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Bankruptcy rules and innovation

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What are the optimal bankruptcy rules to stimulate entrepreneurial innovation?

- Importance of small firms (entrepreneurs) for innovation
- Risky & opaque projects in need of outside financing, partly with debt
- Importance of *personal* bankruptcy code
- Project failure → insolvency → enter *bankruptcy* → **ex ante incentives**
    1. Debt discharge & exemptions (risk sharing) → demand for credit ↑
    2. Fraud, risk shifting & limited effort (moral hazard) → supply of credit ↓
- Which of the two dominates? Is there a trade-off?
- Open question: lots of cross-country variation (e.g. U.S. vs continental Europe)

Empirical challenges:

- Most countries (e.g. U.S.): established bankruptcy rules with limited cross-sectional or time-series variation → effect of relatively small changes
- Large cross-country differences ≠ random variation

Introduction of the first permanent U.S. Federal Bankruptcy code in 1898

1. *Voluntary*: debt discharge upon voluntary surrender of assets
2. *Involuntary:* forced liquidation of fraudulent debtors' assets

- Effects on patenting by *independent* inventors (non-corporate)
- Pre-existing state-level variation in both elements
  - Treatment states: large change in bankruptcy rules
  - Control states: state-level rules already similar to Federal code
- Different pre-existing levels of bankruptcy exemptions (unchanged)

Research questions:

- Did innovation (patenting) increase or decrease in response to *more lenient voluntary,* or *stricter involuntary bankruptcy* rules?
- How did this differ by (pre-existing) exemption levels?

Contribution to the literature

- **U.S. variation in homestead exemptions between states** (Gropp, Scholz and White 1997, Fan and White 2003, Berkowitz and White 2004, Berger, Cerquiero and Penas 2011, Cerquiero and Penas 2016, Cerqueiro et al. 2017) – mixed / negative
  - Challenge 1: In modern U.S., other options to protect home equity (e.g. LLC). Increasing exemptions might not provide more protection, but it does reduce the amount of collateral that can be pledged.
  - Challenge 2: Existing bankruptcy protection; effect linear for all protection levels?
  - Design possibly biased towards finding negative effects.
  - ***This paper: no LLCs, etc + large change in bankruptcy regime at different (existing) protection levels***
- **Cross-country variation in bankruptcy protection** (Cumming et al. 2024) - positive
  - Challenge: may reflect deeper economic or institutional differences (Efrat 2002)
  - ***This paper: more homogeneity across U.S. states***
- **Marriage laws in 1840s** (Koudijs and Salisbury 2020) – non-linear effect
  - Challenge: generalizable?
  - ***This paper: entire U.S. in a more industrialized economy + focus on entrepreneurial risk-taking***
- **Creditor protection** (De la Porta et al. 1998, Djankov, McLeish and Shleifer 2007, Acharya and Subramaniam 2009, Acharya, Amihud and Litov 2011, Vig 2013, Lilienfeld-Toal, Mukherjee and Visaria 2013, Mann 2018) – mixed effects
  - ***This paper: interaction of creditor and debtor protection***

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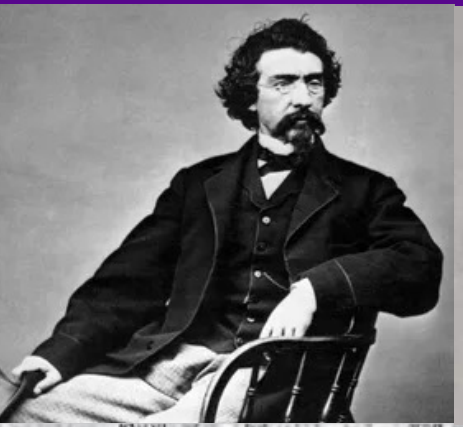
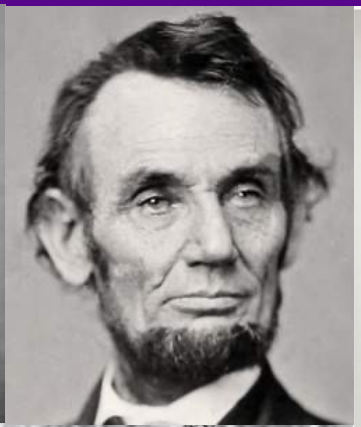
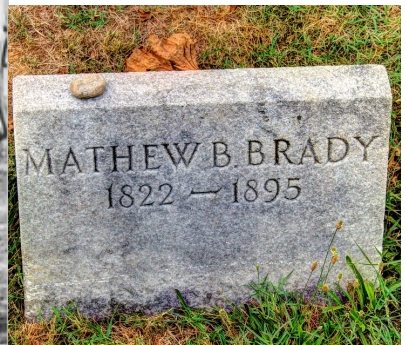
Historical background

Mathew Brady (1822-1896)







- Famous pioneer of 19th c. wet glass photography
- Borrowed ~$100,000 to create ~10,000 Civil War plates
- Unable to sell the plates after the end of the Civil War
- Insolvent in 1873 → loss of studio and equipment

- Did not participate in dry glass revolution after 1871
- Died penniless in NY Charity Ward Presbyterian Hospital
- Funeral paid for by Veterans of the 7th New York Infantry

Claurence Saunders (1881-1953)

- Famous pioneer of self-service grocery stores → various patents
- Starts “Piggly Wiggly” chain in 1916, listed in 1922
- Borrowed personally to support the company’s stock price → failed → filed for *personal* bankruptcy

- Loss of all of his property (incl. “Pink House)” but made a fresh start
- Later businesses:
  - Sole Owner Stores
  - Keedoozle automated stores

Limited debtor protection under U.S. Common law (Williston 1909)

- No debt discharge after insolvency
  → Creditor has full recourse without time limitations

State level bankruptcy laws – pre 1898 (Coleman 1974)

- Debtors protected by bankruptcy exemptions
  (limit on the amount of assets that can be seized)
- No debt discharge → future assets remain at risk

→ ***Voluntary*** bankruptcy laws: debt discharge after *voluntary* surrender of assets

Limited creditor protection under U.S. Common law (Williston 1909)

- No restrictions on voluntary assignment of assets, no involuntary assignment
  → Risk of fraud: debtors may hide assets or assign assets to a privileged creditor

State level bankruptcy laws – pre 1898 (Coleman 1974)

- Creditors protected through limits on the assignment of assets
- No orderly way to seize and liquidate assets for the benefit of all creditors

→ ***Involuntary*** bankruptcy laws: *forced* liquidation of all assets after insolvency

Bankruptcy at the Federal level – pre 1898 (Warren 1935)

- Because of interstate debt, need for federal law
- Temporary acts in aftermath of crises (1800, 1841, 1867)
- Several attempts at a **permanent** law, but debtor and creditor-friendly factions in Congress cannot agree

***Permanent* National Bankruptcy Act of 1898** (Skeel 2001)

- Continuous debate since 1880: "18-year odyssey of shifts and near misses."
- Creditor-friendly Torrey bill of 1890
- Many debtor-friendly amendments afterwards
- "11th hour compromise" in 1898: (limited) involuntary bankruptcy in exchange for voluntary bankruptcy
- Uncertain (attempted repeals) until 1905.

***Voluntary* bankruptcy:** Full discharge and fresh start

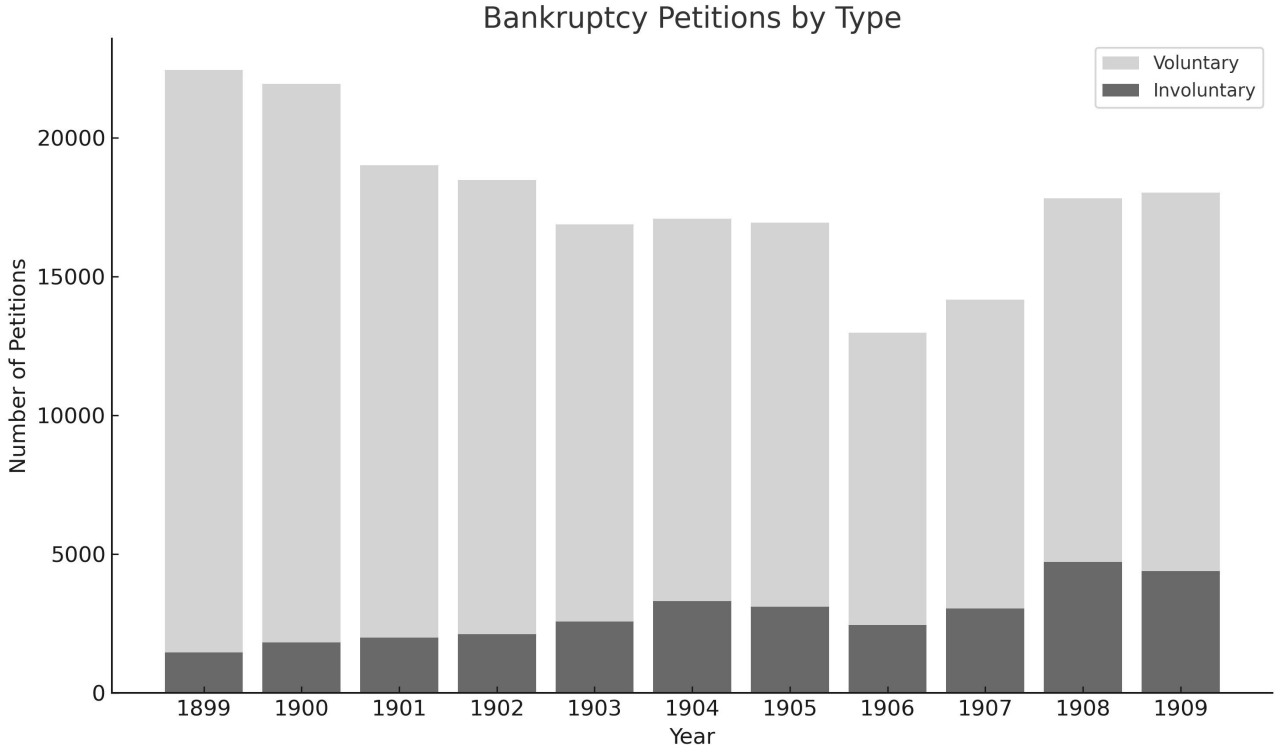
- Debtor *voluntarily* surrenders all assets and an overview of all liabilities
- Discharge conditional on full and honest disclosure

