## The Malthusian Economy

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- Clark's point of departure is the observation that the average person was no better off in 1800 than in 100,000 BC.
  - As Clark puts it on p.1. of his book, "Life expectancy was no higher in 1800 than for hunter-gatherers."
  - Something changed after that of course. But this is for later in the course.....





- Clark's point of departure is the observation that the average person was no better off in 1800 than in 100,000 BC.
  - How could he possibly know this?





#### Various forms of evidence, but first and foremost that on heights

- There is little sign in modern populations of any genetically determined differences in potential stature, except for some rare groups such as the pygmies of Central Africa.
- But nutrition does influence height.
- In addition to the direct impact of nutrition on human development, episodes of ill health during growth phases can stop growth, and the body catches up only partially later on. And nutrition is an important determinant of childhood health.
- As Clark puts it, "stature, a measure of both the quality of diet and of children's exposure to disease, was [as high or] higher in the Stone Age than in 1800."
  - This is a pretty striking observation. How are we to understand it?

# The standard framework for doing so is the Malthusian model

- Thomas Robert Malthus was born into a wealthy family in 1766, educated at Cambridge, and became a professor at Cambridge and eventually an Anglican parson.
- His students referred to him as Pop Malthus ("Pop" for population).
- Malthus' Essay on the Principle of Population, published in 1798, became a contemporary best seller. (All economists should be so lucky.)



- Malthus' model was based on 3 assumptions:
  - The tendency for population growth to put pressure on the land, depressing living standards in what were predominantly agricultural economies.
  - The tendency for lower living standards to raise mortality rates (by, inter alia, increasing susceptibility to infectious disease).
  - The tendency for lower living standards to depress fertility (in the English case, with which Malthus was most familiar, by raising age of marriage).

#### Graphically, the three elements look like this...



• So we can run this model through some comparative-statics paces...

### What is the effect of technological progress in this model?

- Malthus did not deny the existence of technological progress.
- Despite emphasizing the stagnation of living standards, he was aware of new crops (the potato, introduced into Europe from Peru in the 1570s) and new methods ("the new husbandry" – symbolized by the seed drill for planting and horse-drawn hoe for clearing weeds of Jethro Tull in the early 18th century) that raised yields on existing crops.
  - The seed drill allowed seeds to be planted in straight lines, in turn permitting a horsedrawn hoe to clear and turn the rows between them.





## So what is the effect of technological progress in this model?



## Stationary equilibrium is restored with higher population, no change in living standards



#### Clark shows how this happened in practice (Notice not just shift in the locus to the right but also reversion of real wages to previous levels)



## What is the effect of improvements in sanitation, medical knowledge in this model?



## Answer: deterioration in the material standard of living



## Recall...

- Clark on p.1, "The vast swath of humanity... eked out a living under conditions probably significantly poorer than those of cavemen.... Stature, a measure of both the quality of diet and of children's exposure to disease, was higher in the Stone Age than in 1800."
  - Improved knowledge about sanitation, medicine etc. can explain this in the Malthusian model...

#### And the effect of fertility control in the model?

(Not surprisingly, fertility control is important for stories about the transition



### And the effect of the Black Death?

(the plague that killed 40% of Europe's population in the 14<sup>th</sup> century)



## The plague as a "natural experiment" for testing the model

- We can look at the response of real incomes to the shock.
- Here we have a series for the real wage of London masons from Clark.
  - From the surviving records of churches (which employed lots of masons...).
- Real wages show a noticeable increase following the Black Death and then reversion.



## The Black Death

- "The mother of all natural experiments."
- 40-50% of Europe's population died.
- In certain places, such as Venice, death rates were been as high as 75 per cent.
- Only a handful of areas were spared: in the Low Countries, in Southwest France, and in Eastern Europe.



## This is generally thought to have been an outbreak of bubonic plague

- Bubonic plague (so called because of the "buboes" or boils resulting from the swelling of the lymph nodes) was caused by a bacterium, yersinia pestis.
  - There are alternative theories, but modern DNA evidence has confirmed this one.
- Symptoms include high fever, convulsions and pain in the limbs, leading to exhaustion, heart failure and internal hemorrhage.
  - Sufferer's skin would darken due to hemorrhaging; hence "black" plaugue.
- If the patient avoids this collateral damage, he/she then recovers after a couple of weeks.

