Labor Scarcity, Finance, and Innovation: Evidence from Antebellum America

Yifei Mao
Cornell

Jessie Jiaxu Wang
ASU

Western Finance Association

June 18th, 2018

Does greater access to finance always spur innovation?

- A large literature on the role of finance on innovation
  - Amore et al. 2013; Chava et al. 2013; Cornaggia et al. 2015
- A fundamental incentive to innovate is to reduce production costs
  - Rosenberg 1969; Spence 1984
- We study finance-innovation nexus under cost reduction motives

  ☞ new evidence and new channel: labor scarcity

Does greater access to finance always spur innovation?

- A large literature on the role of finance on innovation
  - Amore et al. 2013; Chava et al. 2013; Cornaggia et al. 2015
- A fundamental incentive to innovate is to reduce production costs
  - Rosenberg 1969; Spence 1984
- We study finance-innovation nexus under cost reduction motives
  - ☞ new evidence and new channel: labor scarcity
- Exploit a unique historical era: Antebellum America (1812–1860)
  1. staggered passage of free banking laws across 18 states
  2. contrast in labor scarcity in free states vs. slave states

Finance spurred innovation when labor was scarce

1. Staggered passage of free banking laws spurred innovation.

Finance spurred innovation when labor was scarce

1. Staggered passage of free banking laws spurred innovation.

2. Finance spurred innovation when labor was scarce:
   - In free states with scarce labor, free banking
     - had highest positive effect on innovation
   - In slave states with scarce free labor and prevalent slave labor, free banking
     - encouraged manufacturing innovation
     - discouraged agricultural innovation
     - banking further increased slave population via mortgage and trade

Finance spurred innovation when labor was scarce

1. Staggered passage of free banking laws spurred innovation.

2. Finance spurred innovation when labor was scarce:
   - In free states with scarce labor, free banking
     - had highest positive effect on innovation
   - In slave states with scarce free labor and prevalent slave labor, free banking
     - encouraged manufacturing innovation
     - discouraged agricultural innovation
     - banking further increased slave population via mortgage and trade

☞ Necessity is the mother of invention!

Contribution to Literature

The first to show labor scarcity as a channel in banking-innovation nexus.

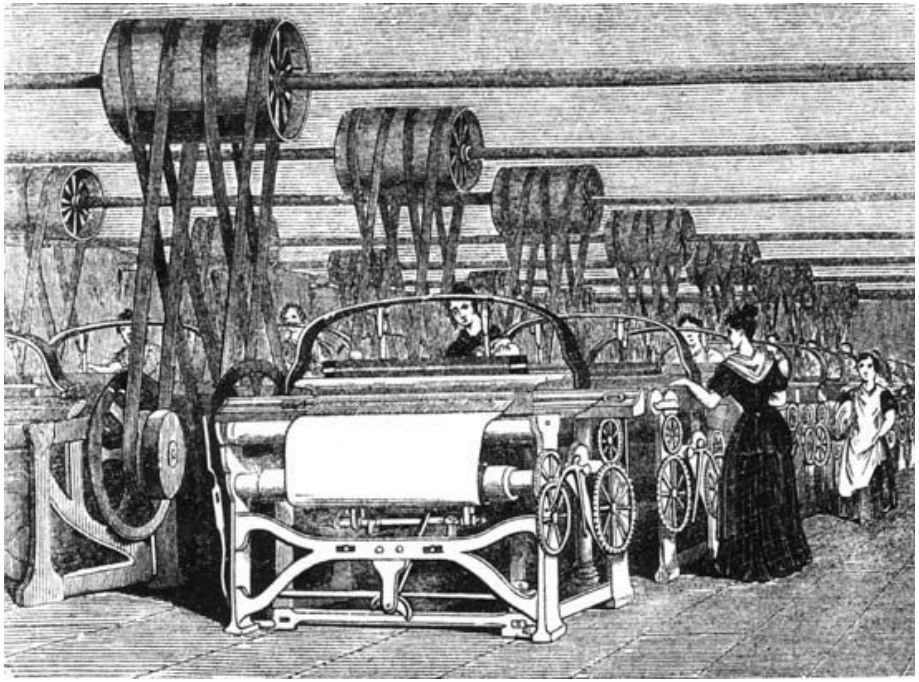
- Finance-growth nexus
  - Schumpeter 1934; King & Levine 1993; Levine 1997
  - Jayaratne & Strahan 1996,; Hall & Lerner 2010; Kerr & Nanda 2015
  - Bank deregulation: Amore et al. 2013; Chava et al. 2013; Cornaggia et al. 2015; Hombert & Matray 2016
- Labor scarcity and technology adoption
  - Hicks 1932; Habakkuk 1962; Acemoglu 2010
  - Bena & Simintzi 2017; Zhang forthcoming; Tuzel and Zhang 2018

    Hornbeck & Naidu 2014; Hanlon 2015

Background

Antebellum America: the economy

- Antebellum America: the war of 1812 to 1860 before the Civil War
- In free states, slavery was prohibited
  - early industrialization, factories hired and trained employees
  - new concept of labor: wage earners



Antebellum America: the economy

- Antebellum America: the war of 1812 to 1860 before the Civil War
- In slave states, farmers obtained cheap land and used slave labor
  - no education, cannot resign or higher wages, continue for generations.
  - low marginal cost, especially in agriculture

SOUTHERN COTTON PLANTATION.
"Knowing thy master also is in heaven."