***Involuntary* bankruptcy:** *Forced* liquidation of a debtor's estate

- Debtor needs to be truly insolvent (more than liquidity problems)
- Debtor has taken some action to defraud creditors (conceal assets; assign assets to a privileged creditor; give one creditor a preference)
- Creditors need to agree: # < 12: 1; # ≥ 12: 3

Pre-existing bankruptcy exemptions remain in place

Aggregate # bankruptcy petitions under National Act



- Voluntary petitions more frequent → actively used for *risk sharing*
- Involuntary petitions less frequent → *threat against fraud*

Source: Annual Reports of Attorney General of the United States, 1899-1909

receive; and after judgment obtained against any such debtor, the person obtaining the same shall be considered in every respect as another creditor, whose debt was due before the delivery of the petition; but if, in the space of eighteen months after the petition is delivered, no judgment shall be obtained against the insolvent, the moneys so reserved shall be divided among the other creditors in the same manner as if the sum so annexed to the account of his creditors was paid; if judgment should be obtained against such debtor as bail for any sum, within eighteen months after the petition is delivered, and after the division of his or her effects among his or her creditors, and the said debtor shall have omitted either wholly or in part to annex the said sum to the account delivered, the person obtaining such judgment shall recover against the said debtor, either for the whole or the part omitted, as the case may be, so much as the other creditors of the said debtor ought to have received for the like debt, and no more.

Debts not due allowed. Ib., § 19.

27. That all other persons who have given credit to such insolvent debtor on valuable consideration for any sum of money, or other matter or thing, which is or may not be due or payable at or before the time of the delivery of the petition, shall and may be admitted and considered as creditors, whose debts are then due, and shall receive a dividend in the same proportion as the other creditors, deducting thereout only a rebate of lawful interest for what shall be received on such debt, to be computed from the actual payment thereof to the time it would have become due.

The debtor's discharge. Ib., § 20.

28. That every such insolvent debtor, having given up all his or her estate, and conformed in all things to the directions of this act, shall forever thereafter be discharged from all debts due at the time of the assignment, or contracted for before that time, though payable afterwards, so far as regards the imprisonment of his or her person. (*a*)

Law example (New Jersey 1895)

State level regimes - voluntary

	Repayment requirement	Consent of majority of creditors	States
Treatment (1)	No discharge		AL, AZ, AK, CO, DE, DC, FL, GA, IL, IN, IO, KS, KT, LA, MS, MO, NE, NM, NC, OH, OK, PA, SC, SD, TN, UT, VA, WV
	50-75%	Yes	CT, MA, MI, MN, NV, NH, NY, OR, WA, WI, WY
Control	~30%	No	TX, VT, NJ
(0)	0%	No	CA, ID, ME, MD, ND, RI
National	*0%*	*No*	

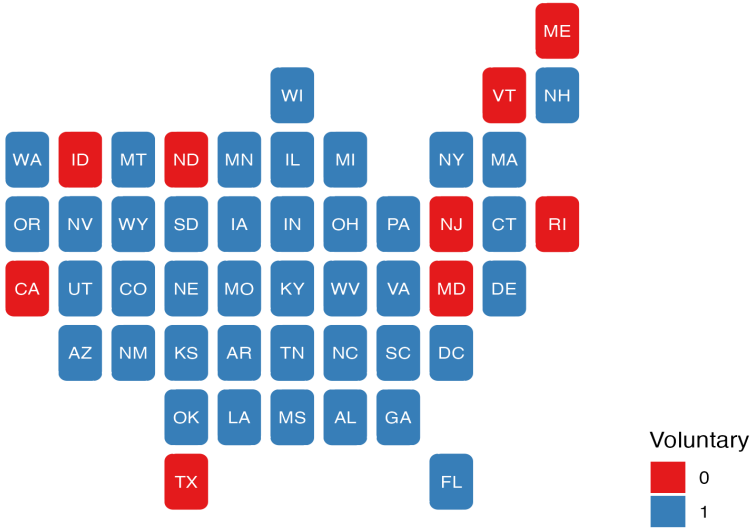
State level regimes - involuntary

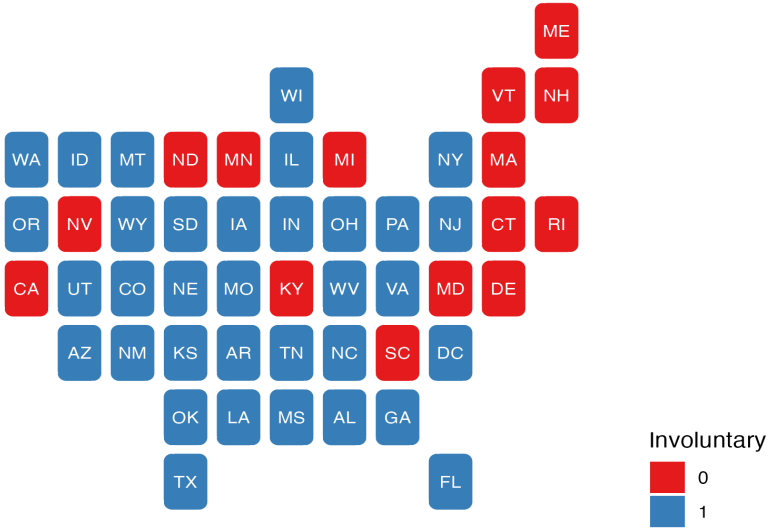
	Debtor arrest	# Creditors petition†	Act of Insolvency?*	States
Treatment (1)	No mechanism to force liquidation			AL, AZ, AK, CO, DC, FL, GA, ID, IL, IN, IO, KS, LO, MS, MO, MT, NE, NJ, NM, NY, NC, OH, OR, PA, SD, TN, TX, UT, VA, WA, WV, WI, WY
Control	Yes	N/A	F	DE, KT, SC
(0)	No	>1	F	CA, NV, MI, MN
	No	≥1	F	MA, ND
	No	≥1	F+	CT, ME, MD, NH, RI, VT
National	*No*	*≥1*	*F*	

* *F* : Action to defraud creditors; + : Broader set of reasons

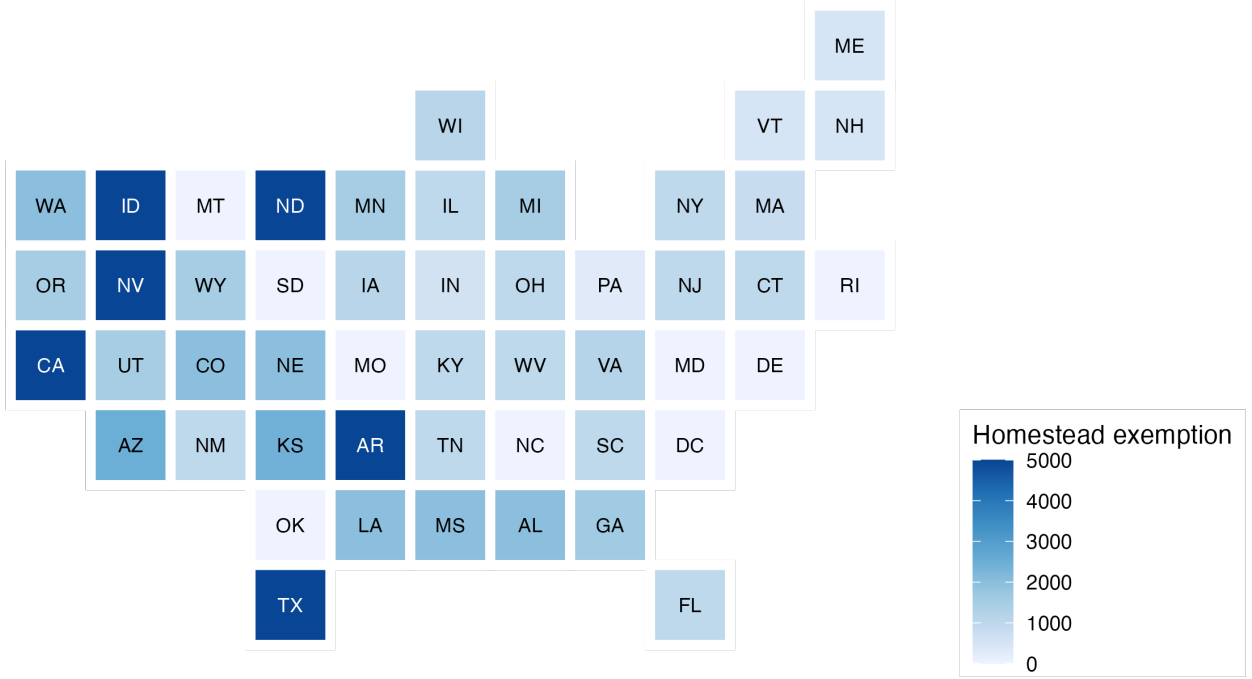
† *>1*: Multiple (varies by state); *≥1*: Single, more if large # of creditors

