Announcements

Announcements

- If you had any technical issues with the quiz (even if you fixed them) let me know so I can ensure future quizzes go smoothly
- Answers for the quiz are posted in the Quizzes folder on Blackboard
- Remember that grades will be curved at the end of the semester, I am expecting the typical student to get one or two questions wrong on each quiz
- In general, quiz answers will always be posted the next day

Announcements

Remember that any group preferences need to be submitted by February 8th.

Announcements

- Plan for the next couple of classes is to move from the Middle Ages to the Industrial Revolution
- We'll work our way through the North and Thomas paper (required reading)
- I'll also talk about a couple of interesting empirical papers looking at intellectual property rights during industrialization (non-required readings)
- No new required readings for next week other than North and Thomas
- Before we move on to the Industrial Revolution and increasingly formal institutions, let's finish off thinking about the voluntary institutions related to trade in the Middle Ages with an experiment

Voluntary Institutions

Golden Balls - $100,000 Split Or Steal? 14/03/08

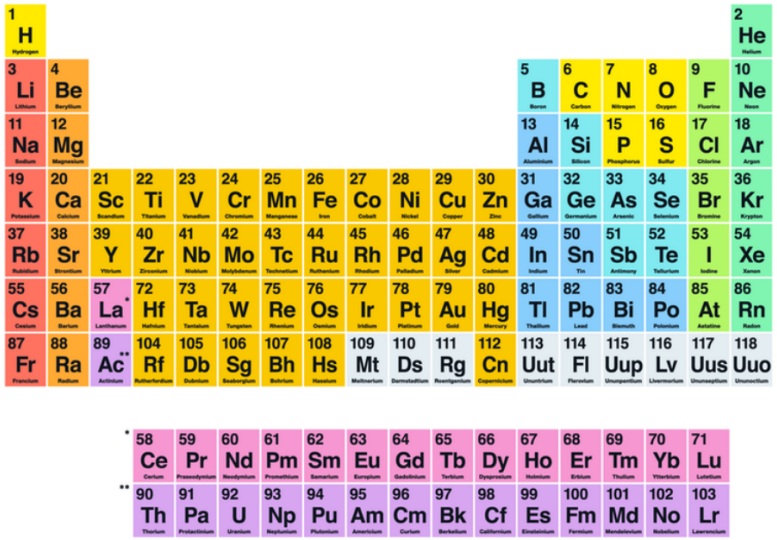
Voluntary Institutions

- We're going to play a variation on this game here in class
- Four of you will have the chance to win up to $30
- Here are the basic rules:
  - Two people will play at a time
  - You will have approximately two minutes to talk to each other
  - After that, each player will secretly choose either the Steal card or the Split card
  - If both choose split, each player wins $10
  - If one chooses split and the other steal, the player choosing split gets nothing and the player choosing steal gets $30
  - If both choose steal, both get nothing
  - Honor Code is suspended during game

Voluntary Institutions

If you would like a chance to compete, click on an element. (Remember which one you clicked on.)

When poll is active, respond at **PollEv.com/jmparman**



Voluntary Institutions

- So what did we learn? (I don't know since this slide was made ahead of time)
- Did I dole out $30 (the biggest increase in total surplus), $20, or nothing (the worst outcome in terms of total surplus)?
- How did students negotiate?
- Could they make credible statements?
- Were any deals incentive compatible?
- Would outcomes have changed with enforceable contracts?
- How important was social pressure?

Announcements

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Voluntary Institutions

Golden Balls - $100,000 Split Or Steal? 14/03/08

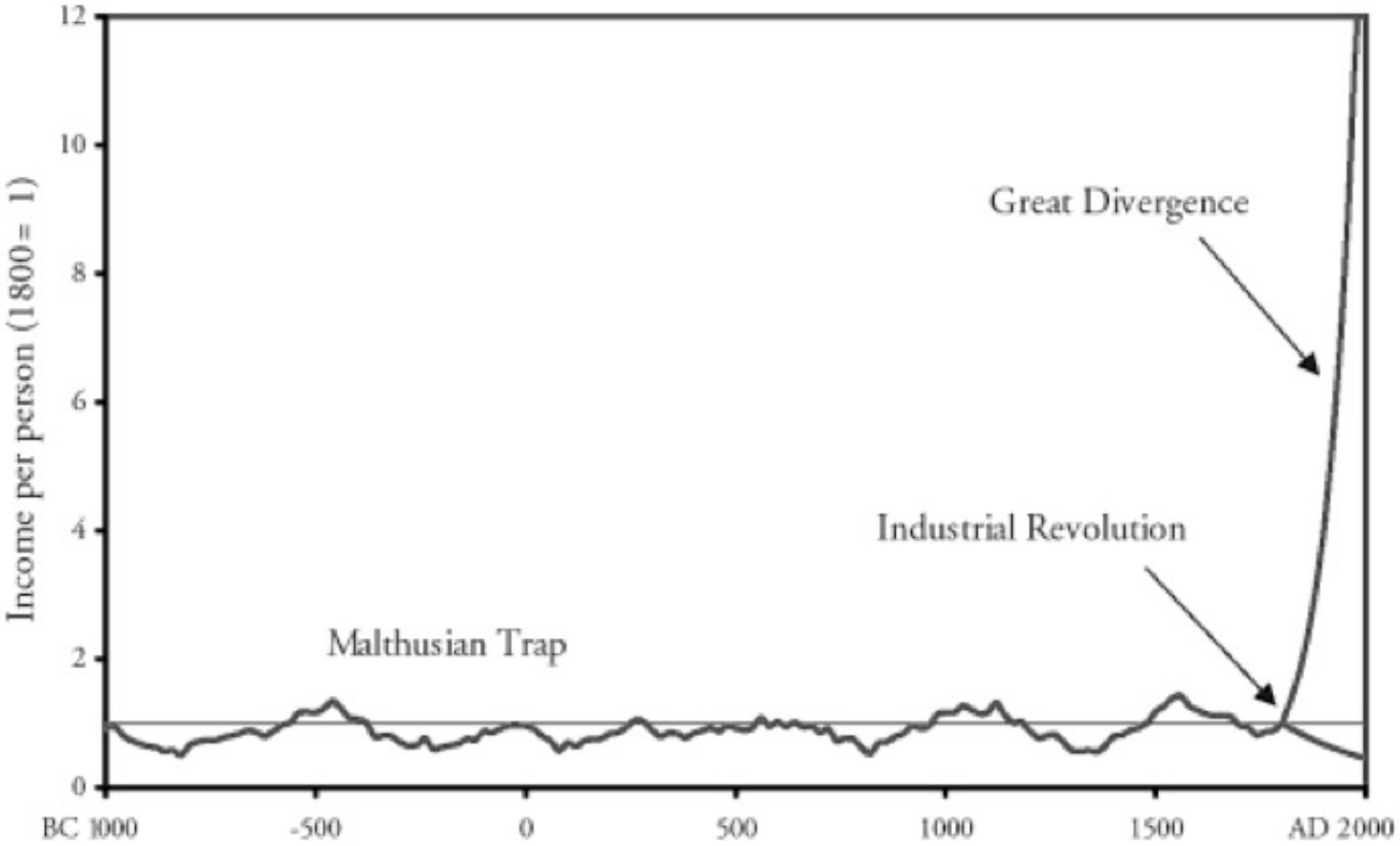
Voluntary Institutions

- Let's wrap up our Golden Balls game, now that we know how it turned out
- Both groups wisely colluded to go Split/Steal to get the $30 and then split the $30 afterward
- This was the efficient outcome, the combined earnings of the players were higher than if they went Split/Split
- This outcome was highly dependent on voluntary and informal institutions
- I never said I would enforce any deals yet the players contracted anyway
- Note that there were no explicit punishment strategies
  - One shot game
  - 150 classmates watching them

Voluntary Institutions

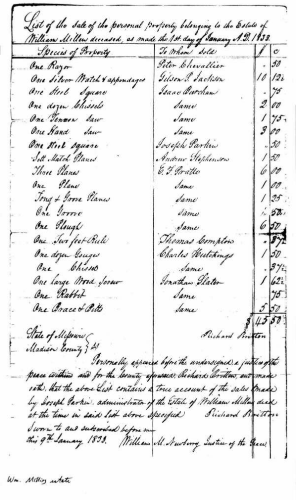
- What would have happened if we did this anonymously online?
- Probably no credible commitment to sharing the winnings
- Would Split/Split make the most sense? Would we see Steal/Steal emerge as a strategy?
- What if we repeated the game?
- What if I promised to enforce contracts?
- Time to start thinking about moving into a world with more strangers, more trade, and more formal institutions

Institutions and Industrialization



Institutions and Industrialization

The Palace of Versailles, First Expansion 1661-1678



List of the Sale of the personal property belonging to the Estate of William Miller deceased, as made the 1st day of January A.D. 1833.

Species of Property	To whom Sold	$	c
One Razor	Peter Chevallier	.	50
One Silver Watch & appendages	Gilson P. Jackson	10	12½
One Steel Square	Isaac Burcham	.	75
One dozen Chissels	Same	2	00
One Tenson Saw	Same	1	75
One Hand Saw	Same	3	00
One Steel Square	Joseph Parkin	.	50
Sett Match Planes	Andrew Stephenson	1	50
Three Planes	C. F. Pratte	6	00
One Plane	Same	1	00
Tong & Groove Planes	Same	1	25
One Groove	Same	.	50
One Plough	Same	6	50
One Two feet Rule	Thomas Compton	.	87½
One dozen Gouges	Charles Hutchings	1	50
One Chissel	Same	.	37½
One large Wood Screw	Jonathan Slater	1	62½
One Rabbit	Same		75
One Brace & Bitts	Same	5	50
		$ 45	50

Richard Britton

State of Missouri }
Madison County } ss

Personally appeared before the undersigned, a justice of the peace within and for the County aforesaid, Richard Britton, and made oath, that the above List contains a true account of the sales made by Joseph Parkin, administrator of the Estate of William Miller decd at the time in said list above specified. Richard Britton

Sworn to and subscribed before me this 9th January 1833. William M. Newberry Justice of the Peace

Wm. Millers estate

Inventory of the sale of all the worldly belongings of one William Miller, 1833

Institutions and Industrialization

- North and Thomas are going to try to explain this break from the Malthusian world in terms of institutions
- How they characterize the pre-industrial world:
  - abundant land of good quality available for colonization and settlement
  - workers were a relatively scarce factor of production
  - small volumes of trade, mostly local exchange
  - long distance trade was based on differentials in resource endowments
  - rate of innovative activity was very low
- So how do we escape this world?
- First things first, let's model what's trapping us in this world

Population in the Modern World

Population growth in the United States, 1850-2010

Year	Population (in thousands)	Surviving children per woman
1850	23,261	--
1870	39,905	--
1890	63,056	--
1910	92,407	2.672
1930	123,188	1.968
1950	151,684	2.870
1970	205,089	2.336
1990	250,181	1.994
2010	309,776	--

Population in the Preindustrial World

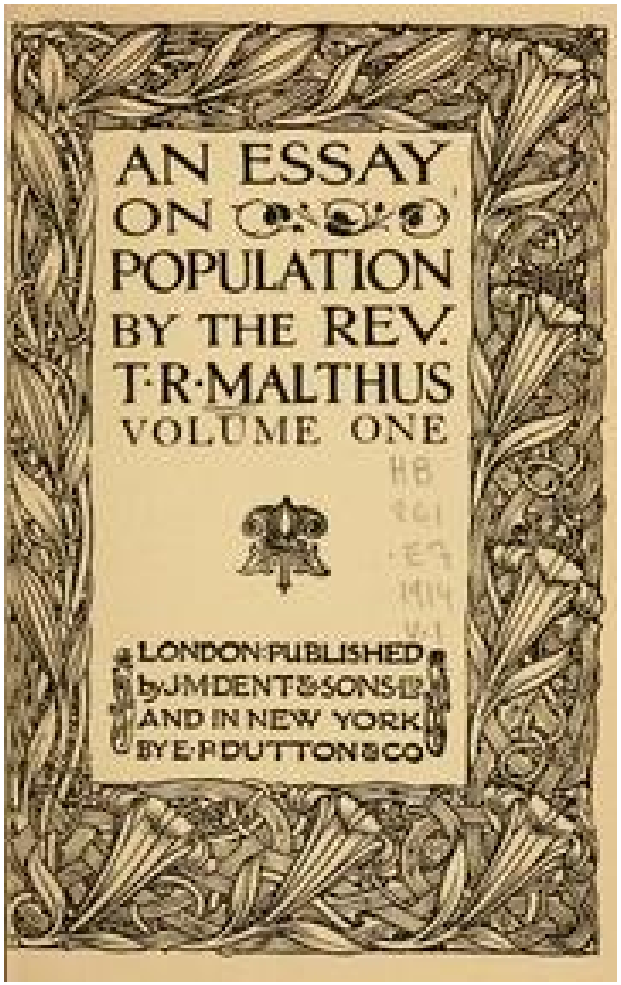
Location	Population in 1300	Population in 1800	Surviving children per woman
Norway	0.4	0.88	2.095
Southern Italy	4.75	7.9	2.061
France	17	27.2	2.056
England	5.8	8.7	2.049
Northern Italy	7.75	10.2	2.033
Iceland	0.084	0.047	1.93

Note: population is given in millions.

The Malthusian Trap

The Reverend Thomas Robert Malthus

The Malthusian Trap



Essay on the Principle of Population, 1798

The Malthusian Trap

A basic but powerful framework was proposed in the late 1700s by Thomas Robert Malthus, built upon two basic principles:

- *"First, That food is necessary to the existence of man."*
- *"Second, That the passion between the sexes is necessary and will remain nearly in its present state."*

The Malthusian Trap

These two basic principles lead to societies being trapped at a particular standard of living. According to Malthus:

> *Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio...This implies a strong and constantly operating check on population from the difficulty of subsistence.*

Explaining Stationary Populations

- One of the key differences between the preindustrial world and the modern world was that population size was pretty much static
- Malthus helps provide a very simple economic argument for why this was the case that we'll try to formalize
- The argument depends on three assumptions about how preindustrial economies worked:
  - Each society had a birth rate increasing with living standards
  - Each society had a death rate decreasing with living standards
  - Living standards decline as population increases

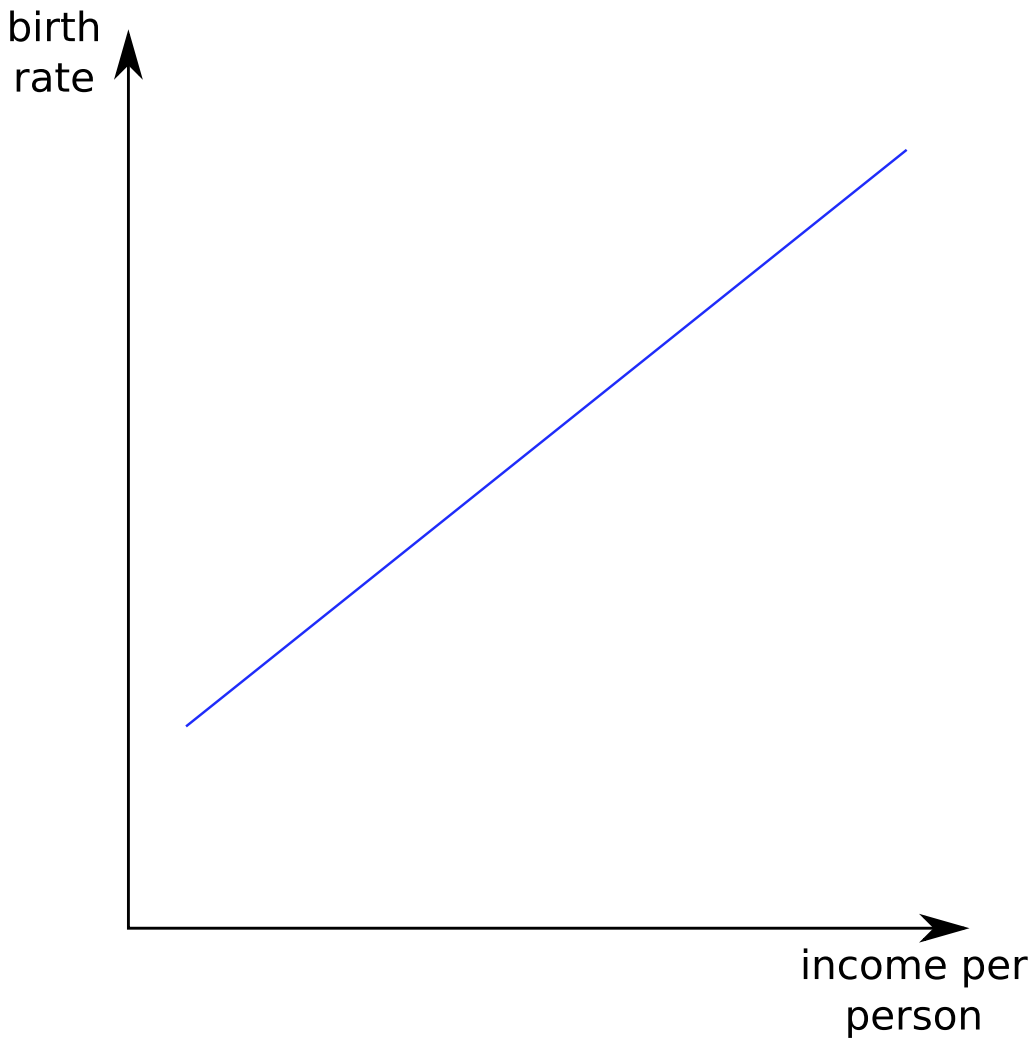
The Birth Rate Schedule

- The birth rate is just the number of births per year per thousand people
- For example, there were 4,059,000 births in the United States in 2000 and the US population was 281,421,906:

$$b_{2000} = \frac{4059000}{\frac{281421906}{1000}} = 14.4$$

- We assume that in the preindustrial world, birth rates rose with material living standards
- Why? A wealthier family could better afford an additional child, a healthier woman was more likely to have a successful pregnancy, ...

The Birth Rate Schedule



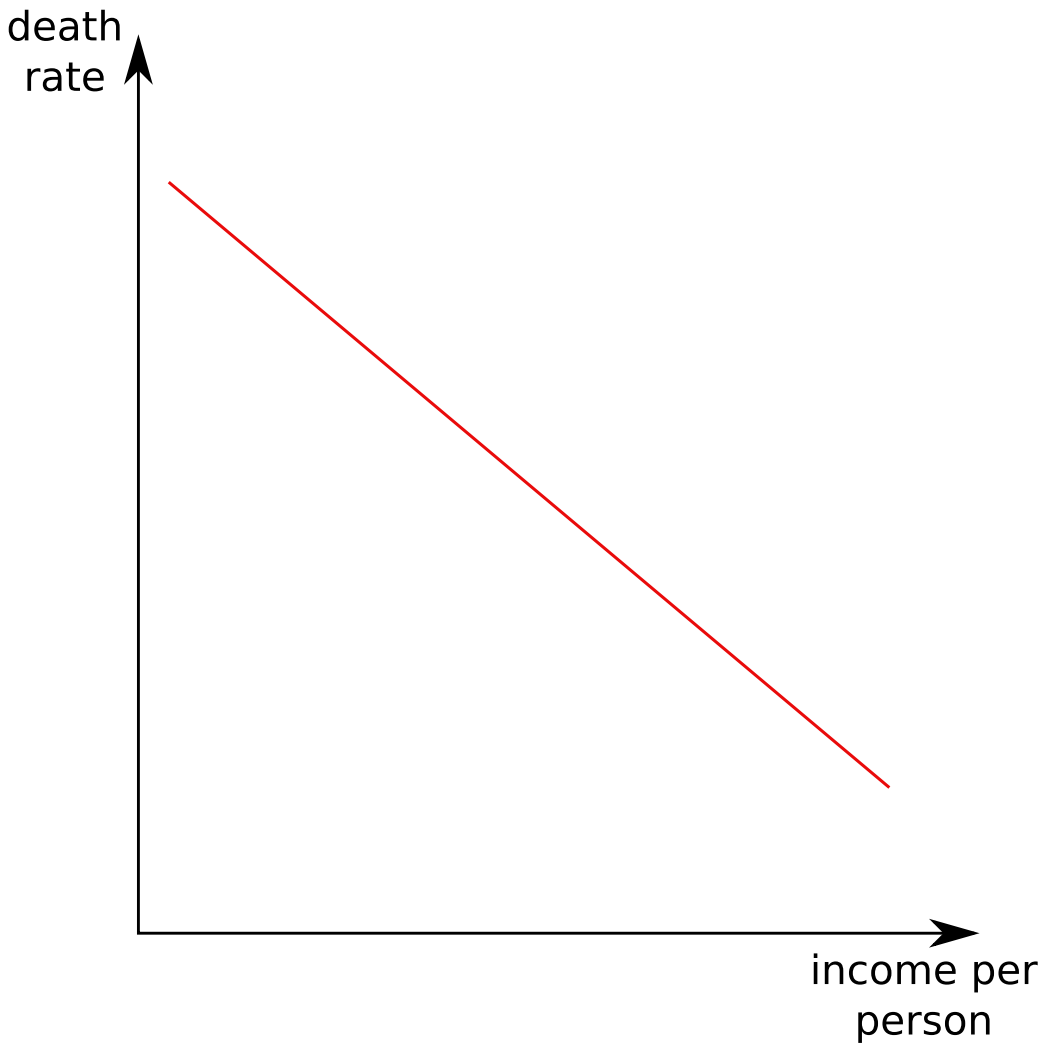
The Death Rate Schedule

- The death rate is just the number of deaths per year per thousand people
- For example, there were 2,403,000 deaths in the United States in 2000 and the US population was 281,421,906:

$$d_{2000} = \frac{2403000}{\frac{281421906}{1000}} = 8.5$$

- We assume that in the preindustrial world, death rates fell with material living standards
- Why? Higher levels of consumption (better food, clothing, shelter, etc.) help you live longer