Antebellum America: the innovations

- Boom in patenting reflected demand-induced advances in invention.
- "the dearness and inelasticity of American labour gave the American entrepreneur[...]a greater inducement than his British counterpart to replace labour by machines" Habakkuk (1962)

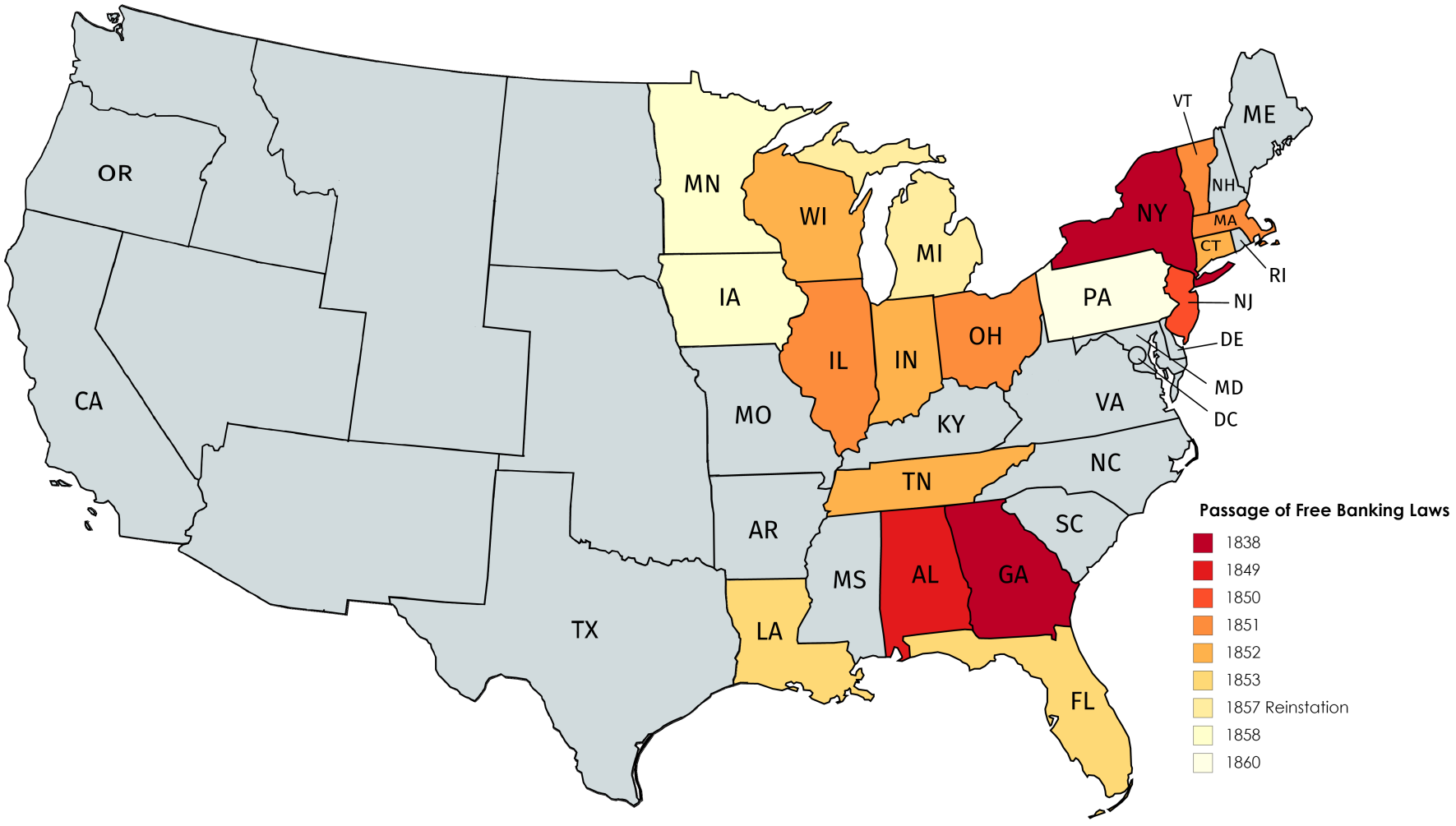
Antebellum America: the banking system

- Banks were state-chartered, issued own notes, in shortage
  - limited charters, operated in major cities with a local focus.
  - chartering process was tedious, delayed, corrupted
  - loans made in favor of bank insiders with connections

Antebellum America: the banking system

- Banks were state-chartered, issued own notes, in shortage
  - limited charters, operated in major cities with a local focus.
  - chartering process was tedious, delayed, corrupted
  - loans made in favor of bank insiders with connections
- Free Banking Laws as a banking reform
  - staggered passage across 18 states, 1837-1860
  - replaced charters with "free entry" upon standard requirements
  - allowed speedy bank entry with lower costs

Passage of the Free Banking Laws



Passage of the Free Banking Laws

- Staggered passage was triggered by exogenous events than demand.
  - LA: repercussions of antibanking
  - NY: an unlikely event, kidnapping of Morgan → anti-Masonry → Regency lost support

    ☞ "serendipitous nature of economic reform" (Bodenhorn)

Free Banking Laws and Greater Local Access to Finance

- Direct effects
  - bank entry (Economopoulous and O'Neill, 1995)
  - wider geographical coverage, customer base (Bodenhorn, 2000)
  - ☞ free banks as innovation-inducing Schumpeterian bank
    - microlevel lending records of Black River Bank (Bodenhorn, 1999)
    - the free bank financed: Bradford's portable steam engine (1849), Hotchkin's harness manufactory (1854), Remington's paper mill (1853)
- Indirect effects
  - made charter banks more efficient, competitive (Bodenhorn, 1990)
  - improved bank capital allocation (Rockoff, 1974)
  - transportation, railroad, information, currency