Change in bankruptcy regimes





Cross-sectional variation in exemptions



Homestead exemption:

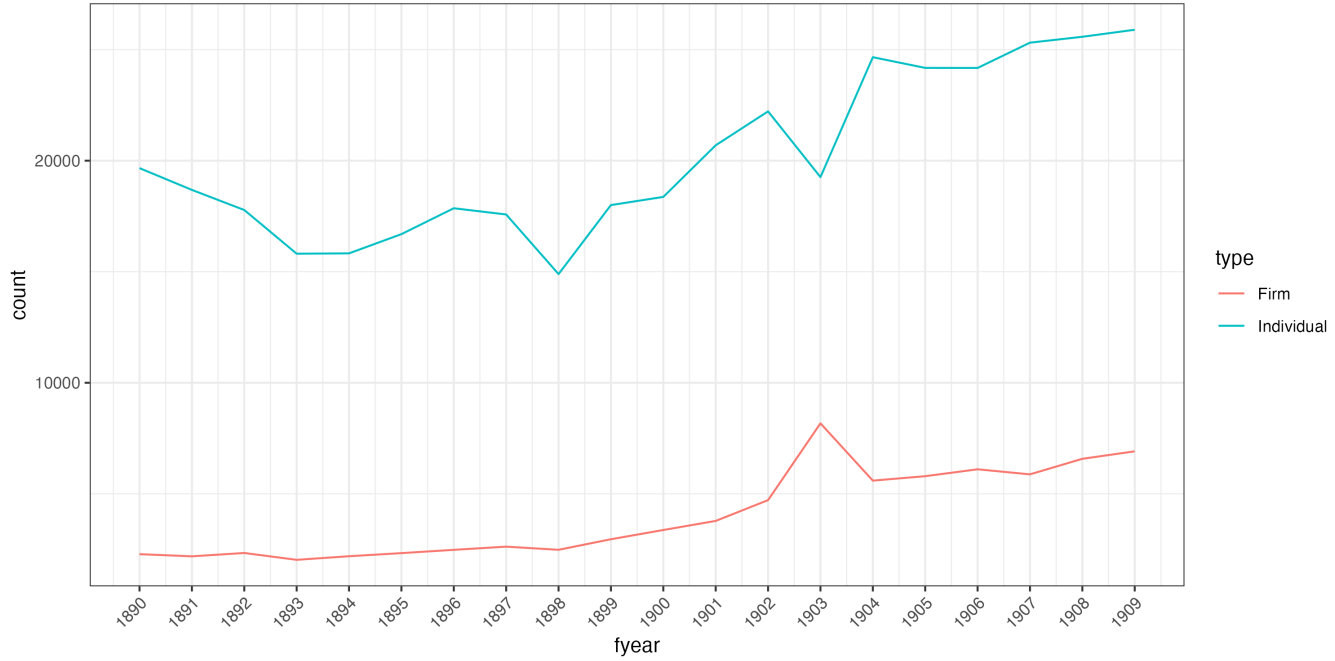
- Home equity exempted in bankruptcy, up to a limit
- Typically defined in $
- If only defined in acres, we set it to zero or we take the town $ value (if provided)

High exemption:

- >$1,000 (median)

Does not change with passage of the 1898 Act.

Patenting around 1898



Individual (independent) patents:

- Patent non-assigned (inventor owner by default)
- Patent assigned to other individual

Firm patents:

- Patent assigned to a firm (single proprietorship, partnership or corporation)

cuit; and means carried thereby to subsequently operate a switch-contact between the drop-plate circuit and a main line; substantially as specified.

5. A telephone instrument containing a drop adapted to be automatically thrown by a signal-current on a line, a selector device in circuit with the signal-line, contacts beneath said drop for establishing circuit through a receiver and transmitter, means controlled by a switch-hook for releasing said drop and cutting out said selector, and means for automatically restoring said drop when the receiver is returned to a support therefor and establishing circuit through said selector; substantially as specified.

6. In a telephone instrument, a selector device comprising a disk and contact-point, a selector-magnet to operate said disk in circuit with a selector-line, a switch-hook arranged to release a drop device to establish circuit through a receiver and transmitter when the receiver is removed from said hook, and means controlled by said hook for restoring said drop and establishing circuit through the selector; substantially as specified.

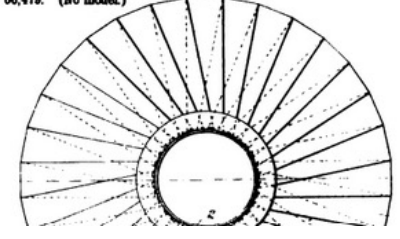
7. A telephone lock-out device comprising a pivoted switch-hook, a lever pivoted thereto and extending above the same, a bridging drop-plate pivoted at one edge above said lever, circuit-contacts in the path of travel of said plate, and a contact-roller on said lever and insulated therefrom to traverse the face of said plate in the upward movement of said lever; substantially as specified.

8. A telephone lock-out device comprising a pivoted switch-hook, a lever extending above the same, a drop-plate above said lever and adapted to be engaged in the upward movement of said lever; electrically-controlled means for retaining said drop-plate in an elevated position, and a wiping contact adapted to momentarily establish circuit through said electrically-controlled means during the movement of the switch-hook; substantially as specified.

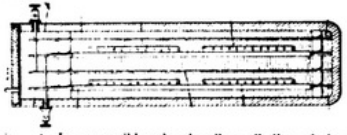
9. A telephone lock-out device comprising a pivoted switch-hook, a lever extending above the same, a drop-plate above said lever and adapted to be engaged in the upward movement of said lever, electrically-controlled means for retaining said drop-plate in an elevated position, a wiping contact adapted to momentarily establish circuit through said electrically-controlled means during the movement of the switch-hook, an insulating-contact at the upper end of the restoring-lever, and a contact device beneath said drop-plate adapted to establish circuit through the receiver and transmitter; substantially as specified.

10. A telephone system comprising electrically-controlled drops or relays at the central office and subscriber, a signal-battery in circuit with the same, means for temporarily establishing circuit through the central drop and the subscriber's drop, and contacts controlled by the movement of said drop to establish circuit through a receiver and transmitter; substantially as specified.

684,203. ROTARY BRUSH. William G. Eaton, Boston, Mass., assignor to G. H. P. Flagg, same place. Filed June 29, 1901. Serial No. 66,479. (No model.)



684,204. REVERSIBLE GALVANIC BATTERY. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 31, 1900. Serial No. 34,996. (No model.)



Claim.—1. In a reversible galvanic cell, an alkaline solution, a negative element, a positive electrode-support of metallic magnesium, and a metal in solution capable of being electrodeposited upon the magnesium to constitute the positive electrode, substantially as set forth.

2. In a reversible galvanic cell, an alkaline solution, a negative element, a flat numerously-perforated positive electrode-support of metallic magnesium, and a metal in solution capable of being electrodeposited upon the magnesium to constitute the positive electrode, substantially as set forth.

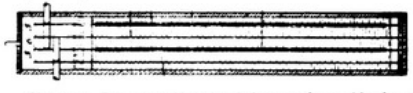
3. In a reversible galvanic cell, an alkaline zincate electrolyte, a magnesium support for receiving the deposit of zinc, and a negative electrode having a suitable depolarizer, substantially as set forth.

4. In a reversible galvanic cell, an alkaline zincate electrolyte, a flat numerously-perforated magnesium support for receiving the deposit of zinc, and a negative electrode having a suitable depolarizer, substantially as set forth.