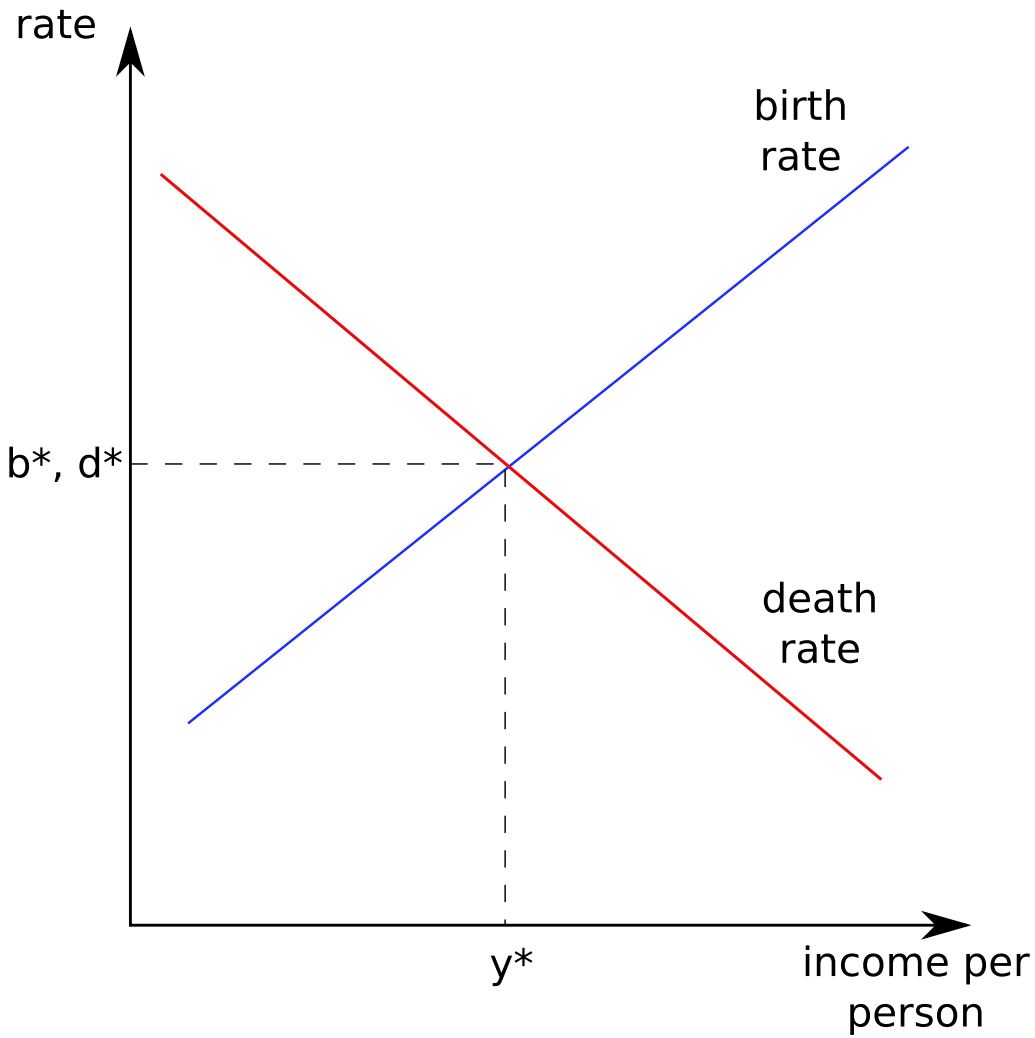
The Death Rate Schedule



Stationary Population

- Notice that for our US figures, the birth rate was 14.4 births per 1,000 people per year and the death rate was 8.5 deaths per 1,000 people per year
- This means that each year, more people are being born than are dying so population must be growing
- Recall that the preindustrial world had almost no population growth
- So in the preindustrial world, the birth rate roughly equaled the death rate (the income per person at which this occurs is called the *subsistence income*)

Stationary Population



Stationary Population

- But why a stationary population?
- Because of the technology curve relating population to income per person
- With some resources fixed (for example land), the marginal product of an extra person is positive but smaller than the marginal product of the previous person
- This means that while total output increases as population increases, it increases at a slower rate than population

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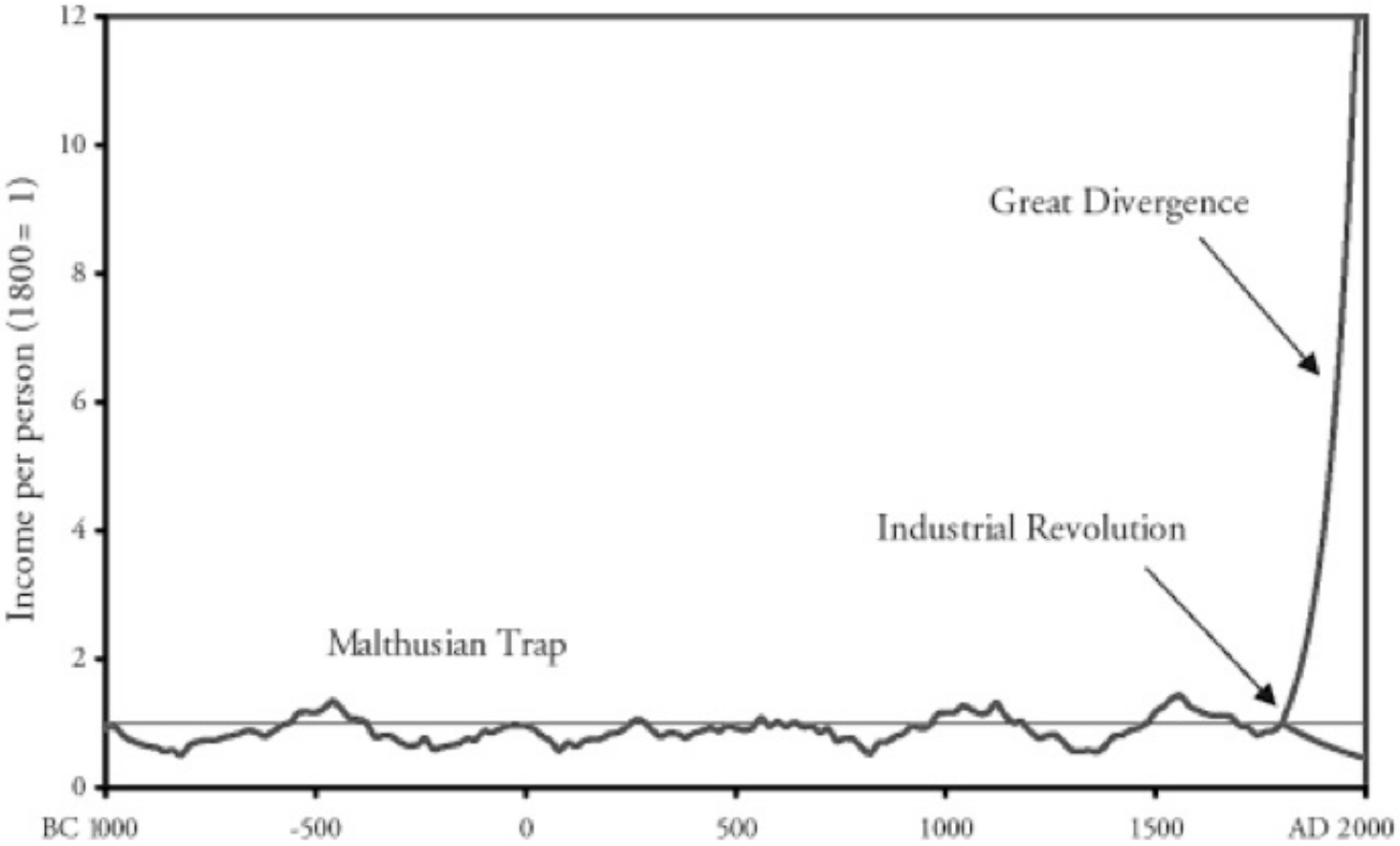
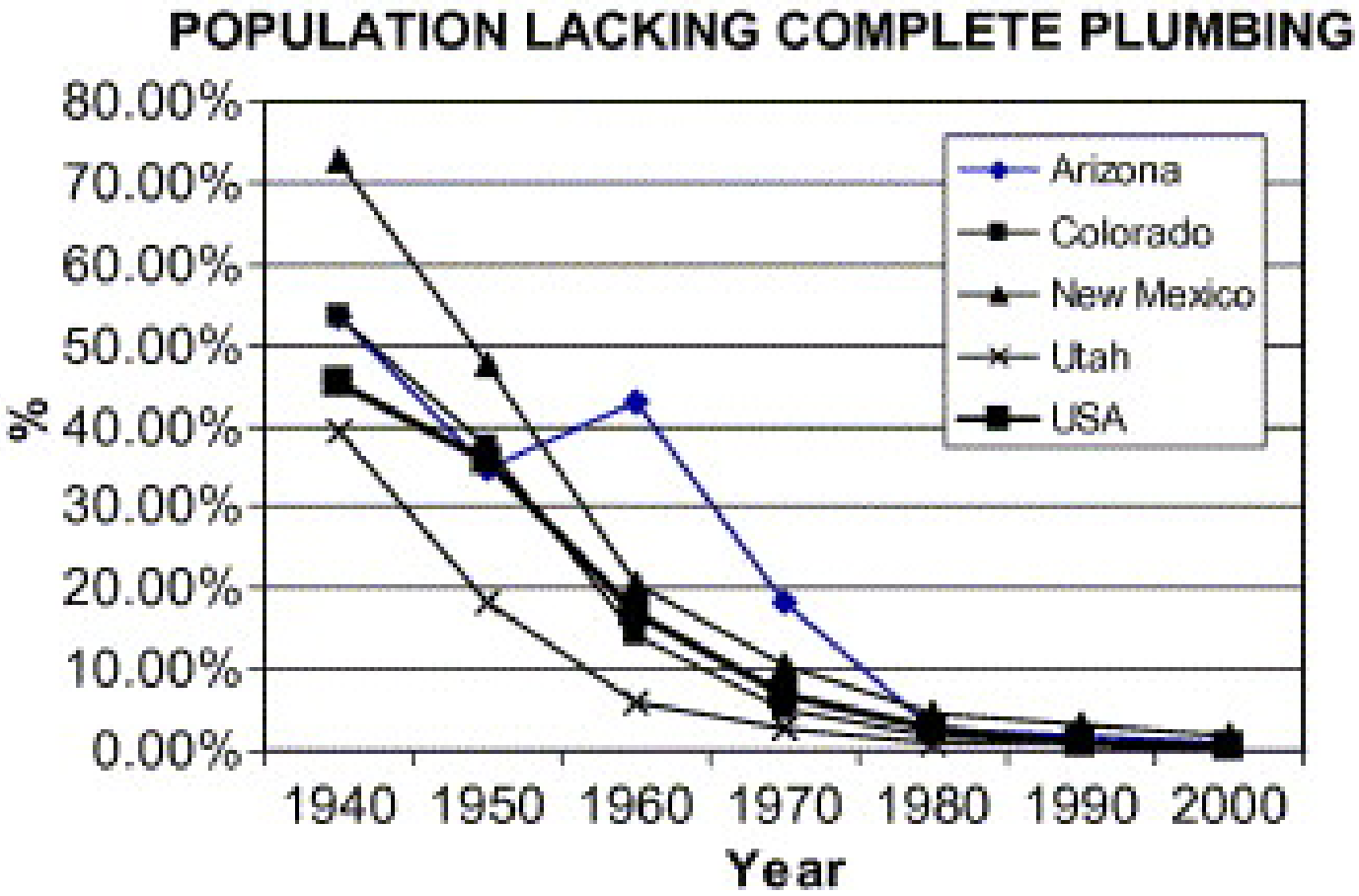
Institutions and Industrialization

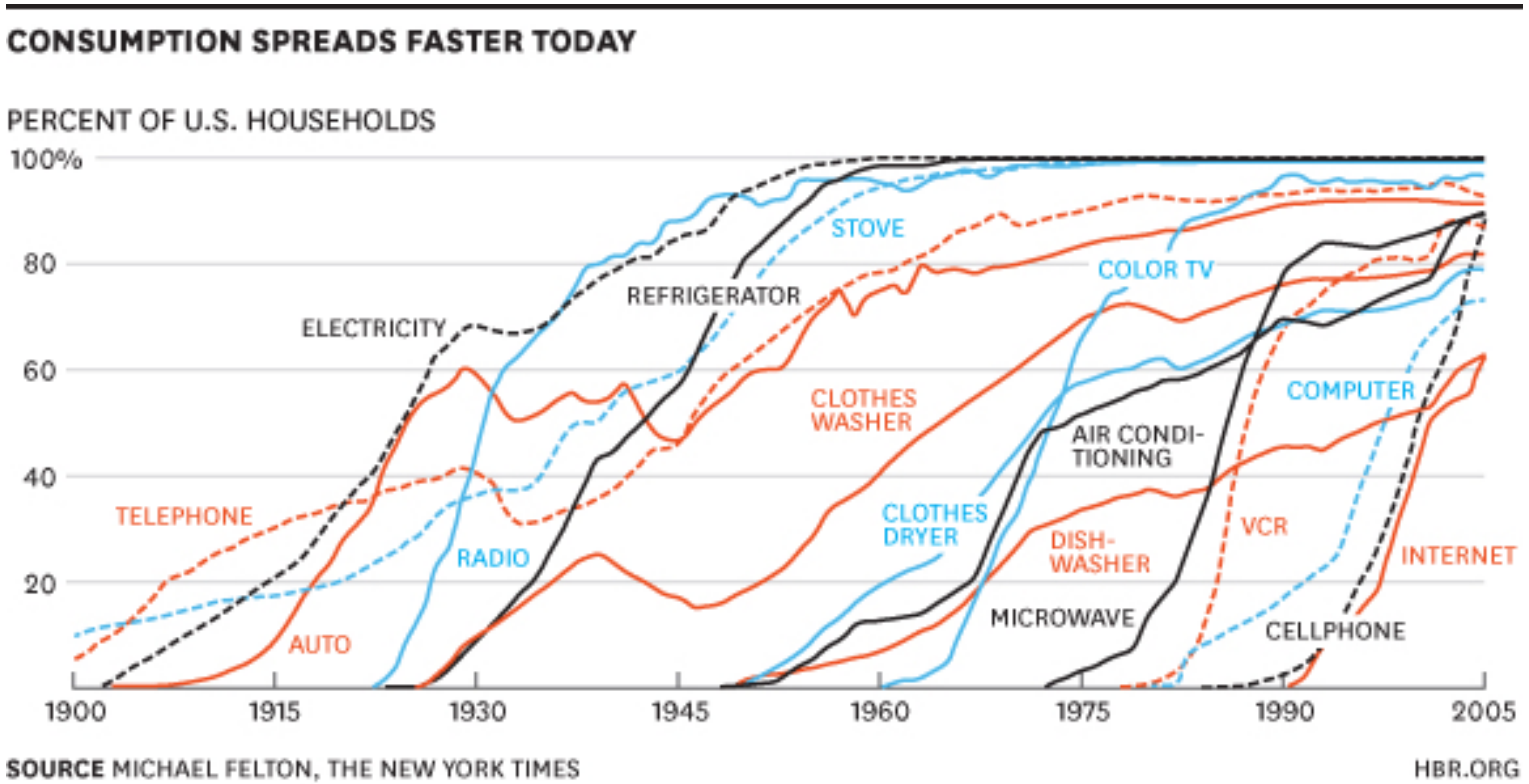


Institutions and Industrialization

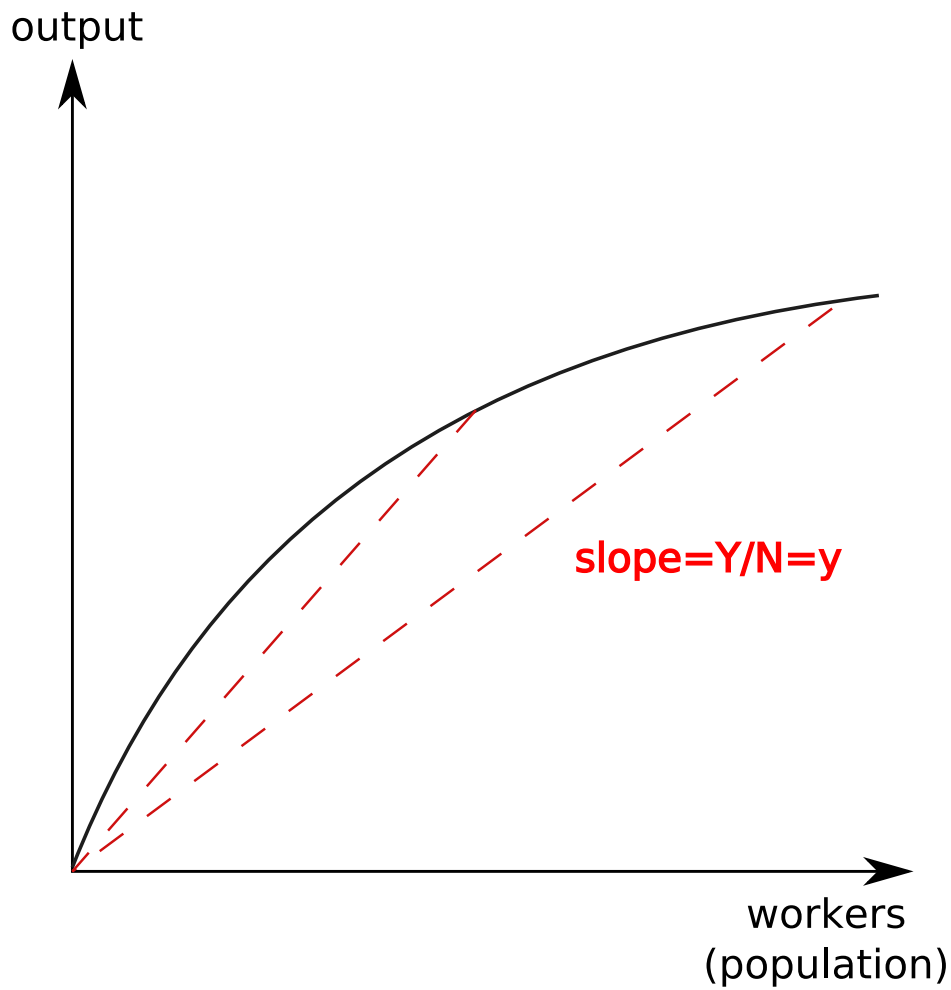


From Wescoat, Headington and Theobald "Water and Poverty in the United States" Geoforum (2007)