Model

Model: a rep producer's demand of technology

- A monopoly entrepreneur develops patent θ, manufactures machines q
- A rep producer uses technology θ, labor L, machines q in production.
  - innovation θ is labor-saving: $\frac{\partial^2 F}{\partial L \partial \theta} < 0$ to reflect antebellum innovation
- The producer maximizes profits, given wage w, machine price χ

$$\max_{L,q} AF(L,\theta)^{\alpha} q^{1-\alpha} - wL - \chi q$$

  - $A = \alpha^{-\alpha}(1-\alpha)^{-1}$ is a scalar for normalization
  - FOC gives demand for machines

$$q^* = \alpha^{-1} F \chi^{-\frac{1}{\alpha}}$$

Model: the monopoly entrepreneur

- Given q^*, monopoly entrepreneur choose θ, χ to maximize profit

$$\max_{\theta,\chi} \underbrace{(\chi - (1-\alpha))}_{\text{net unit profit}} q \qquad \underbrace{-C(\gamma,\theta)}_{\text{setup cost for manufacturing}}$$

  - χ is monopoly unit price, $(1-\alpha)$ is marginal cost
  - $C(\gamma,\theta)$ is setup costs for manufacturing, e.g. R&D, constructing prototypes, marketing, gathering information about demand
  - $\gamma \uparrow$ reduces setup cost: $\frac{\partial C(\gamma,\theta)}{\partial \gamma} < 0$, $\frac{\partial C(\gamma,\theta)}{\partial \theta} > 0$, $\frac{\partial^2 C(\gamma,\theta)}{\partial^2 \theta} > 0$

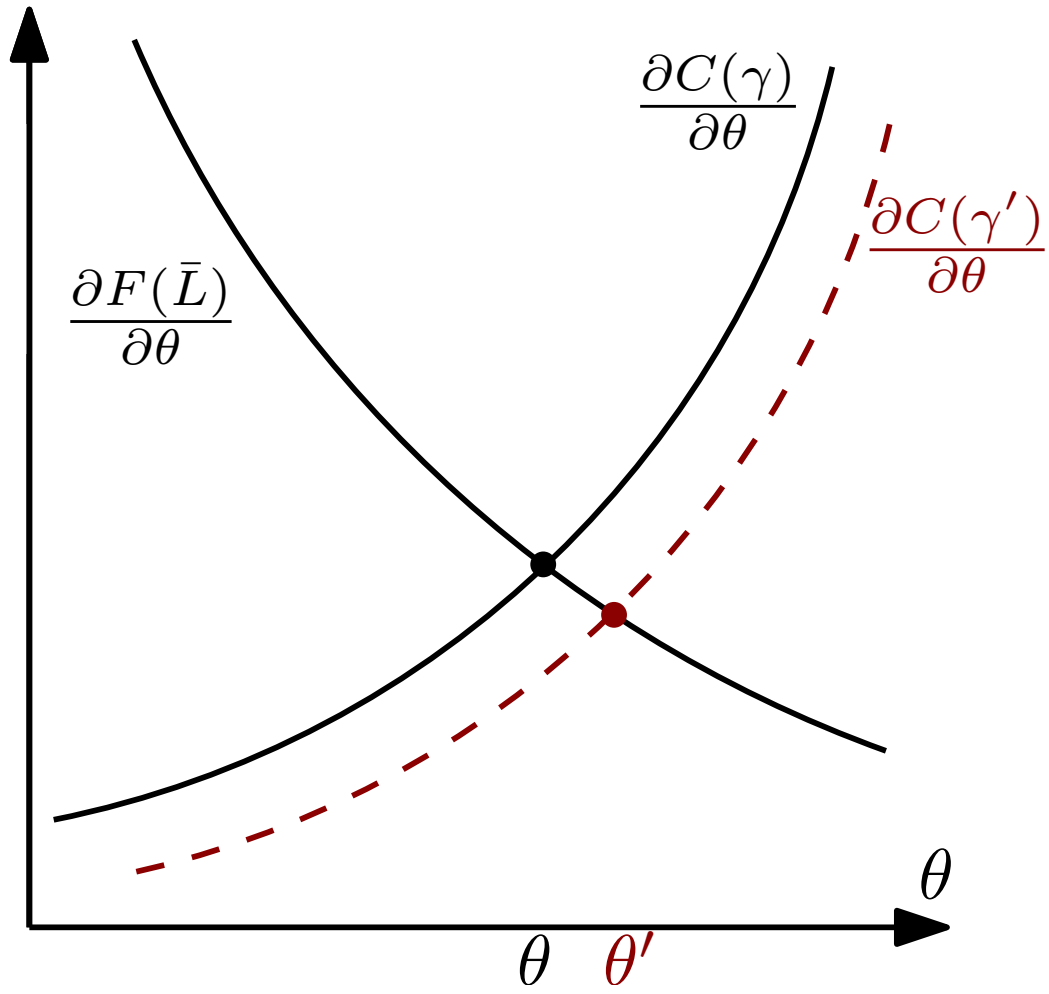
- Labor market clears with given labor supply $\bar{L}$

Entrepreneur's problem becomes $\max_{\theta} F(\bar{L},\theta) - C(\gamma,\theta)$