5. In a reversible galvanic cell, an alkaline zincate electrolyte, a magnesium support for receiving the deposit of zinc, and a negative electrode having a depolarizer composed of copper sufficiently finely divided to prevent the formation of a soluble copper salt on oxidation, substantially as set forth.

6. In a reversible galvanic cell, an alkaline zincate electrolyte, a magnesium support for receiving the deposit of zinc, nickel receptacles immersed in said electrolyte, and copper in said receptacles sufficiently finely divided to be oxidized by the current without producing copper salts soluble in the solution, substantially as set forth.

684,205. REVERSIBLE GALVANIC BATTERY. Thomas A. Edison, Llewellyn Park, N. J. Filed June 20, 1901. Serial No. 65,286. (No model.)



Claim.—1. In a reversible galvanic battery, the combination of an alkaline solution, an electrode-support of metallic magnesium, a metal in solution capable of being electrodeposited upon the magnesium to constitute the oxidizable electrode on discharge, a second electrode-support, and an electrolytically-active oxid of a magnetic metal other than iron carried by the latter support, substantially as set forth.

2. In a reversible galvanic battery, the combination of an alkaline solution, an electrode-support of metallic magnesium, a metal in solution capable of being electrodeposited upon the magnesium to constitute the oxidizable electrode on discharge, a second electrode-support having perforated pockets or receptacles, and an electrolytically-active oxid of a magnetic metal other than iron carried within said receptacles, substantially as set forth.

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Stylized model

Model (Koudijs and Salisbury 2020, Appendix)

Setup:

1. Risk-averse entrepreneur: wealth W with log utility
2. Debt instruments only: D; invest $I = W + D$ in project
3. Project succeeds or fails: $\overline{R}$ or $\underline{R}$ with prob. $\frac{1}{2}$, with $R_f = 1$
4. Fraction α of wealth W protected in default (cannot contract a different $\tilde{\alpha}$)

Timing:

- $t = 1$: entrepreneur borrows and invests
- $t = 2$: project realizes, entrepreneur repays and consumes

"Risk-free" debt (always repaid) or "Risky" debt (default after project failure)

Entrepreneur's utility function:

$$\frac{1}{2}log\{\overline{R}(W + D) - \rho D\} + \frac{1}{2}log\{max[\underline{R}(W + D) - \rho D, \alpha \underline{R} W]\}$$

Feasibility constraint under risk-free debt (slack):

$$D \leq \underline{R}\,[(1-\alpha)W + D]$$

Lenders' zero profit condition under risky debt:

$$\frac{1}{2}\rho D + \frac{1}{2}\,\underline{R}\,[(1-\alpha)W + D] = D$$

Entrepreneur's IC constraint under risky debt

- In $t = 2$, entrepreneur can pretend the project failed (fraud):

$$\overline{R}(W + D) - \rho D \geq \beta\left(\overline{R} - \underline{R}\right)[(1-\alpha)W + D] + \overline{R}\alpha W$$

- Smaller α and $\beta \rightarrow$ looser borrowing constraint ($\Delta R \equiv \overline{R} - \underline{R}$):

$$D \leq \frac{(2-\beta)\Delta R}{2-(2-\beta)\Delta R}\,(1-\alpha)W$$

Two regimes:

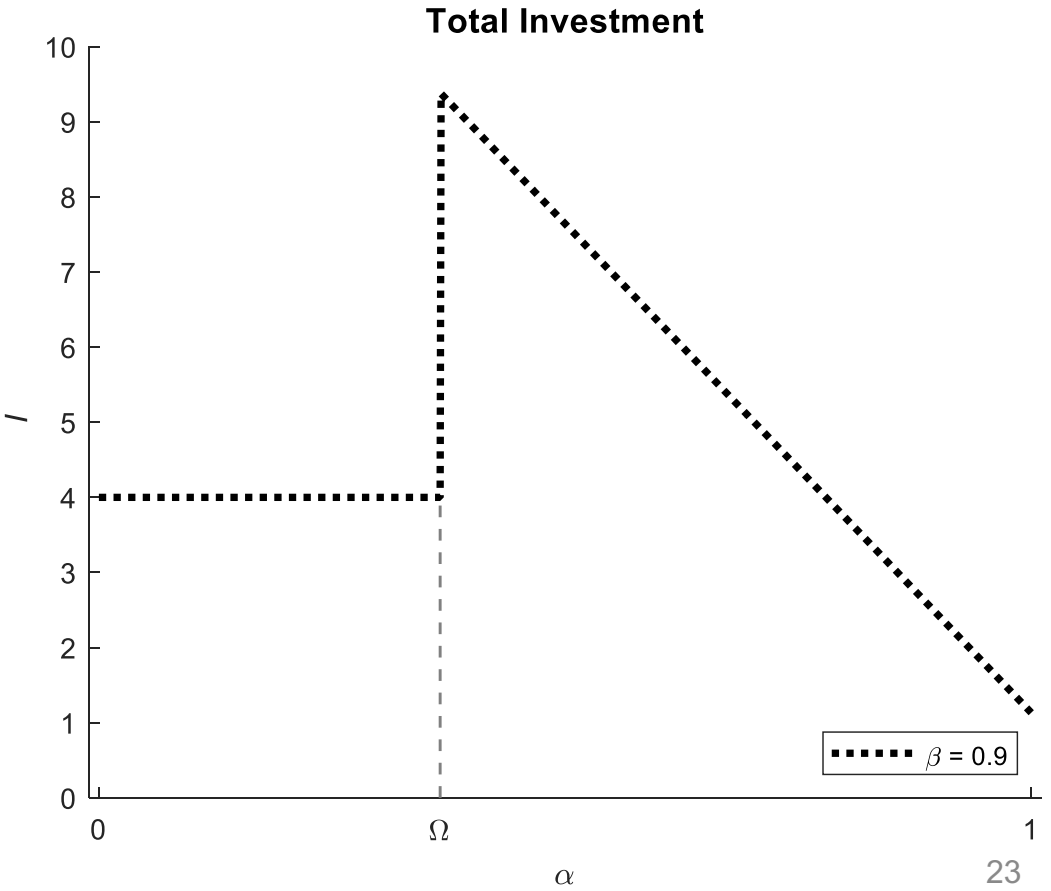
1. $\alpha \leq \Omega$: borrow risk-free amount
2. $\alpha > \Omega$: Borrow risky amount (with default in bad state)

Intuition:

- If $\alpha > \Omega$, consumption in bad state of the world sufficient to warrant risky borrowing

Observations:

- Ex ante, all debtors want $\beta = 0$, but this is time inconsistent
- Optimal $\alpha^* = \Omega$, but government will only enforce the α they set

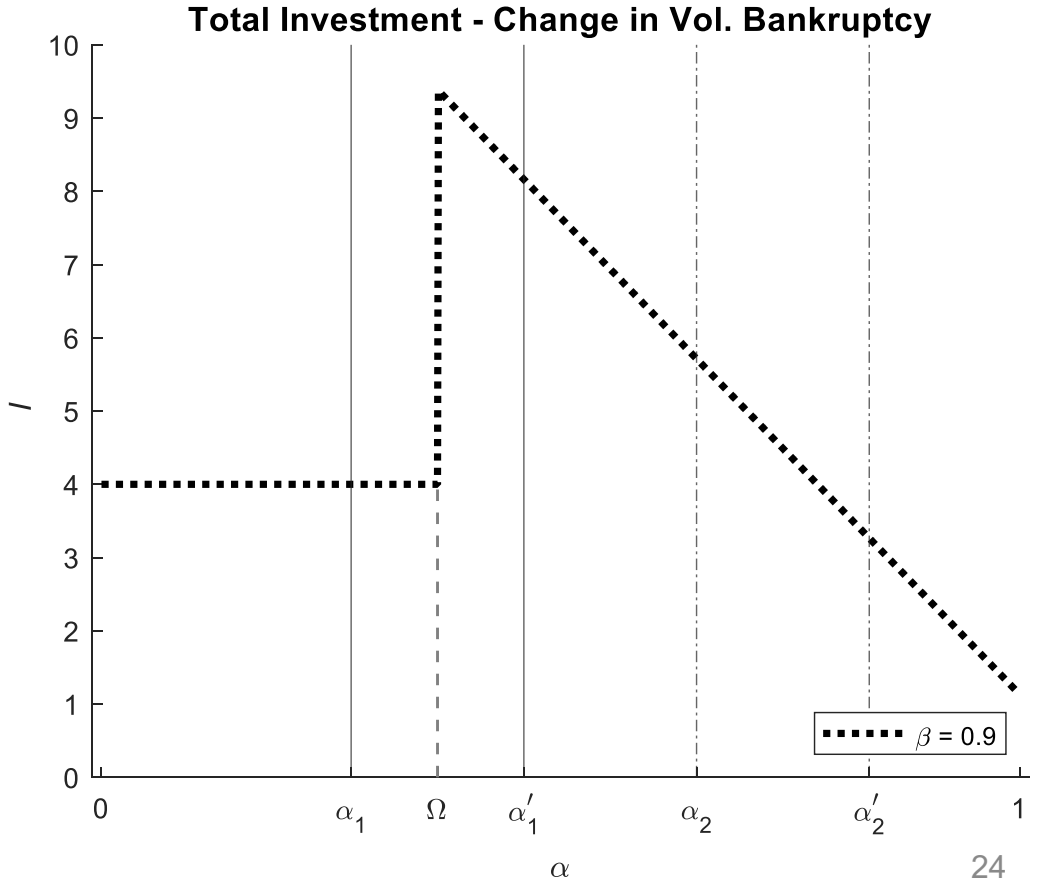


Non-linear effect from increasing protection α:

1. $\alpha_1 \rightarrow \alpha_1'$: go from risk-free to risky borrowing; increase in total investment
2. $\alpha_2 \rightarrow \alpha_2'$: continue risky borrowing, but now with tighter borrowing constraint

Intuition:

- Pre-existing protection matters
- Under too much protection, tighter borrowing constraint dominates risk-sharing benefits



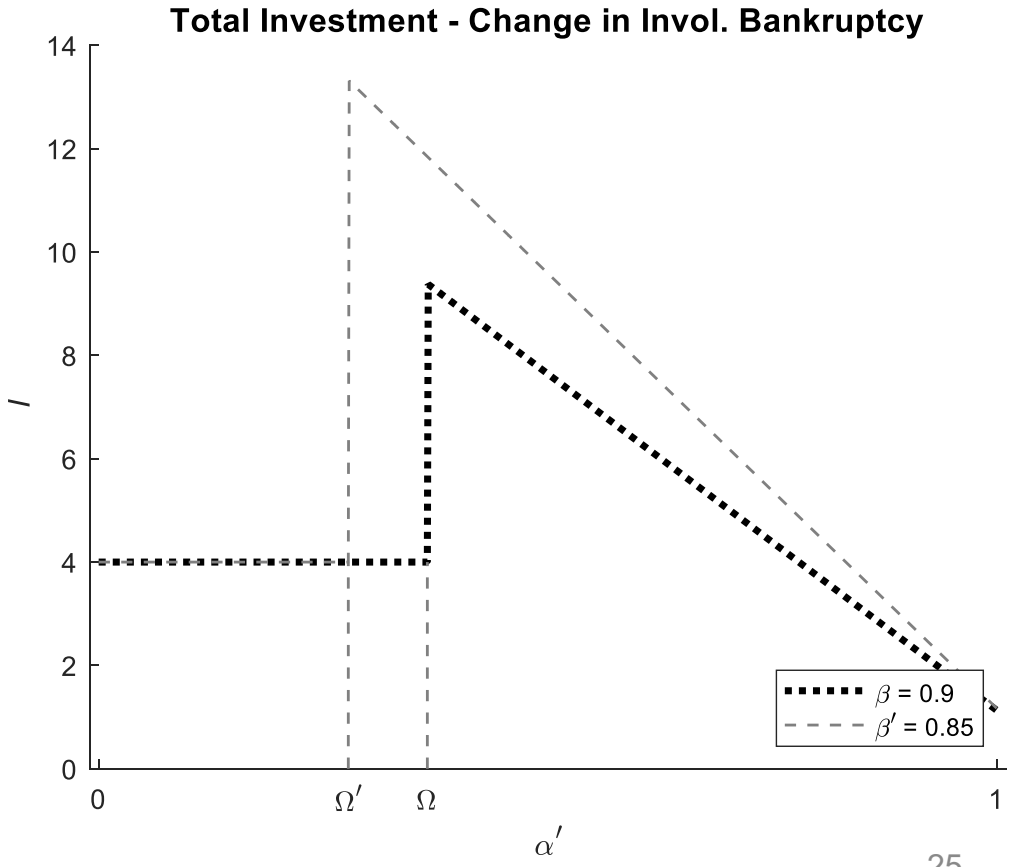
Changing the payout from opportunistic default (β)

Unambiguous effect from decreasing β:

- Borrowing constraint moves outward, with largest effect around Ω
- Smaller Ω'

Intuition:

- Smaller payout after fraud; especially effective for smaller α where there is potential for looser borrowing constraint
- Risky borrowing becomes more attractive



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Empirical analysis

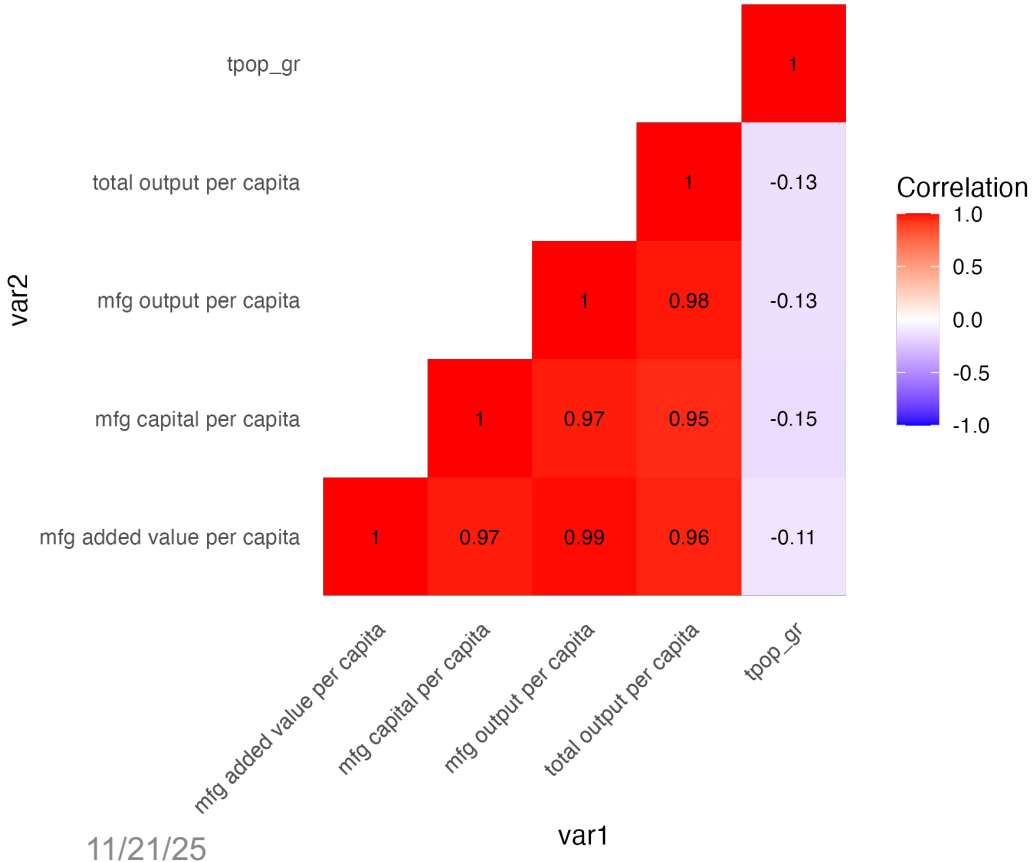
Balancing tables - Voluntary

Characteristic	0 N = 9	1 N = 39	p-value
manufacturing added value per capita (1890)	68.37	49.12	0.4
manufacturing capital per capita (1890)	116.15	79.25	0.5
manufacturing output per capita (1890)	148.33	107.69	0.4
total output per capita (1890)	196.80	147.28	0.2
population growth rate (1880-1890)	0.38	0.51	0.7

Balancing tables - Involuntary

Characteristic	0 N = 15	1 N = 33	p-value
manufacturing added value per capita (1890)	80.22	40.23	0.021
manufacturing capital per capita (1890)	143.54	60.10	0.007
manufacturing output per capita (1890)	174.80	88.27	0.017
total output per capita (1890)	219.21	128.09	0.003
population growth rate (1880-1890)	0.19	0.63	0.010

Correlation matrix of covariates



Manufacturing variables / Capita in 1890

- Highly correlated
- Mfg Added Value / Capita
- Higher value added: more innovative industries

Population growth, 1880-1890

- Measures the frontier

Dynamic two-by-two fixed effects:

$$\ln(ip_{i,t}) = \sum_{\tau \neq \tau_0} \beta_\tau^{vol} Vol_i * I[\tau] + \sum_{\tau \neq \tau_0} \gamma_\tau^{vol} X_i * I[\tau] + s_i + \theta_t + \varepsilon_{i,t}$$

