Announcements

- The second referee report is due **today** at 5pm
- The empirical project is due April 14th at 5pm

Differences in Social Evolution

- Measuring social evolution: interest rates, level of education
- Interest rates were low in England compared to in Asia
- In 1760, secured loans had interest rates around 15% in Japan and around 5% in England
- Literacy and numeracy were lower in Asia than in England
- Clark takes these observations as evidence that England was further along in terms of social evolution than Asia, even if Asian societies were moving in the same direction

Where does this evidence on the education of society come from?

- Not much data out there measuring actual education level
- Can find crude measures of literacy and numeracy which serve as proxies for education
- Still problems with measuring literacy and numeracy
- Indirect evidence comes from the kinds of documents that survive and how many documents survive
- Look at things like how well people could report their ages, whether they could sign their name

Refresher on Age Heaping

- Age heaping occurs when people round to ages ending in zero or five when estimating their ages.
- If everyone reported age correctly, 20 percent of the population would report an age ending in a zero or five.
- If everyone rounded, 100 percent would report an age ending in a zero or five (20 percent of these people would get lucky and actually be correct).

$$H = \frac{5}{4}(X - 20)$$

- When $X = 20$, $H = 0$ and when $X = 100$, $H = 100$.

Refresher on Age Heaping

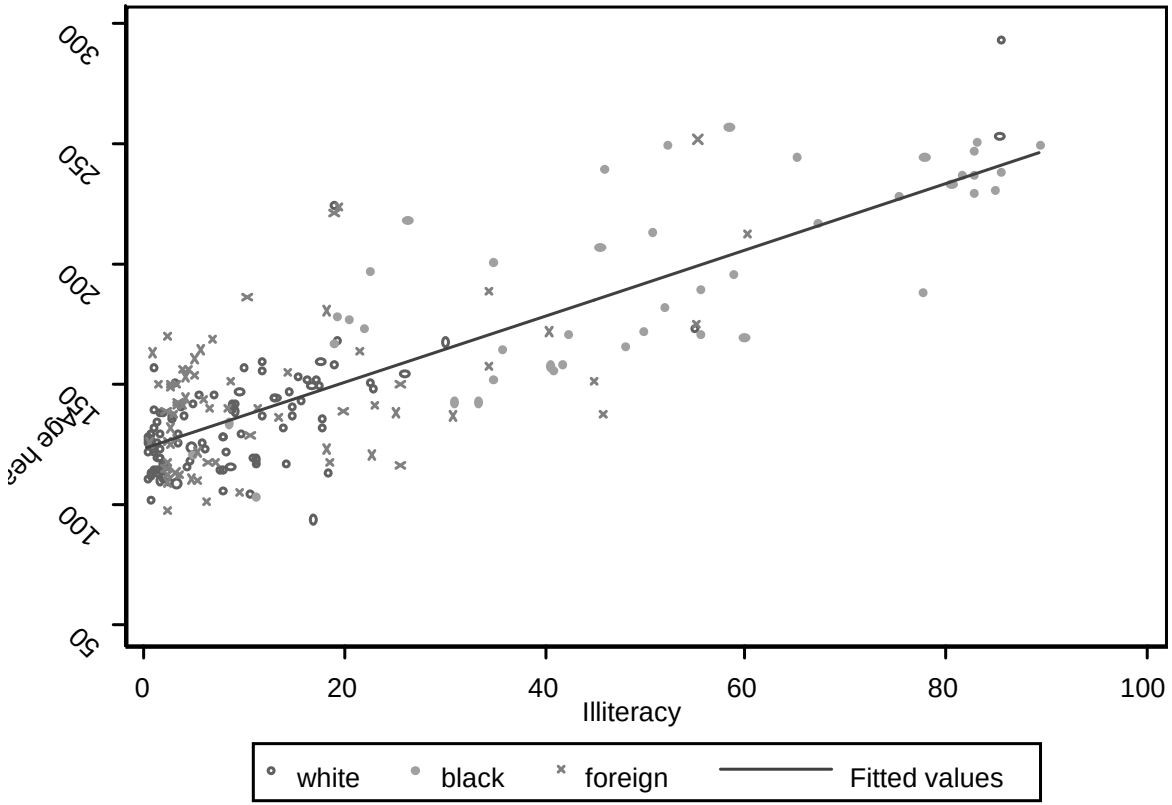
- An alternative measure is the Whipple Index (George Whipple, 1866-1924)
- Focuses on the population between ages 23 and 62
- $Pop_{0,5}$ is the number of people with an age ending in 0 or 5
- Pop_{all} is the total population

$$W = 500 \cdot \frac{Pop_{0,5}}{Pop_{all}}$$

- $W = 100$ when 20 percent have an age ending in 0 or 5
- $W = 500$ when 100 percent have an age ending in 0 or 5

Age Heaping and Illiteracy

Figure 6. Age heaping and illiteracy in three U.S. censuses



From Hearn, Baten and Crayen, age heaping is measured using the Whipple index, an observation is a state-census year

