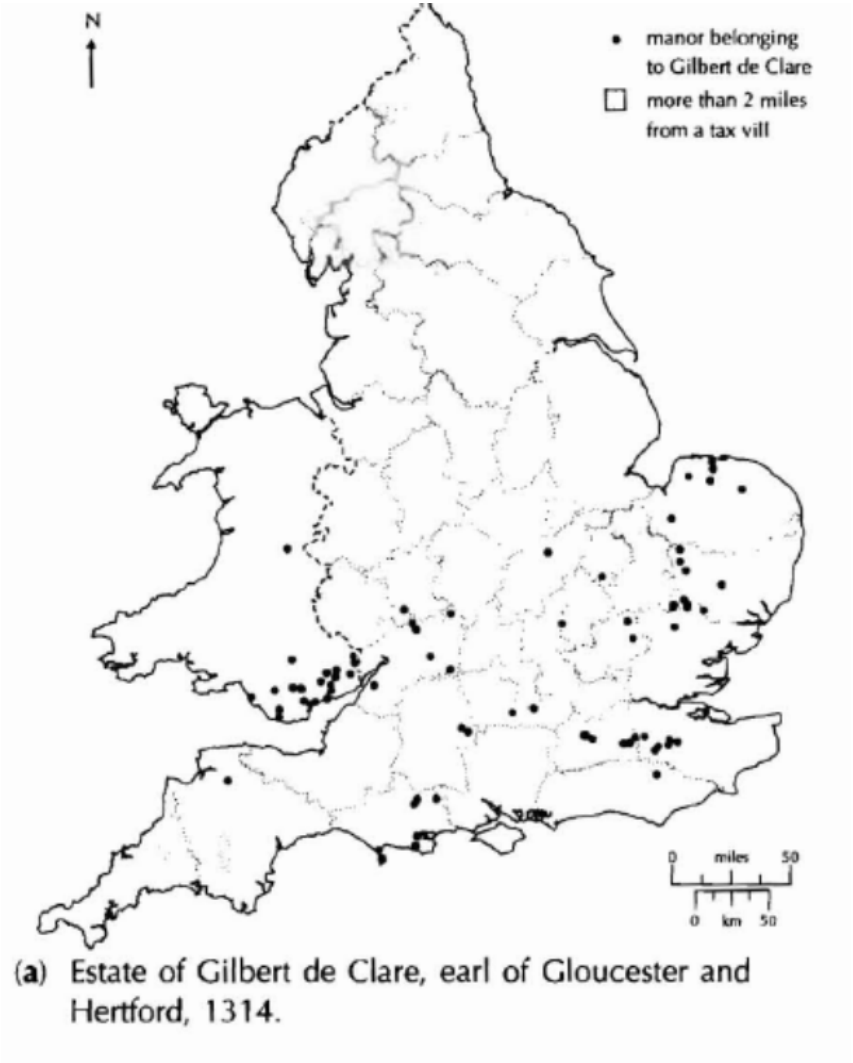
Slide taken from Melissa Dell

The Emergence from the Middle Ages Begins with the Black Death

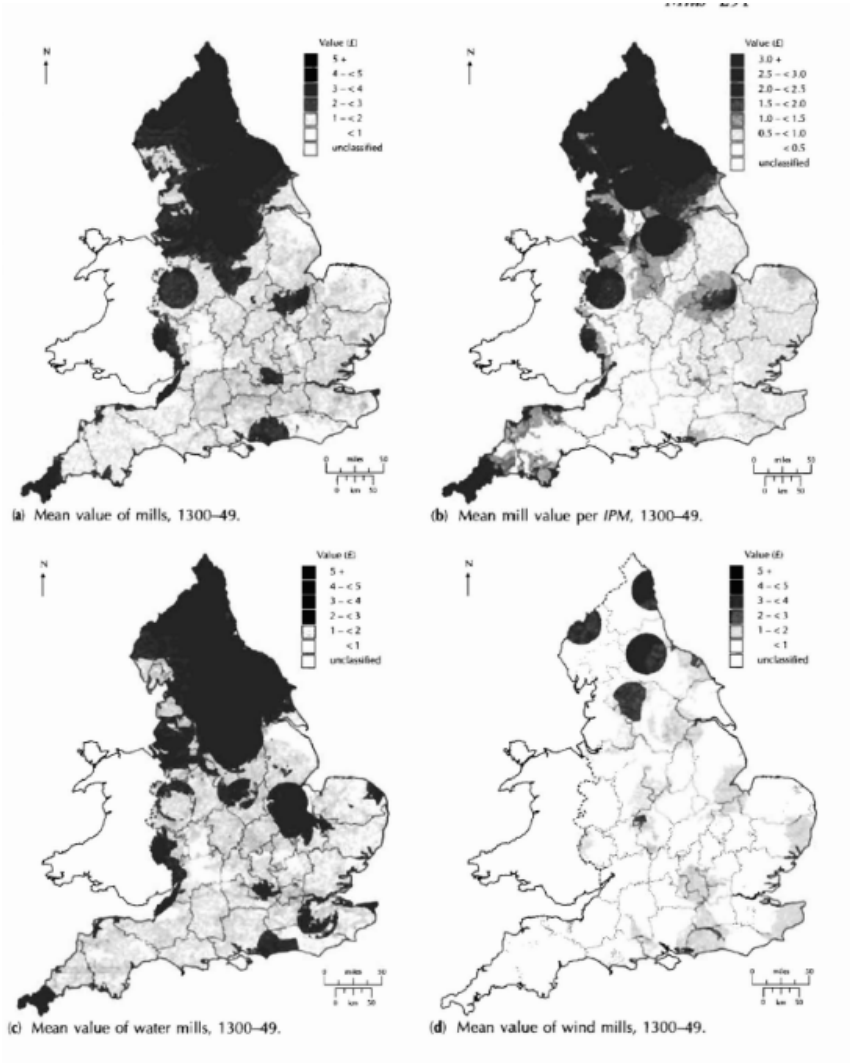
- What was it that allowed landlords in Eastern Europe to intensify serfdom, when in England after the Black Death the state was incapable of enforcing the Statue of Laborers and stopping wages from rising?
- The economic historian Bruce Campbell has proposed that this may have been because of the differential organization of landholdings in Britain, which increased competition between landowners for workers after the Black Death.
- He uses data on the prices of mills in different parts of England. These were owned by Lords and valued on their death.