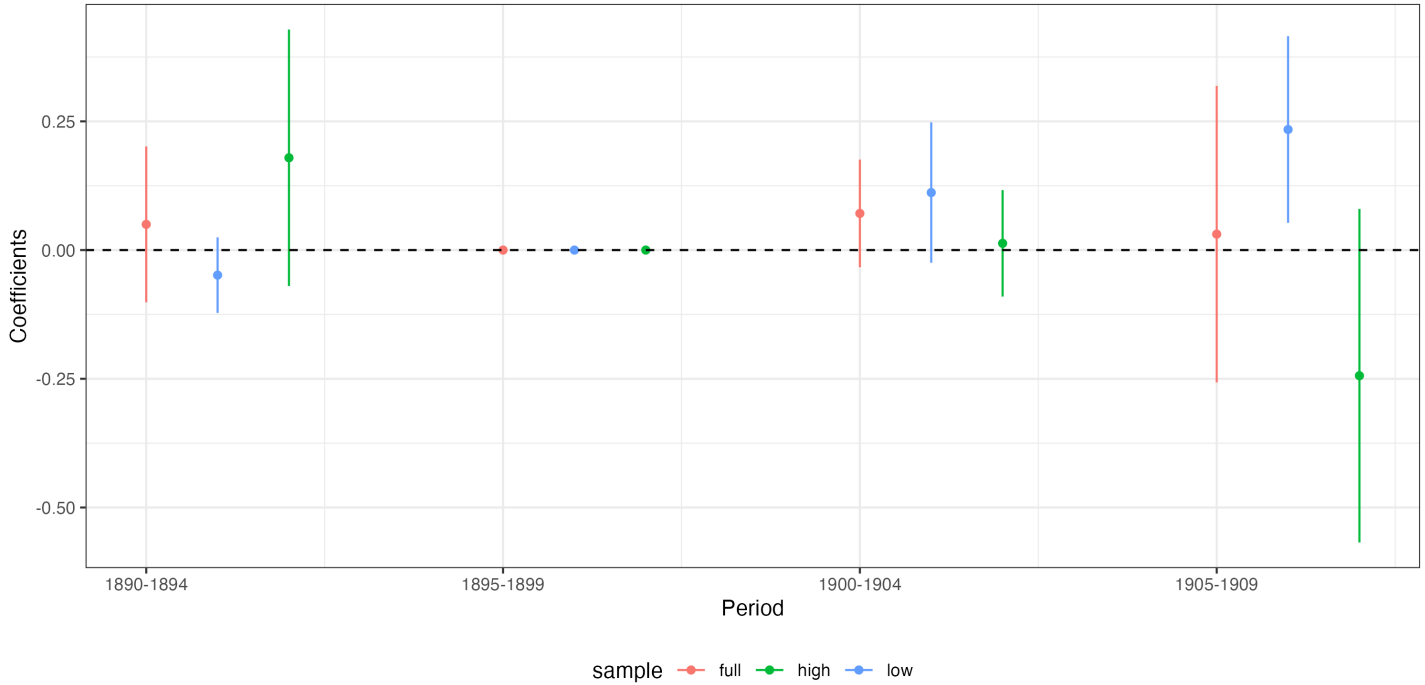
$$\ln(ip_{i,t}) = \sum_{\tau \neq \tau_0} \beta_\tau^{invol} Invol_i * I[\tau] + \sum_{\tau \neq \tau_0} \gamma_\tau^{invol} X_i * I[\tau] + s_i + \theta_t + \varepsilon_{i,t}$$

where:

- $ip_{i,t}$: independent patents in state i in year t
- Vol_i: state i has a large change in its *voluntary* bankruptcy code after 1898
- $Invol_i$: state i has a large change in its *involuntary* bankruptcy code after 1898
- τ: five year periods {1890-1894, 1895-1899, 1900-1904, 1905-1909}
- s_i, θ_t: year and state fixed effects
- X_i: control variable(s) as of 1890
- $\varepsilon_{i,t}$: standard errors clustered at the state level

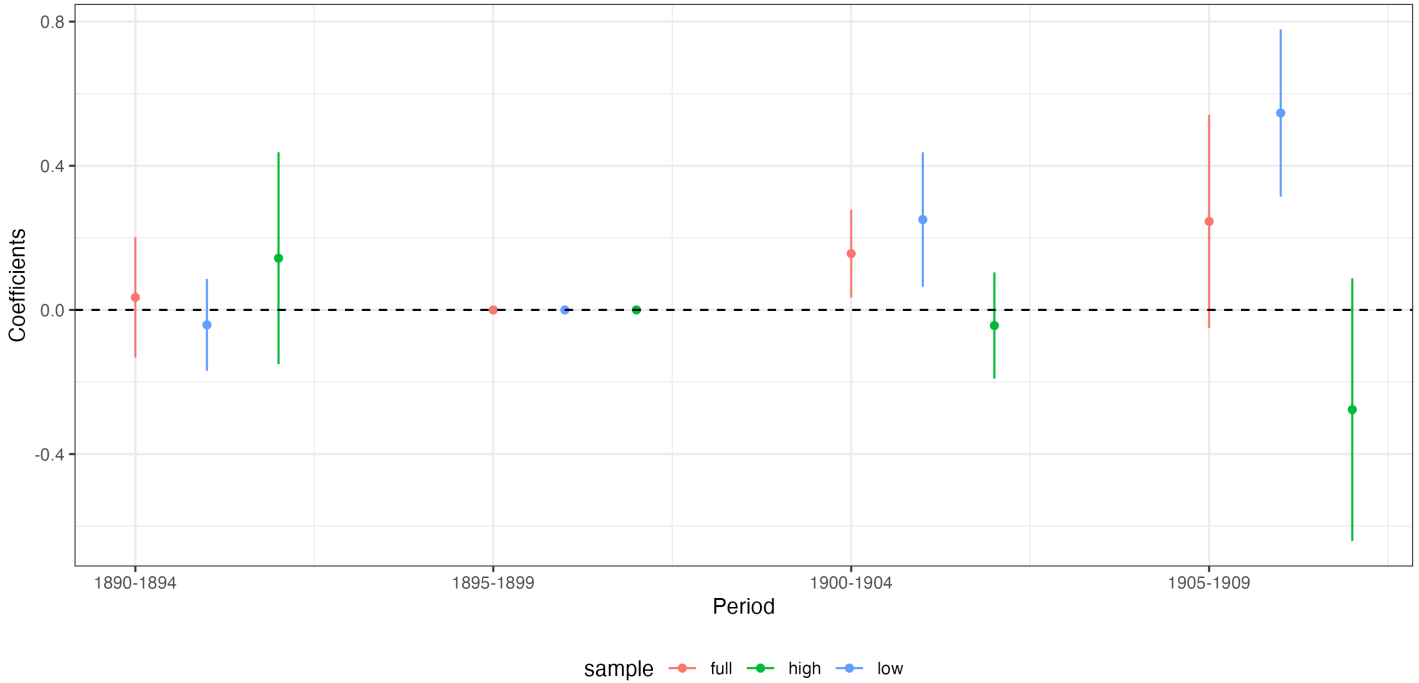
Estimate for ALL states and separately for states with higher/lower exemptions