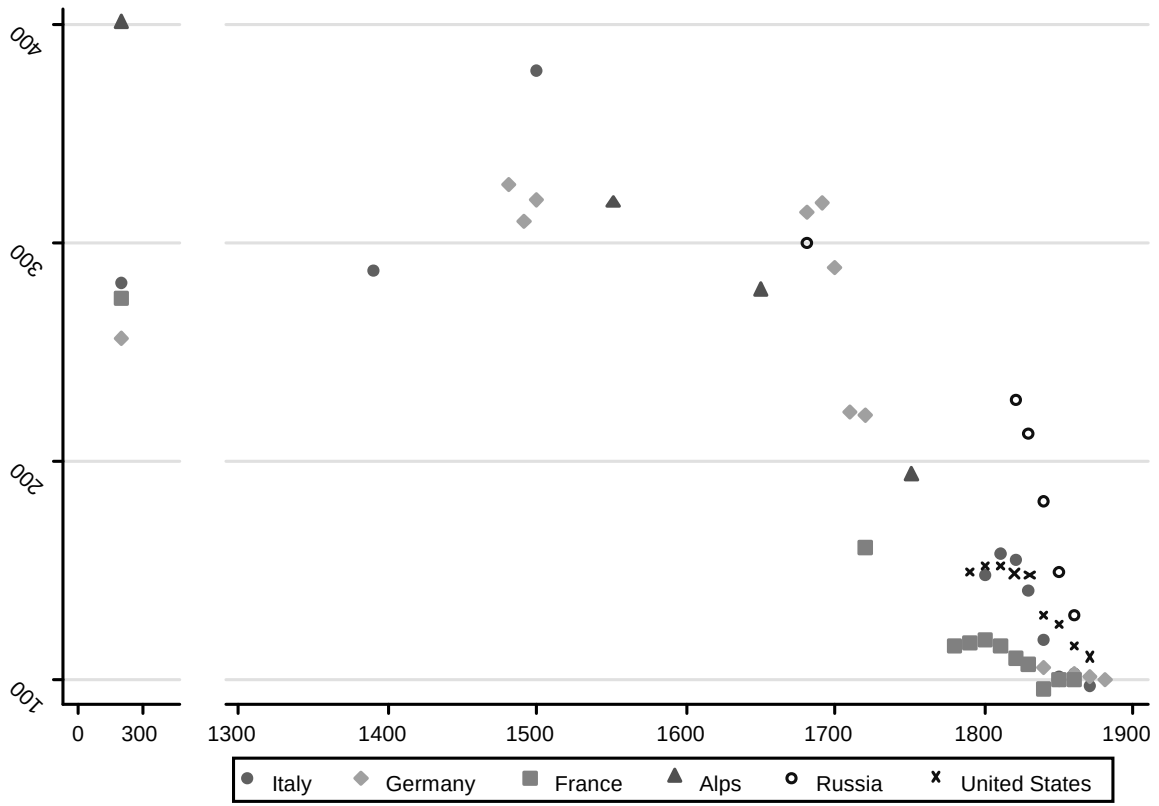
Age Heaping in the Long Run

Age Heaping Over Time

Location	Date	Type	Group	Heaping
England	1350	Both	Rich	61
Florence, Italy	1427	Urban	All	32
Florentine territory	1427	Rural	All	53
Corfe Castle, England	1790	Urban	All	8
Corfe Castle, England	1796	Urban	Poor	14
Ardleigh, England	1796	Rural	All	30
Terling, England	1801	Rural	Poor	19
Cotton operatives, England	1833	Both	Workers	6

