Econ 113: February 3, 2015

- Regression interpretation tips
- Transportation
  - Roads
  - Canals
  - Railroads
  - Effect on prices
- Early Industrialization
- Population Patterns
- Fertility Decline
  - Modeling Fertility Decisions

PS 1 is available on course website
Due Thursday Feb 5 at 11:10 a.m.

Regression tips

- A table is showing you the coefficients for an equation
- Not always, but usually, a nice equation like this

Determinants of spending on cars	
Variable	*Coefficient (s.e.)*
Constant	4.3 (1.2)
Income	100.4 (20.2)
Wealth	0.004 (0.0001)
Age	-15.3 (3.1)

$$Cars = 4.3 + 100.4 * Income + 0.004 * Wealth - 15.3 * Age$$

So if you know Income, Wealth, and Age for a person, you can predict how much s/he would spend on cars. Plug in the values for Income, Wealth, and Age, and calculate value for Cars.

Regression tips, 2

- Sometimes the relationship between 2 variables (e.g., income & cars) is a "linear" relationship – when you draw it, it's a straight line
- But sometimes the relationship between 2 variables is **not** "linear" – it's not a straight line when you draw it

Regression tips, 3

Determinants of spending on cars	
Variable	*Coefficient (s.e.)*
Constant	4.3 (1.2)
Income	100.4 (20.2)
Income^2	-2.5 (0.6)
Wealth	0.004 (0.0001)
Age	-15.3 (3.1)

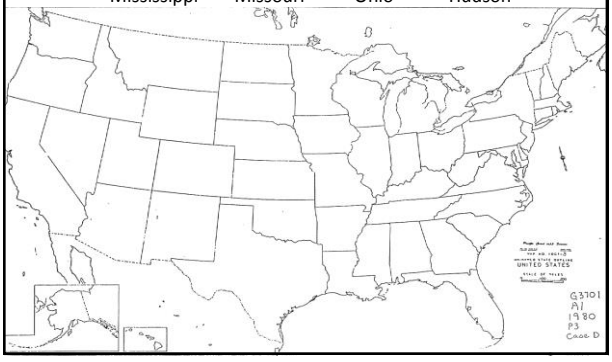
- One way to capture a non-linear relationship is using both the variable (income) and its square (income^2). That's called "a **quadratic**."

$$Cars = 4.3 + 100.4 * Income - 2.5 * Income^2 + 0.004 * Wealth - 15.3 * Age$$

- Predicting how much s/he would spend on cars: same process. Plug in the values for Income, Income^2, Wealth, and Age, and calculate value for Cars.

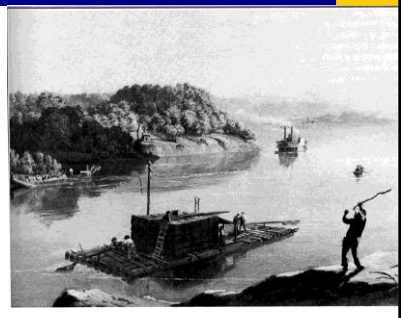
Geography Reminder: Rivers!

- Mississippi Missouri Ohio Hudson



Boats

- Flatboats
- keelboats
- steamboats



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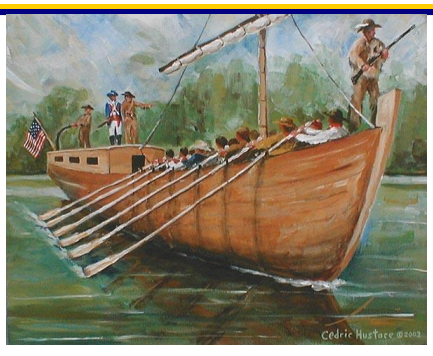
Transportation Developments Early Industrialization Population Patterns

Keelboat



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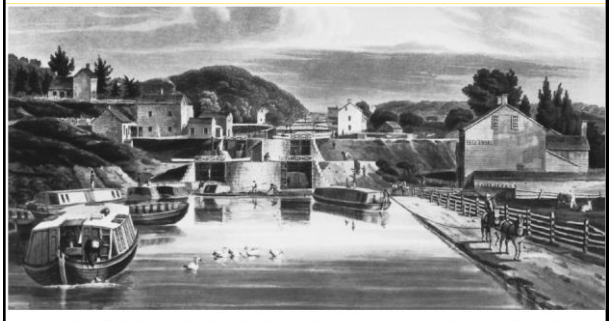
Transportation Developments Early Industrialization Population Patterns Fertility Decline