Voluntary – 5-year period dummies



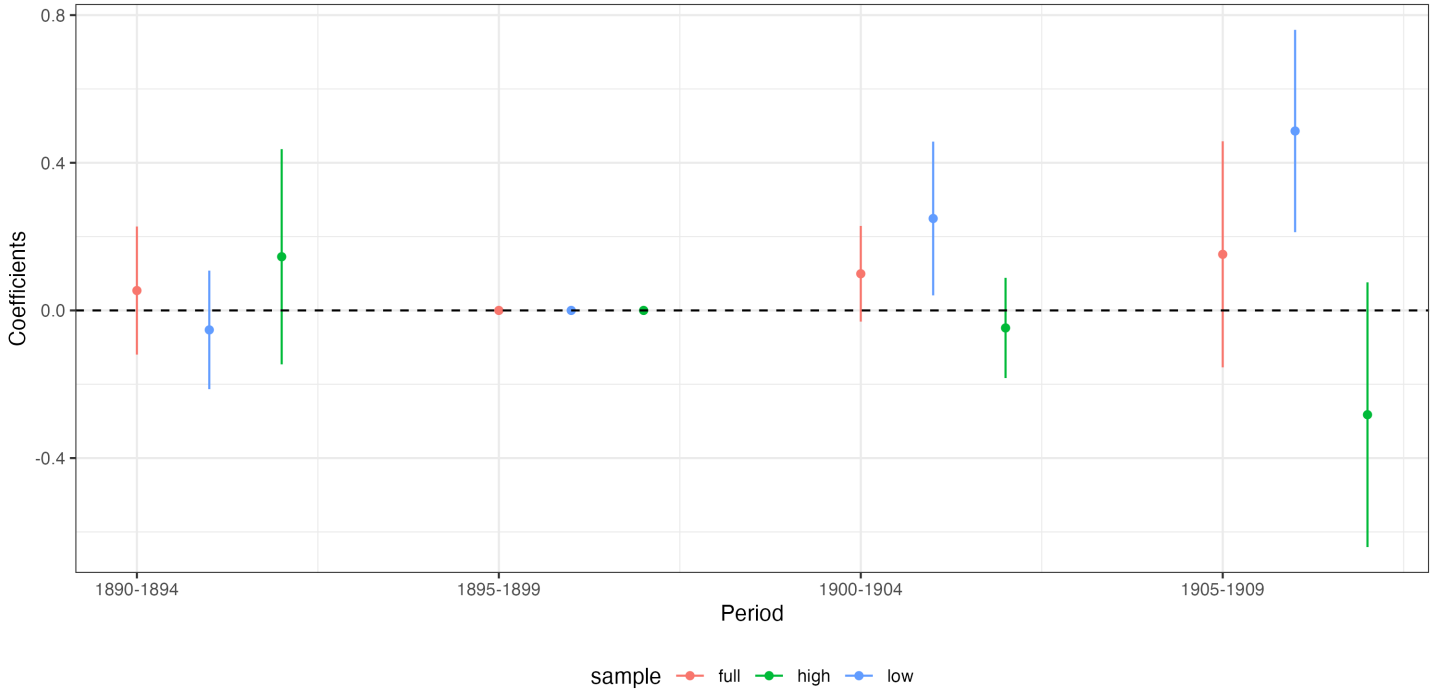
No covariates

Voluntary – 5-year period dummies



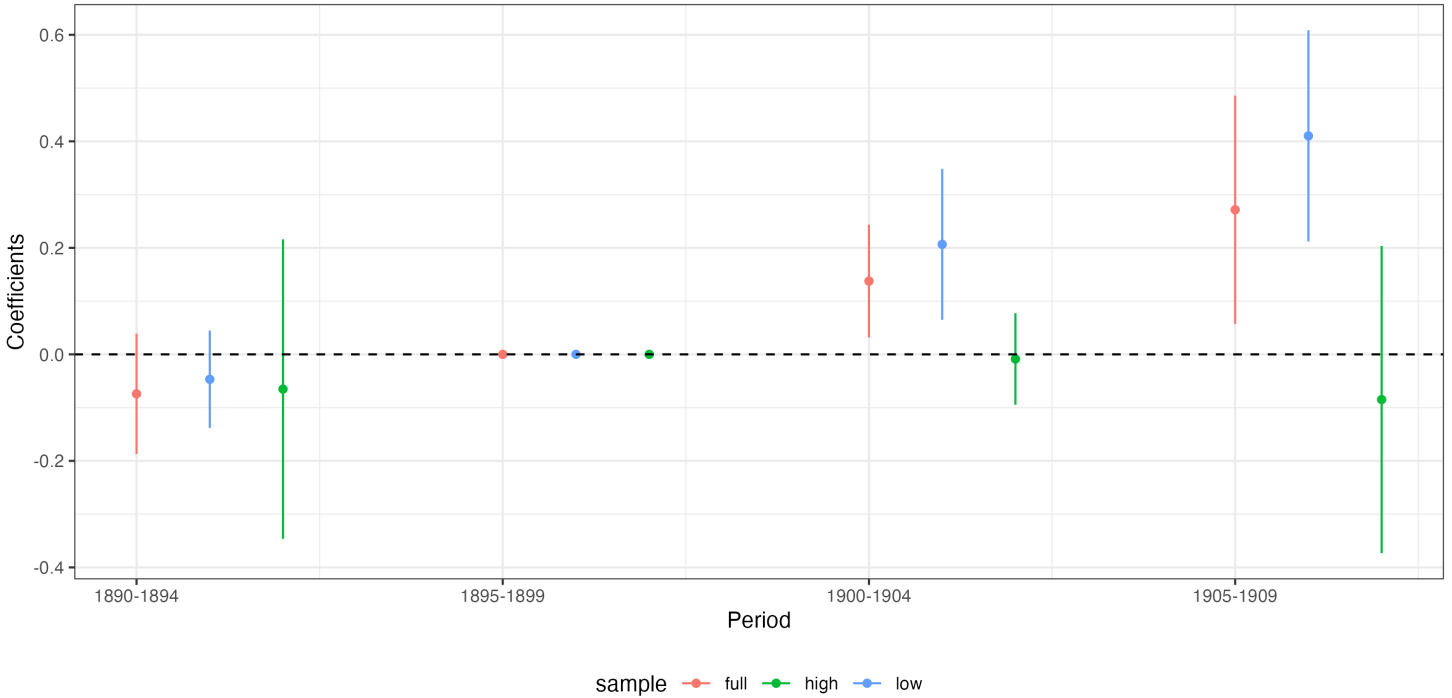
Including Mfg. Added Value / Capita * 5-year period dummies

Voluntary – 5-year period dummies



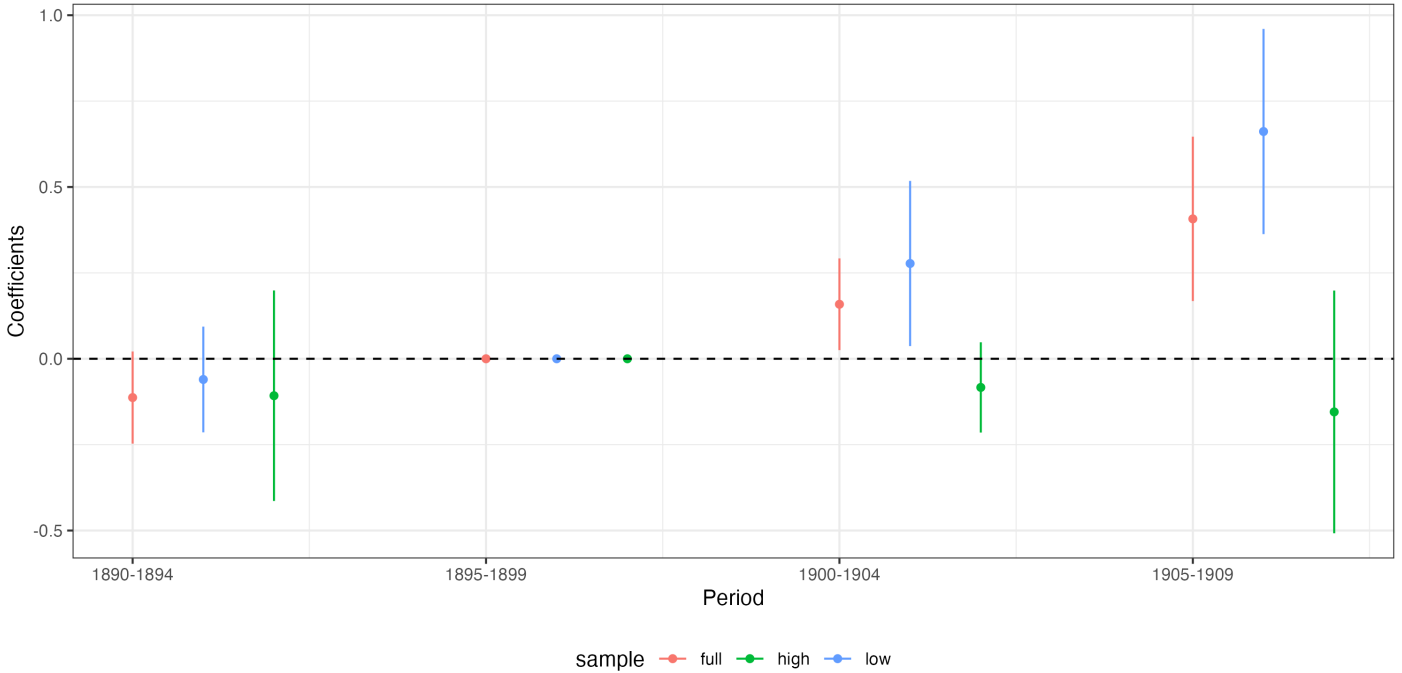
Including {Mfg. Added Value / Capita & Pop. Growth} * 5-year period dummies