Slide taken from Melissa Dell

The Manors in 1314 of Gilbert de Clare, and the Mills of England



(a) Estate of Gilbert de Clare, earl of Gloucester and Hertford, 1314.



(a) Mean value of mills, 1300–49.

(b) Mean mill value per *IPM*, 1300–49.

(c) Mean value of water mills, 1300–49.

(d) Mean value of wind mills, 1300–49.

Slide taken from Melissa Dell

Different Starting Points and Different Plague Consequences

- This division of landholdings meant that in a given region, there were many landholders - and mill owners - in close proximity.
- This created intense competitive pressures for labor, particularly in the wake of the Black Death
- This contrasts to Eastern Europe

- The direction in which institutions move can differ dramatically depending on the initial conditions.
- In the 1340s in Eastern Europe the Grand Duchy of Lithuania (founded by Mindaugas in 1253) was expanding East and South.
- Hungary was ruled by Charles I, from the House of Anjou in France. Another line of this family ruled England until the present day - the House of Plantagenet, Lancashire, York, Tudor ... were all decedents of the Angevins.
- European states all ruled over a rural economy using similar technology and with similar institutions, but certain differences - like landholding patterns - may have been critical.

- A famous analysis of the divergence between Eastern and Western Europe at the end of the Middle Ages is by the Marxist historian Robert Brenner. Brenner's goal is to explain what led to 'capitalism' in Western Europe.
- By capitalism, Brenner means an interlocking set of institutions that emerged from feudalism: private ownership of land and assets, free markets for goods and services, and people motivated by profit and self-interest maximization.
- Brenner argues that the emergence of capitalistic institutions and values are what created the industrial revolution.

- Brenner is interested in what drove this change. He wants to criticize two views of the emergence of capitalism which he regards as wrong: (1) the Commercialization Model, (2) the Demographic Model.
- Brenner himself puts forward what he calls the Class Conflict Model (which of course originates with Marx).

Slide taken from Melissa Dell

We See "Commercialization" and "Demography" and "Institutions" as Drivers of "Class Power"

- The Commercialization view argues that it was expanding trade and the spread of what M.M. Postan called the 'money economy' - during the Medieval Boom - that gradually eroded the feudal 'non-market' economy, inevitably leading to capitalism.
- In the Medieval period the market certainly expanded. By 1330 most of England's wool production was sold in markets, and about 1/3 of grain production was sold in markets (John Hatcher and Mark Bailey, *Modelling the Middle Ages* p. 144).
- The situation was very different 500 years previously. In the wake of the collapse of the Western Roman Empire, money even stopped being used. Trade contracted, as we saw from the shipwreck evidence.
- Significant that early commercial successes were in places practically exempt from traditional feudal institutions - Venice and the Netherlands.

- What is the impact of the rise of the market on social norms? Could the spread of the market have created a different culture that in turn promoted modernization?
- People are not simply self-interested but sometimes behave altruistically and comply with norms of behavior that cannot be explained simply by the anticipation that if they do not follow these norms they will be punished.
- Some economists go further and argue that legal systems are imperfect ways of contract enforcement and that without such norms, it is impossible to have a functioning market economy.
- Very little evidence remains about the attitudes and beliefs of common people during the late Middle Ages. To the extent we know anything, it is mostly about the most elite members of society.
- However, researchers have pointed to modern evidence about the relationship between markets and social norms to support the commercialization hypothesis.
- Consider the large comparative interdisciplinary project on the "Foundations of Human Sociality."
- This project has collected experimental data from different societies around the world in an attempt to explain variation in behavior in simple games: the ultimatum game and the dictator game.

Slide taken from Melissa Dell

Brenner's Attack on the Commercialization Model

- After the Black Death there seems to have been a collapse in international trade, but this is exactly at the point where feudal institutions declined most rapidly.
- We saw the expansion of grain exports and market exchange from Eastern Europe to Western Europe spurred the Second Serfdom in the East. So commerce is perfectly consistent with feudal economic institutions and labor coercion, indeed it may encourage it (i.e. the later Atlantic slave trade).
- Brenner argued that there was no simple relationship between expanding trade and the development of institutions, particularly capitalism. In response to an increase in commercialization, what happened to institutions depended on the 'balance of class power'.

Slide taken from Melissa Dell

The Demographic Model

- This proposes that it was the demographic collapse of the Black Death which undermined the institutions of feudalism and allowed the creation of capitalism.
- This was originally proposed by Postan, who critiqued the Commercialization Model during the 1940s.
- Brenner's attack on this is obvious: both Western and Eastern Europe experienced the same demographic shock but while feudalism led to capitalism in the West, feudalism intensified in the East.
- We've already seen other examples like this.