Steamboat

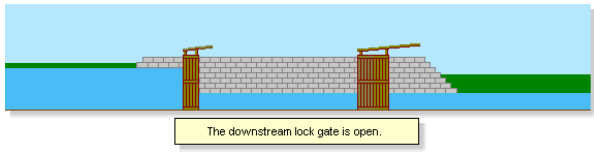
Transportation Developments Early Industrialization Population Patterns

Canals



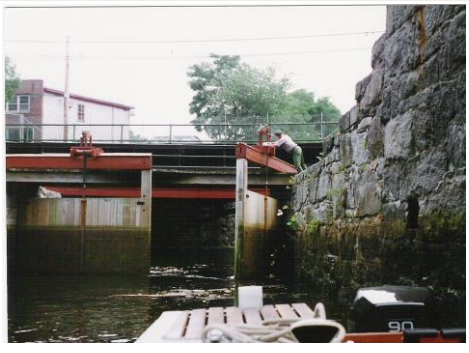
This painting shows the junction of the Champlain Canal and the Erie Canal—an important point on the trade route that was to become the preeminent link between Midwest and East Coast urban centers.
THE NEW-YORK HISTORICAL SOCIETY

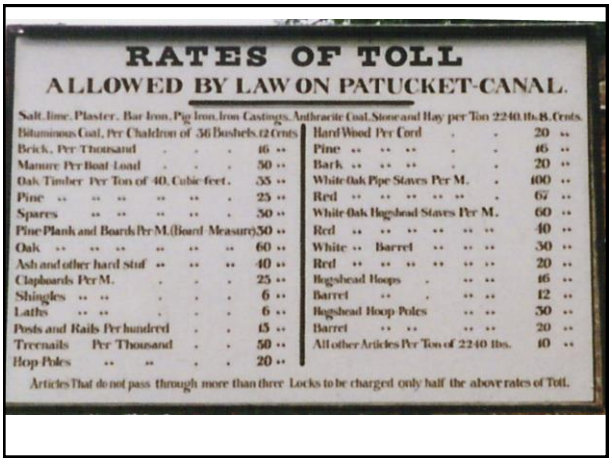
How a canal works



- http://www.eriecanal.org/locks.html

Pa(w)tucket Canal (MA)





RATES OF TOLL

ALLOWED BY LAW ON PATUCKET-CANAL.

Salt, lime, Plaster, Bar Iron, Pig Iron, Iron Castings, Anthracite Coal, Stone and Hay per Ton 2240 lbs. Cents.

Bituminous Coal, Per Chaldron of 36 Bushels, 42 Cents		Hard Wood Per Cord	20 "
Brick, Per Thousand	46 "	Pine " " "	46 "
Manure Per Boat Load	50 "	Bark " " "	20 "
Oak Timber Per Ton of 40, Cubic feet.	55 "	White Oak Pipe Staves Per M.	400 "
Pine " " " " "	25 "	Red " " " " "	67 "
Spares " " " "	50 "	White Oak Hogshead Staves Per M.	60 "
Pine Plank and Boards Per M. (Board Measure)	50 "	Red " " " " "	40 "
Oak " " " " "	60 "	White " Barrel " "	30 "
Ash and other hard Stuf " "	40 "	Red " " " " "	20 "
Clapboards Per M.	25 "	Hogshead Hoops " "	46 "
Shingles " "	6 "	Barrel " "	12 "
Laths " "	6 "	Hogshead Hoop Poles " "	30 "
Posts and Rails Per hundred	15 "	Barrel " "	20 "
Treenails Per Thousand	50 "	All other Articles Per Ton of 2240 lbs.	40 "
Hop Poles " "	20 "		

Articles That do not pass through more than three Locks to be charged only half the above rates of Toll.

Canal Cycles

Table 6 Canal Cycles

period	$ spent (millions)	% financed with government money
1815-43	$31 m.	75 %
1844-60	$66 m.	66 %

Source: Walton & Rockoff, p. 156

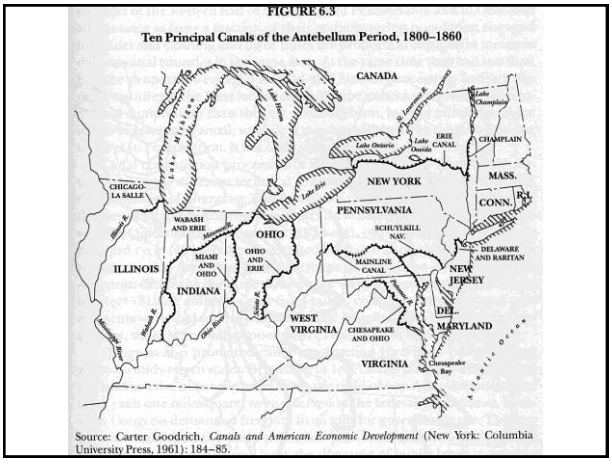


FIGURE 6.3

Ten Principal Canals of the Antebellum Period, 1800–1860

Source: Carter Goodrich, *Canals and American Economic Development* (New York: Columbia University Press, 1961): 184–85.

Impact of Erie Canal

MAP 10.1 Canal Impact Household manufacture of woolen cloth (an index of isolation from commercial routes) underwent a drastic change between 1820 and 1845 along the Erie Canal. The shaded areas indicate the one-third of the counties with the highest home production of woolen goods during this period. (*Source:* Arthur H. Cole, *American Wool Manufacture* [Cambridge, Mass.: Harvard University Press, 1926], vol. 1.)

Railroads

Table 7 Railroad Track

	Mileage
1830	23
1840	2,800
1850	9,000
1860	31,000

Source: U.S. Bureau of the Census (1975), *Historical Statistics*, Series Q15.

- Government financing varied by region

Impact on Prices

$$\frac{\text{Price in Cincinnati}}{\text{Price in Philadelphia}}$$

Table 8. $\frac{P \text{ in Cincinnati}}{P \text{ in Philadelphia}} \times 100$

	Flour	Corn	Whiskey
1816-20	63	51	--
1821-25	52	38	68
1826-30	68	49	80
1831-35	73	55	89
1836-40	73	56	91
1841-45	77	53	80
1846-50	78	51	74
1851-55	82	61	78
1856-60	88	70	85

Source: Walton & Rockoff, Table 9-5.

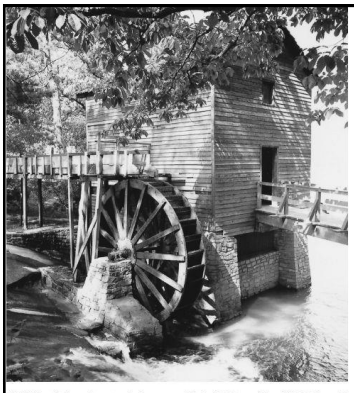
Manufacturing: What?

Table 8. Top 10 Products, by Value Added, 1790 & 1860

1)	cotton goods	6)	iron
2)	lumber	7)	machinery
3)	boots & shoes	8)	woolen goods
4)	flour & meal	9)	carriages & wagons
5)	men's clothing	10)	leather goods

Primary Forms of Manufacturing

- Household Manufactures
- Craft Shops & Artisans
- Mill Industries

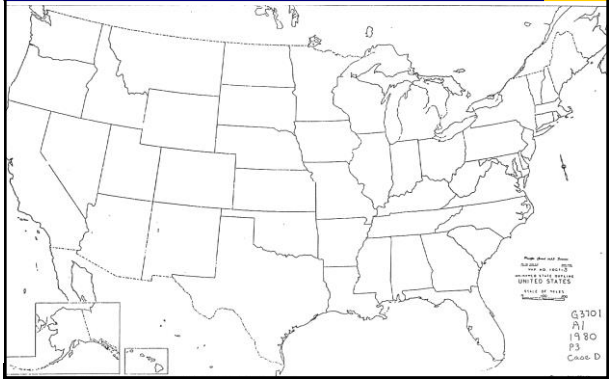


This fairly typical overshot water wheel was one used in the 20,000 sawmills and 14,000 flour mills reported in the 1860 national census.
© H. Armstrong Roberts

Primary Forms of Manufacturing

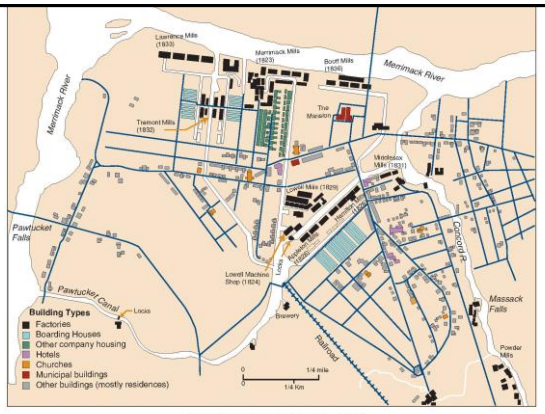
- Household Manufactures
- Craft Shops & Artisans
- Mill Industries
- Factory Production