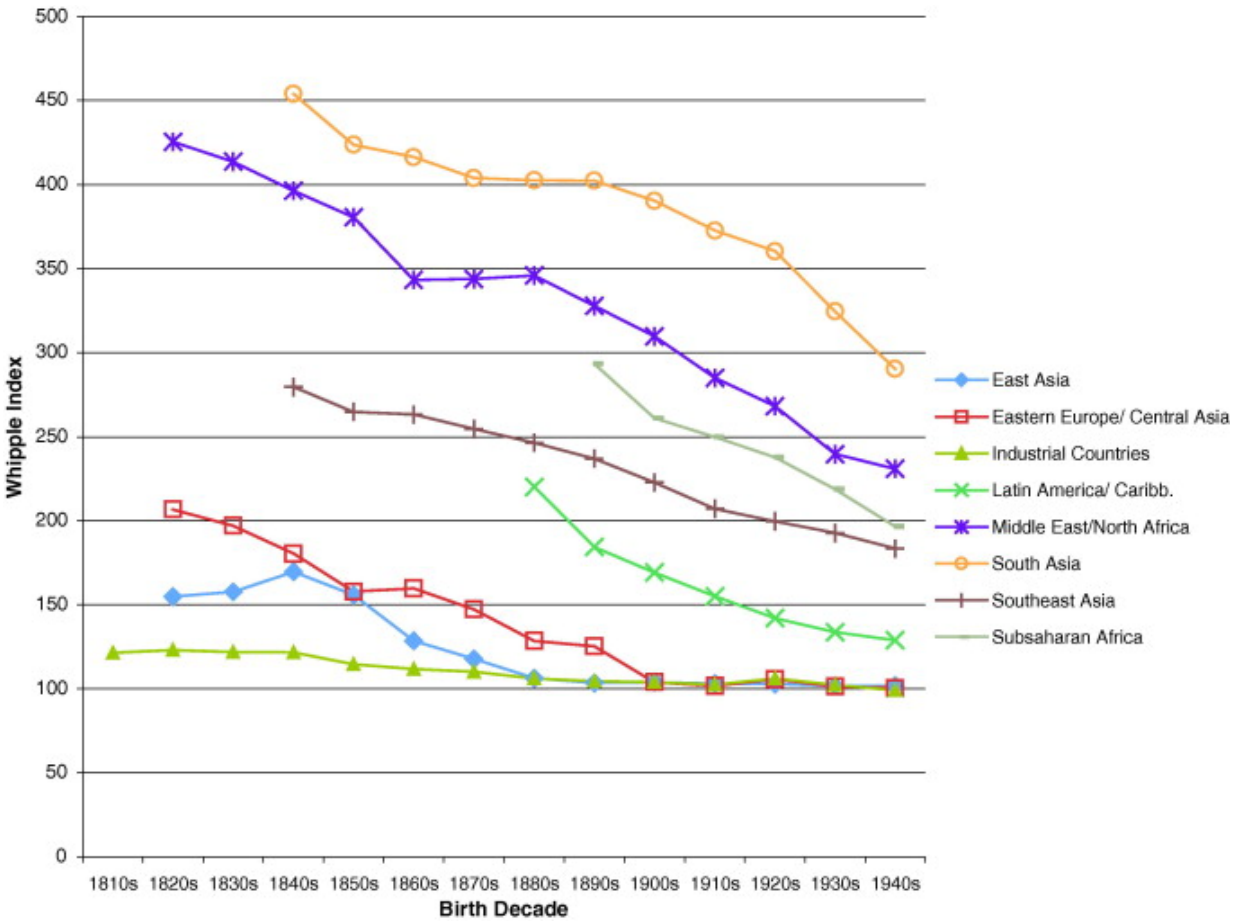
Age Heaping in the Long Run

Figure 7. Age heaping in the long run



From Hearn, Baten and Crayen, age heaping is measured using the Whipple index

Age Heaping by Region



From Crayen and Baten, age heaping is measured using the Whipple index

Refresher on Measuring Literacy Rates

- Can look at volume of records as an indication of overall literacy rates (Clark compares England and India on this basis)
- Can look at the number of people that can sign or read various types of documents:
  - Percentage of grooms who signed the marriage register
  - Percentage of witnesses who signed their depositions
  - Percentage of witnesses who signed ecclesiastical court declarations
  - Number of people who could read a passage of the Bible (to get out of secular court)