Slide taken from Melissa Dell

The Class-Conflict Model

- Brenner instead argues that class conflict was key.
- For instance, wages in England were falling and rents rising 1050-1340. Changes in the Common Law in the late 12th century led to the exclusion of the unfree from the protection of the Royal courts and large increase in the extent of villeinage (about 3/5ths of all rural people were unfree by the late 13th century England, Hatcher and Bailey, p. 99).
- Mixed evidence on the extent of conflict before Black Death. However, intense conflict in England after the Black Death and leading up to the Peasants Revolt in 1381 followed by rapid decline of feudal institutions very consistent with the notion that the emergence from the Middle Ages was driven by conflict.

Slide taken from Melissa Dell

A Four-Cornered Fight

Kings, Lords, Commons, & Peasants:

- Class alliances, class power, and class conflict…
- Plus ideological legitimations…
- Friedrich Engels: "Exceptional periods, however, occur when the warring classes are so nearly equal in forces that the state power, as apparent mediator, acquires for the moment a certain independence in relation to both. This applies to the absolute monarchy of the seventeenth and eighteenth centuries, which balances the nobility and the bourgeoisie against one another; and to the Bonapartism of the First and particularly of the Second French Empire, which played off the proletariat against the bourgeoisie and the bourgeoisie against the proletariat. The latest achievement in this line, in which ruler and ruled look equally comic, is the new German Empire of the Bismarckian nation; here the capitalists and the workers are balanced against one another and both of them fleeced for the benefit of the decayed Prussian cabbage Junker-squires…"
- This is not just in exceptional periods…
- The relative autonomy of the state is the rule, not the exception…

Big Ideas: Lecture 5: Malthusian Agrarian Economies

Takeaways from this lecture:

- Malthus works in the large and in the long run:
  - Populations expand at an average rate of 0.07% per year from -8000 to 1500
    - Population in 1500 250x what it had been in -8000
  - Typical living standards do not (by much)
- But there is lots more going on:
  - Differential rates of exploitation
  - When something—the labor of peasants, for example—becomes very valuable, you can react in either of two ways:
    - You can offer to trade more in exchange for it
    - You can spend resources to control it
      - And those attempts to control can be successful or unsuccessful
  - Trade and law and imperial peace…
  - Luxuries…
  - Sociology that determines what the zpg level of necessities consumption is…

Catch Our Breath…

- Ask a couple of questions?
- Make a couple of comments?
- Any more readings to recommend?

Review: Long-Run Patterns: Global *h, g, & n*

Date	ideas Level H	Total Real World Income Y (billions)	Average Real Income per Capita y (per year)	Total Human Population L (millions)		Rate of Population and Labor Force Growth n	Rate of Efficiency-of-Labor Growth g	Rate of Ideas-Stock Growth h
-68000	1.0	$0	$1,200	0.1				
-8000	5.0	$3	$1,200	2.5		0.005%	0.000%	0.003%
-6000	6.3	$6	$900	7		0.051%	-0.014%	0.011%
-3000	9.2	$14	$900	15		0.025%	0.000%	0.013%
-1000	16.8	$45	$900	50		0.060%	0.000%	0.030%
0	30.9	$153	$900	170		0.122%	0.000%	0.061%
800	41.1	$270	$900	300		0.071%	0.000%	0.035%
1500	53.0	$450	$900	500		0.073%	0.000%	0.036%
1770	79.4	$825	$1,100	750		0.150%	0.074%	0.149%
1870	123.5	$1,690	$1,300	1300		0.550%	0.167%	0.442%
2020	2720.5	$90,000	$11,842	7600		1.177%	1.473%	2.061%

Long-Run Patterns: "Western" *h*, *g* & *n*

Global Growth: The Industrializing West (2019)

Date	ideas Level H	Total Real Income Y (billions)	Average Real Income per Capita y (per year)	Total "West" Population L (millions)		Rate of Population and Labor Force Growth n	Rate of Efficiency-of-Labor Growth g	Increasing Resources ρ	Rate of Ideas-Stock Growth h
-68000	1.0	$0.01	$1,200	0.005					
-8000	4.5	$0.12	$1,200	0.1		0.005%	0.000%	0.000%	0.002%
-6000	4.7	$0.18	$900	0.2		0.035%	-0.014%	0.000%	0.003%
-3000	7.5	$0.45	$900	0.5		0.031%	0.000%	0.000%	0.015%
-1000	15.0	$1.80	$900	2		0.069%	0.000%	0.000%	0.035%
0	23.7	$4.50	$900	5		0.092%	0.000%	0.000%	0.046%
800	30.0	$7.20	$900	8		0.059%	0.000%	0.000%	0.029%
1500	58.9	$25.00	$1,000	25		0.163%	0.015%	0.000%	0.096%
1770	101.0	$105.00	$1,400	75		0.407%	0.125%	0.257%	0.200%
1870	252.0	$490.00	$2,800	175		0.847%	0.693%	0.405%	0.914%
2020	8439.5	$40,000.00	$50,000	800		1.013%	1.922%	0.175%	2.341%