θ^* satisfies FOC $\frac{\partial F(\bar{L},\theta)}{\partial \theta} = \frac{\partial C(\gamma,\theta)}{\partial \theta}$

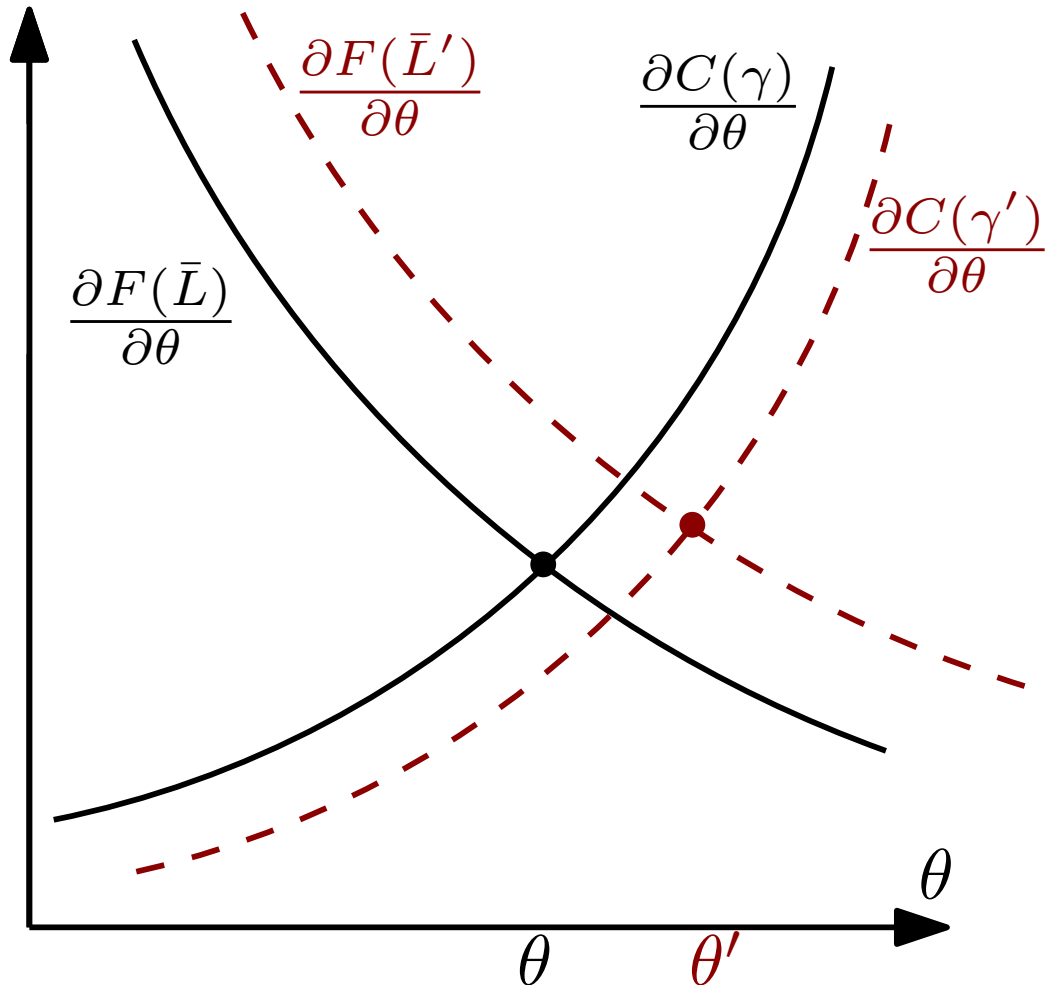
Implications: greater access to finance γ

Greater access to finance promotes innovation.



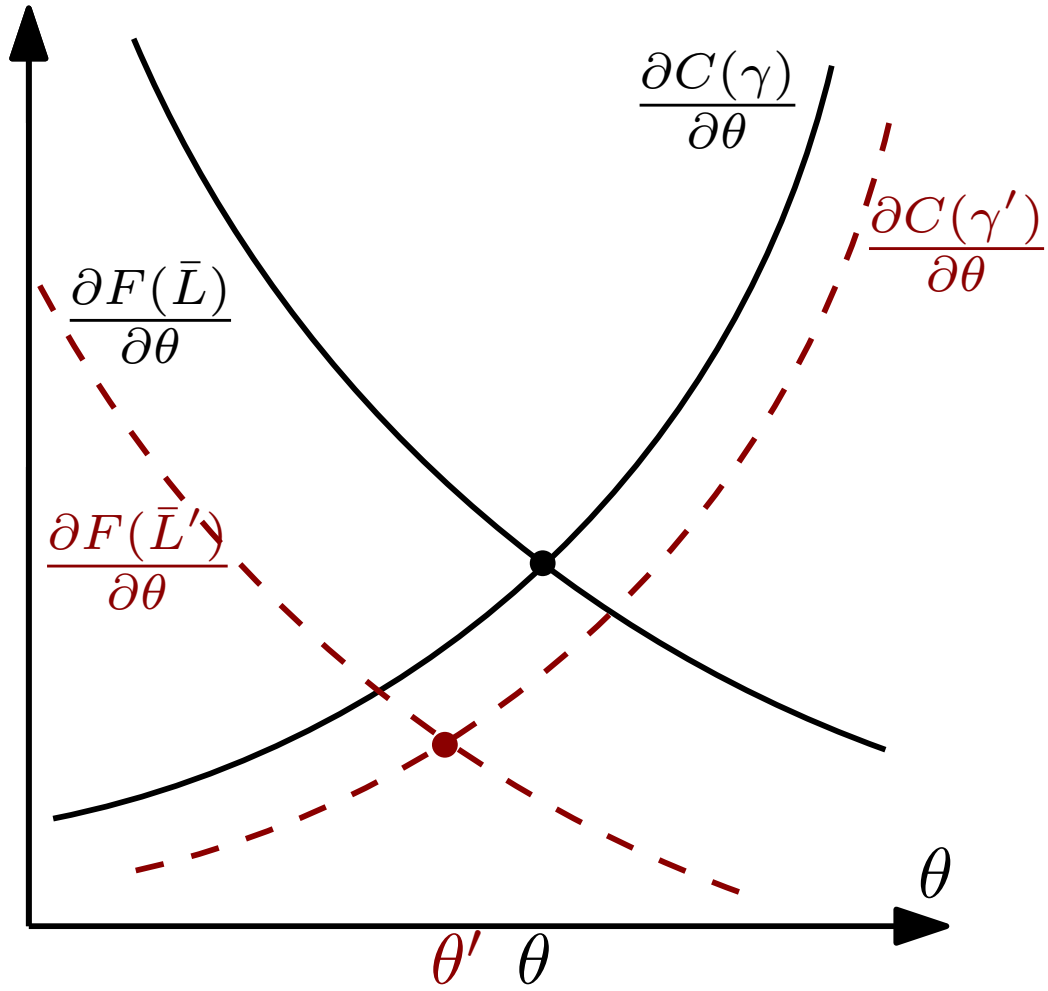
Implications: when labor becomes more scarce