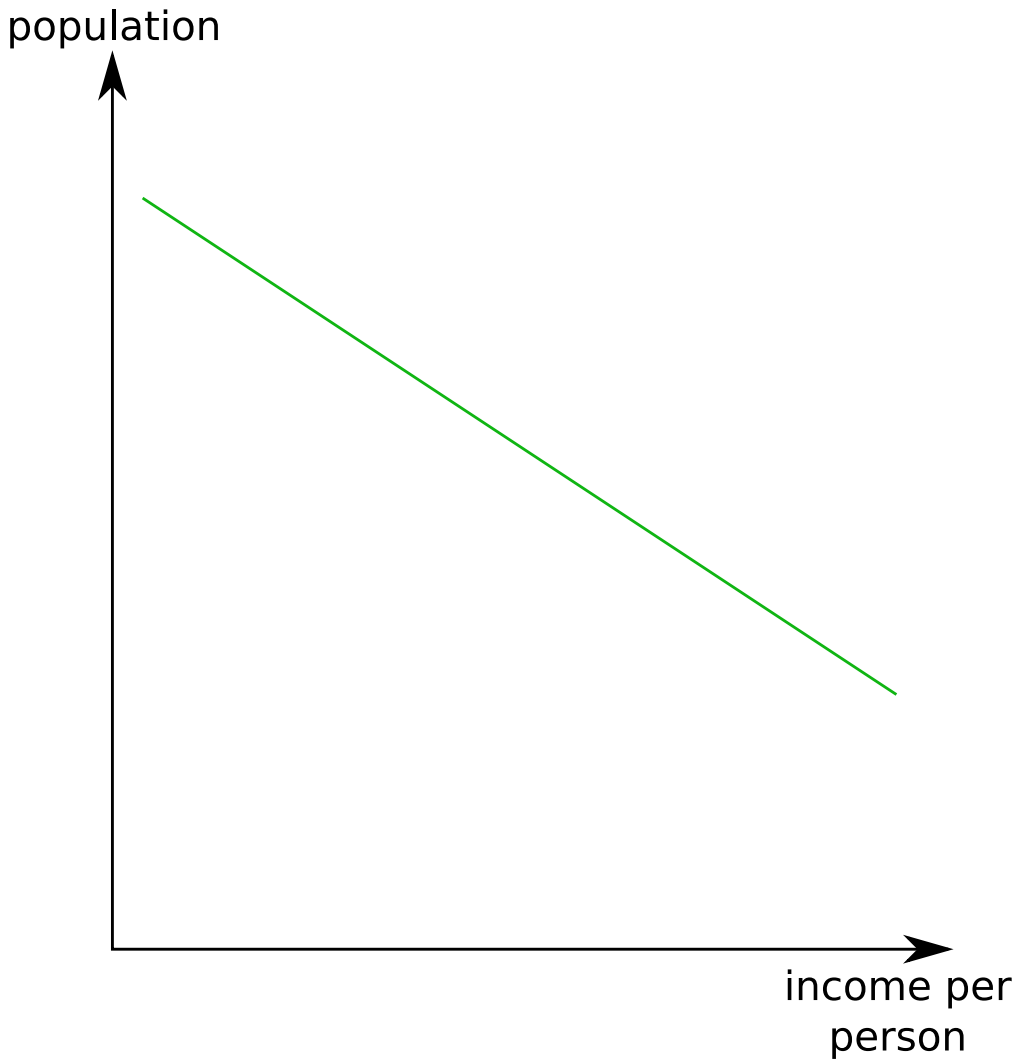
Institutions and Industrialization



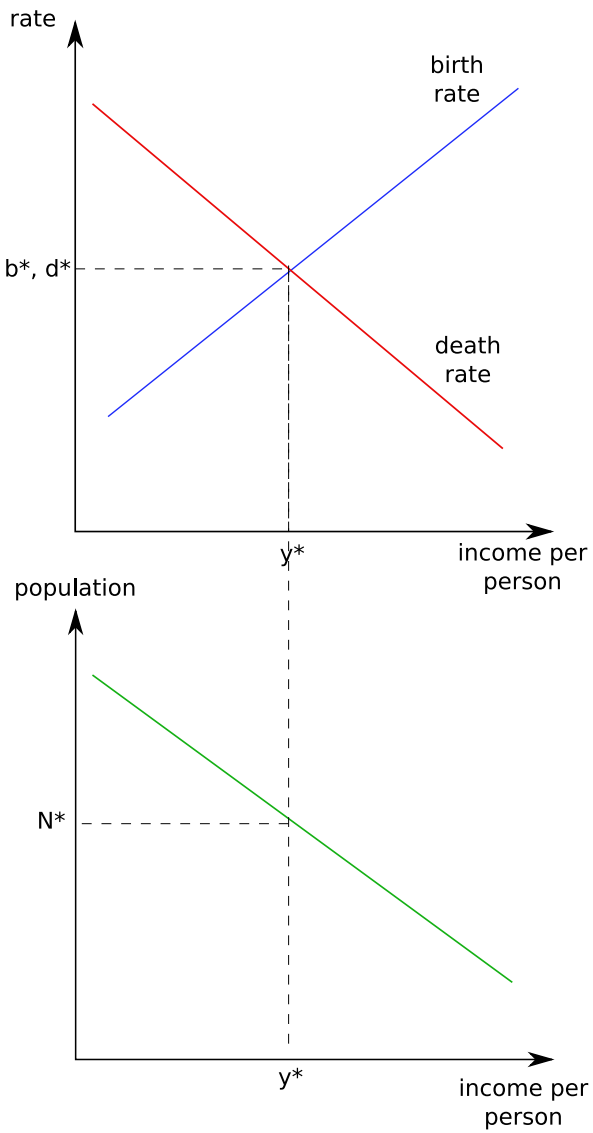
Diminishing Marginal Product of Workers



The Technology Curve



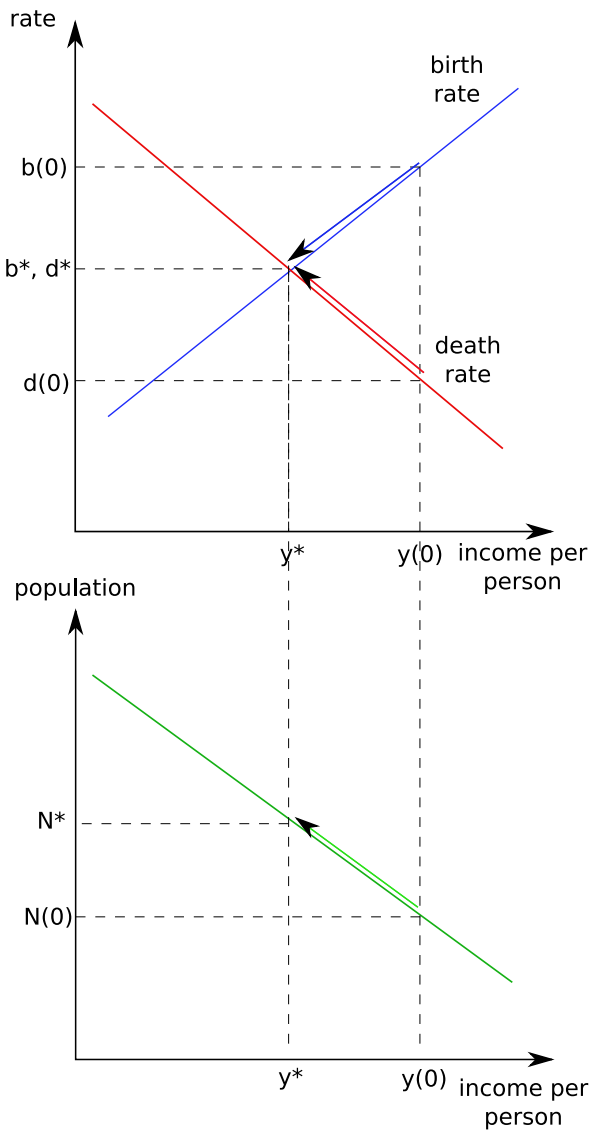
The Malthusian Equilibrium



Moving to the Malthusian Equilibrium

- Suppose we were at an income per person greater than the equilibrium level
- Then births would exceed deaths leading to population growth
- As the population grows, we move up and to the left along the technology curve
- This leads to lower income per person increasing the death rate and decreasing the birth rate
- Things stop moving once the birth rate equals the death rate

Moving to the Malthusian Equilibrium



Moving to the Malthusian Equilibrium

- Notice that equilibrium income per person had nothing to do with the level of technology
- Equilibrium income per person is determined entirely by the birth rate and death rate
- The technology curve mattered for two reasons:
  - The downward slope told us how income per person would change if the population was growing or shrinking
  - The position determined the equilibrium population level

A Coll 300 Twist

- Before digging into the role of technology and why it matters for North and Thomas, let's take a second to think about the birth and death rate curves
- It's differences in these curves that lead to differences in subsistence income across societies
- What can drive these differences?
- Things like disease and warfare are going to have big effects
- But so will a range of social norms and certain types of rituals or ceremonies
- Think about two cases:
  - Ritual and ceremony related to cleanliness
  - Ritual and ceremony related to marriage and children

A Coll 300 Twist

Table 1. Specific indications for hand hygiene according to the most widely represented religions worldwide

Religion	Specific indications for hand hygiene	Reason/purpose
Buddhism	After each meal	Hygienic/cleansing
	To wash the hands of the deceased	Symbolic
	At the new year, young persons pour water over elders' hands	Symbolic
Christianity	Before the consecration of bread and wine	Ritual
	After handling holy oil (Catholics)	Hygienic/cleansing; ritual
Hinduism	During worship (puja) (water)	Ritual
	End of prayer (water)	Ritual
	After any unclean act (toilet)	Hygienic/cleansing
Islam	Repeating ablutions at least 3 times with running water before prayers (5 times/day)	Ritual
	Before and after any meal	Hygienic/cleansing
	After going to the toilet	Hygienic/cleansing
	After touching a dog, shoes, or a cadaver	Hygienic/cleansing
	After handling anything soiled	Hygienic/cleansing
Judaism	Immediately after awakening in the morning	Hygienic/cleansing
	Before and after each meal	Hygienic/cleansing
	Before praying	Ritual
	Before the beginning of Shabbat	Ritual
	After going to the toilet	Hygienic/cleansing
Orthodox	After putting on liturgical vestments before the ceremony	Ritual
Christian	Before the consecration of bread and wine	Ritual
Sikhism	Early in the morning	Hygienic/cleansing
	Before every religious activity	Ritual
	Before cooking and entering the community food hall	Hygienic/cleansing
	After each meal	Hygienic/cleansing
	After taking off or putting on shoes	Hygienic/cleansing

From Allegranzi et al. "Religion and culture: Potential undercurrents in influencing hand hygiene promotion in health care" American Journal of Infection Control (2009)

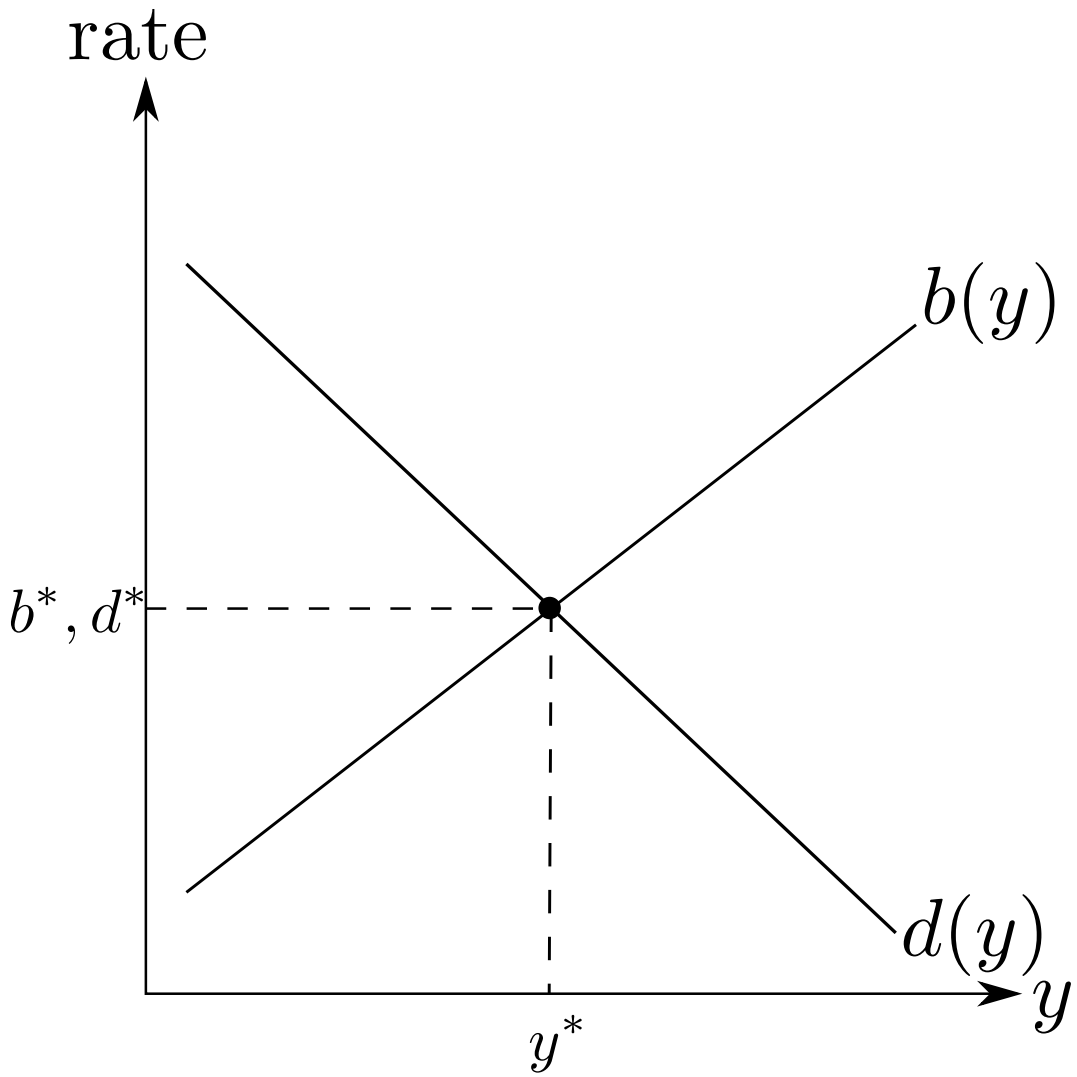
A Coll 300 Twist

Table 2. Alcohol prohibition in some religions

Religion	Alcohol prohibition	Reason for alcohol prohibition	Alcohol prohibition potentially affecting the use of alcohol-based hand rub
Buddhism	Yes	Kills living organisms (bacteria)	Yes, but surmountable
Christianity	No	—	—
Hinduism	Yes	Causes mental impairment	No
Islam	Yes	Causes disconnection from a state of spiritual awareness or consciousness	Yes, but surmountable
Judaism	No	—	—
Orthodox Christian	No	—	—
Sikhism	Yes	Unacceptable behavior disrespectful to the faith; considered an intoxicant	Yes, possibly

From Allegranzi et al. "Religion and culture: Potential undercurrents in influencing hand hygiene promotion in health care" American Journal of Infection Control (2009)

A Coll 300 Twist



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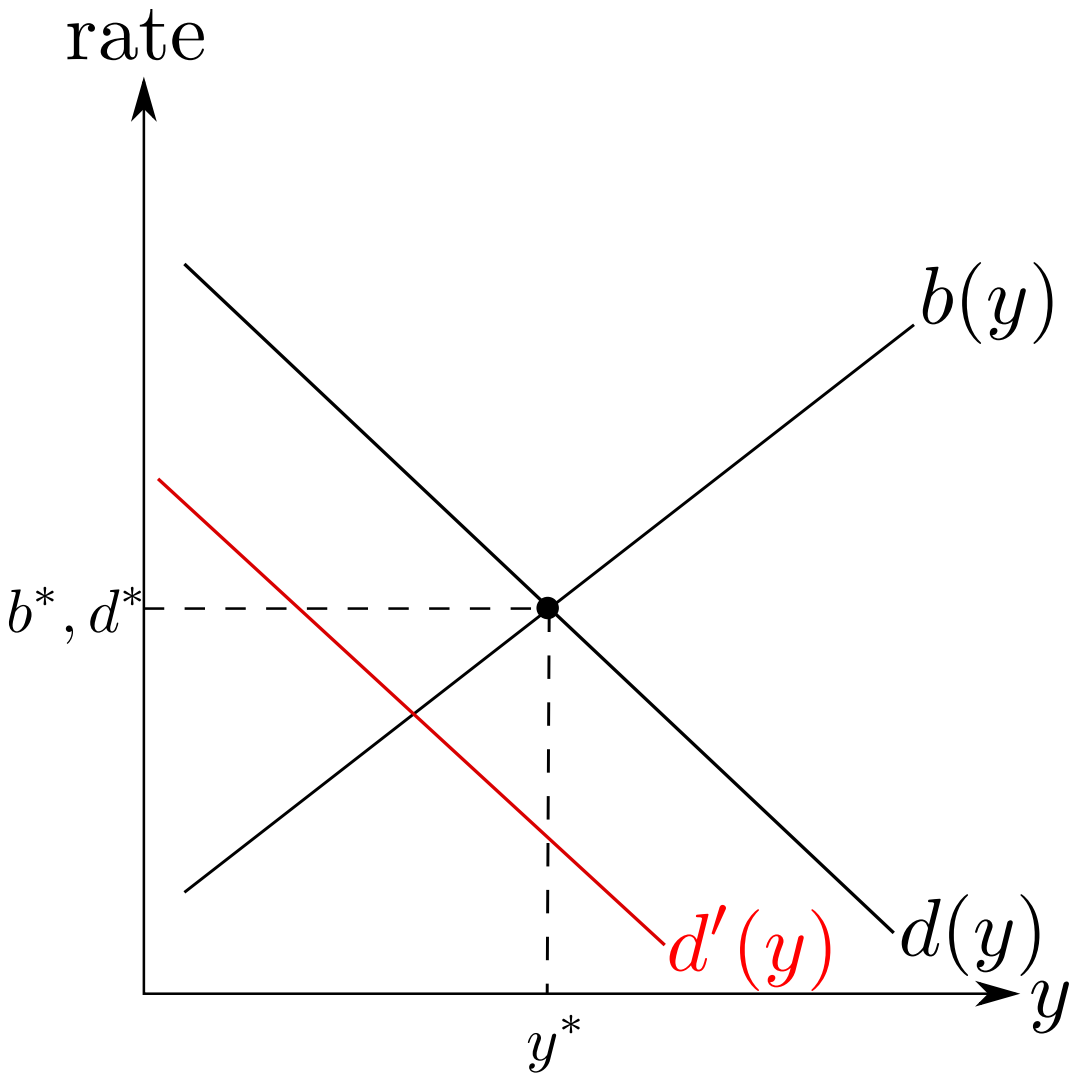

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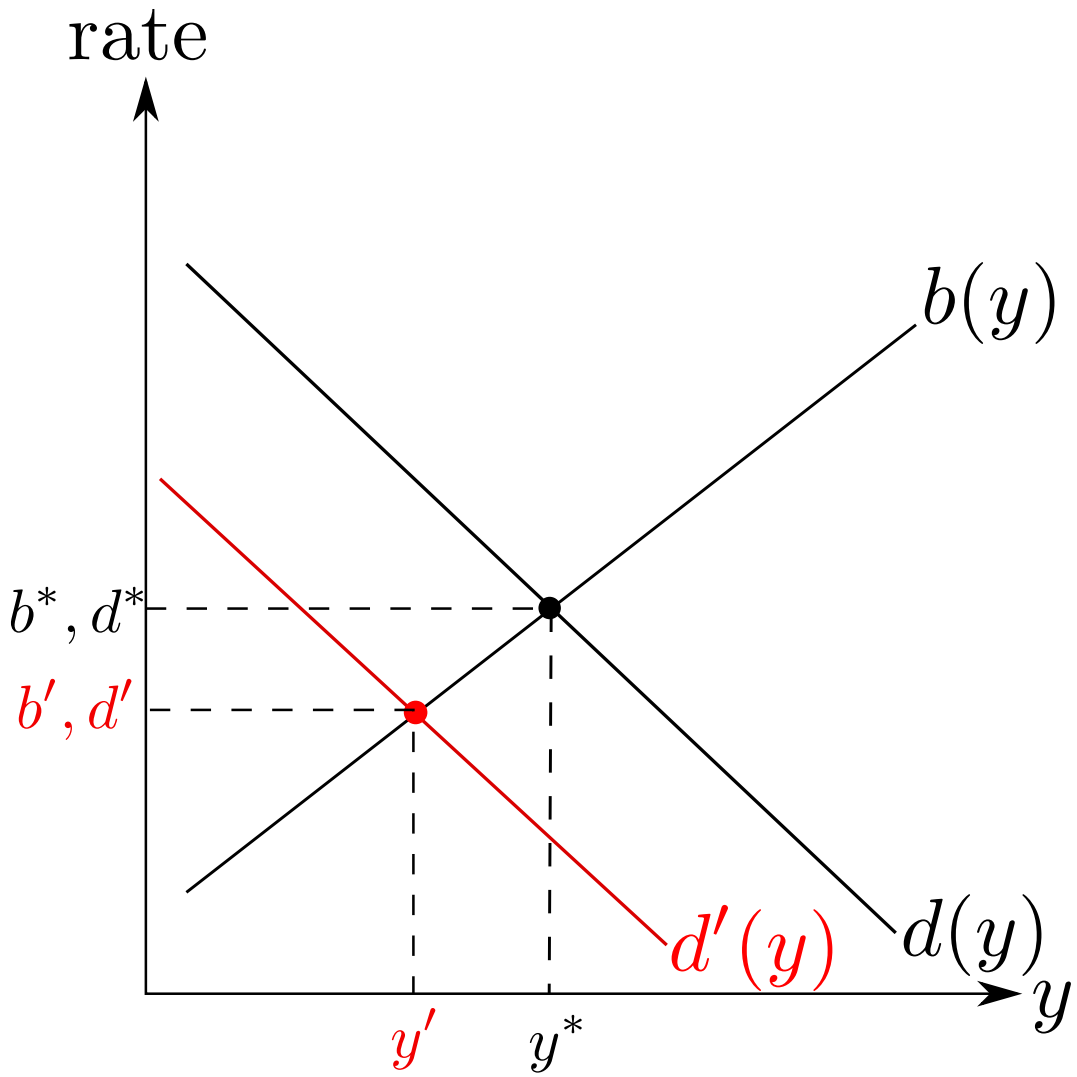

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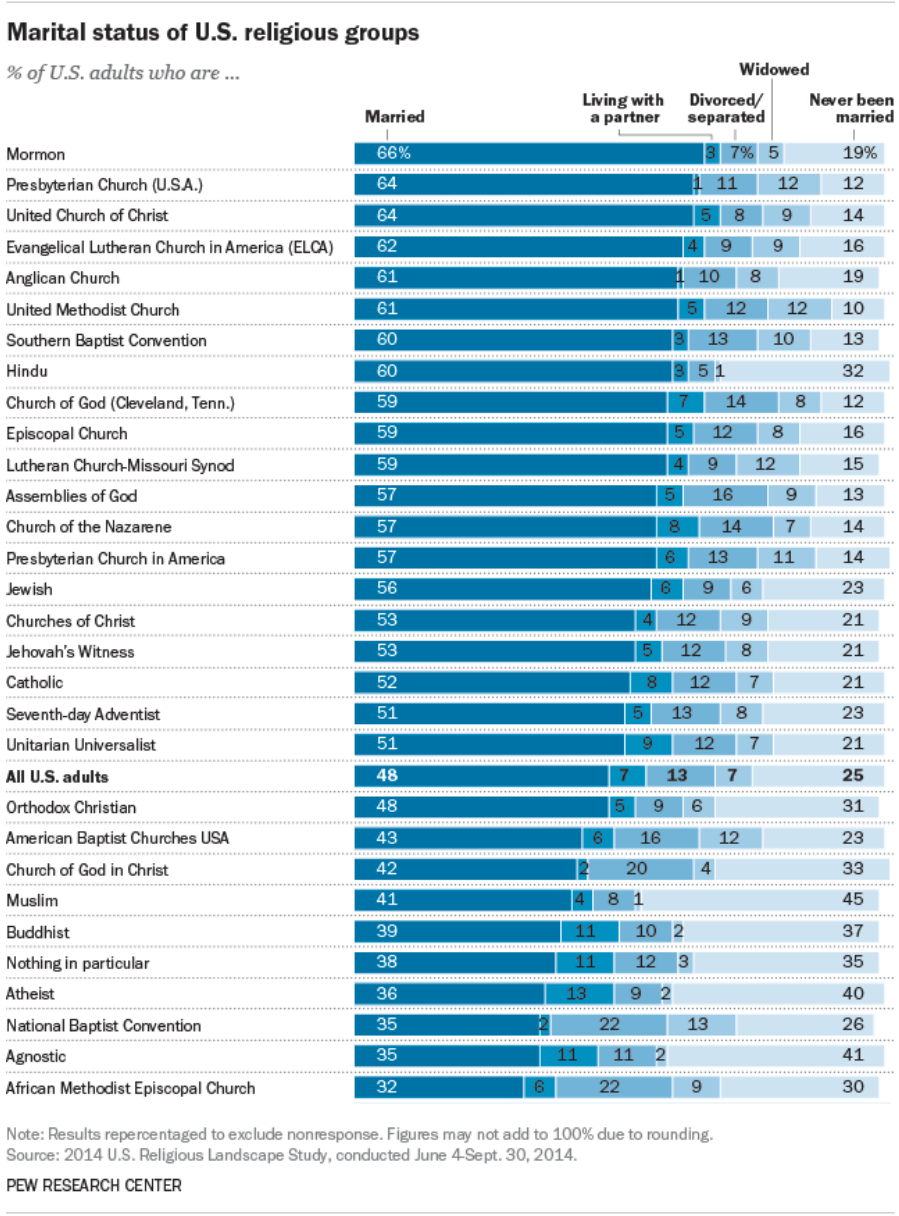