Geography: Manufacturing centers



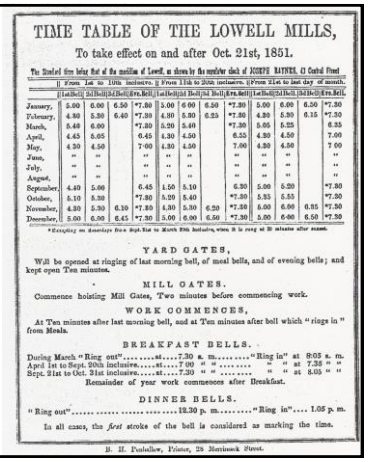
Factory Production: Characteristics

- Lots of standardized output for wide market
- Complex operations in one or more buildings
- Assembly of workers, under organizational discipline



Lowell, Massachusetts, 1832

- Time Table of Lowell Mills



TIME TABLE OF THE LOWELL MILLS,

To take effect on and after Oct. 21st, 1851.

The Standard time being that of the meridian of Lowell, as shown by the regulator clock of JOSEPH BATCHEL, 21 Central Street.

	From 1st to 10th inclusive.			From 11th to 20th inclusive.			From 21st to last day of month.			
	1st Bell.	2d Bell.	3d Bell.	Ev. Bell.	1st Bell.	2d Bell.	3d Bell.	Ev. Bell.	1st Bell.	2d Bell.	3d Bell.	Ev. Bell.
January,	5.00	6.00	6.50	*7.30	5.00	6.00	6.50	*7.30	5.00	6.00	6.50	*7.30
February,	4.30	5.30	6.40	*7.30	4.30	5.30	6.25	*7.30	4.30	5.30	6.15	*7.30
March,	5.45	6.00		*7.30	5.20	5.40		*7.30	5.05	5.25		6.35
April,	4.45	5.05		6.45	4.30	4.50		6.55	4.30	4.50		7.00
May,	4.30	4.50		7.00	4.30	4.50		7.00	4.30	4.50		7.00
June,	"	"		"	"	"		"	"	"		"
July,	"	"		"	"	"		"	"	"		"
August,	"	"		"	"	"		"	"	"		"
September,	4.40	5.00		6.45	4.50	5.10		6.30	5.00	5.20		*7.30
October,	5.10	5.30		*7.30	5.10	5.40		*7.30	5.35	5.55		*7.30
November,	4.30	5.30	6.10	*7.30	4.30	5.30	6.20	*7.30	5.00	6.00	6.35	*7.30
December,	5.00	6.00	6.45	*7.30	5.00	6.00	6.50	*7.30	5.00	6.00	6.50	*7.30

*Excepting on Saturdays from Sept. 21st to March 20th inclusive, when it is rung at 31 minutes after noon.

YARD GATES,

Will be opened at ringing of last morning bell, of meal bells, and of evening bells; and kept open Ten minutes.

MILL GATES.

Commence hoisting Mill Gates, Two minutes before commencing work.

WORK COMMENCES,

At Ten minutes after last morning bell, and at Ten minutes after bell which "rings in" from Meals.

BREAKFAST BELLS.

During March "Ring out".....at.....7.30 a. m....."Ring in" at 8.05 a. m.
April 1st to Sept. 20th inclusive.....at.....7.00 " " ..... " " at 7.35 " "
Sept. 21st to Oct. 31st inclusive.....at.....7.30 " " ..... " " at 8.05 " "
Remainder of year work commences after Breakfast.

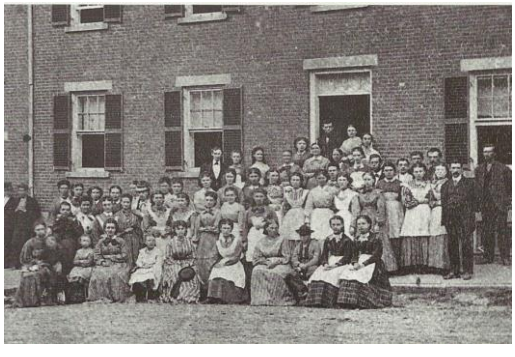
DINNER BELLS.

"Ring out"..... ....12.30 p. m....."Ring in"..... 1.05 p. m.

In all cases, the *first* stroke of the bell is considered as marking the time.