If labor becomes more scarce as γ increases, innovation increases even more.



Implications: when labor becomes less scarce

If labor becomes less scarce as γ increases, innovation could decrease.



Data and Empirical Results

Data

1. Historical patents to proxy for innovation
   - ☞ grant year, inventor location, technology class
     - patents location close to technology adoption (Lamoreaux, Sokoloff 2000)
2. Weber (2005) and archived reported balance sheets of state banks
   - ☞ name, location, charter type, entry/exit, balance sheets
3. Historical decennial census records
   - ☞ social, demographic variables, agricultural, manufacturing output
4. Slave Hires, Slave Sales and Appraisals data (Fogel, Engerman,1974)

Summary Statistics

	P25	P50	Mean	P75	SD	N
Patents	1	5	25.14	18	75.40	1,491
Patents (agricultural)	0	0	2.27	2	7.2	1,491
Patents (manufacturing)	0	1	10.19	6	35.03	1,491
Population (thousands)	270	780	1,100	1,400	1,200	1,491
Urban ratio	0.02	0.05	0.12	0.16	0.18	1,491
Slave ratio	0	0	0.15	0.31	0.19	1,491
White ratio	0.65	0.93	0.82	0.99	0.19	1,491
Political party	0	0	0.38	1	0.48	868
Max rate	0.06	0.06	0.08	0.08	0.07	1,419
Free bank counts	0	0	3.04	0	19.49	1,491
Charter bank counts	1	6	16.54	21	25.37	1,491

Free Banking and Bank Entry

State	Year of passage	Entry in 3 years	Percentage
Michigan	1837, 1857	40	na
New York	1838	82	84%
Georgia	1838	3	8%
Alabama	1849	2	100%
New Jersey	1850	23	88%
Vermont	1851	6	29%
Ohio	1851	38	475%
Massachusetts	1851	18	14%
Illinois	1851	31	na
Connecticut	1852	16	36%
Indiana	1852	93	664%
Wisconsin	1852	43	na
Tennessee	1852	16	73%
Louisiana	1853	3	16%
Florida	1853	0	0%
Minnesota	1858	16	na
Iowa	1858	13	na
Pennsylvania	1860	6	11%

Free Banking and Access to Finance

	Ln(Free bank counts)			Ln(Charter bank counts)		
	t+1	t+2	t+3	t+1	t+2	t+3
Free banking	1.531***	1.326***	1.129***	0.130***	0.110*	0.092
	(0.144)	(0.190)	(0.216)	(0.046)	(0.055)	(0.057)
Ln(Population)	0.126***	0.138***	0.145***	-0.078	0.006	0.089
	(0.039)	(0.045)	(0.050)	(0.090)	(0.112)	(0.122)
Urban ratio	3.312***	2.870***	2.408***	-0.650	-1.267	-1.839*
	(0.692)	(0.799)	(0.838)	(0.638)	(0.820)	(0.923)
Slave ratio	-3.541***	-3.897***	-3.924***	5.531*	2.892	0.304
	(1.313)	(1.139)	(1.061)	(3.236)	(3.716)	(3.723)
White ratio	-3.752**	-4.059***	-3.982***	5.449	2.651	-0.016
	(1.450)	(1.236)	(1.159)	(3.434)	(3.842)	(3.779)
Constant	1.832	2.022**	1.904**	-4.240*	-2.432	-0.824
	(1.145)	(0.959)	(0.830)	(2.483)	(2.604)	(2.473)
Observations	1,491	1,491	1,491	1,491	1,491	1,491
R-squared	0.626	0.573	0.530	0.886	0.867	0.853
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Free Banking Effect: main results