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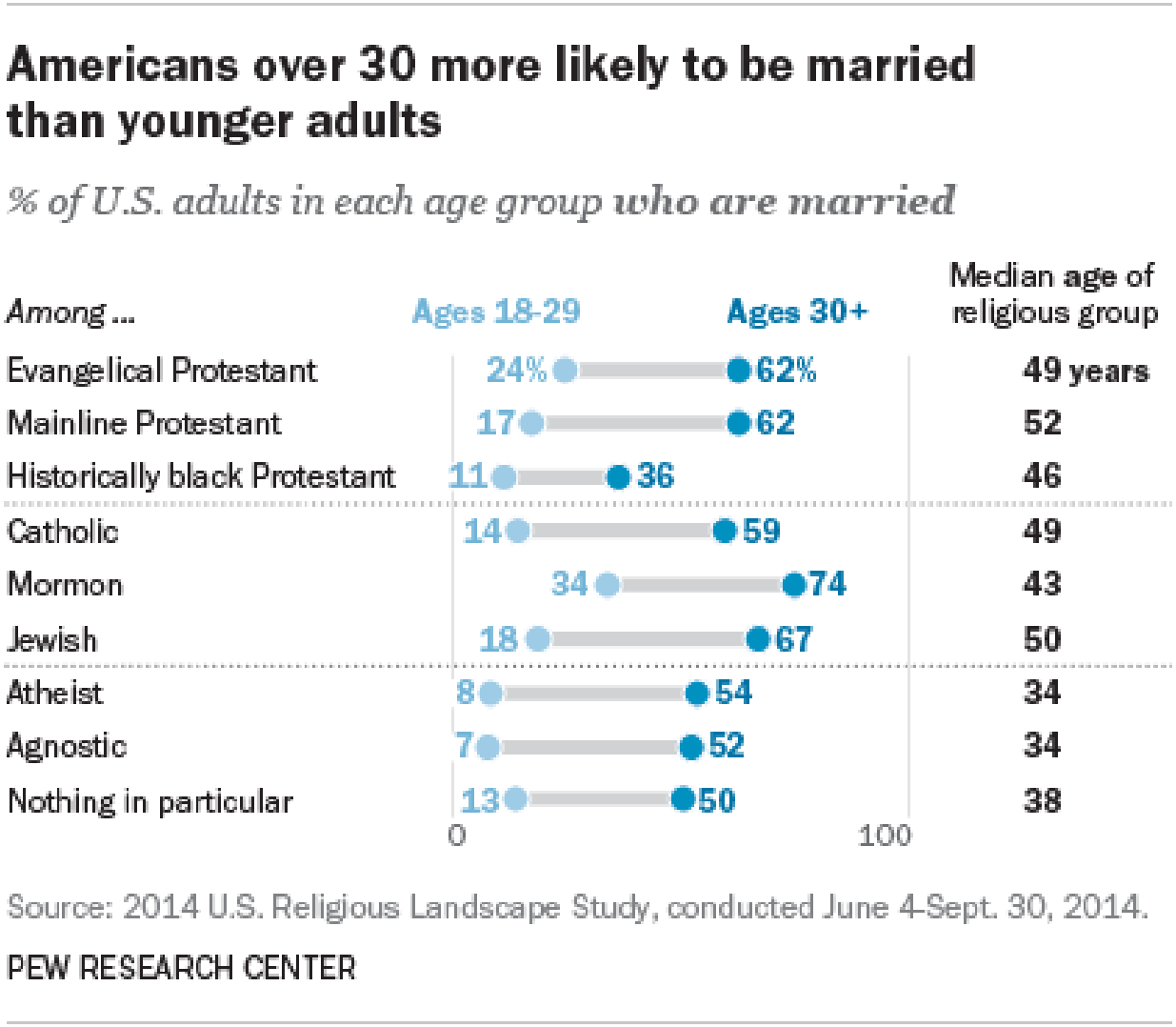

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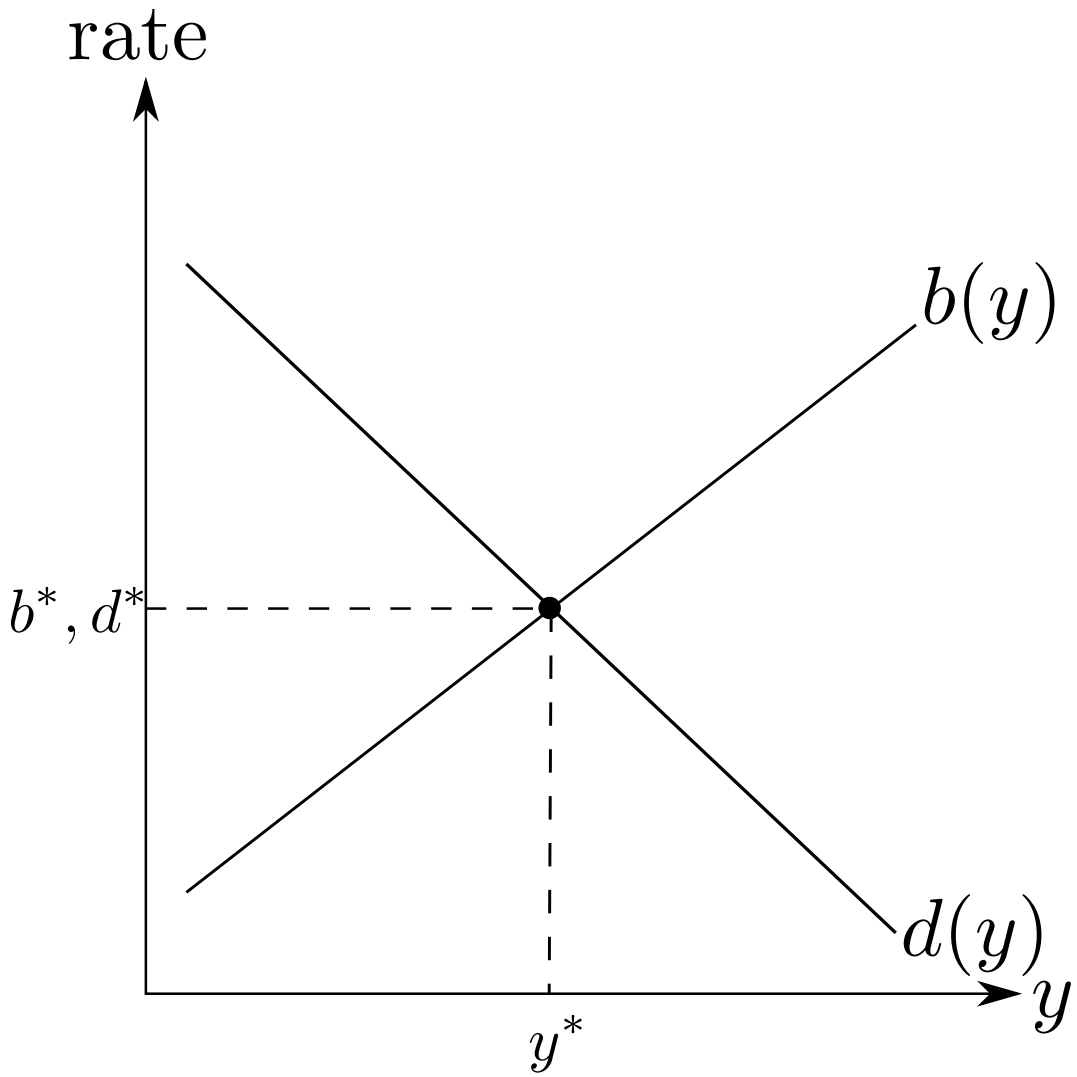

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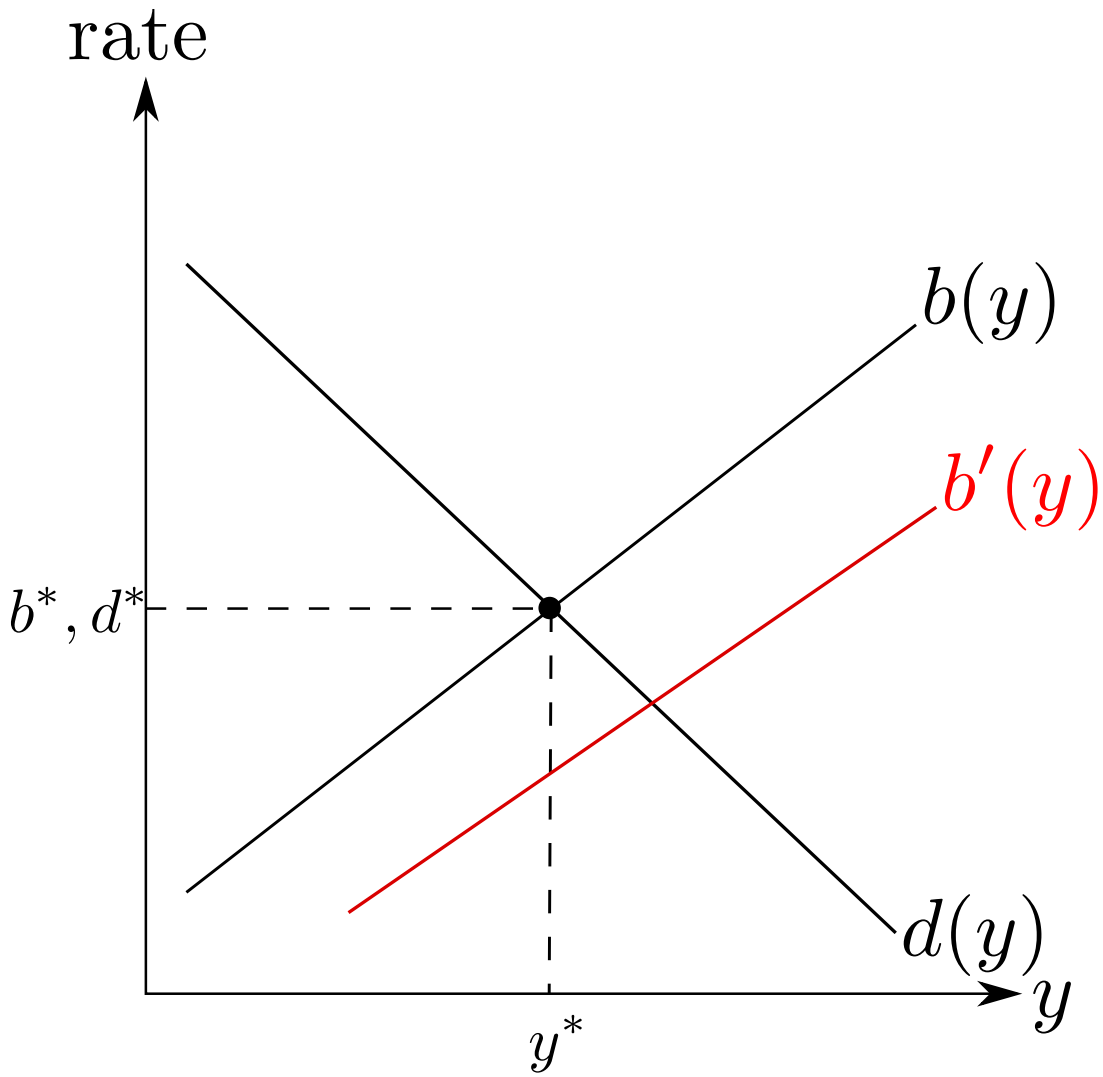

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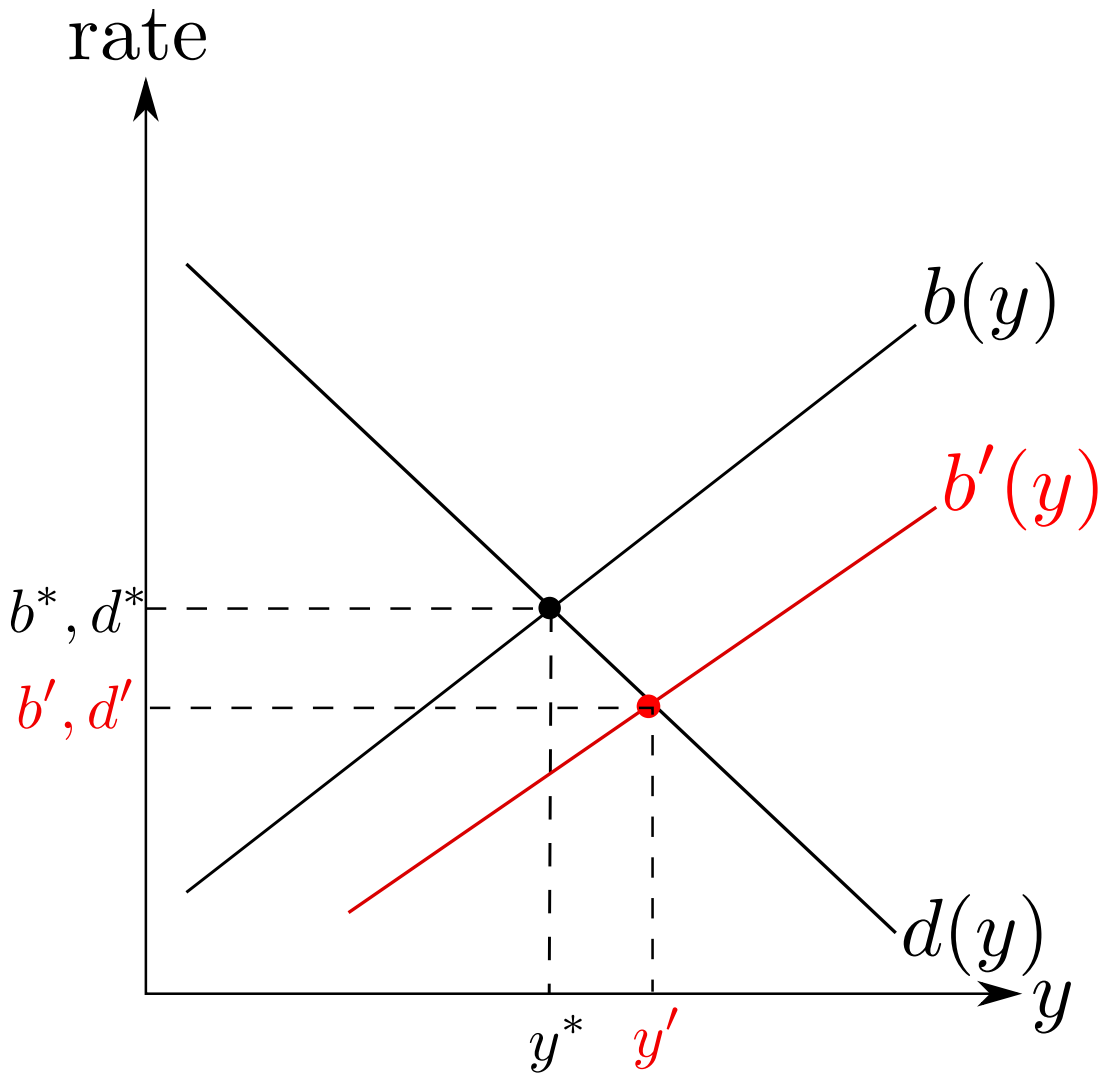


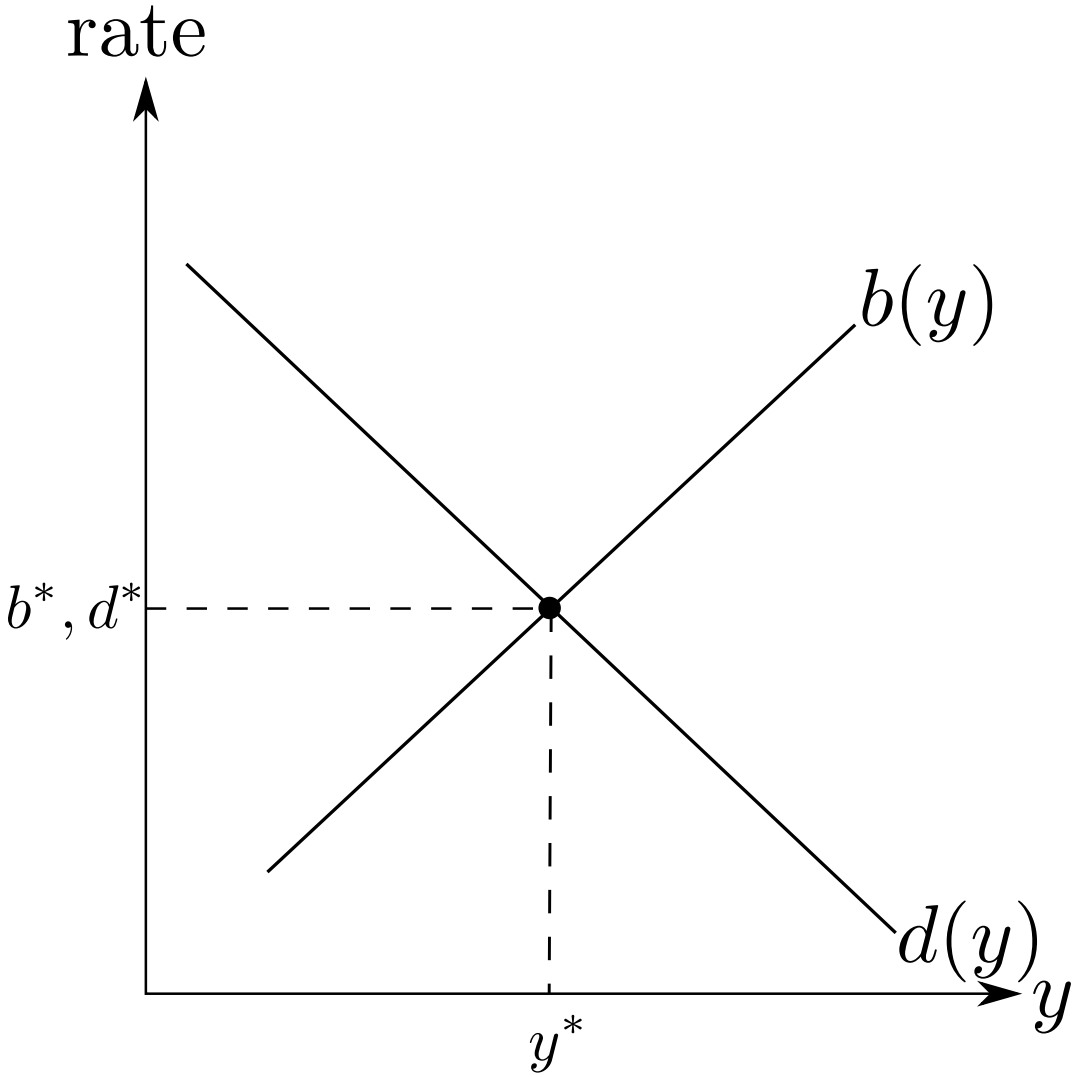
The Effects of a Change in Technology

Back to technology, suppose that there is an improvement in technology (we invent the wheel). What happens?