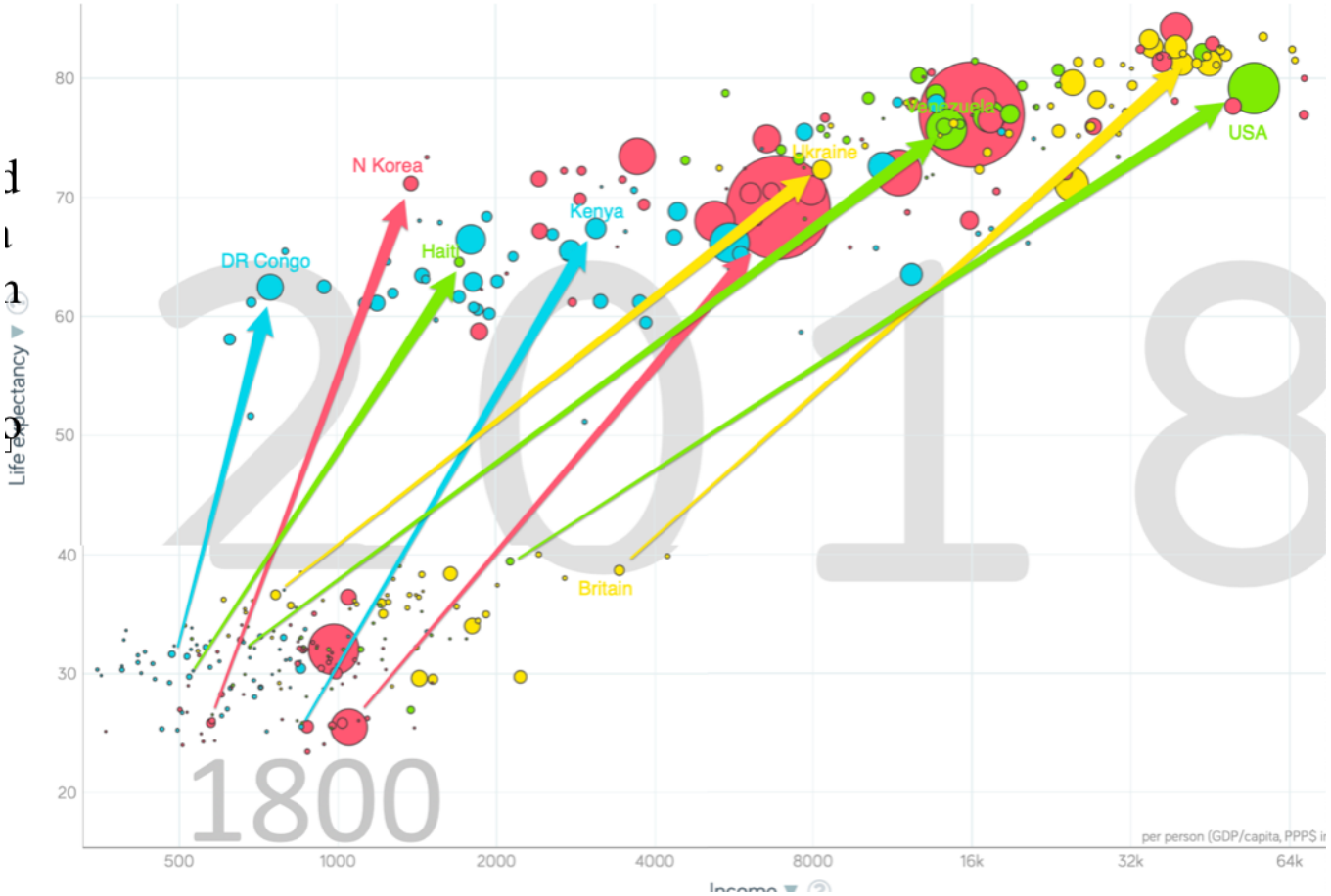
Where does the "ρ" come from?

- "Ghost acreage"—conquest and resource utilization (sugar islands, timberlands, cottonlands, etc.)
- Cultural expansion—Australia, Canada, New Zealand, & U.S.; Spain & Italy & Scandinavia; plus Japan, Korea, Taiwan, Hong Kong, & Singapore

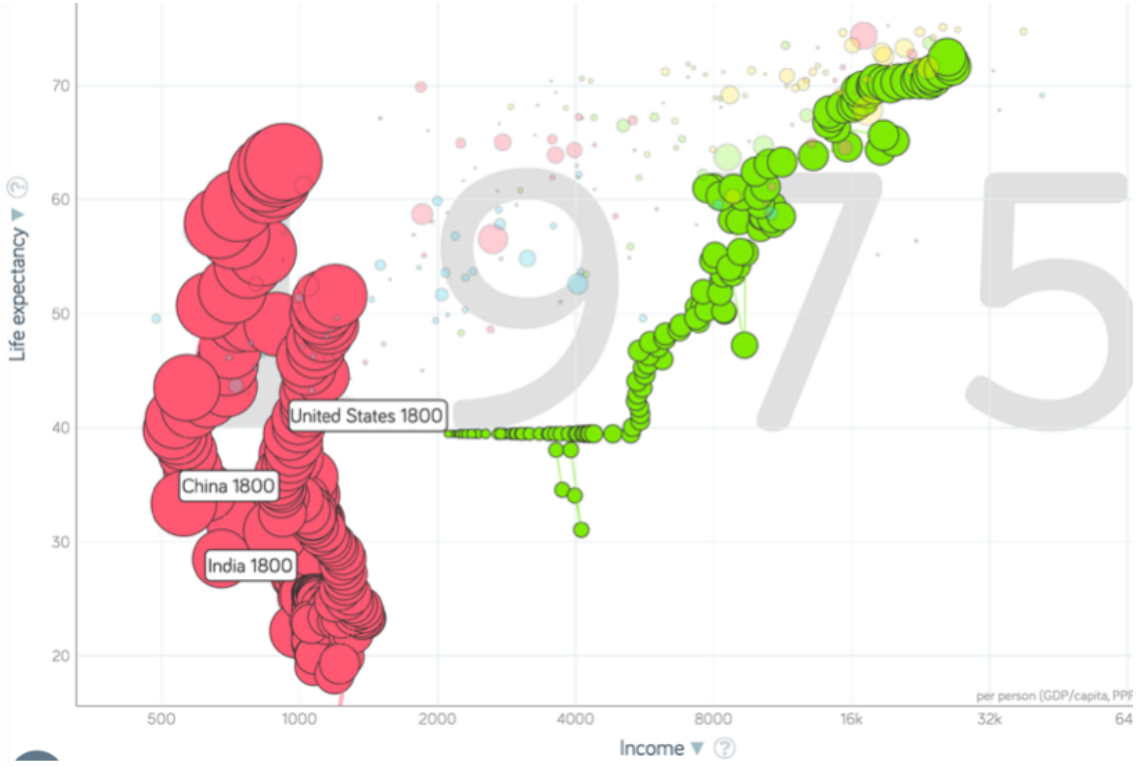
One Figure: A Great Divergence

From 1800 to 2018:

- The dots start with a 3-1 spread in incomes and a 10-year spread in life expectancy.
- All the arrows go up.
- Some arrows—mostly those already to the right—go right fast.
- Other arrows go right slowly.



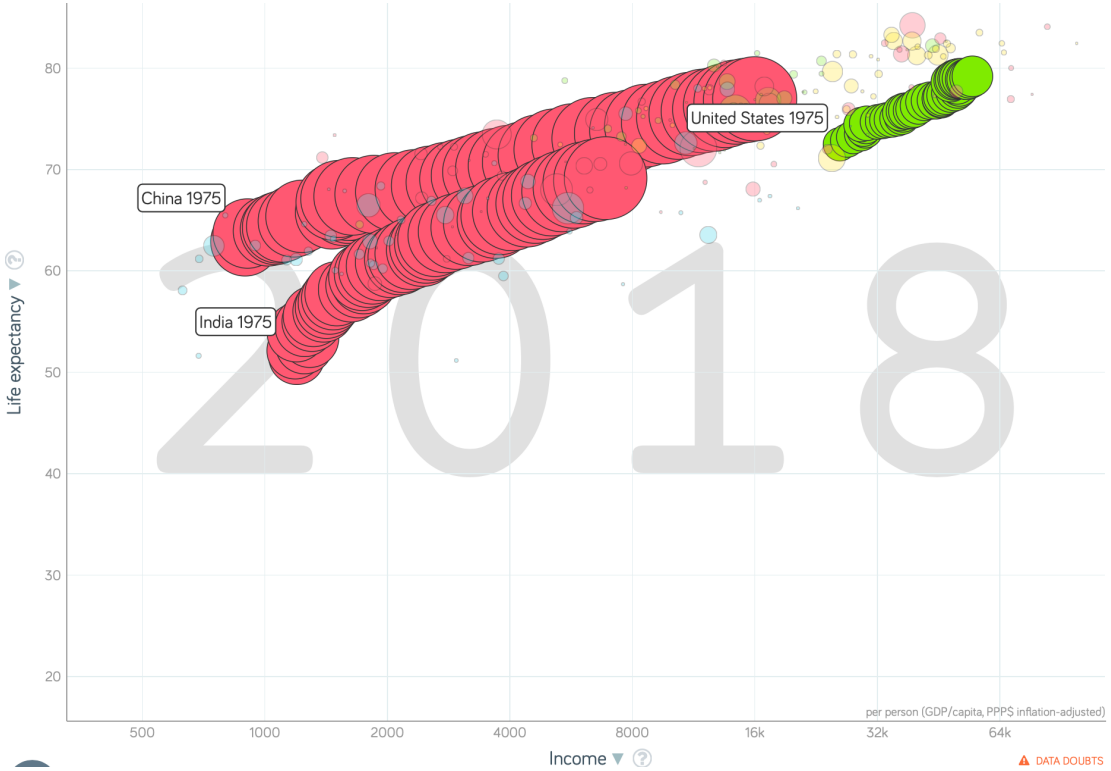
China and India and America, 1800-1975



From 1800 to 1975:

- Measured living standards and productivity levels improve fourteen-fold in the United States…
- …& less than 30% in China & India…
- …in spite of economic, transport, and cultural globalization…
- This is crazy!
- A "great divergence"
  - Not only were China & India relatively poor in 1800, they fell further behind thereafter

China and India and America, 1975–2018



From 1975-2018:

- Measured living standards and productivity levels…
- …54.9/25.9 = 2.12 in America…
- …16.0/0.9 = 17.8 in China…
- …6.9/1.2 = 5.8 in India…

Review: Solow Model Basics

Lecture Notes: <https://www.bradford-delong.com/2020/01/lecture-notes-the-solow-growth-model-the-history-of-economic-growth-econ-135.html>

$$(2.1.2)\ Y = \kappa^{\theta} EL\ ;\ (2.1.3)\ y = \kappa^{\theta} E\ ;\ (2.1.1)\ \kappa = \frac{K}{Y}$$