	Ln(Patents)					
	t+1		t+2		t+3	
Free banking	0.440***	0.385***	0.518***	0.456***	0.531***	0.463***
	(0.081)	(0.064)	(0.104)	(0.081)	(0.111)	(0.085)
Ln(Population)		0.452***		0.517***		0.587***
		(0.044)		(0.055)		(0.063)
Urban ratio		1.493***		2.239***		2.877***
		(0.482)		(0.815)		(0.906)
Slave ratio		-2.924*		-4.504**		-5.955***
		(1.499)		(1.911)		(2.180)
White ratio		-0.944		-2.154		-3.022
		(1.391)		(1.734)		(1.834)
Constant	0.033	-3.925***	0.084	-3.321**	-0.070	-3.234**
	(0.089)	(1.180)	(0.098)	(1.344)	(0.107)	(1.404)
Observations	1,491	1,491	1,491	1,491	1,491	1,491
R-squared	0.878	0.893	0.868	0.889	0.861	0.888
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

E.g., 46.3% increase of patents in year 3 (11.6 patents, 15.4% of state-level variability)

Temporal Dynamics

	Ln(Patents)	
$Before^{1-}$	-0.207	-0.082
	(0.172)	(0.149)
$After^{1}$	0.283***	0.273**
	(0.104)	(0.106)
$After^{2}$	0.230*	0.226*
	(0.138)	(0.137)
$After^{3+}$	0.310***	0.405***
	(0.153)	(0.137)
Constant	0.239	-6.295
	(0.187)	(3.857)
Controls	No	Yes
Observations	1,442	1,442
R-squared	0.880	0.895
State FE	Yes	Yes
Year FE	Yes	Yes

Falsification Test

	Ln(Patents)		
	t+1	t+2	t+3
Free banking	0.061	0.004	0.006
	(0.060)	(0.057)	(0.057)
Ln(Population)	0.467***	0.531***	0.600***
	(0.047)	(0.059)	(0.070)
Urban ratio	1.646***	2.451***	3.091***
	(0.519)	(0.878)	(0.971)
Slave ratio	-1.892	-3.180*	-4.612**
	(1.377)	(1.748)	(2.042)
White ratio	-0.163	-1.203	-2.056
	(1.353)	(1.693)	(1.814)
Constant	-4.934***	-4.514***	-4.446***
	(1.132)	(1.269)	(1.326)
Observations	1,491	1,491	1,491
R-squared	0.890	0.885	0.883
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Evidence against Alternative Interpretations

	Ln(Patents)$_{t+3}$		
Free banking	0.441***	0.350***	0.434***
	(0.087)	(0.095)	(0.082)
Max rate	-0.152		
	(0.324)		
Political party		0.126**	
		(0.058)	
College student ratio			52.179***
			(13.860)
Ln(Population)	0.732***	0.618***	0.717***
	(0.069)	(0.115)	(0.071)
Urban ratio	3.202***	3.375**	2.887***
	(0.917)	(1.489)	(0.918)
Slave ratio	-6.272***	-12.687***	-4.337*
	(2.054)	(3.869)	(2.249)
White ratio	-2.642	-9.832***	-0.298
	(1.737)	(2.231)	(1.986)
Constant	-5.253***	3.521	-7.375***
	(1.492)	(2.133)	(1.890)
Observations	1,419	868	1,491
R-squared	0.888	0.912	0.890
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Labor Scarcity and Finance: Slave vs. free states

	Mean	SD	N
Free states			
Population (thousands)	1,300	1,400	743
Urban ratio	0.13	0.14	743
Slave ratio	0	0	743
White ratio	0.98	0.02	743
Daily average wage (with board)	0.78	0.46	743
Daily average wage (without board)	1.05	0.58	743
Total patents	44.01	102.9	743
Slave states			
Population (thousands)	950	740	748
Urban ratio	0.12	0.22	748
Slave ratio	0.3	0.16	748
White ratio	0.66	0.14	748
Daily average wage (with board)	0.4	0.15	748
Daily average wage (without board)	0.57	0.23	748
Daily slave hire price	0.10	0.08	196
Total patents	6.39	10.87	748

Labor Scarcity and Finance: slave vs. free states

	Ln(Patents)		
	t+1	t+2	t+3
Free banking × *Free state*	0.442***	0.469***	0.558***
	(0.084)	(0.148)	(0.172)
Free banking	0.092	0.146	0.094
	(0.090)	(0.087)	(0.095)
Ln(Population)	0.434***	0.498***	0.564***
	(0.043)	(0.050)	(0.057)
Urban ratio	0.873*	1.581**	2.093***
	(0.469)	(0.670)	(0.714)
Slave ratio	-2.124	-3.655**	-4.945**
	(1.458)	(1.723)	(1.858)
White ratio	-0.154	-1.315	-2.024
	(1.389)	(1.612)	(1.537)
Constant	-4.421***	-3.847***	-3.860***
	(1.213)	(1.315)	(1.261)
Observations	1,491	1,491	1,491
R-squared	0.894	0.891	0.890
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Labor Scarcity and Finance: patent classification