B. H. Penhallow, Printer, 28 Merrimack Street.

Women of Lowell Mills, 1800

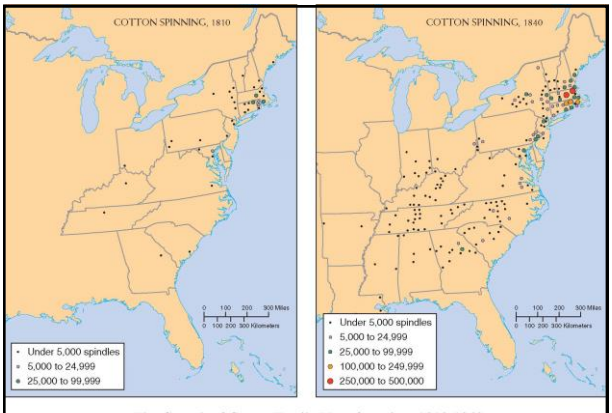


Why women in the mills?

- Concepts: [1] Opportunity cost and [2] reservation wage

Three Stages of Industrialization

- 1790-1815
  New England textiles
- 1815-1840
  Diffusion throughout NorthEast
- 1840-1860
  Rapid Productivity Gains



The Growth of Cotton Textile Manufacturing, 1810-1840

Population Growth

- Growth rate: about 3% annually

Table 1. Population Size

	Total population	Percent Rural	Percent Nonwhite
1790	3.9 m	94.9 %	17.9 %
1820	9.6 m	93.2 %	18.8 %
1850	23.3 m	84.3 %	15.5 %
1860	31.5 m	80.0 %	14.5 %

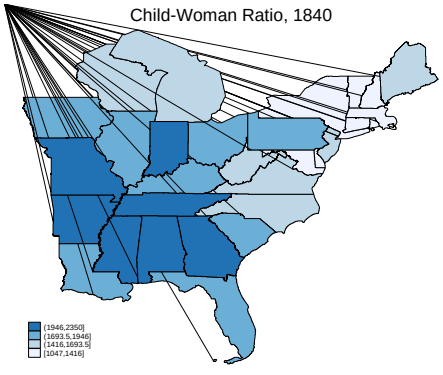
Sources of Population Growth

- Natural increase
  - fertility (births)
  - nuptuality (marriages)
  - mortality (deaths)
- Immigration

Table 2. Number of children (ages 0-9) per 1000 women (16-44), 1840

Missouri	2350
Arkansas	2259
Alabama	2224
Mississippi	2139
Georgia	2109
Tennessee	2026
Indiana	2016
Illinois	1944
Iowa	1874
New Hampshire	1164
Rhode Island	1130
Massachusetts	1071
Connecticut	1047

Source: Paul David & William Sundstrom, "Old-Age Security Motives," *Explorations in Economic History* 25 (April 1988): Table 1.

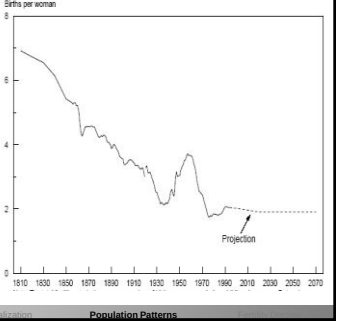


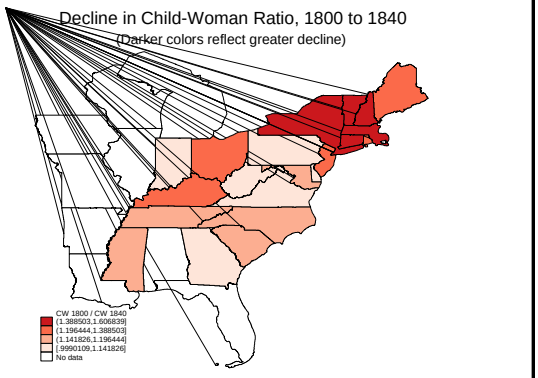
Birth rates decline 1800-2000

Table 3. Birth Rates

	Births per 1000 population	
	White	Black/Other
1800	55	
1840	48	
1855	43	59
1880	34	52
1900	29	44
1920	27	35
1930	21	27
1960	23	32
1990	16	22
2010	13	15

Chart 3-1 Total Fertility Rate
The total fertility rate has been falling steadily over time, with the exception of the post-World War II baby boom.





Modeling Fertility

- Models
  - Question, simplifications, assumptions
- Question: What determines number of children?
- Simplifications: One model "fits" all.
- Building a model:
  - What **goal** are people trying to achieve?
  - What factors influence behavior? (Prices? Income? Other?)
  - What assumptions should we make about behavior?