- The advance in technology will shift the technology curve to the right
- In the short run (before population adjusts), this means greater income per person
- Births will rise, deaths will fall and the population will grow
- The economy returns to the old income per person only at a new higher population

So an improvement in technology can allow for greater population density but doesn't improve average income per person

The Effects of a Change in Technology



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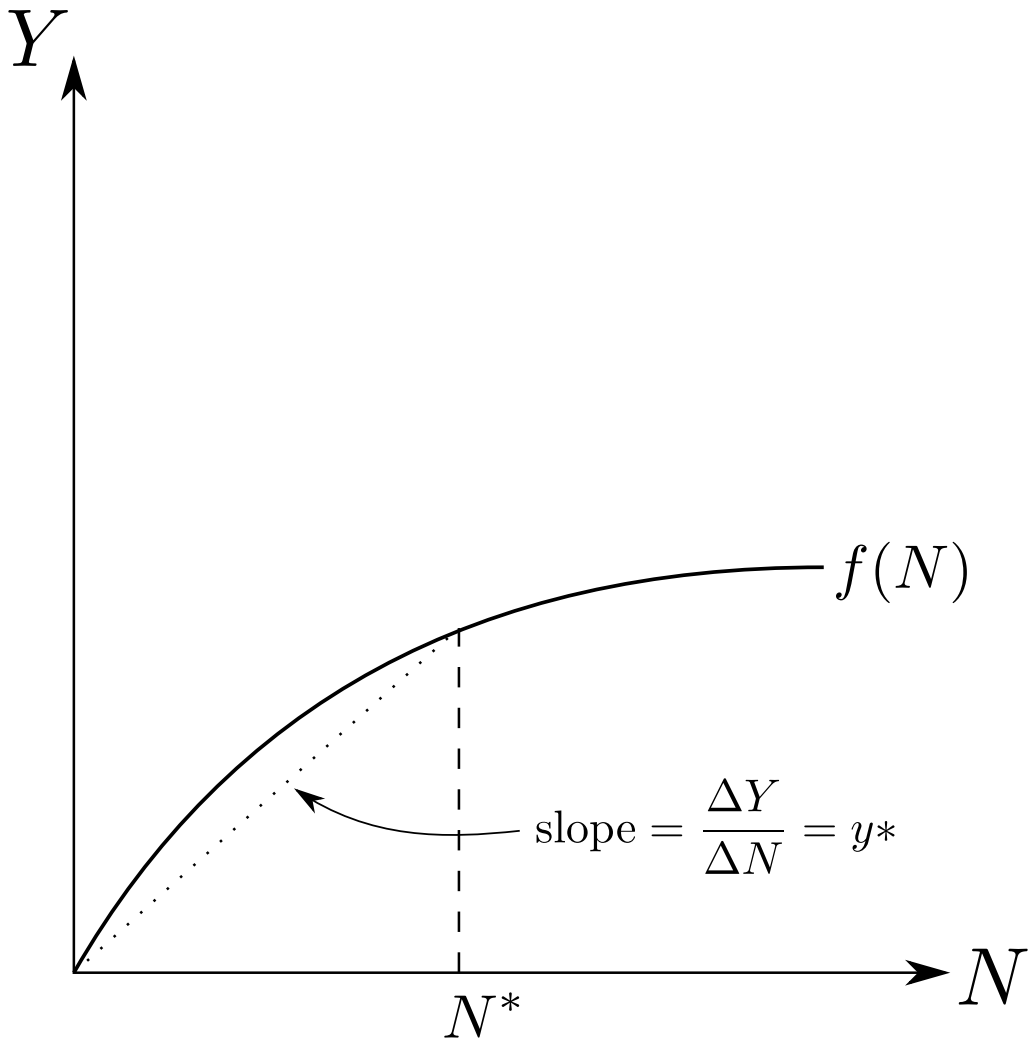

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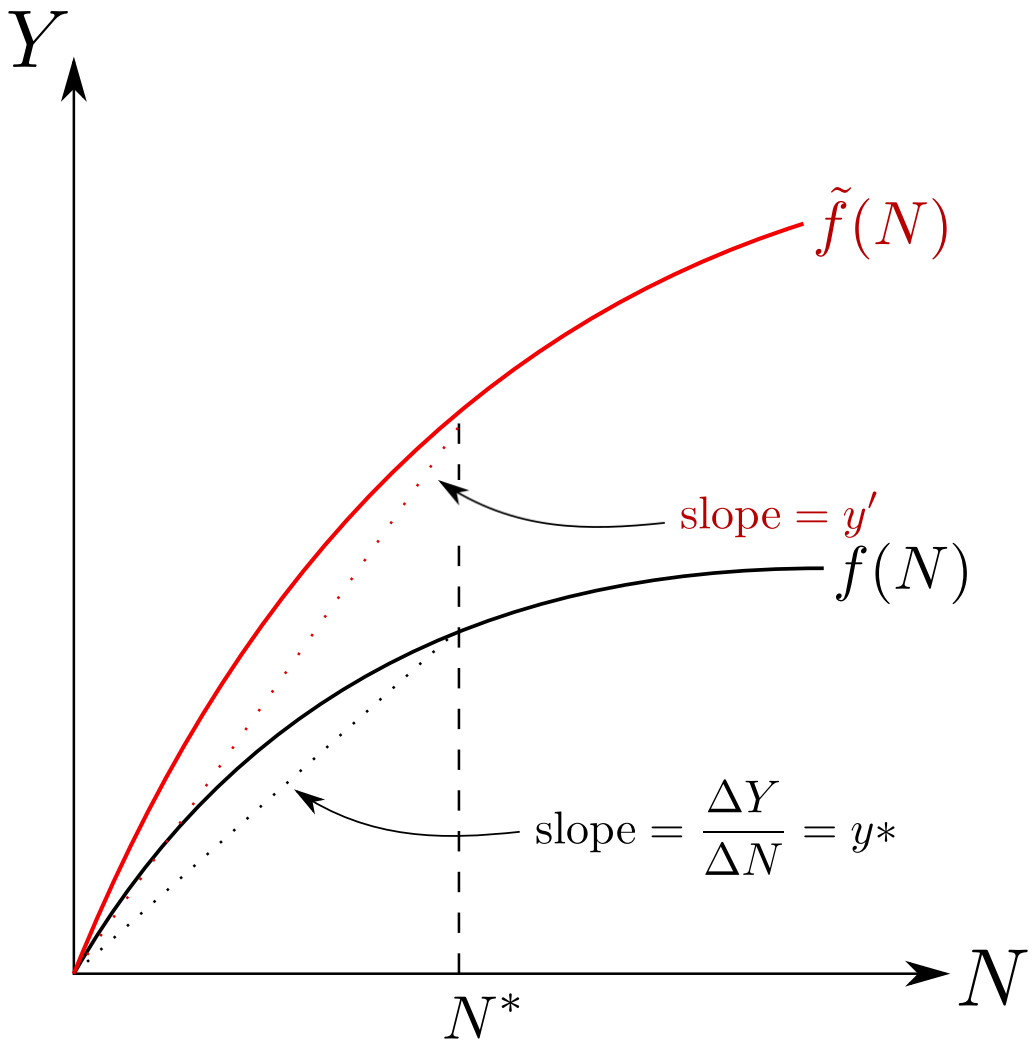

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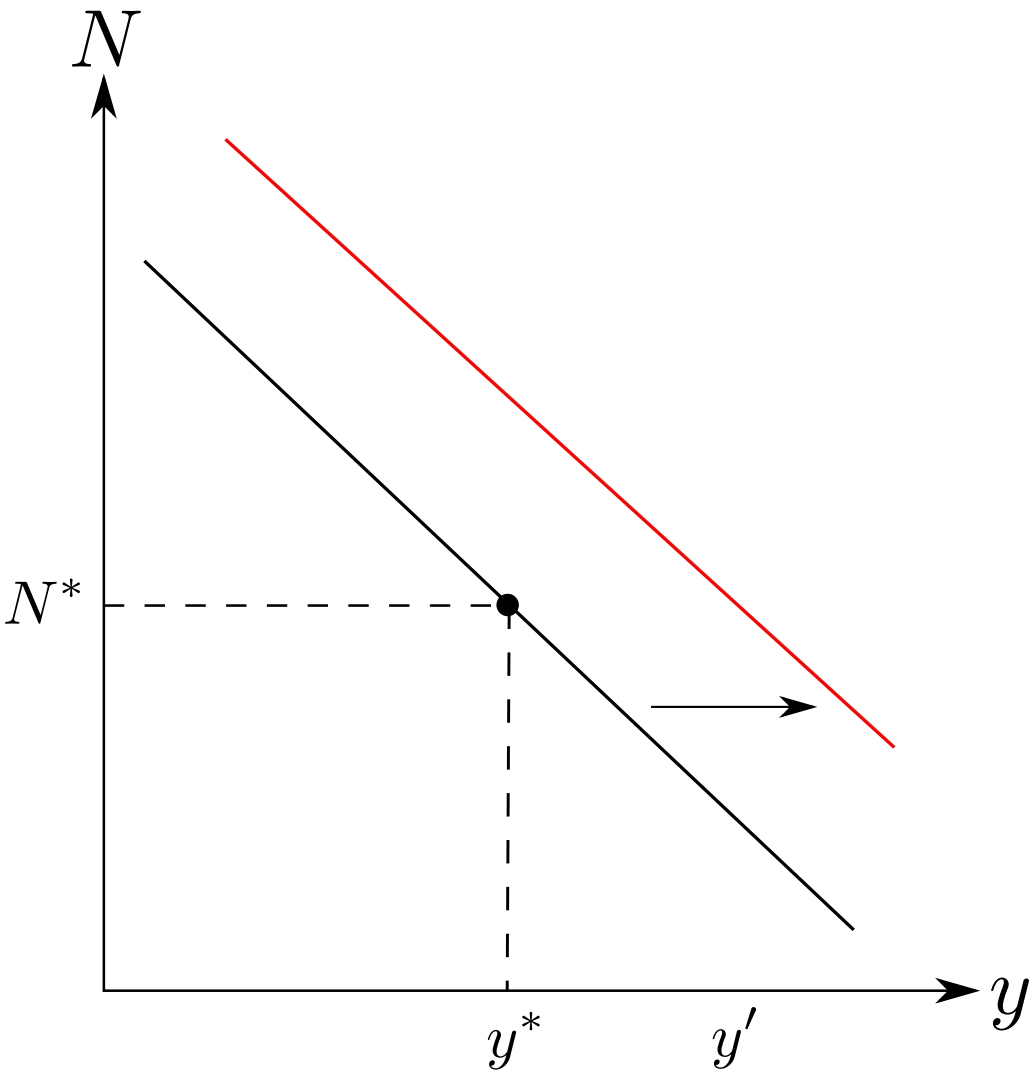

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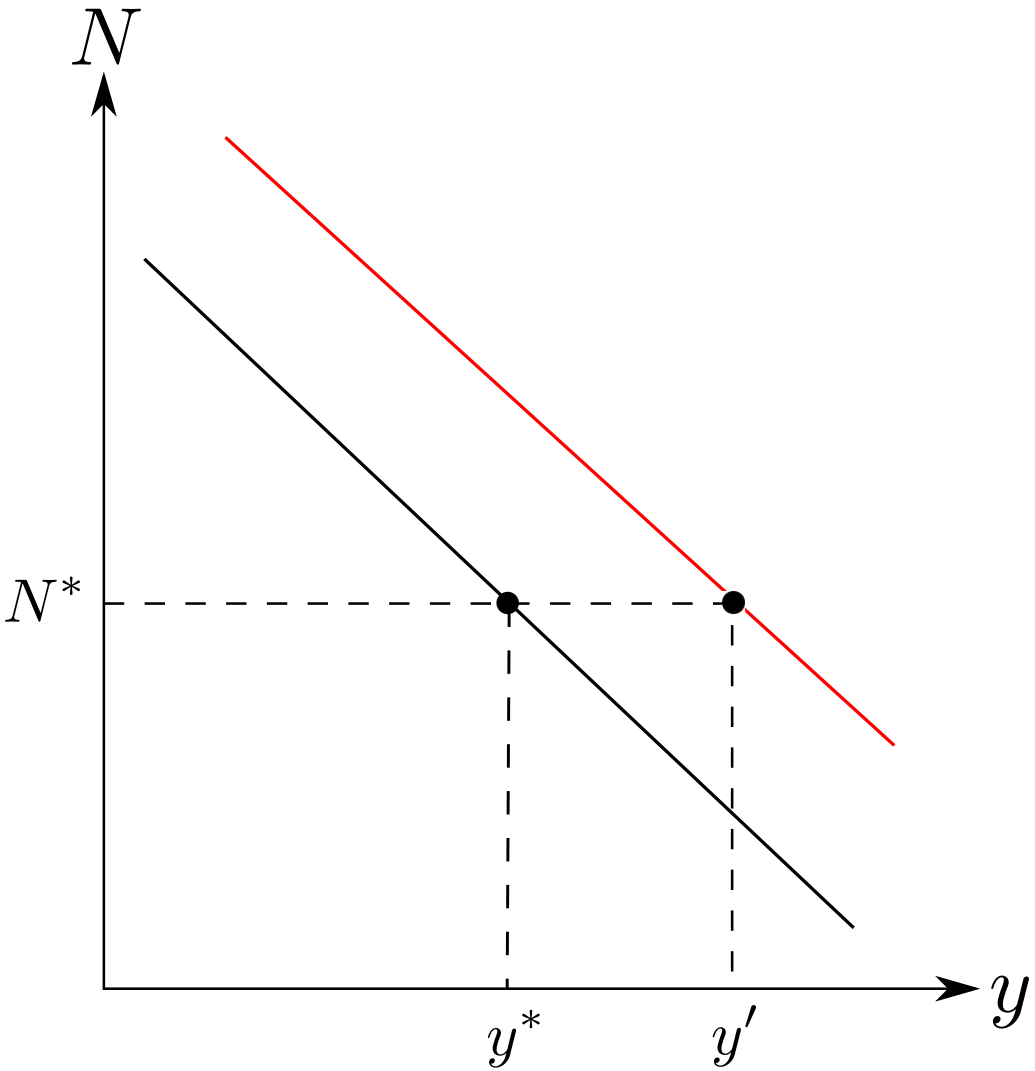

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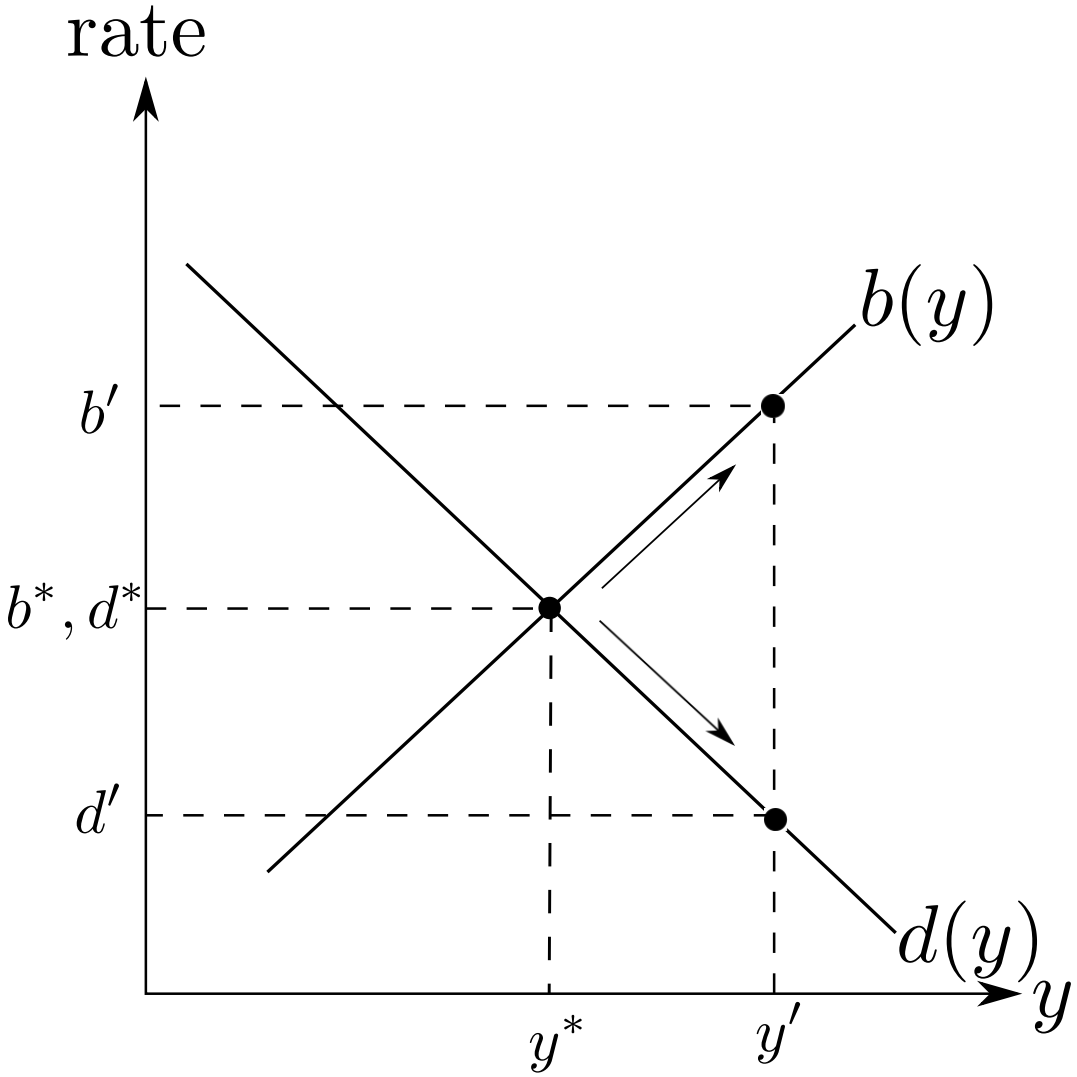

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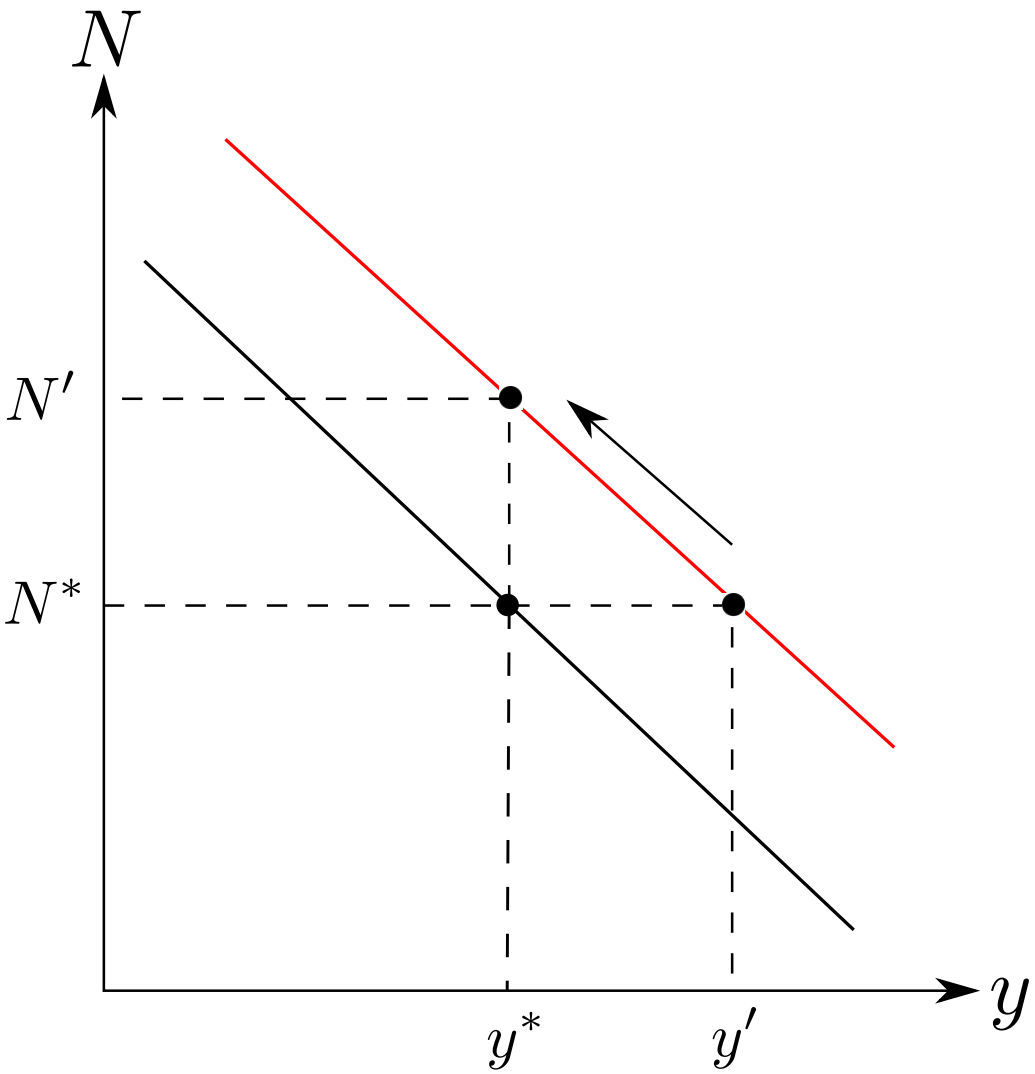

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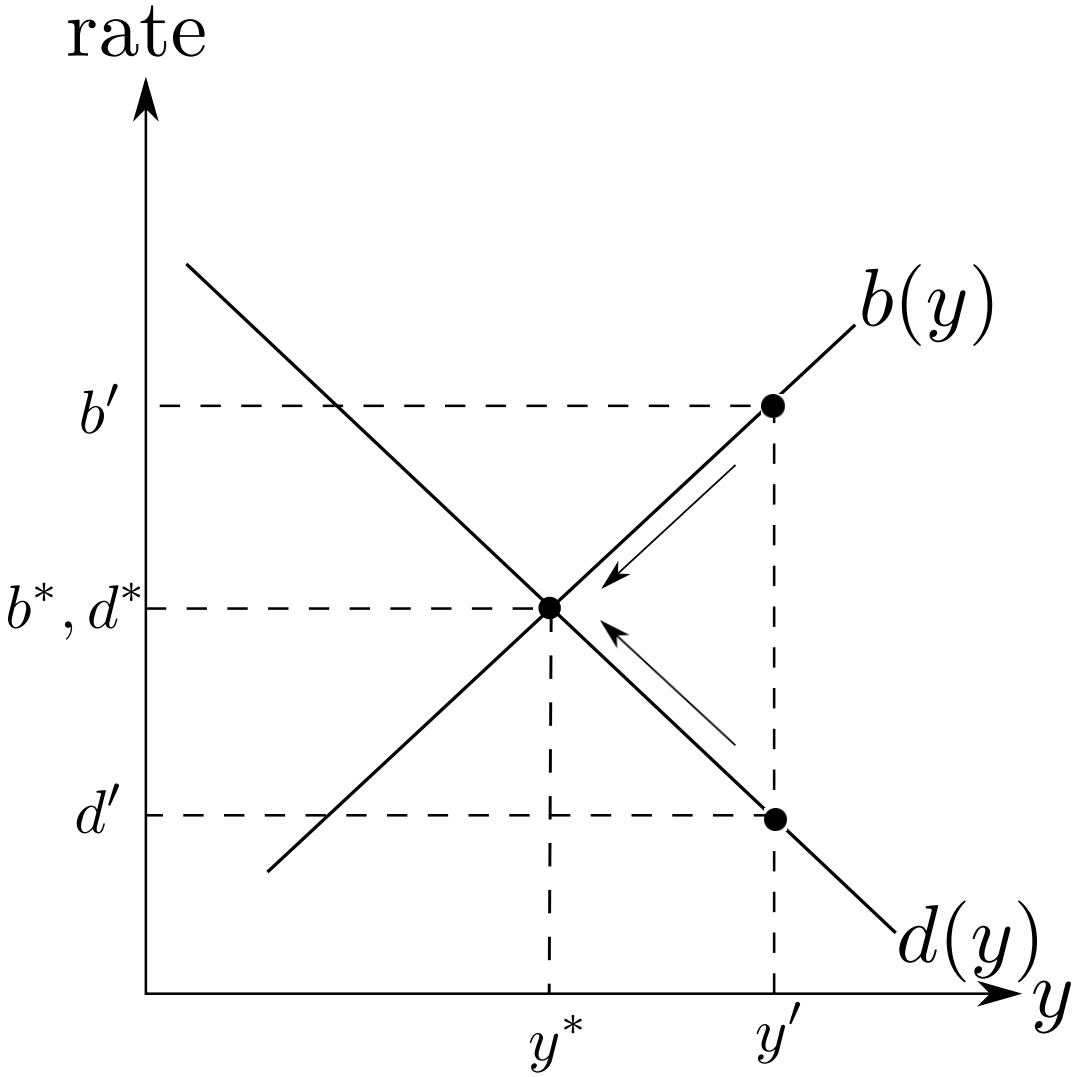
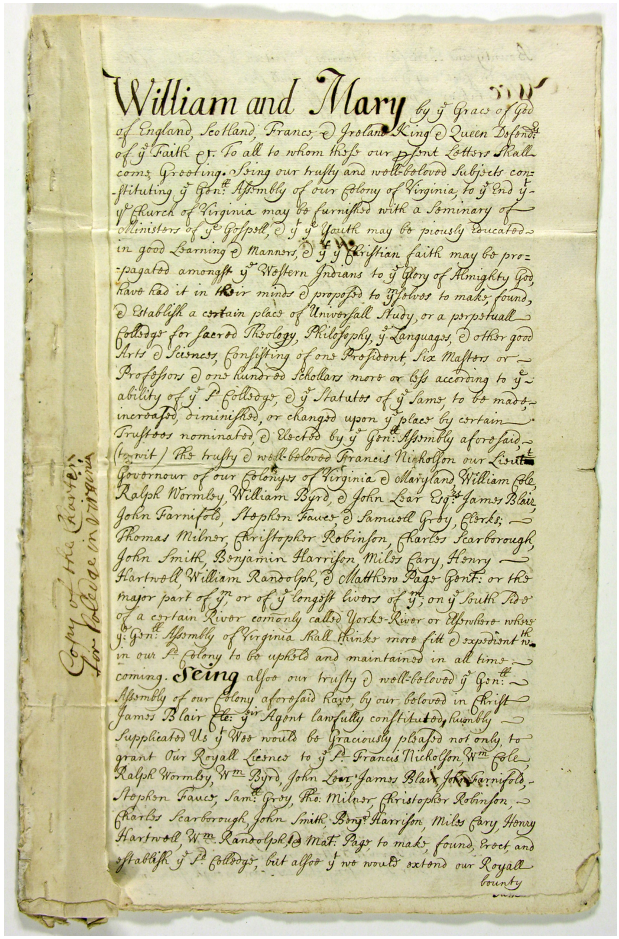


North and Thomas on the Malthusian Trap

- Now let's bring this back to North and Thomas
- Remember their characterization of the pre-industrial world
  - abundant land of good quality available for colonization and settlement
  - workers were a relatively scarce factor of production
  - small volumes of trade, mostly local exchange
  - long distance trade was based on differentials in resource endowments
  - rate of innovative activity was very low
- Where does our simple Malthusian theory fit in?