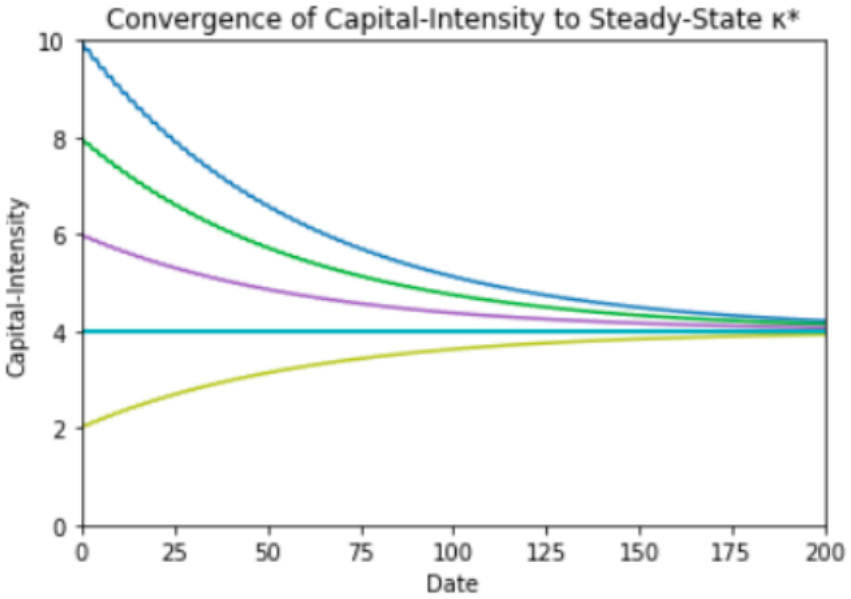
$$\frac{dE}{dt} = gE \qquad \frac{dL}{dt} = g_L L = nL \qquad \frac{dK}{dt} = sY - \delta K = \left(\frac{s}{\kappa} - \delta\right) K$$

$$(1.16)\ \kappa^* = \frac{s}{n+g+\delta}$$

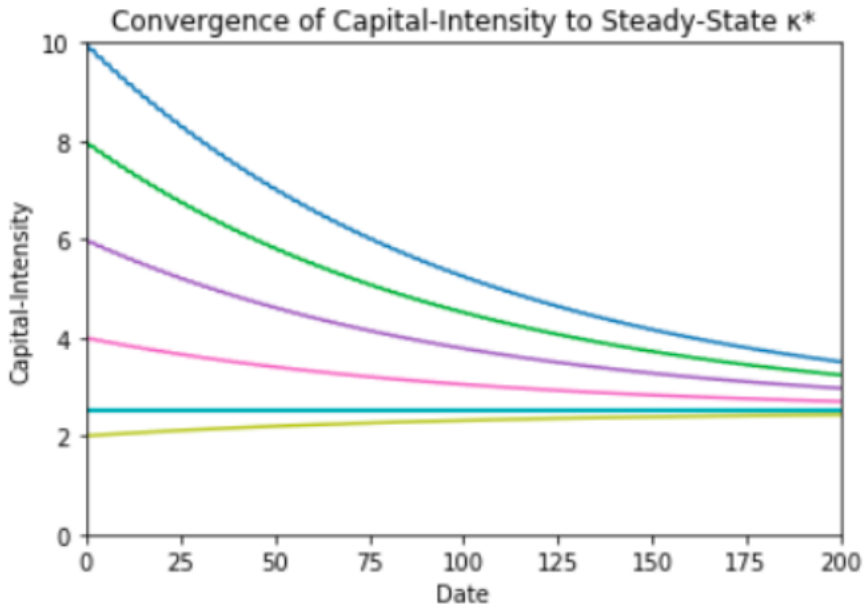
This κ^* we define as the *steady-state balanced-growth equilibrium* value of capital-intensity in the Solow growth model. If the capital-intensity $\kappa = \kappa^*$, then it is constant, and the economy is in balanced growth, with Y and K growing at the rate n+g, E and y growing at the rate g, and L growing at the rate n.

$$(1.18)\ \frac{d\kappa}{dt} = -\frac{n+g+\delta}{1+\theta}(\kappa - \kappa^*)$$

Solving the Model




```
κ_max = 10
κ = κ_max
for i in range(5):
    cg = κ_convergence_graph(κ_0=κ, s = 0.20, n = 0.01,
         g = 0.015, δ = 0.025, θ = 1/2, T = 200)
    cg.draw()
    κ = κ-2
```




```
κ_max = 10
κ = κ_max
for i in range(5):
    cg = κ_convergence_graph(κ_0=κ, s = 0.15, n = 0.02,
         g = 0.015, δ = 0.025, θ = 2, T = 200)
    cg.draw()
    κ = κ-2
```

Along the Balanced-Growth Path

Everything except κ—which is constant—grows at a constant proportional rate: either n, or g, or n+g;

- Labor force L grows at n
- Income per worker y and the efficiency of labor E grow at g
- Total income Y and the capital stock K grow at n+g

$$E_t^* = e^{gt} E_0$$

$$L_t^* = e^{nt} L_0$$

$$Y_t^* = (\kappa^*)^{\theta} E_t L_t = (\kappa^*)^{\theta} e^{gt} E_0 e^{nt} L_0 = (s/(n+g+\delta))^{\theta} e^{gt} E_0 e^{nt} L_0$$

