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Longevity as a choice? The Grossman model

Economic Demography

Econ/Demog c175

Prof. Goldstein

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Week 13, Lecture B

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Inequality in health and longevity

- People who earn more live longer

- People with more education live longer

- Higher "status" groups live longer (race and ethnicity)

Some exceptions

- Women in developed countries?

- Rural/urban divide in historical times?

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Earnings

Chart 3.
Cohort life expectancy at age 65 (and 95 percent confidence intervals)
for male Social Security–covered workers, by selected birth years and earnings group

Years of life expectancy at age 65
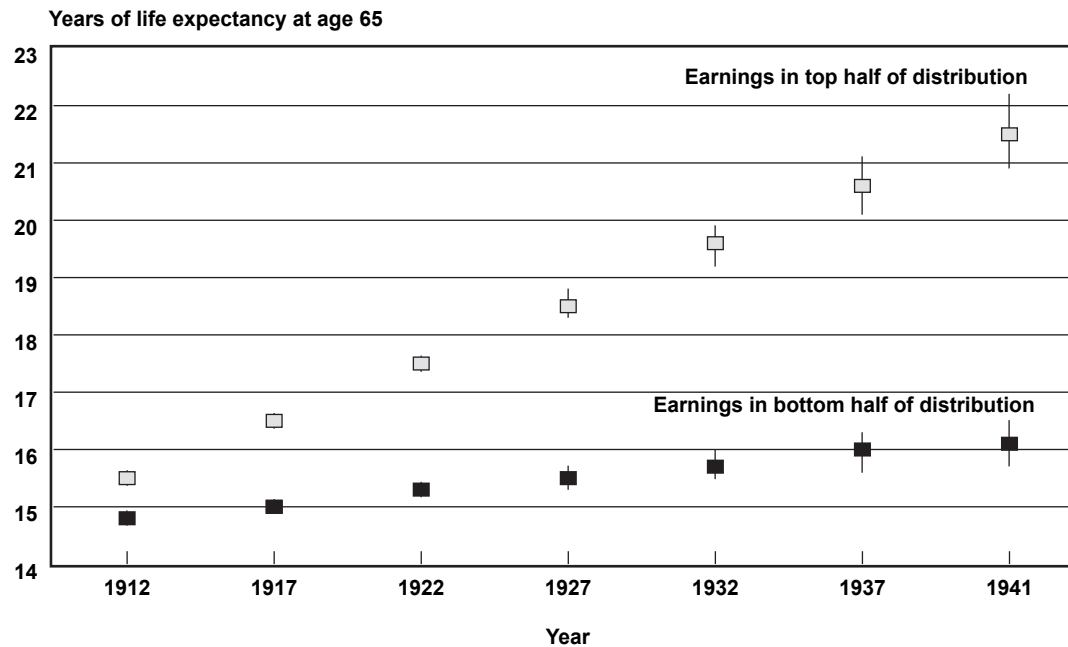
SOURCE: Author's calculations using a matched 2001 Continuous Work History Sample.

NOTE: Confidence intervals for 1912, 1917, and 1922 are so small that they are not visible on the chart.

Waldron (2007)

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Education

- Study of compulsory school laws (Lleras-Muney 2005) finds for those born in 1925

- + 1 year of education →
  +1.7 years of life expectancy (!)

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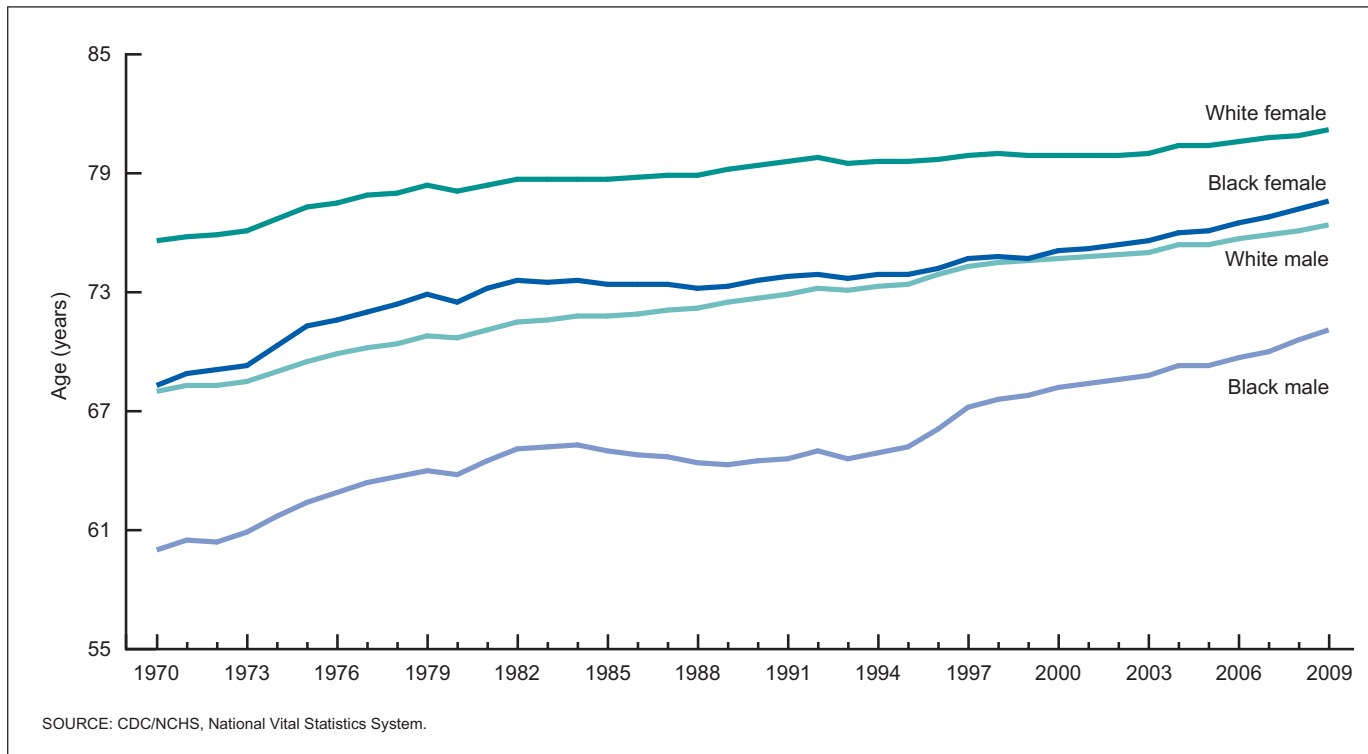UC Berkeley

Race in the U.S.

Figure 1. Life expectancy at birth, by race and sex: United States, 1970–2009

Note: Black-White differences = 40 years of progress

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Causal connections

(Why is socio-economic status linked to longevity?)

- Resource effect
- Education & efficient producer hypothesis
- Stress and hierarchies
- 3rd factors that influence both:
  - time preferences ("life fast, die young"?)
  - endowments (genes and environment)
- Reverse causality
  - Sick can't work

An economic model of health choice?

- U(H, Z)
  - H = stock of health
  - Z = other things (consumption)
- Purchase of more H means less Z → standard consumer choice?
- Grossman's insight
  - H a consumption good providing present utility
  - H also an *investment good* enhancing future productivity

Time constraints (revisited)

- $T_{Total} = T_{Working} + T_Z + T_{Health} + T_{Sick}$

Products of time

T_Z	$\rightarrow$	Z
T_H	$\rightarrow$	H
T_W (\$)	$\rightarrow$	Z & H
T_S	$\rightarrow$	0 (nothing)

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Health → time

- Increased H → less time sick   (investment)
- Decreasing marginal returns. First increase in H helps more than later increases

Stock of health = H

Stock of health = H
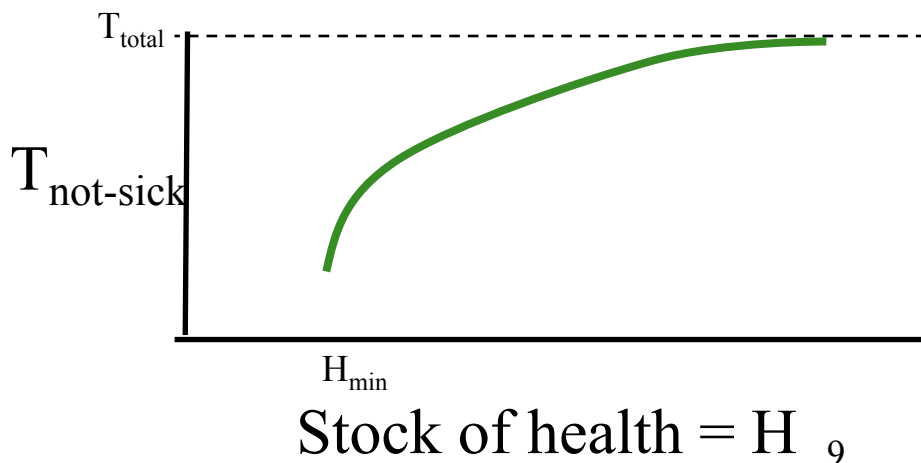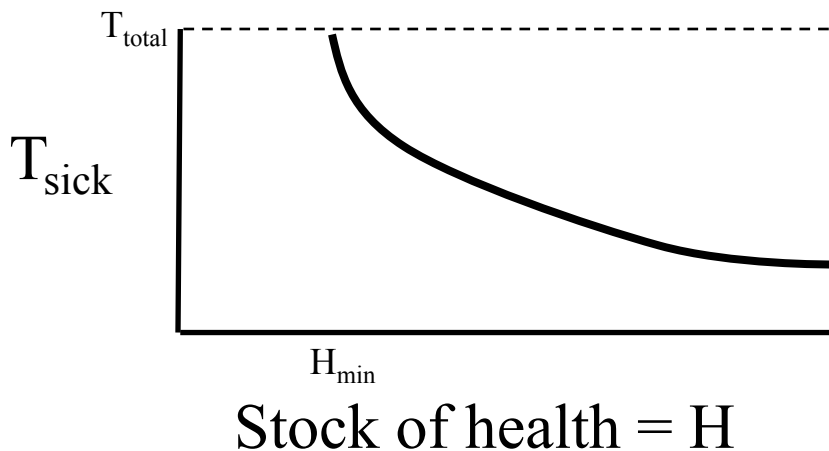
A feedback loop

Purchases of H (with $ or T_H) $\rightarrow$
increase available time ($T_Z + T_W + T_H = T - T_{sick}$) $\rightarrow$
more purchases of H $\rightarrow$
more increases in time $\rightarrow$

....

What is equilibrium? Do we spend our whole day jogging?

Optimal choice

Equilibrium H* when

marginal cost of more H
*exactly equals*
marginal benefit of more H

- If marginal benefit is higher than marginal cost than makes sense to purchase more, and vice versa.

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Marginal Benefits of more H

- We have downward sloping marginal benefit
  - decreasing returns in immediate utility
    U(H, holding Z constant)
  - decreasing returns as an investment in future time
    (T_{sick} curve)

Marginal Benefits of more H

- We have downward sloping marginal benefit
    - decreasing returns in immediate utility U(H, holding Z constant)
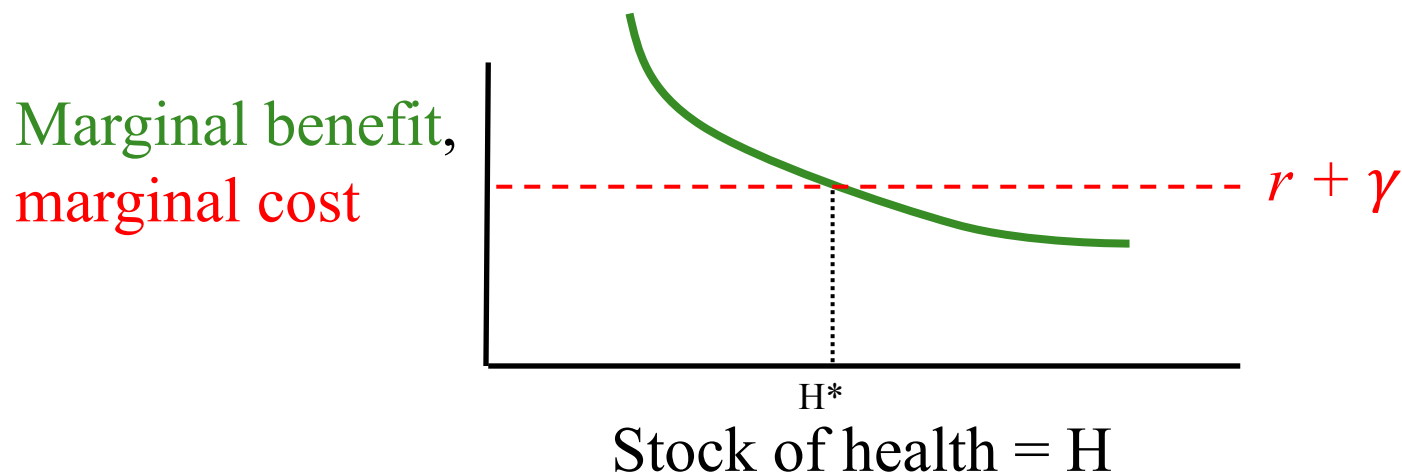   - decreasing returns as an investment in future time (T_{sick} curve)

MB | *"MEC"*

Stock of health = H
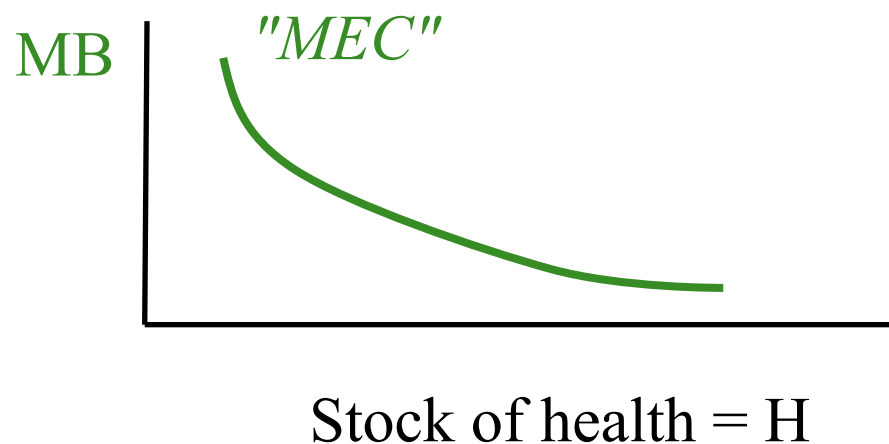
Note: MB is change in life time utility per change in H

$\dfrac{d \, \Sigma U}{d \, H}$

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Marginal cost of H

- Two components:
  - opportunity cost forgoing alternative investment with return rate, r
  - depreciation of H , γ
- Total marginal cost: $r + \gamma$

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Picturing equilibrium

Marginal benefit, marginal cost

$r + \gamma$

H*

Stock of health = H
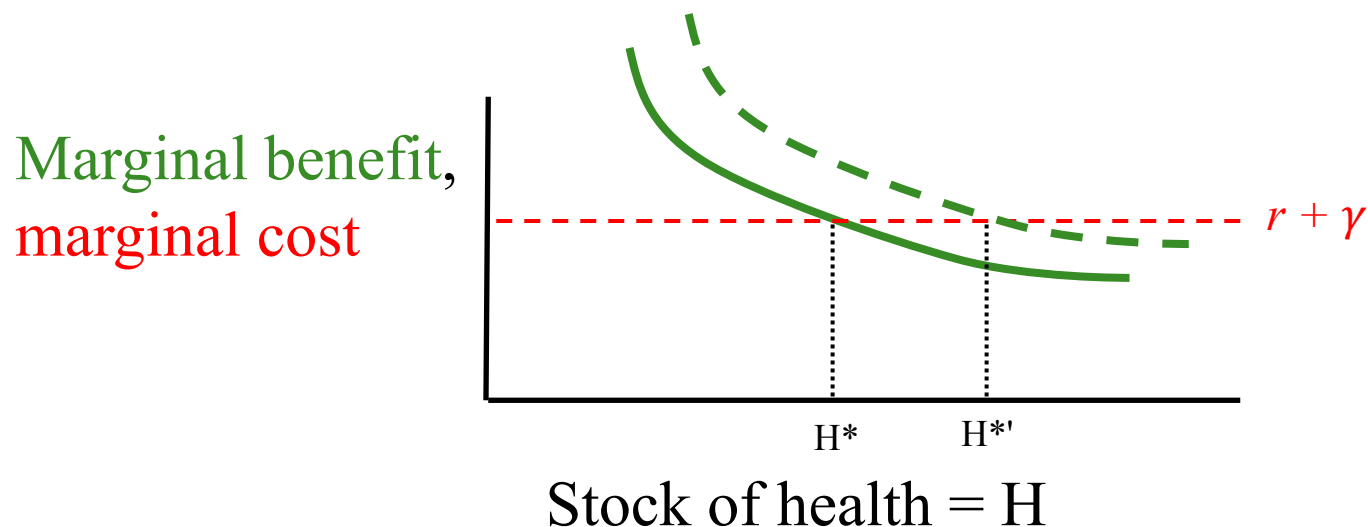
- Equilibrium because, if $H_0 < H^*$ choice will be to increase H a

- What if $H_0 > H^*$?

- (Malthus, except it is consumer not the "eco-demo system" determining dynamics.)

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# Some applications of the Grossman model

- Education

- Age

- Income

Education, increasing rate of return on investments in health

Marginal benefit, marginal cost

$r + \gamma$

H*   H*'

Stock of health = H

- Idea is per unit of time (or $), more educated benefit more
- Better health consumers: obey doctors, adhere to treatments, can choose more effective behavior
- (But educ also increase income, so other pathways)

Age

MEC

MB
&
MC

$r + \gamma(\text{old})$

$r + \gamma(\text{young})$

H*(old)   H*(young)

Stock of health = H
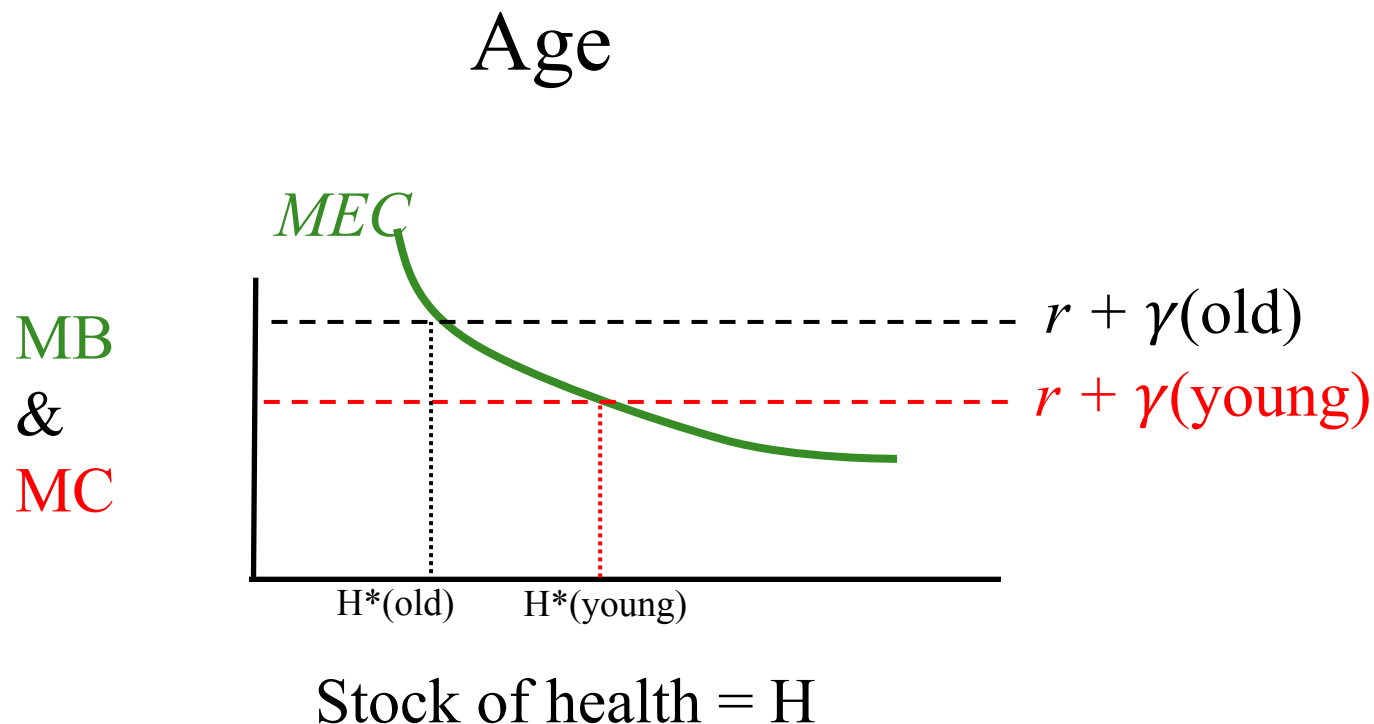
- Idea is because health deteriorates faster with age, depreciation rate will rise

- → Older people may spend more on health but their optimum stock is lower

- Death is rational? – Eventually depreciation rate is so high, better to just enjoy last bit of life, spend everything on Z?

Income and substitution effects?

- Income effect
Wage increase provides more resources, so can afford more H (& Z)

- BUT higher wage also increases price of T_H $\rightarrow$ substitution effect.
(Example: Stars who have "no time" to take care of themselves, too busy consuming)

Conclusions from Grossman's model

- We've only done a brief intro but ...

- We see that it provides a formal model of individual health investment choices

- Can offer insights into
  - why rich are healthier than poor
  - why education has such a large effect on health
  - why we age
  - why we die

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One very last chapter:
Some thoughts on *theory* and *data*

- New approach this year, theory + computing and working with data

- Can ask, why should we do both theory and data?

- Why are models useful (if we already have data)?

- Why are data useful (if we already have a model)?

Utility of models

- Formal models allow *precise communication* of our assumptions and our thinking
  - Malthus's prose → Lee's graphs
  - Health decisions → Grossman model
  - Income and substitution effects
  - Effect of immigrants on native wages
  - ...

Utility of models (cont)

- Formal model → clearer thinking (whether right or wrong)

- Can surprise us (substitution effects, optimal matching, Malthusian trap, ...)

- If you disagree, can point out precisely where (Labor demand curve has little slope?)

Utility of models (3)

- Very efficient way to produce insight: With pencil, paper, and a brain → new ideas, new ways of seeing the world

- BUT dangers
  - don't map the real world (assumptions don't hold, mechanisms left out, false operationalization)
  - take over our thinking ("econ101-ism")

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The uses of Data

- Stylized facts tell us what questions are worth asking

- A reality-check on theories

- BUT their are challenges:
  - drawing conclusions about the world from data
  - coherence of our conclusions

Ending where we began, with Malthus

Crude birth rates, Sweden

Crude death rates, Sweden
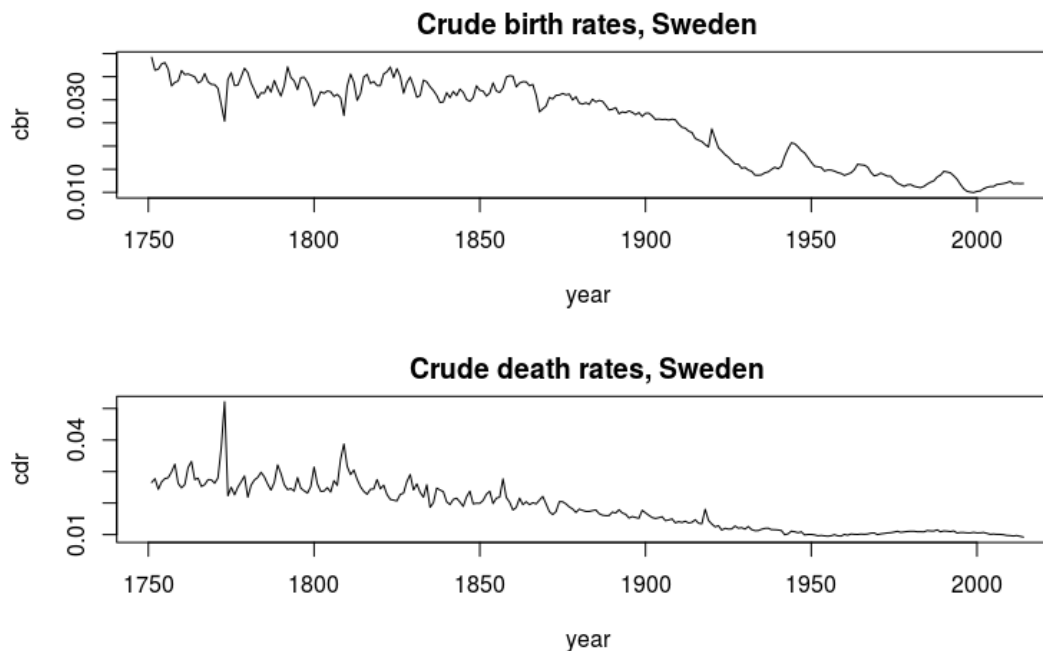
- Malthusian theory told us what to look for; the data told us when it broke down. A perfect union of theory and data?

- Theory, data and you

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