Another Coll 300 Moment



William and Mary by ye Grace of God
of England, Scotland, France & Ireland King & Queen Defend.rs
of ye Faith &c. To all to whom these our present Letters shall
come Greeting. Being our trusty and well-beloved Subjects con-
stituting ye Gen.ll Assembly of our Colony of Virginia, to ye End ye
ye Church of Virginia may be furnished with a Seminary of
Ministers of ye Gospell, & ye Youth may be piously educated
in good Learning & Manners, & ye Christian faith may be pro-
pagated amongst ye Western Indians to ye Glory of Almighty God
have had it in their minds & proposed to Themselves to make, found,
& Establish a certain place of Universall Study, or a perpetuall
College for sacred Theology, Philosophy, ye Languages, & other good
Arts & Sciences, Consisting of one President, Six Masters or
Professors & one hundred Scholars more or less according to ye
ability of ye sd College, & ye Statutes of ye same, to be made
increased, diminished, or changed upon ye place by certain
Trustees nominated & elected by ye Gen.ll Assembly aforesaid,
(to wit) Ye trusty & well-beloved Francis Nicholson our Lieut.t
Governour of our Colonys of Virginia & Maryland, William Cole,
Ralph Wormley, William Byrd, John Lear Esq.rs James Blair,
John Farnifold, Stephen Fouace & Samuell Gray, Clerks,
Thomas Milner, Christopher Robinson, Charles Scarborough,
John Smith, Benjamin Harrison, Miles Cary, Henry
Hartwell William Randolph, & Matthew Page Gent.n or the
major part of ym or of ye longest livers of ym on ye South Side
of a certain River comonly called Yorke-River or Pamunkey where
ye Gen.ll Assembly of Virginia shall think most fit & expedient to
in our sd colony to be upheld and maintained in all time
coming. Being also our trusty & well-beloved ye Gen.ll
Assembly of our Colony aforesaid have, by our beloved in Christ
James Blair Clerk ye Agent lawfully constituted, humbly
Supplicated Us ye Same would be Graciously pleased not only to
grant Our Royall Licence to ye sd Francis Nicholson, Wm Cole,
Ralph Wormley, Wm Byrd, John Lear, James Blair, John Farnifold,
Stephen Fouace, Sam.l Gray, Rich. Milner, Christopher Robinson,
Charles Scarborough, John Smith, Benj.a Harrison, Miles Cary, Henry
Hartwell, Wm Randolph & Matt. Page to make, found, erect, and
establish ye sd College, but also ye we would extend our Royall
bounty

Sir Edmund Andros copy of the College of William and Mary Charter, circa 1693

Another Coll 300 Moment

Image from the Flathat, January 22, 2018

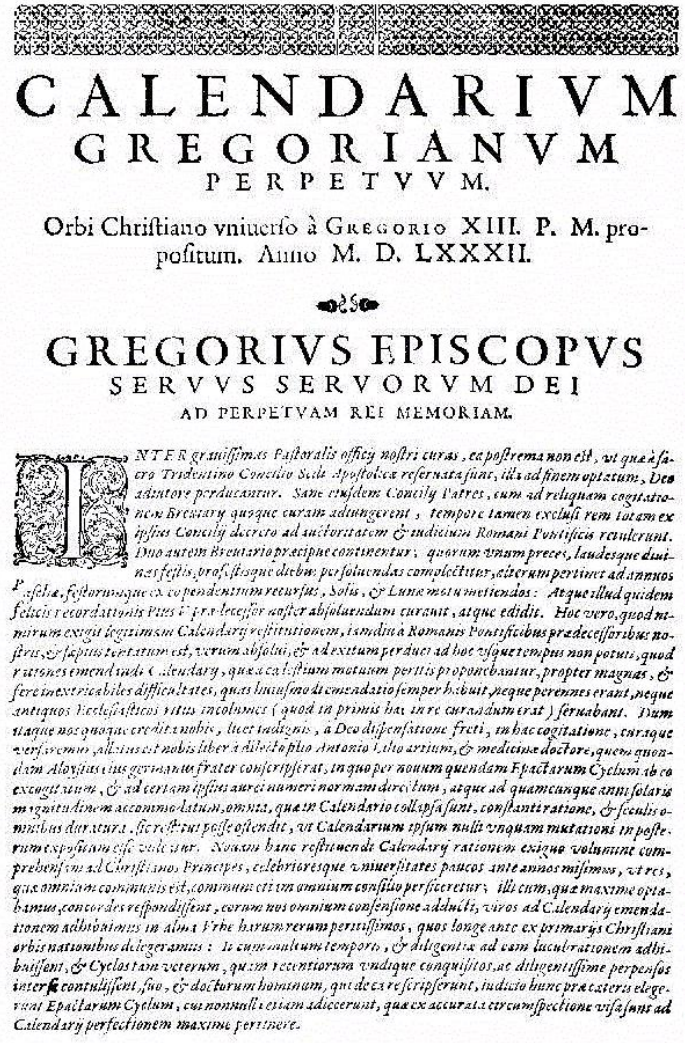
Charter Day is Feb. 8th, or is it?

La clémence de César, Abel de Pujol, 1808

Charter Day is Feb. 8th, or is it?

Portrait of Pope Gregory XIII, 16th century

Charter Day is Feb. 8th, or is it?



CALENDARIVM
GREGORIANVM
PERPETVVM.

Orbi Christiano vniuerso à GREGORIO XIII. P. M. propositum. Anno M. D. LXXXII.

GREGORIVS EPISCOPVS
SERVVS SERVORVM DEI
AD PERPETVAM REI MEMORIAM.

INTER grauissimas Pastoralis officij nostri curas, ea postrema non est, vt quæ à sacro Tridentino Concilio Sede Apostolica reseruata sunt, illa ad finem optatum, Deo adiutore perducantur. Sane eiusdem Concilij Patres, cum ad reliquam cognitionem Breuiary quoque curam adiungerent; tempore tamen exclusi rem totam ex ipsius Concilij decreto ad auctoritatem & iudicium Romani Pontificis remiserunt. Duo autem Breuiario præcipue continentur; quorum vnum preces, laudesque diuinæ festis, profestisque diebus persoluendas complectitur, eiterum pertinet ad annos Paschæ, festorumque ex eo pendentium recursus, Solis, & Lunæ motu metiendos: Atque illud quidem felicis recordationis Pius V. prædecessor noster absoluendum curauit, atque edidit. Hoc vero, quod minimum exigit legitimam Calendarij restitutionem, iamdiu à Romanis Pontificibus prædecessoribus nostris, & sæpius tentatum est, verum absolui, & ad exitum perduci ad hoc vsque tempus non potuit, quod rationes emendandi Calendary, quæ cælestium motuum peritis proponebantur, propter magnas, & fere inextricabiles difficultates, quas huiusmodi emendatio semper habuit, neque perennes erant, neque antiquos Ecclesiasticos ritus incolumes (quod in primis hac in re curandum erat) seruabant. Dum itaque nos quoque credidit nobis, licet indignis, à Deo dispensatione freti, in hac cogitatione, curaque versaremur, allatus est nobis liber à dilecto filio Antonio Lilio artium, & medicinæ doctore, quem quondam Aloysius eius germanus frater conscripserat, in quo per nouum quendam Epactarum Cyclum ab eo excogitatum, & ad certam ipsius aurei numeri normam directum, atque ad quamcunque annorum solarium magnitudinem accommodatum, omnia, quæ in Calendario collapsa sunt, constanti ratione, & seculis omnibus duratura, sic restituì posse ostendit, vt Calendarium ipsum nulli vnquam mutationi in posterum expositum esse videatur. Nouam hanc restituendæ Calendarij rationem exigue volumine comprehensam ad Christianos Principes, celebriores que vniuersitates paucos ante annos misimus, vt res, quæ omnium communis est, communi cum omnium consilio perficeretur; illi cum, quæ maxime optabamus, concorditer respondissent, eorum nos omnium consensione adducti, viros ad Calendarij emendationem adhibuimus in alma Vrbe harum rerum peritissimos, quos longe ante ex primarijs Christiani orbis nationibus delegeramus: Qui cum multum temporis, & diligentiæ ad eam lucubrationem adhibuissent, & Cyclos tam veterum, quàm recentiorum vndique conquisitos, ac diligentissime perpensos inter se contulissent, suo, & doctorum hominum, qui de ea re scripserunt, iudicio hunc præ cæteris elegerunt Epactarum Cyclum, cui nonnulli etiam addiderunt, quæ ex accurata rerum inspectione visa sunt ad Calendarij perfectionem maxime pertinere.

First page of the papal bull "Inter Gravissimas", Pope Gregory XIII, 1582

Announcements

- Our next quiz will be on Wednesday, February 13th
- The quiz will cover the North and Thomas reading and the lectures from 2/1 through 2/11
- Expect a similar format to the last quiz, about half of the questions focused on lecture material and half focused on the North and Thomas paper
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Announcements

- Next week we'll be focusing on empirical evidence of the importance of institutions for development
- The next required reading is Acemoglu, Johnson and Robinson (2001). The colonial origins of comparative development: An empirical investigation. American economic review, 91(5), 1369-1401.
- The reading is up in the Required Readings folder
- Remember, don't get bogged down in the econometrics
- Focus on the big picture, the logic of the argument, the evidence being used, and the conclusions being reached

Institutions and Industrialization

0 CE

From *World Population: A Graphic Simulation of the History of Human Population Growth*, PBS. Each dot represents one million people.

Institutions and Industrialization

1000 CE

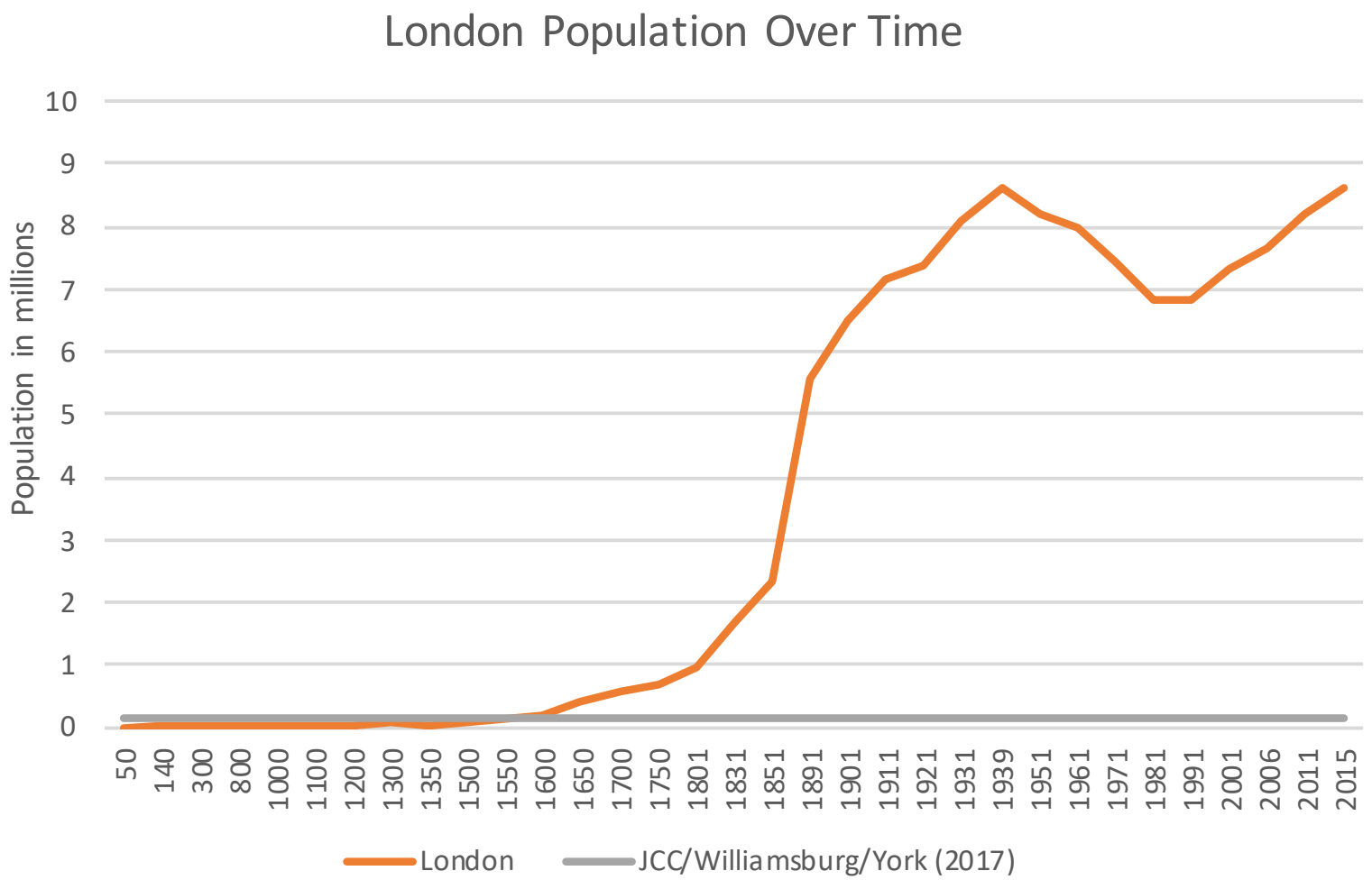
From *World Population: A Graphic Simulation of the History of Human Population Growth*, PBS. Each dot represents one million people.

Institutions and Industrialization

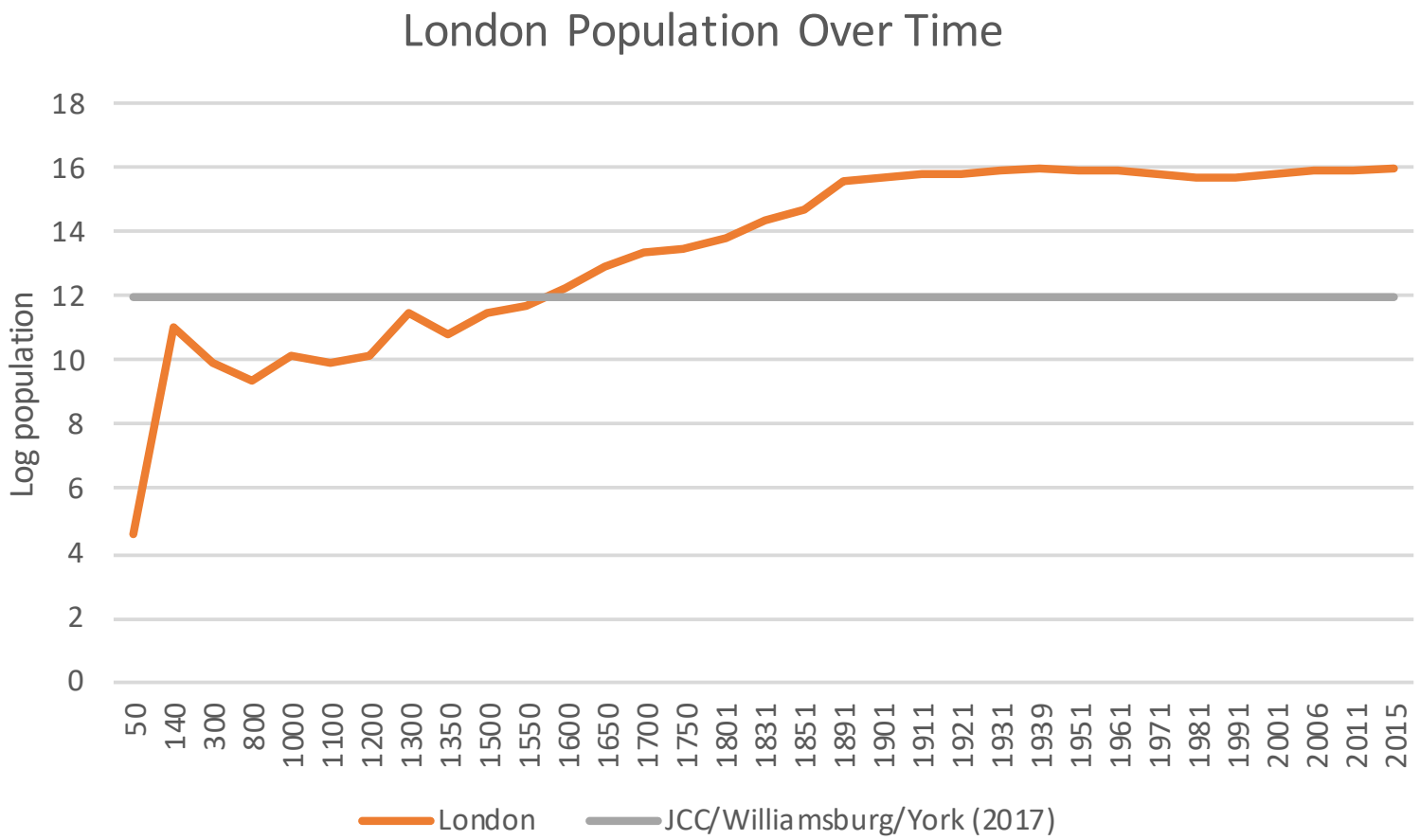
1800 CE

From *World Population: A Graphic Simulation of the History of Human Population Growth*, PBS. Each dot represents one million people.