## Transmission

- Yersinia pestis survives indefinitely in populations of wild rodents like prairie dogs and marmots.
- It can also infect grey rats (which unlike prairie dogs and marmots, are not immune to the bacterium), as well as the fleas they carry.
- Infected fleas (which jump from one host to another) can then spread the disease.
- When rats die, their fleas feast on humans, biting and infecting them in the process.

# Unfortunately, this mechanism was not well understood

- There were many theories of what spread the plague ("stale air" according to the Medical Faculty of Paris in a report to the King of France). Hence efforts to protect against it were often futile.
- By the 19<sup>th</sup> century, when there was an outbreak of plague in Hong Kong and Bombay, science had advanced sufficiently to identify the mechanism, and it was met with quarantine.
  - Clark notes how the British analyzed the scope for transmission by infected fleas by suspending guinea pigs at different heights (hence the colloquial use of "guinea pig") and inferring how high fleas could jump on the basis of which guinea pigs were infected.

This account of the Black Death poses some challenges for historians

- The plague apparently originated in China.
- In the 14<sup>th</sup> century it then moved west to the steppes north of the Black and Caspian Seas and from their to Europe and the Middle East.
- But how did it get all the way from Central Asia to Western Europe in a short period of time, given that rats rarely travel more than an eighth of a mile a day?
- And why in the 14<sup>th</sup> century?

## Why in the 14<sup>th</sup> century?

- Trade expanded along the Silk Road in the 12<sup>th</sup> and 13<sup>th</sup> centuries (as popularized by Marco Polo).
  - Whether as a result of the political stability brought by the Mongol Empire under Genghis Khan or economic development in both China and Europe...
  - We will come to the growth of trade (the Commercial Revolution) in a couple of weeks...
- This explains how the plague made its way out of Central Asia: it followed the silk route.



### How did it get all the way from Central Asia to Western Europe so fast?

- Typically, the plague had spread very slowly if at all, because rats (and fleas) don't travel very fast or far. They don't live long. They don't cross water (since they don't like to swim).
- But with the growth of long distance trade, ships hauling grain and other products became conveyances for their movement.
- We now suspect that it was transmitted to Western Europe via Caffa (a westward point along the silk road know today as Theodosia in the Ukraine).
  - We can thus see the spread of plague via sea-shipping lanes.
  - As shown on the next slide....

### How the plague spread

#### (But why from Caffa?)



# We know more about the spread courtesy of contemporary accounts

 Gabriele de' Mussia, a resident of the region surrounding Genoa, in Northern Italy, wrote extensively about the phenomenon...



- Genoa was a leading trading city-state.
- In 1266 the Genoese negotiated an agreement with the Kahn of the Golden Horde (Genghis Kahn's son), to use the port as a trading center.
- But the Italian traders antagonized their Mongol hosts in various ways.
- The Mongols attacked and threw out the Genoese in 1307.
- But the Genoese returned ten years later, and thus time fortified the city with walls.
- In 1343-5 the Mongols again attempted to throw them out.

- It could be that Mongol encampments outside the city walls brought rats with them.
- These then spread into the city through rodent-torodent transmission.
- In addition, one of the Mongols' military strategies was using catapults to hurl infected cadavers into the city.
- Contact with infected material is also a transmission mechanism. Of 284 known cases of plague in the US in 1970-1995, 20 per cent were though to be by direct contact.
  - Such transmission would have been especially likely at Caffa, where cadavers would have been badly mangled by being hurled, and many of the defenders probably had cut or abraded hands from coping with previous bombardment.
    - Was this the first recorded instance of biological warfare?
    - Were the Mongols seeking to demoralize their enemies?
    - Were they just solving their cadaver disposal problem?



- Next the plague spread from Caffa to Western Europe via Italian trading ships.
- Rat infestations in the holds of cargo ships were the main mechanism.
- Even if most rats died during the voyage, they would have left hungry fleas that could infect the workers unpacking the holds.
- And shore rats foraging aboard newly-docked ships would also have become infected.



- So we have here an historical story for the spread of the plague.
- It would be nice to also have an explanation for its declining virulence over time.
  - Improved sanitation in Western Europe?
  - What would the effects be in the Malthusian model?