Literacy Over Time

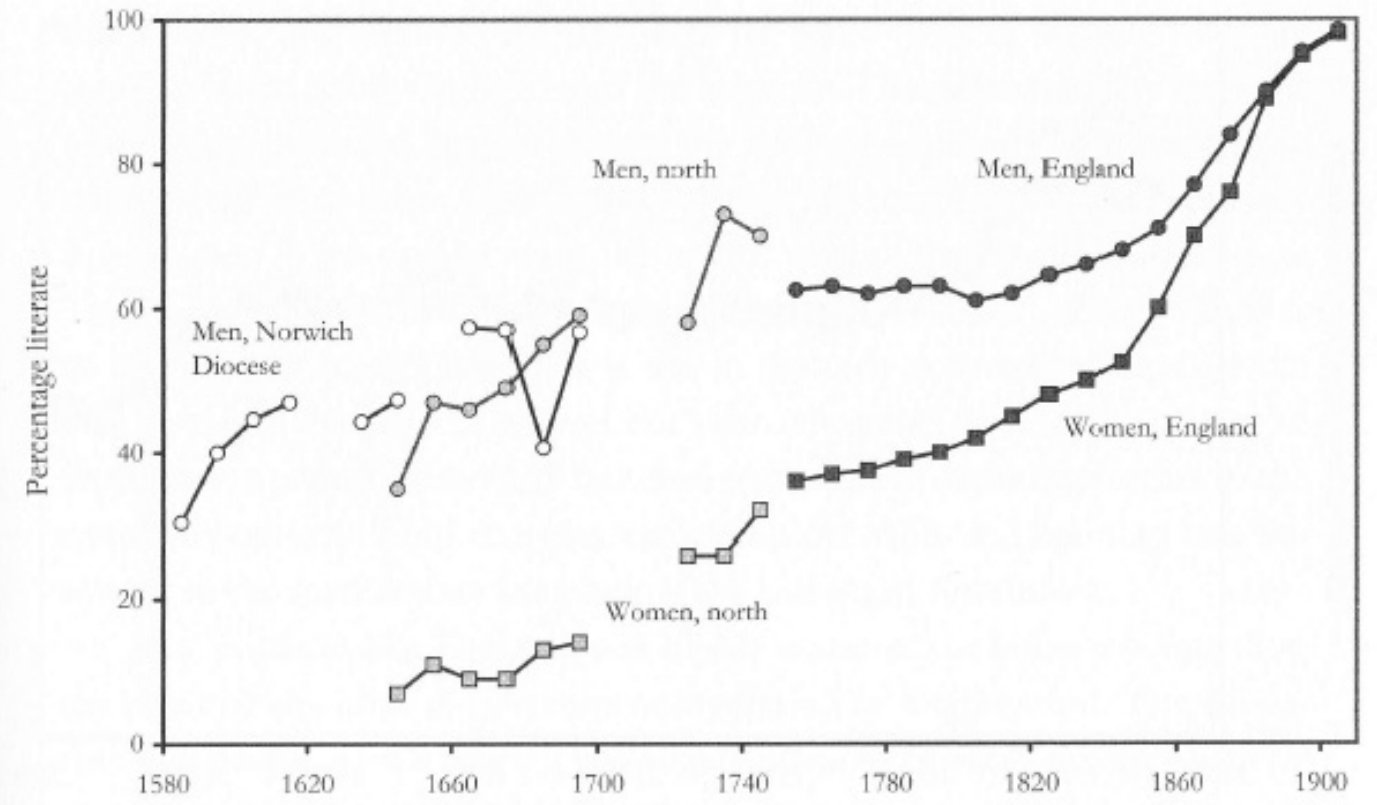
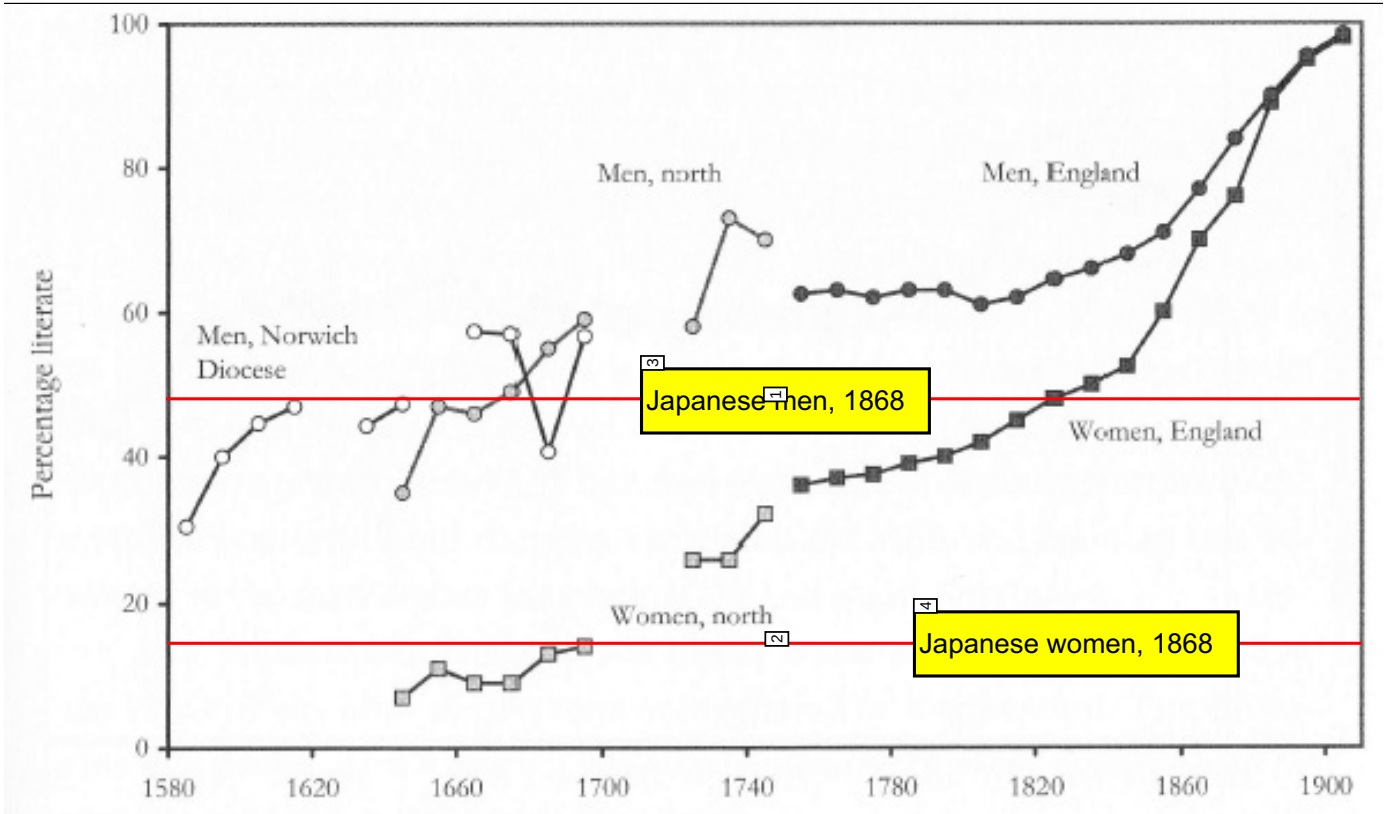


Figure 9.3 Literacy in England, 1580–1920. Data for 1750s–1920s from Schofield, 1973, men and women who sign marriage resisters; for the north, 1630s–1740s, from Houston, 1982, witnesses who sign court depositions; for Norwich Diocese, 1580s–1690s, from Cressy, 1980, witnesses who sign ecclesiastical court declarations.