$$K_t^* = \kappa^* Y_t^* = (s/(n+g+\delta))^{(1+\theta)} e^{gt} E_0 e^{nt} L_0$$

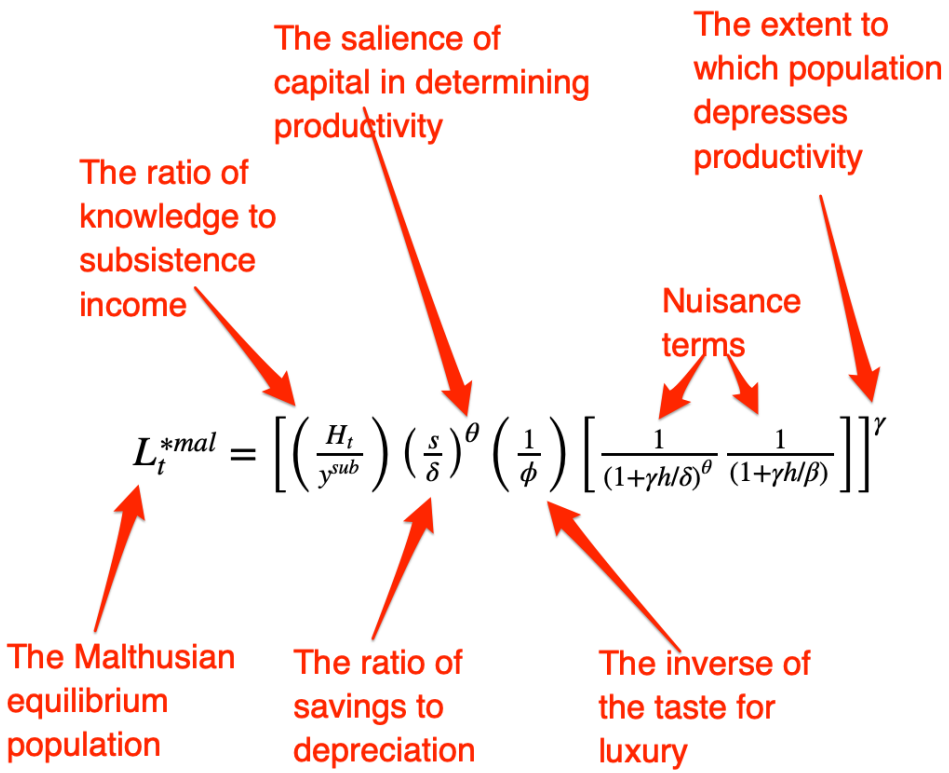
$$y_t^* = (\kappa^*)^{\theta} E_t = (\kappa^*)^{\theta} e^{gt} E_0 = (s/(n+g+\delta))^{\theta} e^{gt} E_0$$

Review: Solow-Malthus Model Basics

How do we make sense of the fact that people were ingenious and inventive back before 1500, and yet standards of living did not increase?

- Although population did increase—slowly
- Other parts of the model
- Balanced-growth equilibrium
- Convergence to equilibrium
- Lecture notes: <https://nbviewer.jupyter.org/github/braddelong/long-form-drafts/blob/master/solow-model-5-pre-industrial.ipynb>
  - datahub: <http://datahub.berkeley.edu/user-redirect/interact?account=braddelong&repo=long-form-drafts&branch=master&path=solow-model-5-pre-industrial.ipynb>

Understanding the Solow-Malthus Equilibrium: Population and Labor Force



Notes:

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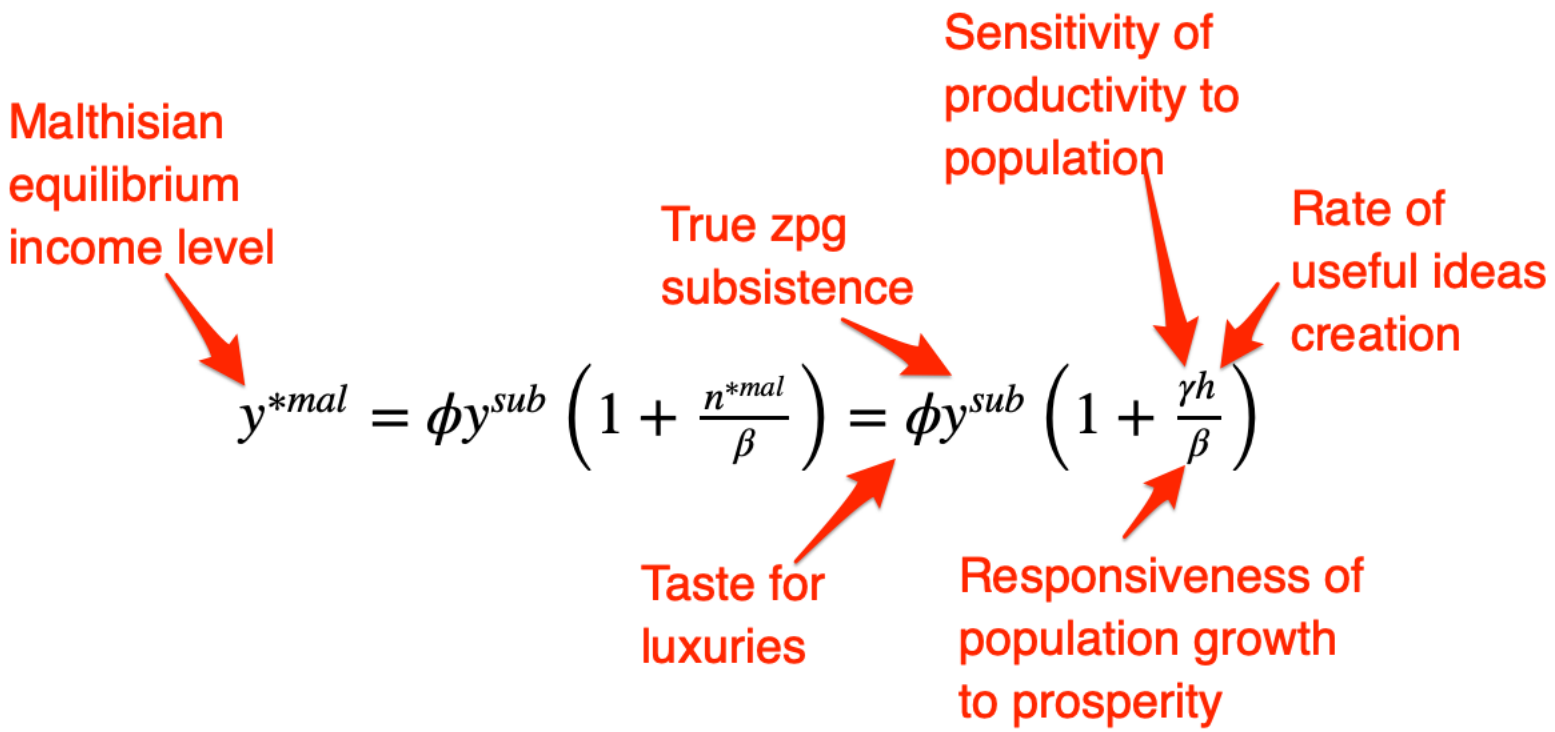
Understanding the Solow-Malthus Equilibrium: Prosperity