Institutions and Industrialization



Institutions and Industrialization

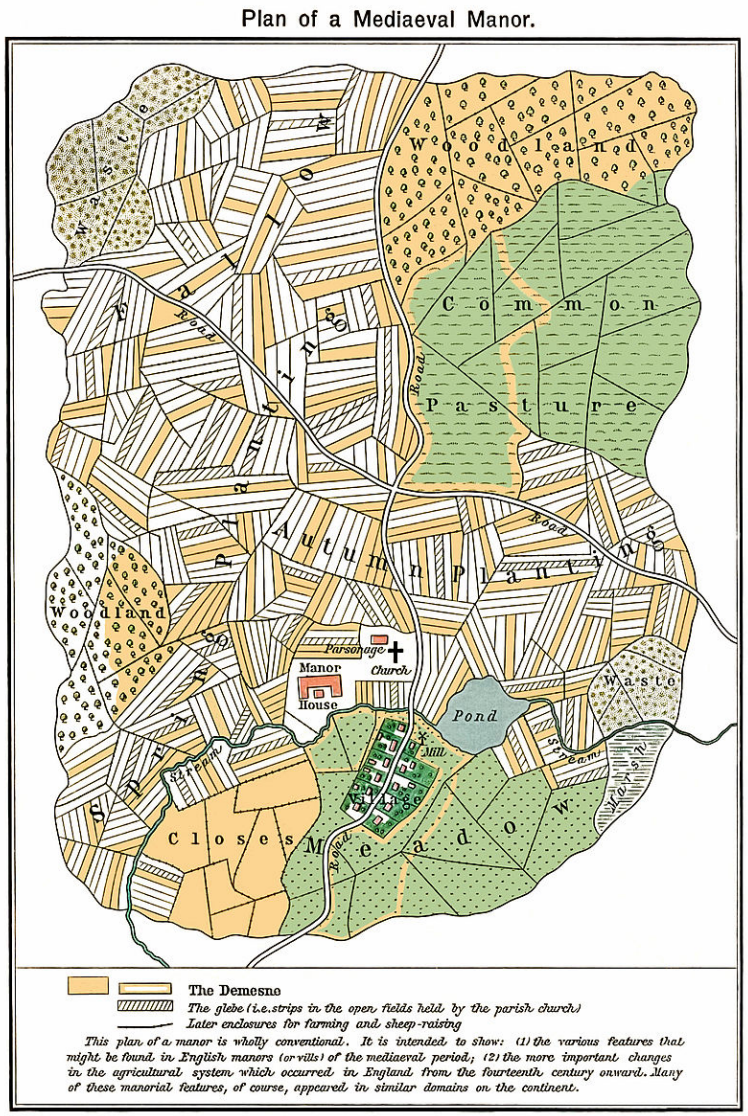


North and Thomas

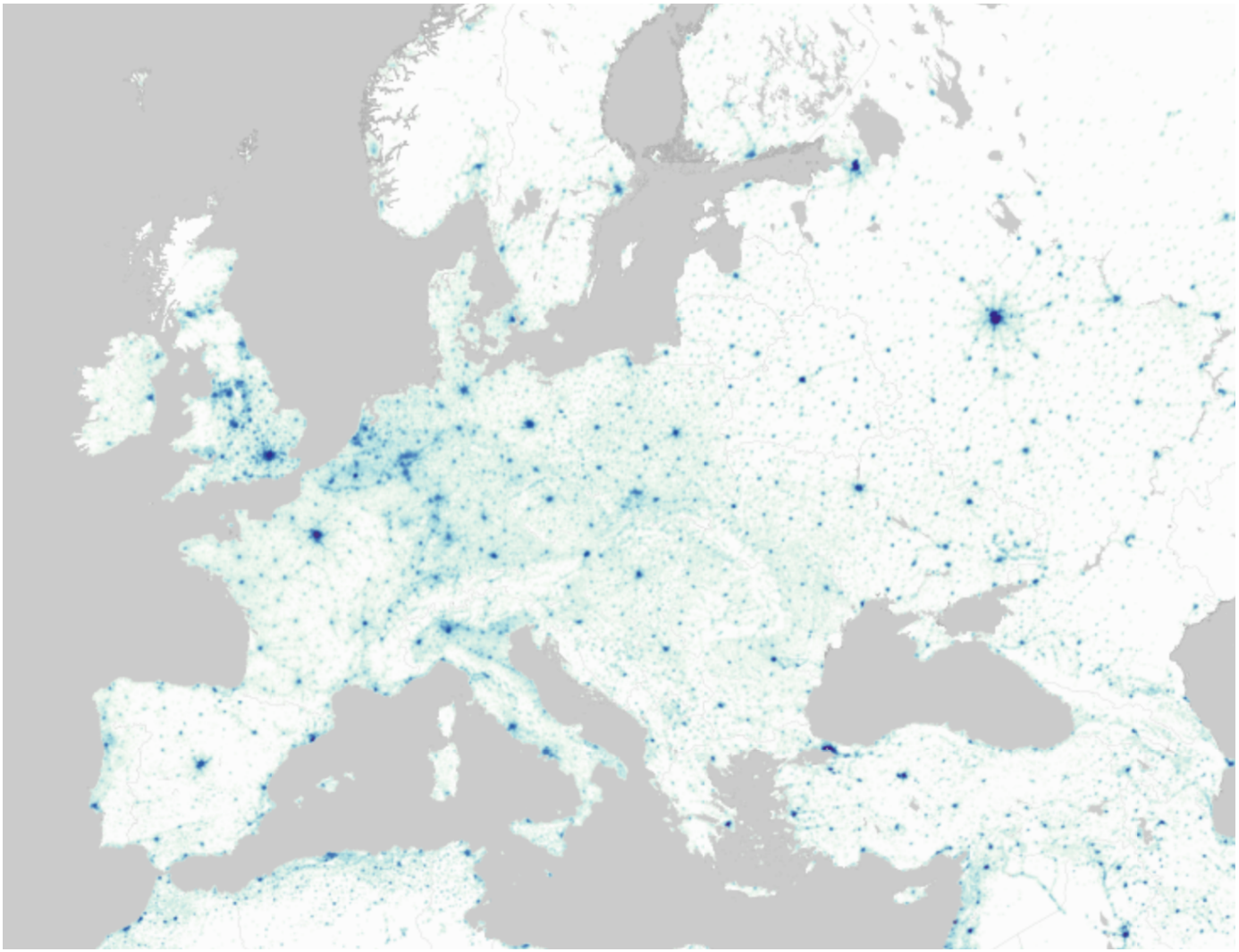
- So Europe is feeling population pressure in the MIddle Ages
- This does a few different, equally important things in the view of North and Thomas
  - Relative factor prices change within countries
  - Relative factor prices change across countries
  - Potential markets are getting bigger
- All of these are going to induce institutional change that will increase efficiency and help break us out of the Malthusian trap

Relative Factor Prices Within Countries

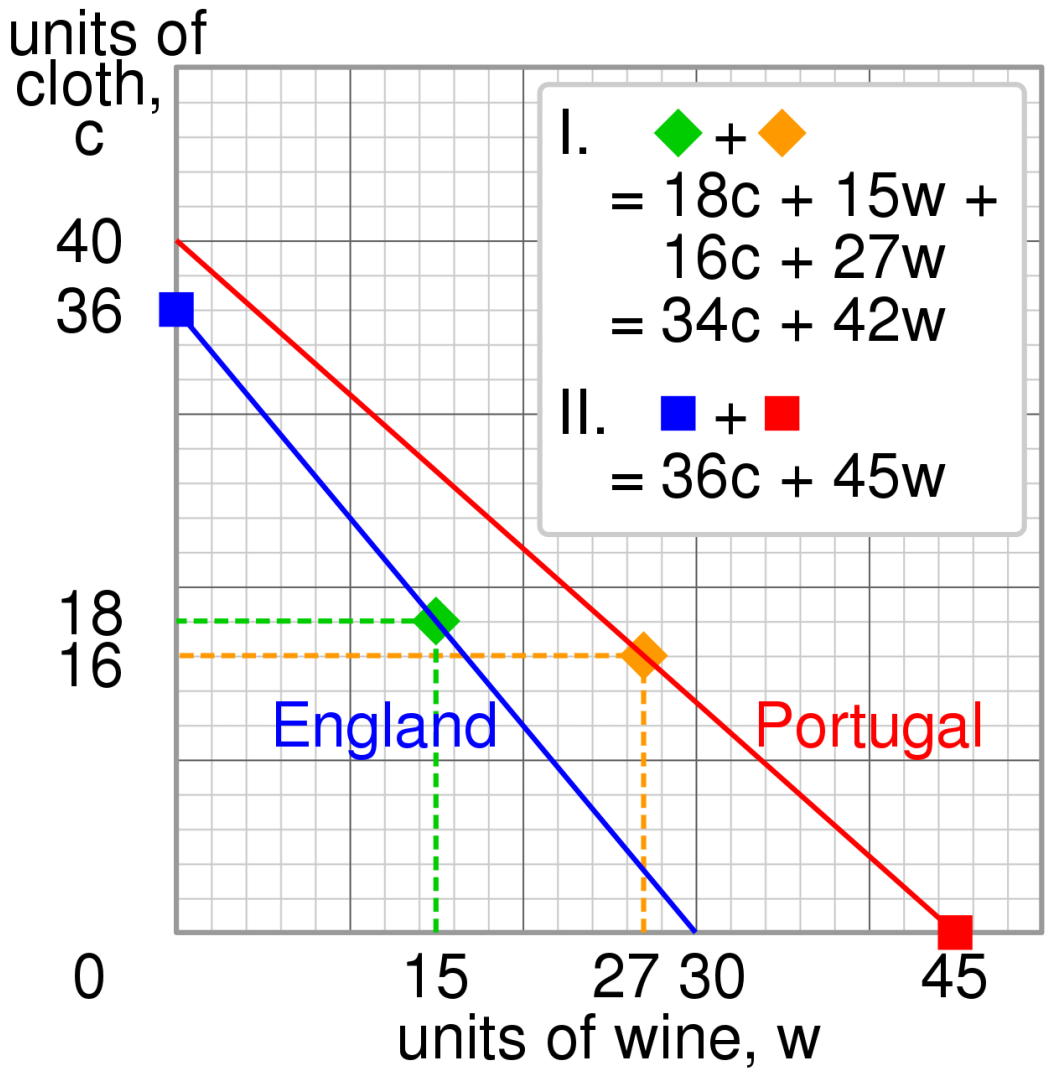
Relative Factor Prices Within Countries



Relative Factor Prices Across Countries



Relative Factor Prices Across Countries



Changing Prices and Markets

- So with the increasing scarcity of land and the increasing abundance of labor, it becomes useful to control land rather than labor
- We get a push for stronger property rights and a decline in the desire for institutions based on control over people (think feudalism)
- With population pressure differing across countries, and resources differing, potential gains from trade are growing
- Growing market sizes are also increasing these potential gains
- What institutional change do we see to take advantage of these gains?

Trade and Institutions

- North and Thomas point to several institutional innovations
- Stronger national governments to protect trade interests and enforce contracts
- A range of changes often described as the "commercial revolution"
  - Joint-stock companies
  - New types of insurance
  - Development of international financial markets
- Last, but certainly not least, the granting of monopoly privilege for inventions

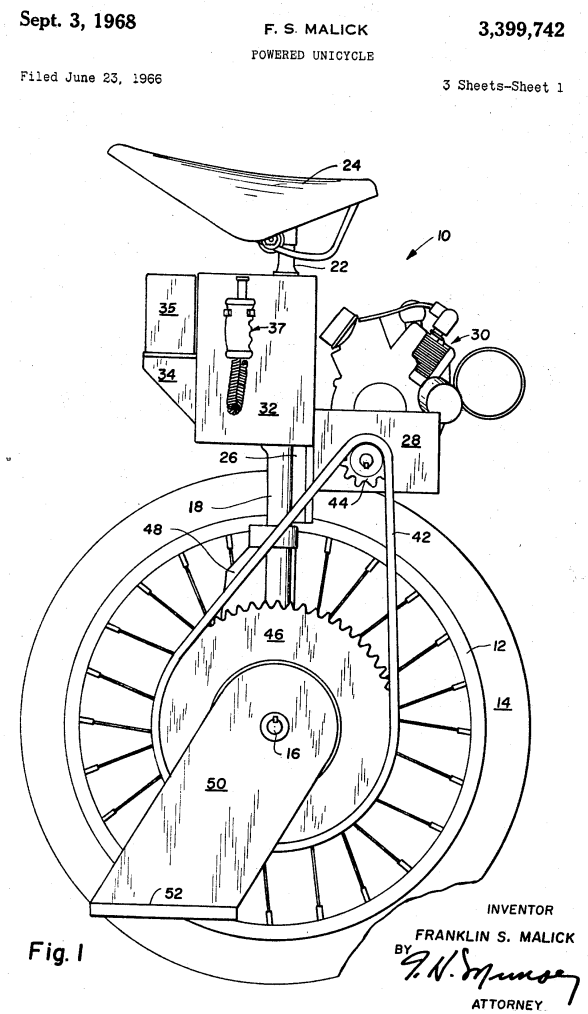
Institutions and Innovation

- A lot of this sounds like one-time albeit permanent gains in productivity
- Our model said income per capita gains should be temporary
- Key to North and Thomas' story is that these institutional changes changed the *incentives* to innovate
    - These new institutions facilitated trade with increasingly large markets increasing the returns to innovation
    - The new property rights directed a greater share of those returns to the innovator
    - So now the incentive to innovate is much, much stronger
- Stronger incentives to innovate will lead to a steady rate of innovation, that's what breaks the Malthusian Trap

Where's the Evidence?

- North and Thomas tell a compelling story
- But they don't exactly provide much empirical evidence, they rely largely on broad stylized facts and anecdotal evidence
- How can we get more convincing evidence of the role institutions played in industrialization?
- We've got a few things working against us:
  - A lot of things moving around at once
  - A lack of good data for many things we care about
  - A host of endogeneity concerns
- One potential solution: look at the impact of patents

Evidence from Patents



Sept. 3, 1968 F. S. MALICK 3,399,742

POWERED UNICYCLE

Filed June 23, 1966 3 Sheets-Sheet 1

Fig. 1

INVENTOR
FRANKLIN S. MALICK
BY
ATTORNEY

Evidence from Patents

- Why look at patents?
- Precisely the type of institution North and Thomas are talking about
- Excellent data (since patents had to be filed)
- Useful variation in patent laws across countries and over time
- Let's take a look at Moser (2005) "How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fairs"

Evidence from Patents

Announcements

Due to a committee meeting, I have to shorten office hours today. I will need to leave at 3:50pm. If you were planning on coming after that, I am happy to schedule a different time to meet.

Announcements

- Groups are posted for the academic festival project
- To see your group, click on "Academic Festival Group" on Blackboard
- Clicking on the group will show you group members and give you options for communicating (discussion board, email)
- I highly recommend touching base with your group members in the next couple of weeks to plan out a schedule for getting the project done
- Remember you'll have two in-class workdays in early April but these will be more productive if you've already made good progress

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- Remember, don't get bogged down in the econometrics
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Very Brief Recap of North and Thomas

- Initially, plenty of land so labor is relatively expensive and land is cheap
- This leads to institutions focused on control over labor
- Population growth makes land scarce, labor abundant flipping relative prices
- This leads to new institutions focused on control over land, not labor
- Growing markets and differing population pressures across locations make trade attractive
- This leads to new institutions to reduce costs of international trade
- Finally, big potential gains from innovation and secure property rights bake in the incentive to innovate

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- How can we get more convincing evidence of the role institutions played in industrialization?
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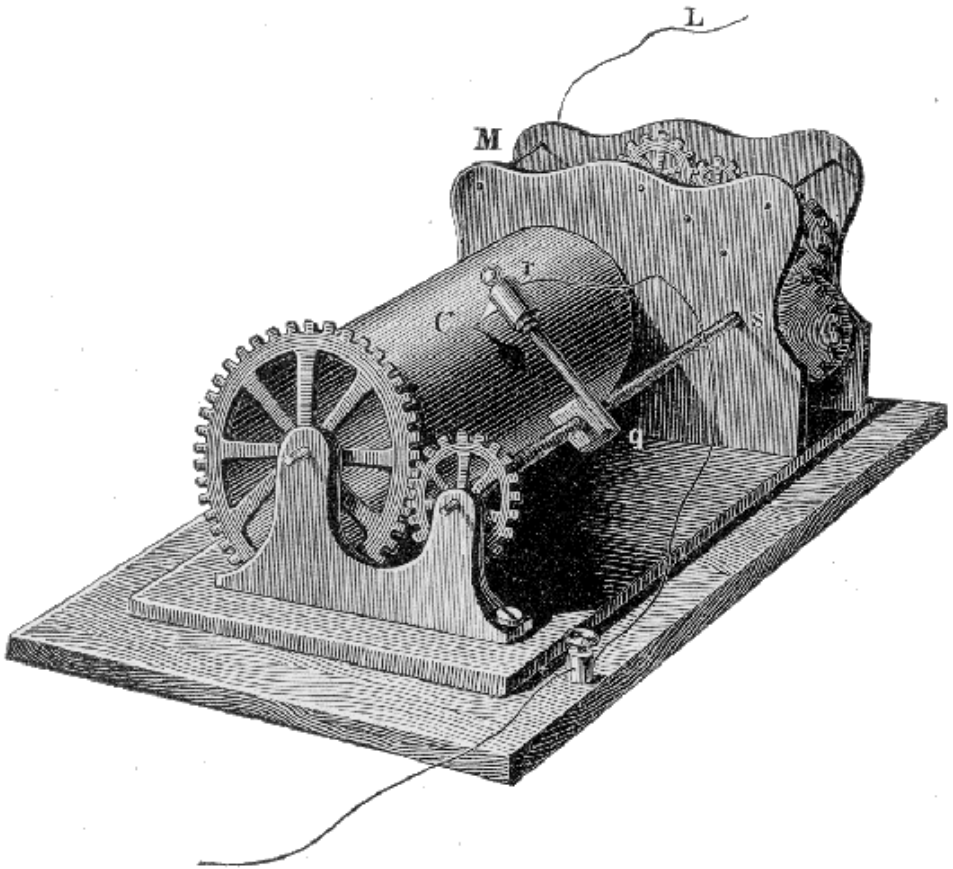
Evidence from Patents



Bakewell, E. P. 12352, 2. 12. 1848

Evidence from Patents

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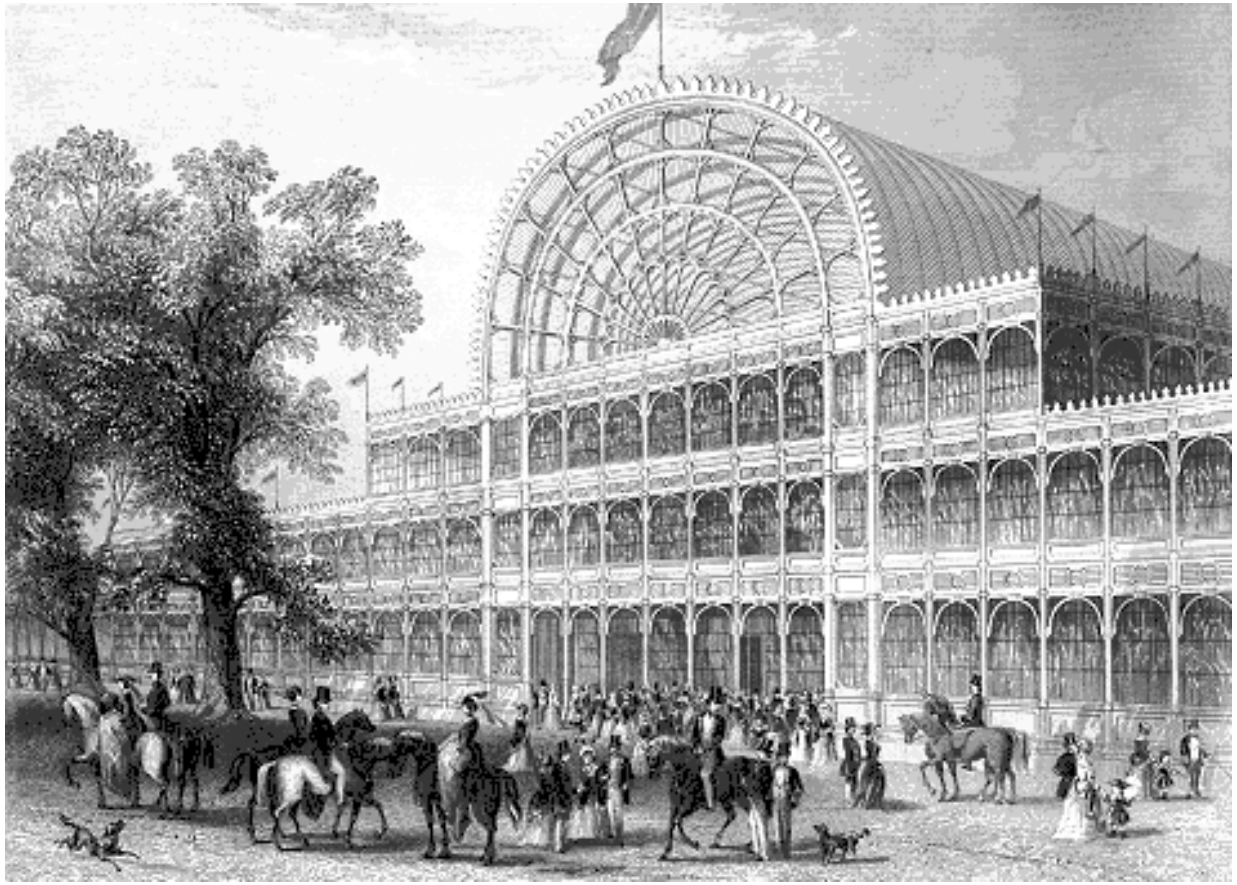
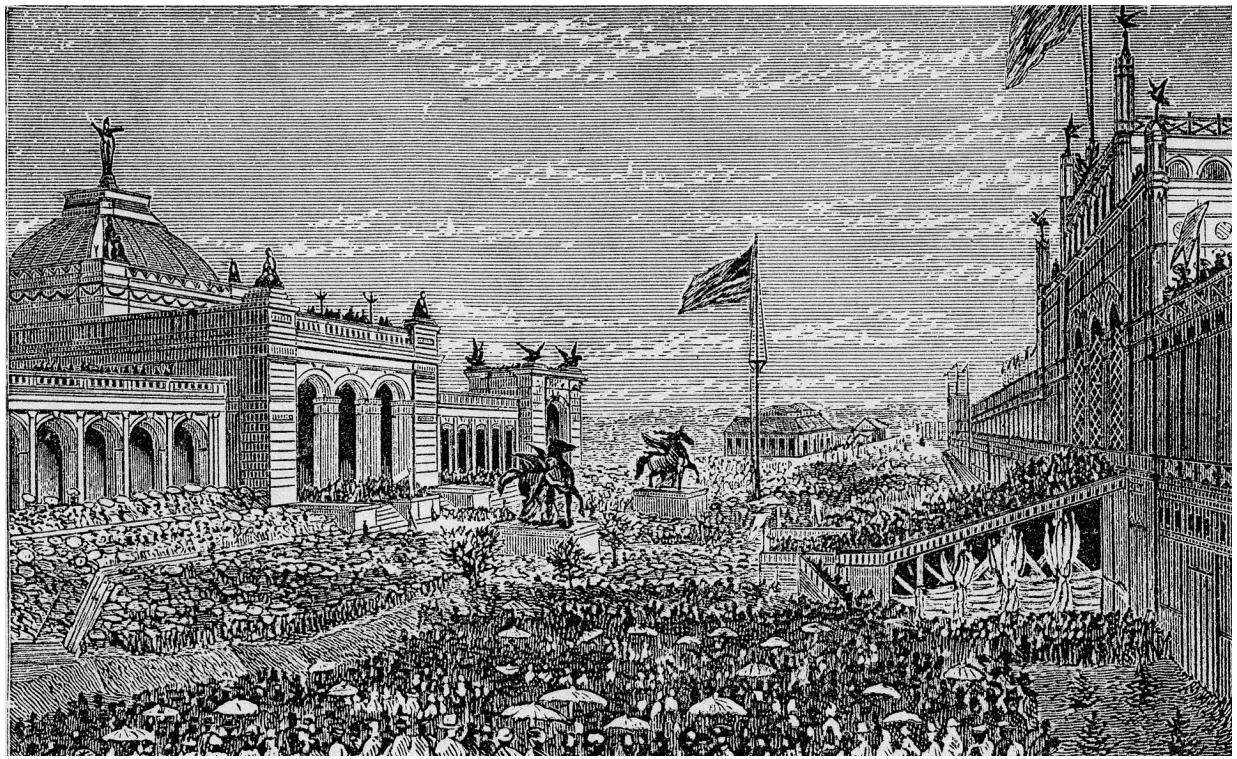
Evidence from Patents



The Crystal Palace Exhibition of 1851, London

Evidence from Patents



Centennial Exhibition of 1876, Philadelphia

Evidence from Patents

- Moser is going to look at exhibits from the Crystal Palace (1851) and Centennial (1876) exhibitions
- She is going to categorize all of the exhibits based on their catalog description:

  > *32 Bendall, J. Woodridge, Manu.-A universal self-adjusting cultivator, for skimming, cleaning, pulverizing, or sub-soiling land; pat.*

- There are two sources of variation that Moser can exploit:
  - Differences in patent laws across countries
  - Changes in patent laws within countries over time
- The basic idea to see how the types of innovation differ across different patent regimes to see if patents influence the direction of innovation

Evidence from Patents

TABLE 1—STATISTICS ON THE WORLD'S FAIRS OF 1851 AND 1876

	Exhibition	
	Crystal Palace	Centennial
Location	London	Philadelphia
Year	1851	1876
Countries		
Total	40	35
N. Europe	12	10
Exhibitors		
Total	17,062	30,864
N. Europe	11,610	6,482
Visitors	6,039,195	9,892,625
Area (in acres)	25.7	71.4

Sources: Bericht III (1853) and Kretschmer (1999).