Literacy Over Time



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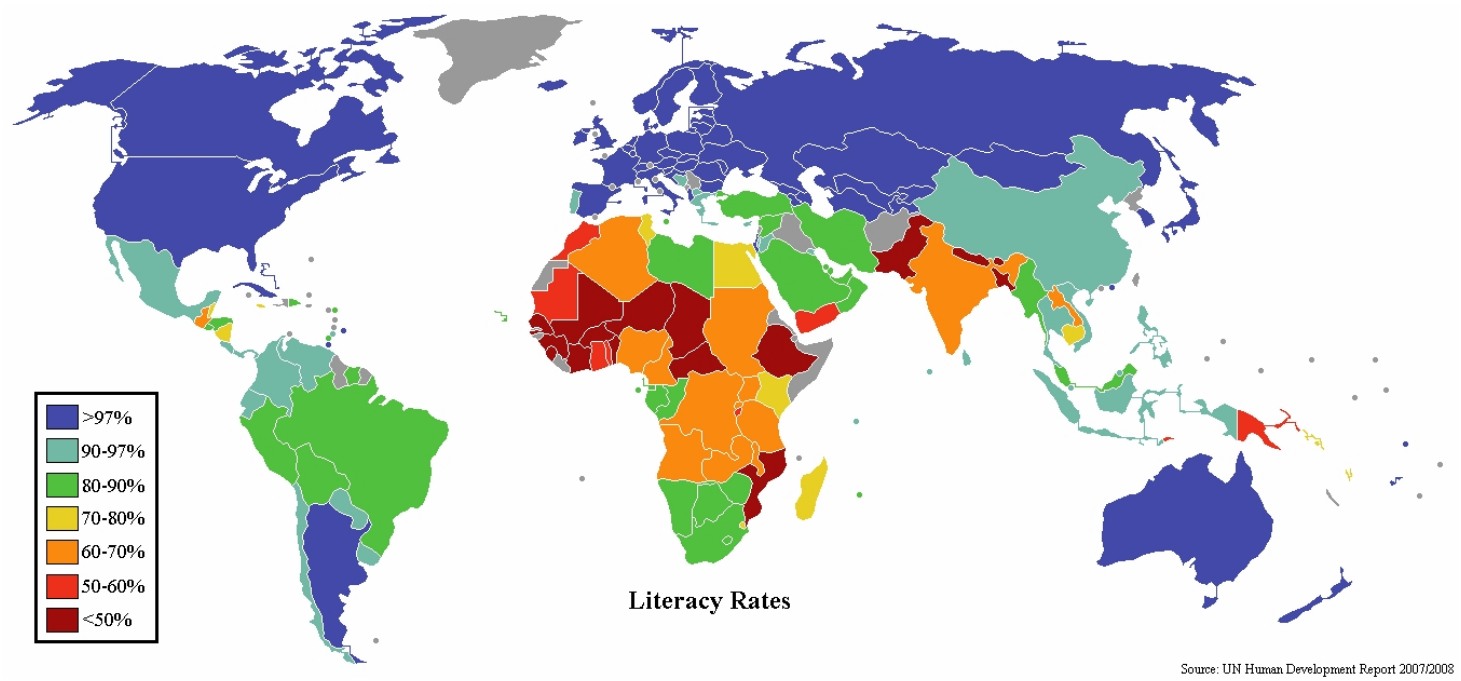
Literacy Now



Literacy by Income

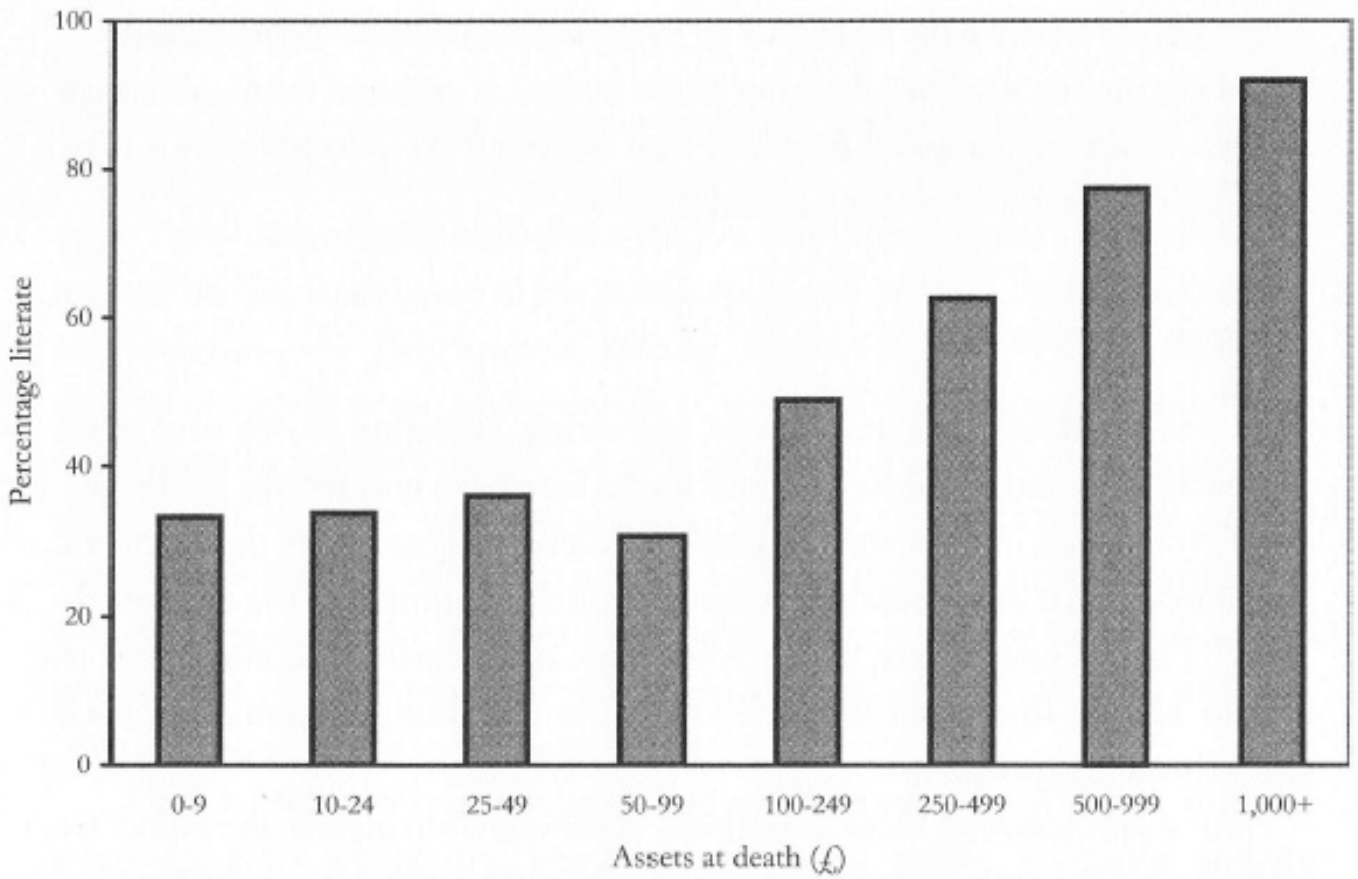


Figure 9.5 Literacy and assets of male testators in England, 1630.

Interest Rates Over Time

Interest Rates Over Time and Place

Country	Period	Interest Rate
Babylonia	500 BC	16-20
Greece	100 BC	10
Rome	200	9-12
India	800	15
England	1200-1349	9.5
Germany	1200-1349	10.7
Italy	1200-1349	10.7
Japan	1600	15
England	1600	5-6
England	1750	4-5

Interest Rates Over Time

$$r = \rho + d + \psi g_y$$

ρ: time preference rate
d: default risk premium
ψg_y: expected annual growth in income

Time Preference Rates

- Consider a paper by Reyes-Garcia et al., "The Origins of Monetary Income Inequality: Patience, Human Capital, and Division of Labor"
- Their basic argument:
  - In a self-sufficient society, patience is exogenously determined and people rely on folk knowledge for human capital
  - With the establishment of schools, patient and impatient people sort themselves
  - Patient and impatient people start to acquire different types of human capital, different jobs and different outcomes

Time Preference Rates

- They're going to test their theory by looking at foraging-farming societies in the Bolivian Amazon
- They ask people to make choices about small rewards today or bigger rewards later on
- The rewards are either in the form of money or food
- The choices reveal time preferences

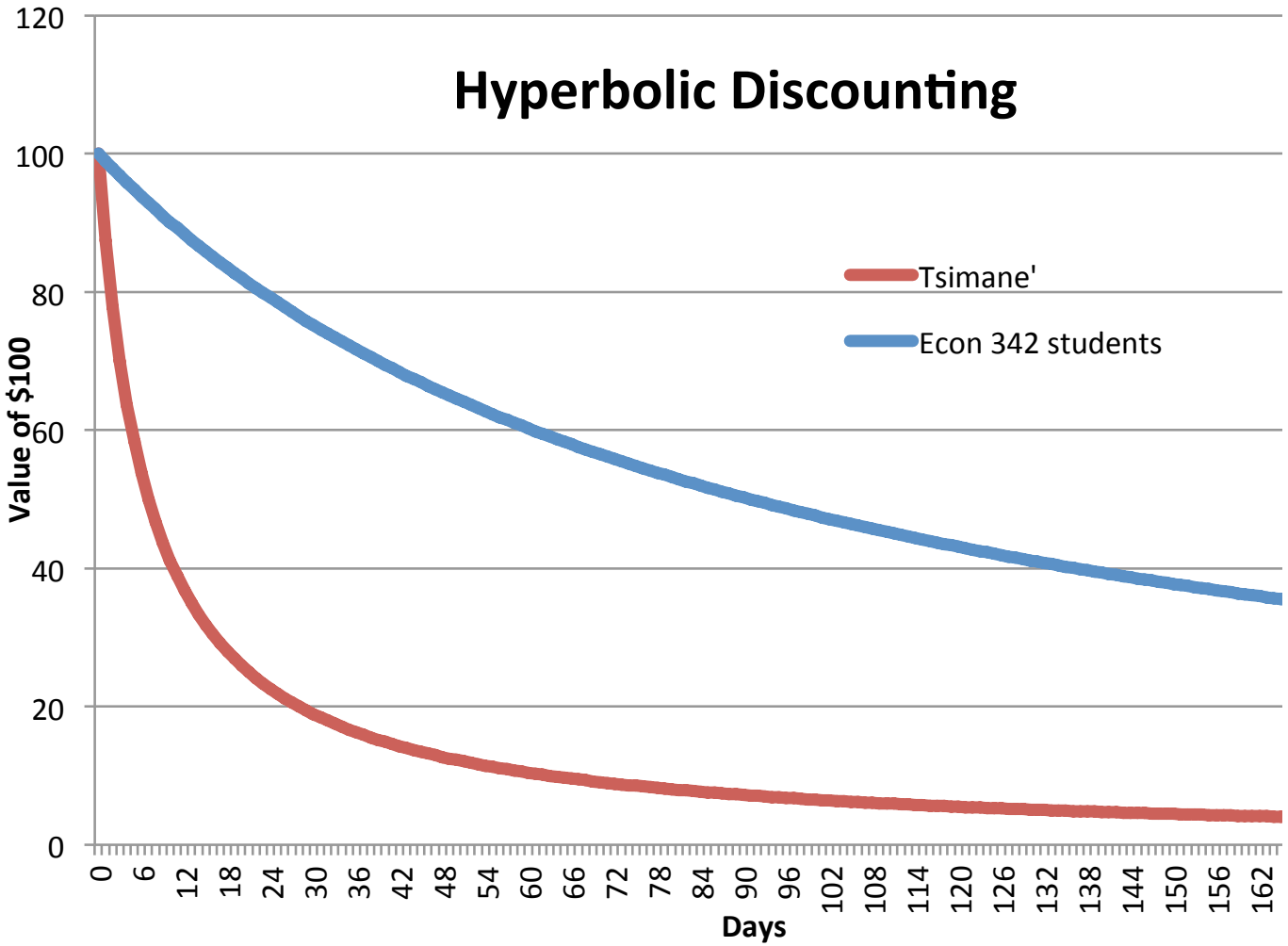
Time Preference Rates

Choice values and associated discount rates for questions used to elicit rates of private time preference for money and food

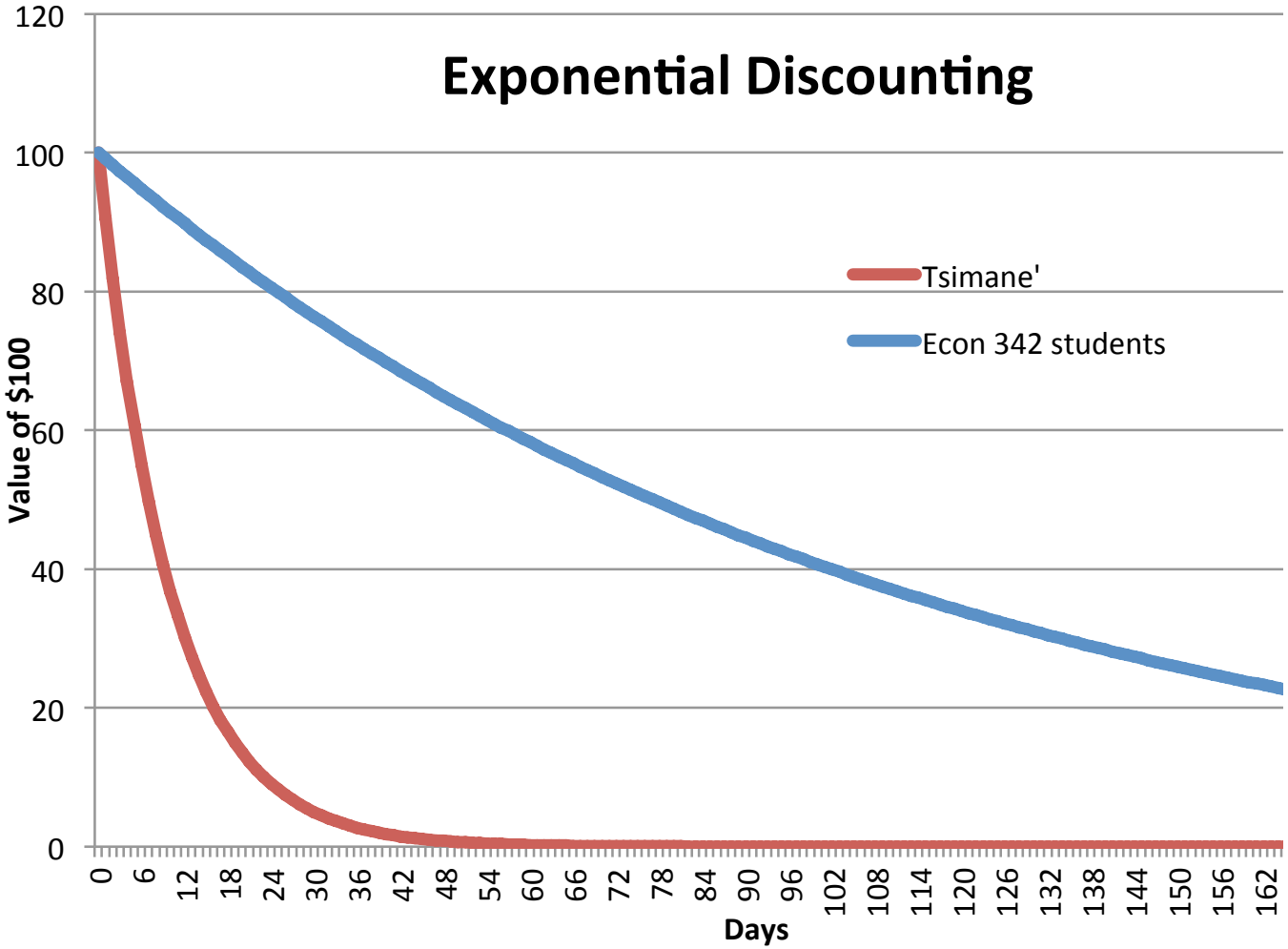
	Reward values (B$)		Delay	Rate at indifference	
Question	Today	Later	(days)	k	r
Money					
5	8.0	8.5	157	0.00040	.00039
3	6.7	7.5	119	0.0010	.00095
4	6.9	8.5	91	0.0025	.0023
1	5.5	7.5	61	0.0060	.0051
8	5.4	8.0	30	0.016	.013
7	4.1	7.5	20	0.041	.030
6	3.3	8.0	14	0.10	.063
2	3.1	8.5	7	0.25	.14
Candy					
4	16	17	157	0.00040	.00039
3	13	15	153	0.00101	.00094
1	11	15	61	0.0060	.0051
7	11	16	28	0.016	.013
6	8	15	21	0.042	.030
5	7	17	14	0.102	.063
2	6	17	7	0.26	.15

"Rate at indifference" indicates the value of hyperbolic (k) and continuously compounded exponential (r) discount rates at which immediate and delayed rewards are of equal value.
US$1.00 ≈ B$6.00.

Time Preference Rates



Time Preference Rates



Time Preference Rates

Relation between impatience and the accumulation of different types of human capital

Explanatory variable	Dependent variable (type of human capital)	
	Schooling	Folk knowledge
Impatience	−0.547 (0.278)**	0.011 (0.004)***
Age	−0.096 (0.017)***	0.001 (0.0003)***
Male	1.592 (0.542)***	0.024 (0.012)***
R^2	0.31	0.39
n	406	309

** Significant at the 5% level.

*** Significant at the 1% level.

Time Preference Rates

Table 5
Comparison of indicators of well-being in 2004 between patient and impatient participants during 1999–2000 (results of two-tailed t test)

Outcomes	Impatient ($n=38$)	Patient ($n=25$)
Income from		
Barter	6.55	6.82
Sales	49.63	9.88
Wages	23.68	152.24***
Credit	32.47	65.04*
Individual wealth		
Modern physical assets	538.55	652.04
Traditional physical assets	199.21	178.00**
Total physical assets	783.03	882.44
Nutritional status		
BMI	23.14	23.42
ZAM	−0.77	−0.42**
ZSF	−0.71	−0.56
ZWT	−1.02	−0.83*
Self-reported days ill	6.8	3.5**

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

Time Preference Rates

- Back to the main point of Reyes-Garcia et al., "The Origins of Monetary Income Inequality: Patience, Human Capital, and Division of Labor"
- Their basic argument:
  - In a self-sufficient society, patience is exogenously determined and people rely on folk knowledge for human capital
  - With the establishment of schools, patient and impatient people sort themselves
  - Patient and impatient people start to acquire different types of human capital, different jobs and different outcomes
  - This leads to divergence within a society (income inequality)
- Clark is going to tell a somewhat related story about differences in traits and economic development across countries

Driving Social Evolution

- Clark is focusing on these traits that seem to be important for economic growth: education, patience, etc.
- Perhaps a necessary condition for industrialization is having a large enough percentage of the population possessing these economic virtues
- This raises the question of how these traits are developed and how they arise or spread throughout the occupational distribution
- Clark's main focus in on how these traits diffuse throughout the population, arguing that the diffusion process is all about fertility patterns

Simple Example of Diffusion Process

- Let's say there are three groups making up a population: A, B and C
- Group A has growth-promoting characteristics
- All three groups initially have 100 people in them
- However, group A is growing at 10 people every generation, group B is staying the same size and group C is shrinking by 10 people every generation
- What percentage of the population in each generation has the growth-promoting characteristics?

Simple Example of Diffusion Process

Generation	A	B	C	Percentage with Trait
1	100	100	100	33
2	110	100	90	37
3	120	100	80	40
4	130	100	70	43
5	140	100	60	47
6	150	100	50	50
7	160	100	40	53
8	170	100	30	57

Simple Example of Diffusion Process

- We can think of the bottom third of the income distribution as the lower class, the middle third as the middle class and the top third as the upper class
- After the first generation, the growth-promoting characteristics begin to diffuse to the middle class
- After roughly ten generations, the growth-promoting characteristics have diffused throughout the entire middle class
- If we assume that some upward mobility exists, this diffusion process would be even quicker
- Note that this depends on the upper class not being able to expand to accommodate all of the extra kids