	Ln(Patents)		
	t+1	t+2	t+3
Free banking	-0.298***	-0.232**	-0.244**
	(0.100)	(0.098)	(0.094)
Free banking × *Free state*	0.789***	0.831***	0.905***
	(0.125)	(0.138)	(0.134)
Free banking × *Manufacturing patent*	0.248**	0.220**	0.249**
	(0.104)	(0.108)	(0.108)
Free banking × *Free state* × *Manufacturing patent*	0.345**	0.355***	0.306**
	(0.129)	(0.128)	(0.115)
Manufacturing patent × *Free state*	0.409***	0.428***	0.453***
	(0.039)	(0.040)	(0.040)
Manufacturing patent	0.337***	0.352***	0.364***
	(0.040)	(0.040)	(0.040)
Constant	-0.048	0.611	0.757
	(0.832)	(0.875)	(0.855)
Controls	Yes	Yes	Yes
Observations	2,982	2,982	2,982
R-squared	0.789	0.791	0.795
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Labor Scarcity and Finance: patent classification

$$
\begin{aligned}
Ln(Patents)_{i,j,t+3} = & Cons \\
& -0.244 \times \textit{Free banking}_{i,t} \\
& +0.905 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \\
& +0.249 \times \textit{Free banking}_{i,t} \times \textit{Manufacturing}_{j} \\
& +0.306 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \times \textit{Manufacturing}_{j} + ...
\end{aligned}
$$

☞ The effects of free banking

	Slave states	Free states
Agricultural	-0.244	0.661
Manufacturing	0.005	1.216

Labor Scarcity and Finance: patent classification

$$
\begin{aligned}
Ln(Patents)_{i,j,t+3} = & Cons \\
& -0.244 \times \textit{Free banking}_{i,t} \\
& +0.905 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \\
& +0.249 \times \textit{Free banking}_{i,t} \times \textit{Manufacturing}_{j} \\
& +0.306 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \times \textit{Manufacturing}_{j} + ...
\end{aligned}
$$

☞ The effects of free banking

	Slave states	Free states
Agricultural	-0.244	0.661
Manufacturing	0.005	1.216

Labor Scarcity and Finance: patent classification

$$
\begin{aligned}
Ln(Patents)_{i,j,t+3} = & Cons \\
& -0.244 \times \textit{Free banking}_{i,t} \\
& +0.905 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \\
& +0.249 \times \textit{Free banking}_{i,t} \times \textit{Manufacturing}_{j} \\
& +0.306 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \times \textit{Manufacturing}_{j} + ...
\end{aligned}
$$

☞ The effects of free banking

	Slave states	Free states
Agricultural	-0.244	0.661
Manufacturing	0.005	1.216

Labor Scarcity and Finance: patent classification

$$
\begin{aligned}
Ln(Patents)_{i,j,t+3} = & Cons \\
& -0.244 \times \textit{Free banking}_{i,t} \\
& +0.905 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \\
& +0.249 \times \textit{Free banking}_{i,t} \times \textit{Manufacturing}_{j} \\
& +0.306 \times \textit{Free banking}_{i,t} \times \textit{Free state}_{i} \times \textit{Manufacturing}_{j} + ...
\end{aligned}
$$

☞ The effects of free banking

	Slave states	Free states
Agricultural	-0.244	0.661
Manufacturing	0.005	1.216

Labor Scarcity and Finance: agricultural states

	Ln(Patents)		
	t+1	t+2	t+3
Free banking	-0.340***	-0.242**	-0.226**
	(0.101)	(0.102)	(0.096)
Free banking × *Free state*	0.814***	0.834***	0.966***
	(0.118)	(0.144)	(0.147)
Free banking × *Manufacturing patent*	0.339***	0.310***	0.340***
	(0.105)	(0.108)	(0.109)
Free banking × *Free state* × *Manufacturing patent*	0.149	0.205	0.135
	(0.134)	(0.143)	(0.134)
Manufacturing patent × *Free state*	0.153***	0.158***	0.184***
	(0.038)	(0.039)	(0.039)
Manufacturing patent	0.246***	0.262***	0.273***
	(0.035)	(0.035)	(0.036)
Constant	1.565	3.601	5.617***
	(2.095)	(2.207)	(2.045)
Controls	Yes	Yes	Yes
Observations	1,836	1,836	1,836
R-squared	0.750	0.749	0.755
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Free Banking and Slavery

Free banking increased slave labor and further discouraged innovation.

- banking made slave investment and trade easier (Murphy 2017)
- migration of slave owners and slaves across states (Fogel Engerman 1974)

	Slave ratio	
Free banking	1.090*	0.751**
	(0.470)	(0.217)
Ln(Population)		0.273
		(0.232)
Urban ratio		-2.827
		(2.660)
White ratio		-77.427***
		(14.425)
Constant	40.244***	82.519***
	(2.657)	(6.977)
Observations	160	160
R-squared	0.986	0.996
State FE	Yes	Yes
Year FE	Yes	Yes

Conclusion

An important topic

- The role of labor scarcity on how finance impacts innovation

A unique historical approach

- Exploit staggered passage of Free Banking laws across states
- Exploit differences in labor scarcity across slave and free states

Key findings

- Access to finance spurred innovation when labor was scarce.

Thank you!

Free banking and Access to Finance

	Ln(Free bank counts)			Free bank ratio		
	t+1	t+2	t+3	t+1	t+2	t+3
Free banking	1.531***	1.326***	1.129***	0.232***	0.189***	0.151***
	(0.144)	(0.190)	(0.216)	(0.027)	(0.033)	(0.036)
Ln(Population)	0.126***	0.138***	0.145***	0.053***	0.054***	0.053***
	(0.039)	(0.045)	(0.050)	(0.012)	(0.014)	(0.015)
Urban ratio	3.312***	2.870***	2.408***	0.421***	0.381***	0.335***
	(0.692)	(0.799)	(0.838)	(0.086)	(0.099)	(0.105)
Slave ratio	-3.541***	-3.897***	-3.924***	-0.959***	-0.974***	-0.931***
	(1.313)	(1.139)	(1.061)	(0.286)	(0.248)	(0.229)
White ratio	-3.752**	-4.059***	-3.982***	-0.836***	-0.877***	-0.844***
	(1.450)	(1.236)	(1.159)	(0.298)	(0.243)	(0.220)
Constant	1.832	2.022**	1.904**	0.184	0.217	0.193
	(1.145)	(0.959)	(0.830)	(0.225)	(0.182)	(0.150)
Observations	1,491	1,491	1,491	1,491	1,491	1,491
R-squared	0.626	0.573	0.530	0.537	0.484	0.444
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Free banking and Access to Finance