Evidence from Patents

TABLE 3—COUNTRY CHARACTERISTICS

	Patent length		Population		GDP		Primary education	
Country	1851	1876	1851	1876	1851	1876	1851	1876
Austria	15	15	3,950	4,730	6,563	9,395	389	426
Bavaria	15	—	4,521	—	6,673	—	—	—
Belgium	15	20	4,449	5,303	8,042	14,849	549	582
Britain	14	14	25,601	30,662	60,479	107,661	555	680
Denmark	0	5	1,499	1,973	2,549	4,008	—	—
France	15	15	36,350	38,221	60,685	84,014	515	737
Germany	—	15	—	24,023	—	—	—	732
Netherlands	15	0	3,095	3,822	5,844	52,805	541	639
Prussia	12	—	16,331	—	24,105	—	730	—
Saxony	12	—	1,894	—	2,796	—	—	—
Norway & Sweden	15	—	4,875	—	5,993	—	615	—
Norway	—	3	—	1,803	—	2,650	—	658
Sweden	—	3	—	4,363	—	8,006	—	568
Switzerland	0	0	2,379	2,750	1,986	5,787	—	759
Württemberg	10	—	1,745	—	2,575	—	—	—

Notes: Patent length measures the maximal duration of patent grants (Lerner, 2000; Coryton, 1855). Data on population and GDP (in million 1990 dollars) are drawn from Maddison (1995, 2001). Population data for Bavaria, Prussia, Saxony, and Württemberg from the *Annuaire statistique* (1916). Primary education is measured as the number of children in primary education per 1,000 persons between the age of 5 and 14 (Lindert, 2004).

Evidence from Patents

TABLE 5—MULTINOMIAL LOGIT REGRESSIONS

	(1) 1851 and 1876	(2) 1851 and 1876	(3) 1851 only	(4) 1876 only	(5) 1851 and 1876	(6) (excl. Switzerland)
Mining						
No patent laws	−1.8171	−1.5864	−2.1358	−1.1898	−1.2505	−1.8636
	(0.4996)	(0.4058)	(0.7379)	(0.4971)	(0.4024)	(0.6289)
In population	−0.4344	−0.2004	−0.2558	−0.2369	−0.0823	−0.4348
	(0.0575)	(0.0444)	(0.0697)	(0.0620)	(0.0388)	(0.0576)
GDP per person	0.6960	0.5682	1.0752	0.2117	—	0.6970
	(0.0931)	(0.0896)	(0.1566)	(0.1206)		(0.0931)
Education	0.0031	—	—	—	—	0.0031
	(0.0006)					(0.0006)
Crystal Palace	−0.0368	−0.4213	—	—	−0.4977	−0.0389
	(0.1048)	(0.0813)			(0.0793)	(0.1046)
Constant	−0.4759	−0.4307	−1.3793	0.6829	−0.3307	−0.4677
	(0.4299)	(0.3851)	(0.5522)	(0.5644)	(0.3787)	(0.4299)

Evidence from Patents

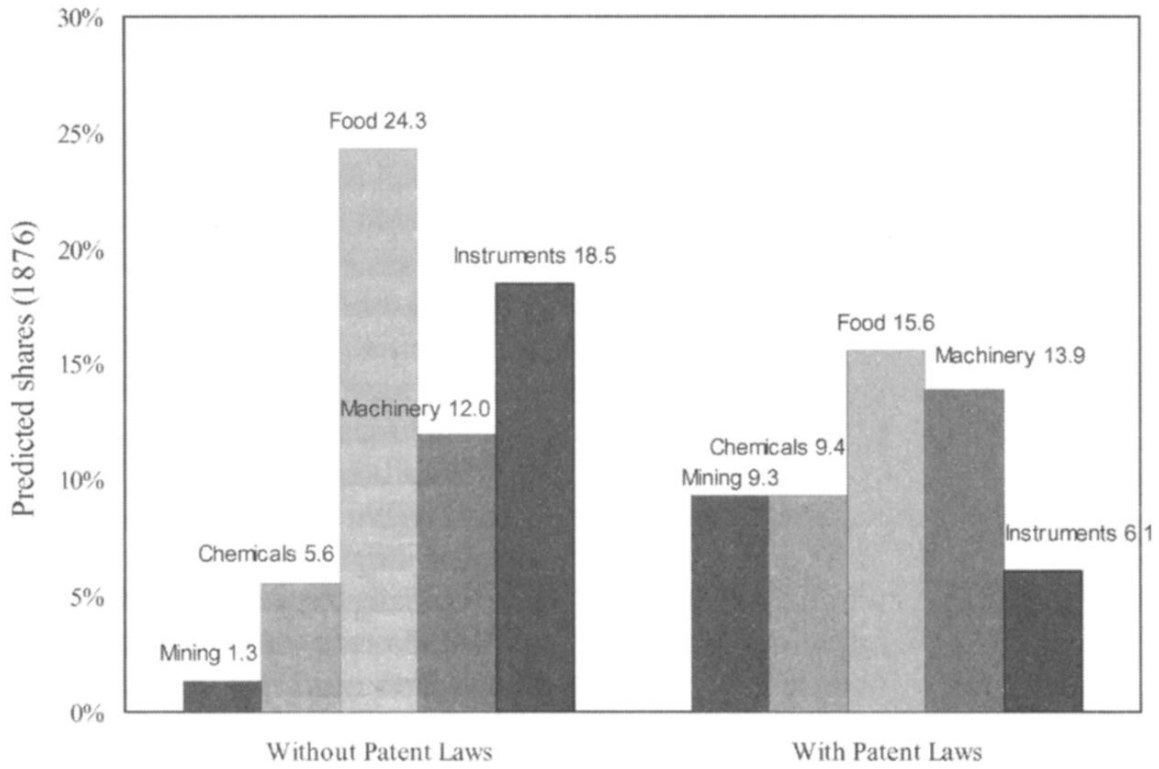


FIGURE 2. PREDICTED INDUSTRY SHARES, 1851 AND 1876

Notes: Predicted values are calculated as $\pi_i(x_{ij}) = \exp(\alpha_i + \beta_i x_j)/\Sigma \exp(\alpha_i + \beta_i x_j)$ from multinomial regressions that control for the logarithm of population and GDP per person (Table 5).

Evidence from Patents

- So looking across countries, it seems that innovation in countries with patent laws follows a different path than in countries without patent laws
- Innovation in food and instruments is relatively more common without patents
- Innovation in mining and machinery is relatively more common with patents
- But what if there is an omitted variable or some reverse causality going on here?

Evidence from Patents

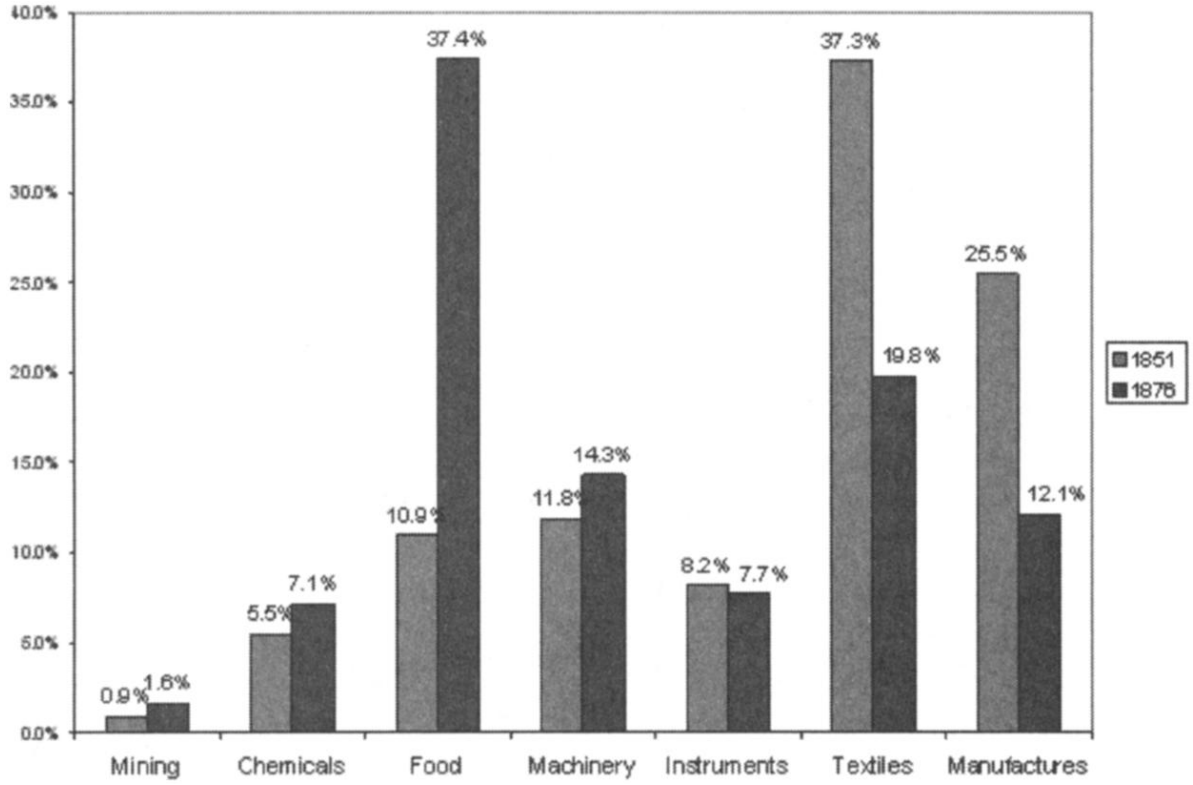


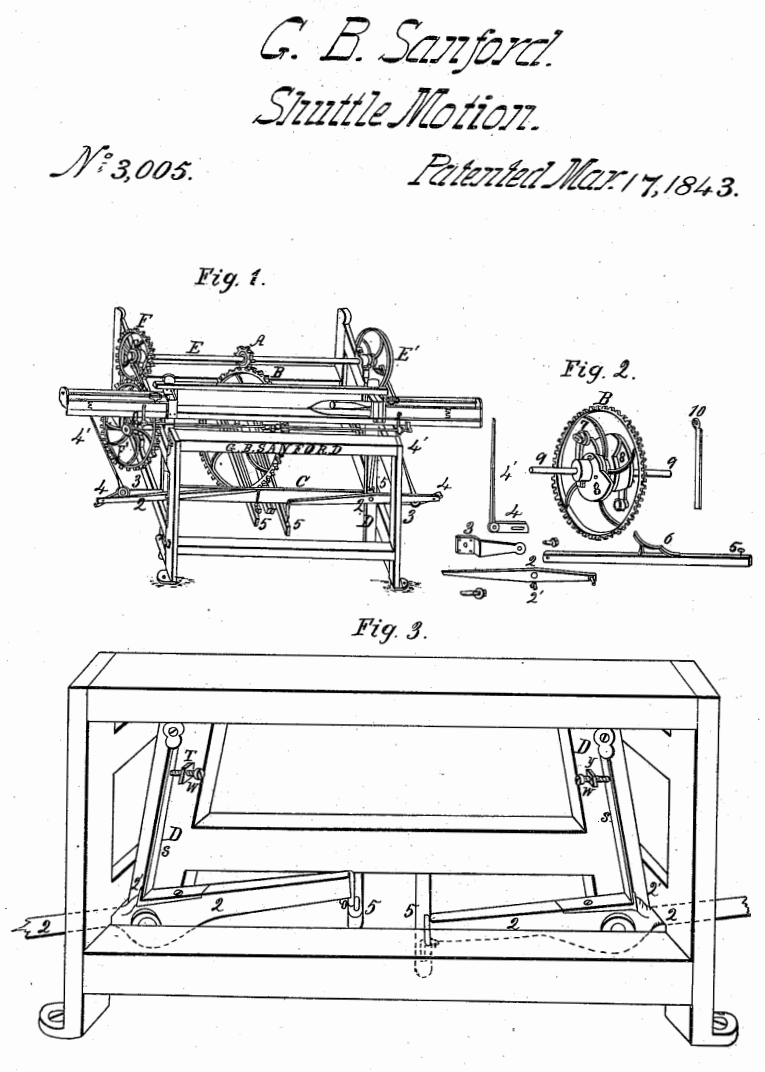
FIGURE 3. DUTCH INNOVATIONS ACROSS INDUSTRIES BEFORE AND AFTER THE ABOLITION OF PATENT LAWS IN 1869

Note: Calculated from entries in *Official Catalogue* (1851) and United States Centennial Commission (1876).

Evidence from Patents

- The Dutch case of abolishing patents seems to back up the cross-country evidence
- When patents are abolished, innovation moves away from textiles and manufactures
- Innovation moves dramatically toward food
- These are the same patterns as the cross-country regressions reveal
- What is driving these patterns?

Evidence from Patents


C. B. Sanford.
Shuttle Motion.
No. 3,005. Patented Mar. 17, 1843.
Fig. 1.
Fig. 2.
Fig. 3.

Evidence from Patents

partially hydrogenated mono-diglyceride mixture contains both saturated and unsaturated fatty acid glycerides, and both are available to form esters with the phosphoric acid provided by the phosphorus derivative.

The phosphoric acid ester compositions obtained as above are used at a total ester concentration of about 0.1% to 2%, preferably about 0.3% to 1%.

The glycerides used to prepare the phosphoric acid ester compositions of this invention can be a pure mono-glyceride, a mixture of pure mono-glycerides, or a mixture of mono- and diglycerides. It is also preferable to have similar or substantially the same fatty acid residues in the mono-glycerides and in the mono- and diglyceride mixture, although this is not essential.

The reasons for employing a combination of phosphoric acid esters prepared from both saturated and unsaturated components, rather than a single one, are several. If, for example, only an essentially unsaturated ester is used, i.e., one prepared from a mono- and/or diglyceride mixture from a triglyceride fat having an iodine value above about 70, the topping does not dispense smoothly, is too dry and short rather than creamy, and the emulsion may tend to become firm in the can during storage and thus be relatively incompletely dispensed. On the other hand, if only an essentially saturated ester is used, i.e., one prepared with a mono-diglyceride mixture from a triglyceride having an iodine value below about 30, the dispensed topping may be too dense and marshmallow-like in texture, rather than light and fluffy.

3.0% of a casein material with the balance being water and other optional components.

A base fat is incorporated into a topping mix to impart the desired creamy-mouth feel. Fats for this invention should have a capillary melting point in the range of about 35° to 40° C. Suitable fats include partially hydrogenated soybean oil having an iodine value of about 80, partially hydrogenated cottonseed oil having an iodine value of 74, mixtures of fully hydrogenated coconut oil with partially hydrogenated cottonseed oil having an iodine value of 65, and the like.

The partially hydrogenated base fats referred to in the preceding paragraph are preferably prepared by the so-called selective hydrogenation technique. Selective hydrogenation techniques are well-known in the art, and generally indicate that a relatively high temperature is employed with a spent nickel catalyst. This technique provides a hydrogenated fat with a relatively sharp melting point, which is preferred in fats for use in aerosol whipped toppings.

The casein material in the compositions of this invention include isoelectric casein, sodium caseinate and calcium caseinate. When the isoelectric casein is used, it must be adjusted to the proper pH value either prior to or after it is incorporated into the topping emulsion. The amount of casein material used is important in determining both the characteristics of the dispensed foam and the stability of the emulsion to wide variations in storage temperature. Generally, about 0.1 to 3.0% of the casein material is used, preferably about 0.1–0.6%. At higher

Evidence from Patents

A Final Thought on North and Thomas

- Moser provides some compelling evidence to back up the logical argument from North and Thomas that intellectual property rights can alter the incentives to innovate
- There is one last element of the North and Thomas story worth a few words
- They are telling a story of *endogenous* institutional change
- When relative prices changed and the potential gains from trade grew, people pushed for changes to institutions
- But will people always push for the right institutions?
- Certainly serfs would have benefited from changing institutions earlier, something North and Thomas note

A Final Thought on North and Thomas

- There are a few things that are going to impact pushes to change institutions
- Who gains from keeping institutions the same?
- Who gains from institutional change?
- Who has the power to shape institutions?
- Do the benefits of changing institutions exceed the costs?
- Let's think of a modern day example

A Final Thought on North and Thomas

A Final Thought on North and Thomas

- The 2007-08 Writers Guild of America strike lasted 14 weeks and 2 days
- Estimates of the economic losses caused by the strike range from $380 million to $2.1 billion
- Strikes are basically intended to force a rewriting of the rules, a change in institutions
- But they are incredibly costly, especially for workers forgoing 3 months of earnings
- So why did the writers go through with it?

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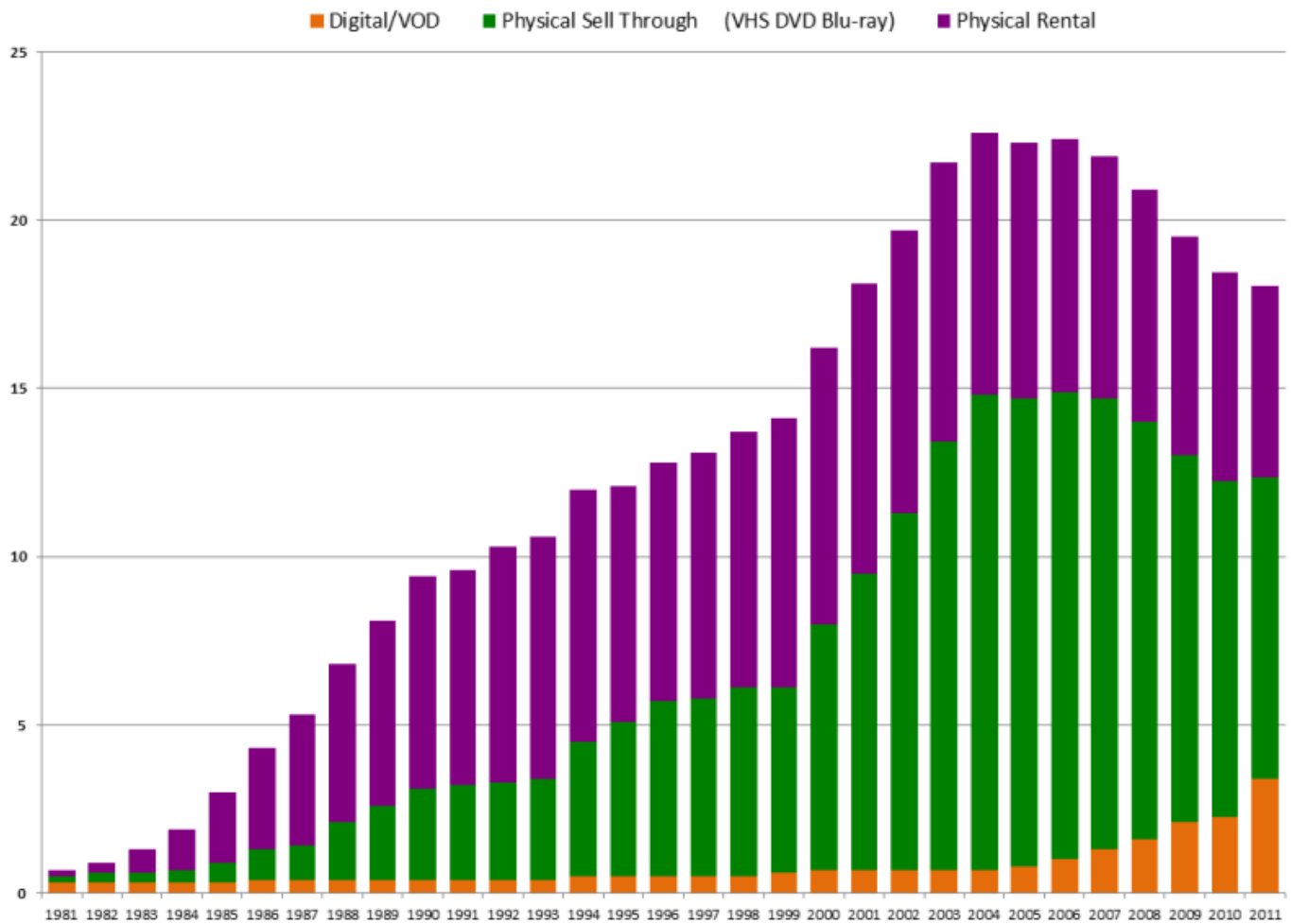

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- This question of what causes institutional change will be important throughout the course
- We'll think about why some countries remain stuck with 'bad' institutions while others end up with 'good' institutions
- We'll also think about how changes to the economy can change which institutions are 'good'
- Acemoglu, Johnson and Robinson will be our starting point next class