Notes:

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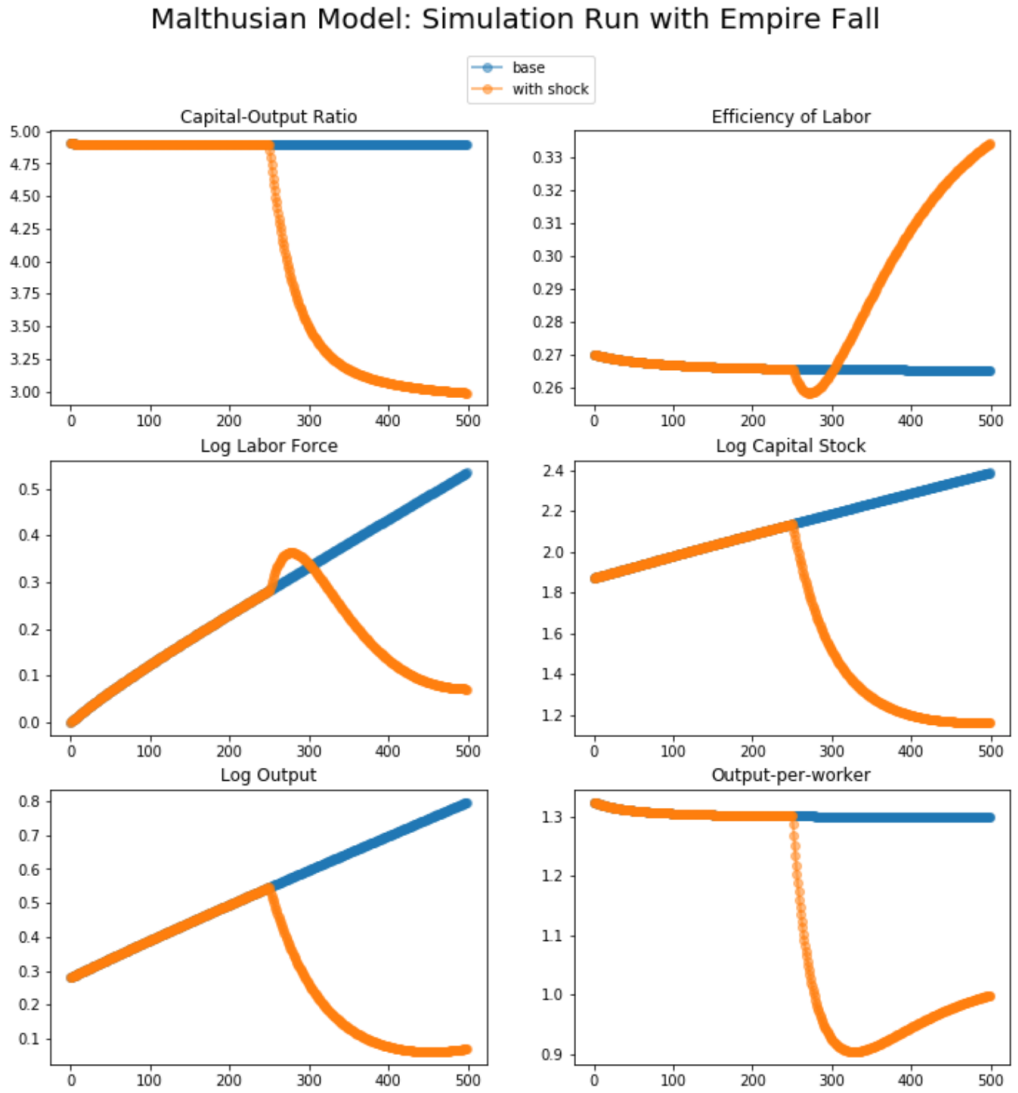
Steady-State and Along the Transition Path

The fall of an empire:

- <https://nbviewer.jupyter.org/github/braddelong/LS2019/blob/master/2019-10-14-Ancient_Economies.ipynb>
  - A decline in inequality, taste for luxuries, and taste for urban living: $\Delta\varphi = -0.25$
  - A decline in law-and-order that produces a sharp fall in the savings rate: $\Delta s = -0.10$



Review: Determinants of Technological and Organizational Progress

How do we make sense of the fact that technological and organizational progress was so slow back then and is so (relatively) rapid now?

- Two heads are (almost) better than one
  - But that does not quite work
- Add in additional drag from first picking low-hanging fruit
- What causes the increase in L_{stem}?
- What institutions make it profitable for n_{stem} to be higher?
- Plus:
  - Learning by doing
  - Productivity through embodiment
  - Technology transfer through contact

$$\frac{dp}{dt} = \frac{\pi p^2}{1-\alpha}$$

$$\frac{dH/dt}{H} = \delta L_{stem}^{\lambda} H^{\phi-1}$$

$$h^* = \frac{\lambda n}{1-\phi}$$

$$H^* = \left(\frac{\delta(1-\phi)}{\lambda}\right)^{1/(1-\phi)} \left(\frac{1}{n}\right)^{1/(1-\phi)} L_{stem}^{\lambda/(1-\phi)}$$