### Economic effects of the population decline

- Because the shock was very large, with up to half of the population dying, land-labor ratios improved, and wages increased substantially.
- Farmers could concentrate on the most fertile land. And produce more agricultural goods than they themselves needed.
- This surplus of foodstuffs allowed some workers to stop farming and turn to the production of manufactures (linens, cloth, apparel, shoes, horseshoes, etc.)
- So this gave a boost to *proto-industry* (defined as manufacturing using handicraft methods).
- There may be reason to think that proto-industry was where learning by doing and innovation were most pronounced.
- And then one darn thing led to another (as Brad will discuss later in the course)...

## But why didn't population respond, and wipe out the income growth, as Malthus would have predicted?





- The Black Death didn't last forever. By the end of the 14<sup>th</sup> century that bacterium carrying the plague had largely disappeared from Europe (to reappear periodically).
- In other words, Malthus' mortality schedule should have "shifted back to the left."
- The behavior of real wages 1450-1500 is consistent with this...

# So something else must have been going on

• What could it have been?

## Fertility limitation?

- This would have meant higher living standards by Malthusian logic
  - Agriculture could support a larger urban population.
  - Proto-industry, innovation, etc., all heavily urban phenomena, could have followed.
  - More investment in children (increased literacy).
    More schooling and market work for women.
- But is there evidence of this?
- And through what mechanisms?

- Let's say you wanted to investigate the extent of fertility limitation in Early Modern England or France.
  - How would you do so?
  - To what sources would you go?

## Censuses

- Most comprehensive example was the Domesday Book, completed in 1086.
- (Domesday is an Old English word for "accounting" or "reckoning." Think of Doomsday – or Domesday – as the day of reckoning, when the Lord takes final account of his subjects.)
- William I, also known as William the Conqueror – a Norman Duke (Normandy being in Northern France) invaded England in 1066 and gained control; he naturally wanted information about the country he had just conquered.
- The main purpose of the census was to find out who owned land and livestock, and how much, so that it could be taxed.
- But such comprehensive surveys were expensive and rare. The next comprehensive census in England was in 1801!



### What other sources?

## Parish registers

- The Church recorded baptisms and funerals, from which estimates of population growth can be derived
- But baptisms are not births, and funerals are not deaths.
   Why might they differ?



## Parish registers

- Answer: illegitimacy for births, nonconformism for both births and deaths.
- In addition, migration may cause us to miss deaths because people are buried elsewhere.
  - This is a problem not just in the case of international migration but sometimes even in the case migration between neighboring parishes insofar as demographers take a sample of parishes (not all of the many thousands of English parishes) when gathering data.

#### THE BURIALLS 1653.

Susanna Beardall.buried the 17<sup>th</sup> of October 1653. An Infant of Tho: Brookes buried the 3<sup>d</sup> of December. John Veluine buried the 9<sup>th</sup> of December 1653. Elizebeth Bartholmew buried the 1<sup>th</sup> ffebuary 1653. Robert Browninge thelder buried the 12<sup>th</sup> ffebuary 1653. Thomas Steer buryed the 16<sup>th</sup> of ffeb.

Richard Warren buryed Aprill 3th. Margaret Warren buryed Aprill 19th. (Ellen Lombard buryed May 3th. Mary West buryed May 13th. Edward Morris had a child buryed May 18th. Thomas Allen buryed May the 19th. John Lombard buryed June 21th. Daniel Giles buryed June 27th. Nicholas Hone buryed July 4th. Michael Kely buryed July the 5th. Ann Cooper buryed the 1st of August. Edward Matthew buryed Septemb 2th. John Billinghurst buryed Octob 25th. Garthright Cole buryed Octob. 26th. John Beacham buryed Octob. 28th. Elizabeth Marlow buryed Octob. 30th. William Hayhoe buryed Nouemb 2th. Hannah Brittaine buryed Nouemb 15th Margaret Beacham buryed Nouemb. 23th. Vrsely Barnet buryed Nouemb. 29th. Thomas Smith buryed Decemb 21th. Elizabeth Goodin buryed Jan : 17th. Henry Soan buryed ffeb. 16th.

<sup>1654.</sup> 

# You can attempt to correct for these biases

- In which case you have to construct estimates of the prevalence of nonconformism, illegitimacy, migration etc. from other sources.
- English and French demographers have used these sources and made complex statistical adjustments to parish registers.
- It is from on the resulting series that historical work on fertility, mortality and marriage patterns is based.