	Ln(Free bank loans)			Free bank loan ratio		
	t+1	t+2	t+3	t+1	t+2	t+3
Free banking	7.486***	7.229***	6.915***	0.187***	0.176***	0.160***
	(0.613)	(0.590)	(0.770)	(0.015)	(0.018)	(0.028)
Ln(Population)	0.510***	0.651***	0.825***	0.073***	0.078***	0.084***
	(0.148)	(0.161)	(0.175)	(0.009)	(0.010)	(0.011)
Urban ratio	13.088***	13.477***	14.133***	0.430***	0.453***	0.484***
	(3.402)	(3.683)	(3.824)	(0.079)	(0.083)	(0.079)
Slave ratio	-9.392	-12.445	-15.819**	-0.692***	-0.779***	-0.879***
	(7.522)	(7.533)	(7.072)	(0.231)	(0.235)	(0.230)
White ratio	-13.925	-18.122*	-22.842**	-0.308	-0.407	-0.527**
	(10.247)	(10.280)	(9.081)	(0.265)	(0.277)	(0.252)
Constant	5.796	7.837	9.924	-0.509**	-0.479*	-0.441*
	(9.494)	(9.338)	(8.262)	(0.226)	(0.250)	(0.236)
Observations	1,452	1,413	1,374	1,452	1,413	1,374
R-squared	0.586	0.563	0.539	0.487	0.482	0.477
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Free banking and Access to Finance: slave states

	Ln(Free bank counts)			Free bank ratio		
	t+1	t+2	t+3	t+1	t+2	t+3
Free banking	0.235***	0.209***	0.183***	0.038***	0.033***	0.031***
	(0.045)	(0.047)	(0.048)	(0.009)	(0.007)	(0.007)
Ln(Population)	-0.035***	-0.030***	-0.026***	-0.004***	-0.003**	-0.003**
	(0.010)	a(0.010)	(0.009)	(0.001)	(0.001)	(0.001)
Urban ratio	0.638***	0.627***	0.587***	0.124***	0.126***	0.122***
	(0.165)	(0.140)	(0.133)	(0.034)	(0.027)	(0.026)
Slave ratio	-0.807**	-0.787***	-0.691***	-0.151***	-0.143***	-0.124***
	(0.329)	(0.277)	(0.254)	(0.054)	(0.035)	(0.032)
White ratio	-2.084***	-2.034***	-1.883***	-0.367***	-0.357***	-0.328***
	(0.577)	(0.493)	(0.461)	(0.099)	(0.074)	(0.071)
Constant	2.111***	2.015***	1.841***	0.355***	0.338***	0.307***
	(0.573)	(0.501)	(0.465)	(0.094)	(0.071)	(0.068)
Observations	748	748	748	748	748	748
R-squared	0.454	0.421	0.389	0.426	0.394	0.378
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Free banking and Access to Finance: slave states

	Ln(Free bank loans)			Free bank loan ratio		
	t+1	t+2	t+3	t+1	t+2	t+3
Free banking	2.894***	2.924***	2.947***	0.007***	0.008***	0.009***
	(0.691)	(0.698)	(0.702)	(0.002)	(0.002)	(0.002)
Ln(Population)	-0.332***	-0.319***	-0.300**	-0.001***	-0.000***	-0.000**
	(0.112)	(0.112)	(0.114)	(0.000)	(0.000)	(0.000)
Urban ratio	8.193***	8.840***	9.761***	0.025***	0.029***	0.033***
	(2.683)	(2.642)	(2.257)	(0.008)	(0.009)	(0.008)
Slave ratio	-10.585**	-11.373**	-12.154***	-0.030**	-0.035**	-0.039***
	(4.821)	(4.622)	(3.824)	(0.014)	(0.014)	(0.012)
White ratio	-26.118***	-28.402***	-30.940***	-0.073***	-0.082***	-0.092***
	(8.964)	(8.718)	(7.419)	(0.025)	(0.026)	(0.024)
Constant	25.699***	27.322***	29.035***	0.070***	0.077***	0.084***
	(8.679)	(8.377)	(7.249)	(0.024)	(0.024)	(0.023)
Observations	730	712	694	730	712	694
R-squared	0.402	0.403	0.404	0.334	0.357	0.376
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Free banking and Access to Finance: slave states

	Ln(Patents)		
	t+1	t+2	t+3
Free banking	0.191**	0.270***	0.247***
	(0.090)	(0.083)	(0.083)
Ln(Population)	0.315***	0.412***	0.516***
	(0.064)	(0.086)	(0.102)
Urban ratio	0.805	1.418	2.326
	(1.167)	(1.492)	(1.414)
Slave ratio	4.114**	2.043	-0.208
	(1.553)	(1.949)	(2.086)
White ratio	6.590***	5.135***	3.423*
	(1.711)	(1.897)	(1.944)
Constant	-9.367***	-8.850***	-8.371***
	(1.562)	(1.520)	(1.540)
Observations	748	748	748
R-squared	0.810	0.802	0.795
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes