

10-4-05

①

Ch 5/6 HW due End Next week

Ch<sub>5</sub> 6 RQ Open later today due  
End of Next week.

Test back on Thurs

Tues Lab NEW TA  
Starting today

Lab E 2 weeks

Use both to do a good job!

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Thomas Malthus 1766-1834

① Population. Under ideal  
conditions Pop doubles  
every 25 yrs "geometric  
growth" or "exponential growth"  
- based on data.

②

② Food · Increase by the Production Same amount every 25 yrs. "Arithmetic growth" or "linear growth"

③

time	Pop	Food Prod	unprod Left	Food per cap unprod
0	7	7		$\frac{7}{7} = 1$
25	14	14		$\frac{14}{14} = 1$
50	28	21		$\frac{21}{28} = .75$
75	56	28		<del>Left <math>\frac{28}{56} = .50</math></del>
100	112	35	$112 - 35 = 77$	$\approx \frac{1}{3}$

A Dismal prediction

3

What Really Happened?

US Pop M: should be exponential

p 88 % growth  $\sim 3\%$  1790-1860

Decrease after that

Malthus pretty much right  
about pop.

US Food Wheat.

Yield 1869-1899.  $\sim$  Constant

~~total~~

Production

increased dramatically  
due to extra land

Food/Capita.

but Wheat/person Went Up!

Malthus was wrong here.

(4)

Population Now

Modern U.S. 1962-1998

% growth rate decreasing

Modern Great Britain 1962-1998

% growth rate decreasing

Mexico

"

Sri Lanka

"

If Malthus was pretty much right about exponential growth under constant conditions, there must be some change causes decline in % growth.

5

To check for exponential growth

look at  $\frac{\Delta y}{y} = \% \text{ growth rate}$

Bolivia		$\frac{\Delta y}{y}$
yr	POP	
62	3503	$= \frac{(3835 - 3503)}{3503} = .094$ $\approx 9.4\%$
66	3835	$\frac{(4212 - 3835)}{3835} = .098$
70	4212	$\dots$ $= 9.8\%$
94	7237	$\frac{(7957 - 7237)}{7237} = .0949 \approx 9.5\%$
98	7957	

There seems to be a constant growth rate of  $\sim 9\%/4 \text{ yrs}$ .

This indicates exponential growth, making Malthus' Prediction.

(6)

To check for linear growth  
look at  $\frac{\Delta Y}{\Delta t}$

t	Food	$\Delta Y / \Delta t$
62	33.8	$\frac{(39.1 - 33.8)}{4} = 1.32$
66	39.1	
70	47.1	$\frac{47.1 - 39.1}{4} = 2.$
⋮	⋮	⋮
90	100.6	
94	113	$\frac{113 - 100.6}{4} = 4.$
98	136.1	$\frac{136.1 - 113}{4} \approx 5.85$

$\frac{\Delta Y}{\Delta t}$  The rate of increase  
in Food in Bolivia appears to  
increase & not stay constant.

But Malthus should it should  
stay constant. So this data  
contradicts Malthus' Theory

⑦

Modern Malthusianism:

Food/person decreases

Bolivia

t	Pop	Food	F/P
62	3503	33.8	$33.8/3503 = .0096$
66	3835	39.1	$39.1/3835 = .011$
70			
94	7237	113	$113/7237 = .0156$
98	7957	136	$136/7957 = .017$

There's no evidence of  
Modern Malthusianism here.  
Food/person went up instead  
of down.