## What do you do with this information?

- Demographers like Wrigley (whose work you will read) use "back projection."
  - We have reliable population estimates, courtesy of the census, for the 19<sup>th</sup> century (say, for convenience, for the beginning of 1801).
  - We can then subtract off estimated births in 1800 and add back in estimated deaths in 1800 to get an estimate of population at the beginning of 1800.
  - Similarly, we can subtract off estimated births in 1799 and add back in estimated deaths in 1799 to get an estimate of population at the beginning of 1799.
  - And so forth...

## Problems with this method?

## Problems with this method?

- Estimates of births and deaths may be biased.
- And if they are regularly biased in the same direction (imagine that we are always underestimating births because we are underestimating the extent of noncomformism), then errors compound.
  - In this case we will have too high an estimate of the size of the population in 1800. Both because we are starting from too high a base AND because we are again subtracting too small a number for estimated births when back-projecting to 1799, that number will be off by even more. The further back one goes, the more serious the bias.

So what does the evidence on French and English fertility, such as it is, suggest?

- Average birth rates were 3.5 4 per adult woman.
- This was a period when the biological maximum was 9 children per woman (1 child per 2 years during the 18 fecund years of life).
- Evidently, actual fertility was less than half the biological maximum.
- This seems like evidence of birth control.
  - How was this achieved, you might ask?

## How was this achieved?

- Abstinence
- Coitus interruptus
- Extended periods of breastfeeding
- But, in practice, the most important method was delaying the age of marriage (and in some cases never marrying) – the so-called "Western European marriage pattern" – and limited sexual activity outside marriage.

- As Clark describes, the average age of first marriage for women in England was 25 (not 18...).
  - Using parish registers.
- He shows how 10 to 25 per cent of women never married.
  - This information comes from parish registers as well
- These two factors alone can account, arithmetically, for avoiding a bit less than half of all possible births.
- So the Western European marriage pattern explains much of what we observe.
- And, so far as we know, fertility limitation of this magnitude was unique to Northwest Europe.
  - Malthus himself was aware this "preventive check" (as Clark notes), maybe because the pastor himself didn't get married until the age of 38.

## The explanation for this European marriage pattern is obscure

- Some economic historians like Carlo Cipolla suggest that it was supported by social convention.\*
  - Priests, monks and nuns were precluded from marrying by religious law.
  - The School of Medicine in Paris did not allow married men to graduate.
  - Oxford and Cambridge did not admit married men until the end of the 19th century.
  - Married men were not allowed to serve as fellows (professors).
- Contemporaries thus understood that fertility threatened living standards, so they developed conventions and social arrangements to limit it.
  - Social convention, in this view, adapts to economic need...

\*Carlo Cipolla, *The Economic History of World Population* (1979).

### Clark disputes this

- He argues that marriage patterns were regulated not simply by social convention but by the individual decisions of rational economic agents.
- He argues that early marriage was desired on both consumption and investment grounds (it was pleasant to have a mate; grown children were an economic asset), but that it also had costs (young workers had limited means, and hence limited ability to support a family).

#### That age of marriage declined in good economic times and rose in bad ones is consistent with this view



REAL WAGE TRENDS AND CRUDE FIRST MARRIAGE RATES (BOTH 25-YEAR MOVING AVERAGES)

\* Notes and sources: The 25-year moving averages are centred on the years shown. The crude first marriage rate relates the number of those marrying for the first time to the total population aged 15-34. It may be noted that the prevalence of clandestine marriage in the second half of the seventeenth century substantially reduced the number of marriages recorded in Anglican registers. Wrigley and Schofield, *Population History of England*, figure 10.9, p. 425, and figure 10.11, p. 428 (further details of sources and methods of estimation may be found in the notes to the figures and the accompanying text).

But why this mechanism should have operated less powerfully elsewhere is less clear

- In China, where living standards were lower than in Western Europe by this time, age of first marriage should have been higher, by this logic.
  - But for women it was on average 19.
  - And fully 99 per cent of women appear to have married.
- There was some family limitation behavior in China also (the typical number of children per married woman was 5 – not 9, but also not 4).
- But the mechanism must have been different.
  - Some recent China scholars emphasize extended breastfeeding as a spacing mechanism and cultural beliefs that sexual activity was damaging to health as a cultural more.

- The comparison between the West and China will loom large in this course.
- Stay tuned....