Involuntary – 5-year period dummies



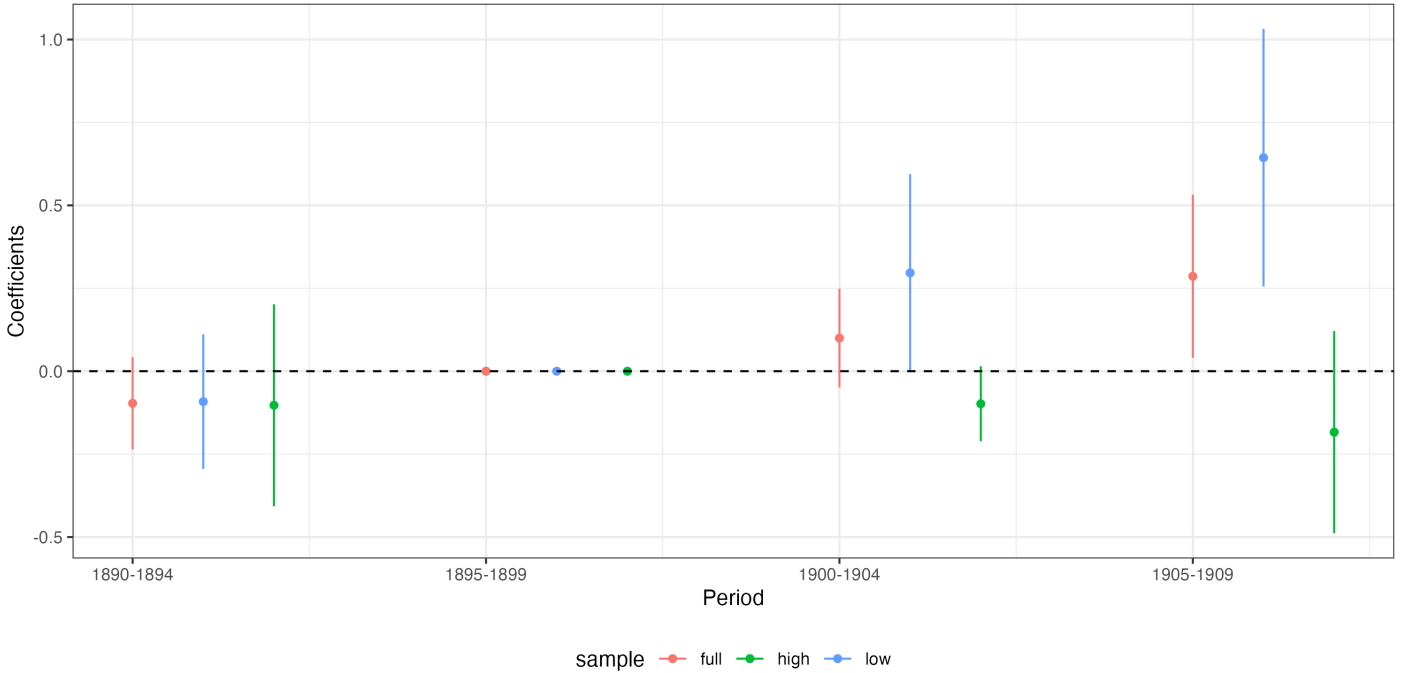
No covariates

Involuntary – 5-year period dummies



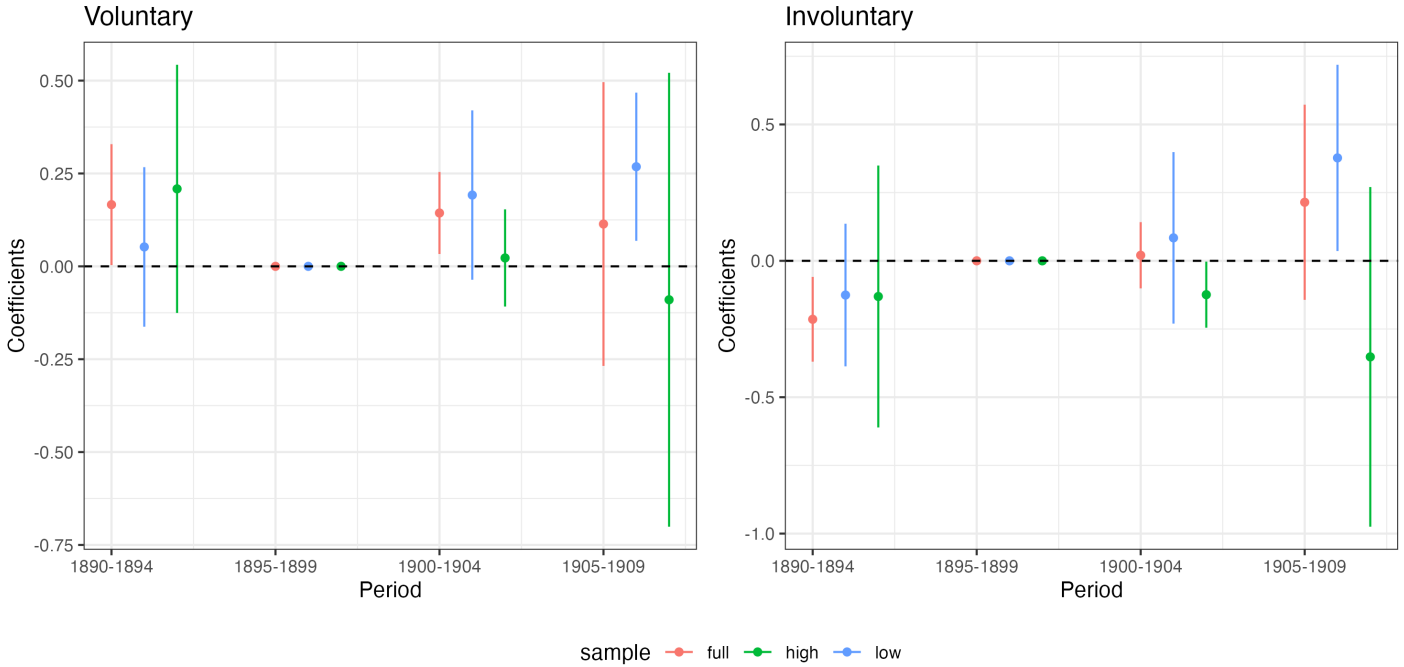
Including Mfg. Added Value / Capita * 5-year period dummies

Involuntary – 5-year period dummies



Including {Mfg. Added Value / Capita + Pop. Growth} * 5-year period dummies

Voluntary and involuntary



Includes {Mfg. Added Value / Capita} * 5-year period dummies

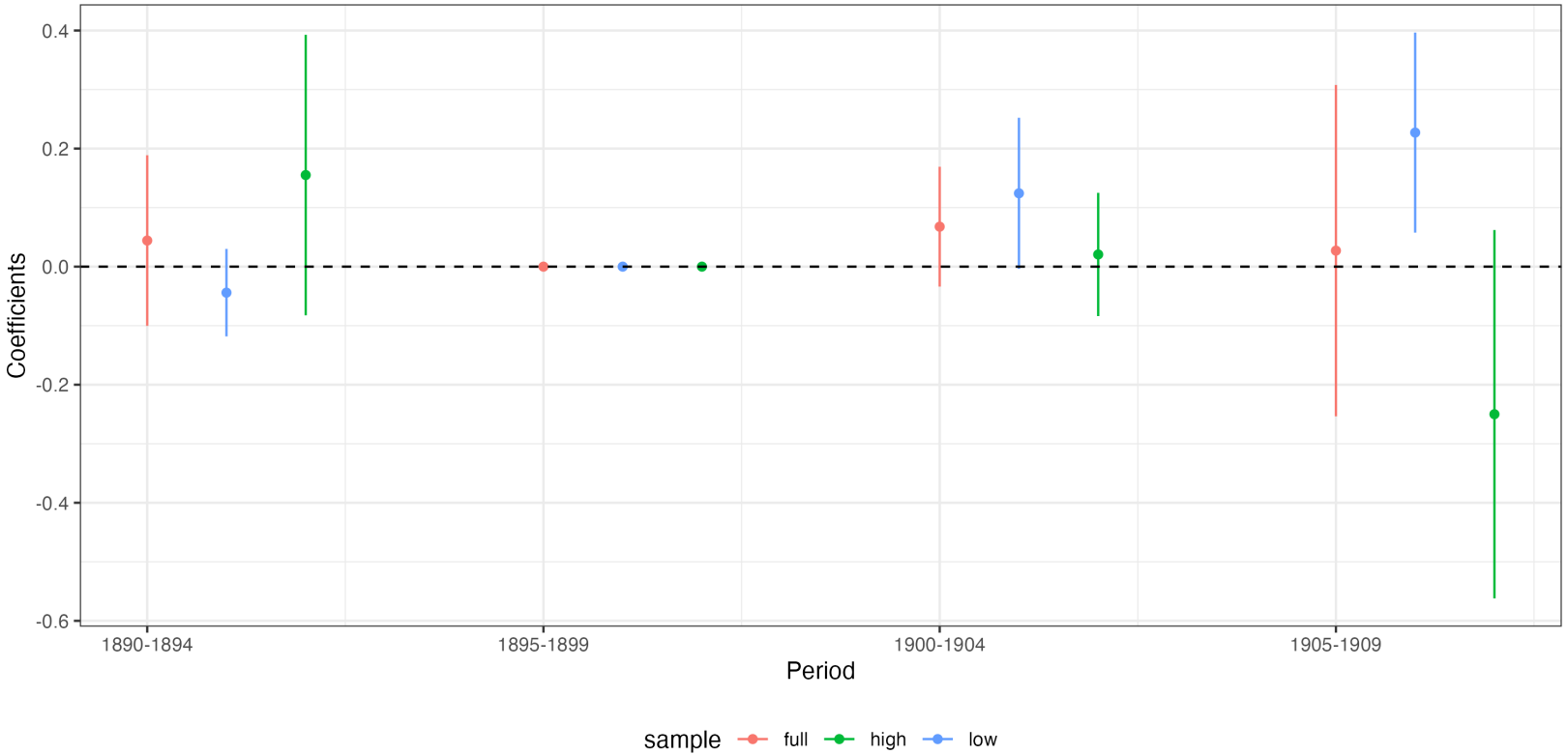
Create synthetic states based on county level information

- Mfg. Added Value / Capita
- ~~Population growth~~: hard to measure at county level b/c county border changes, county splits, etc. between 1880 and 1890.

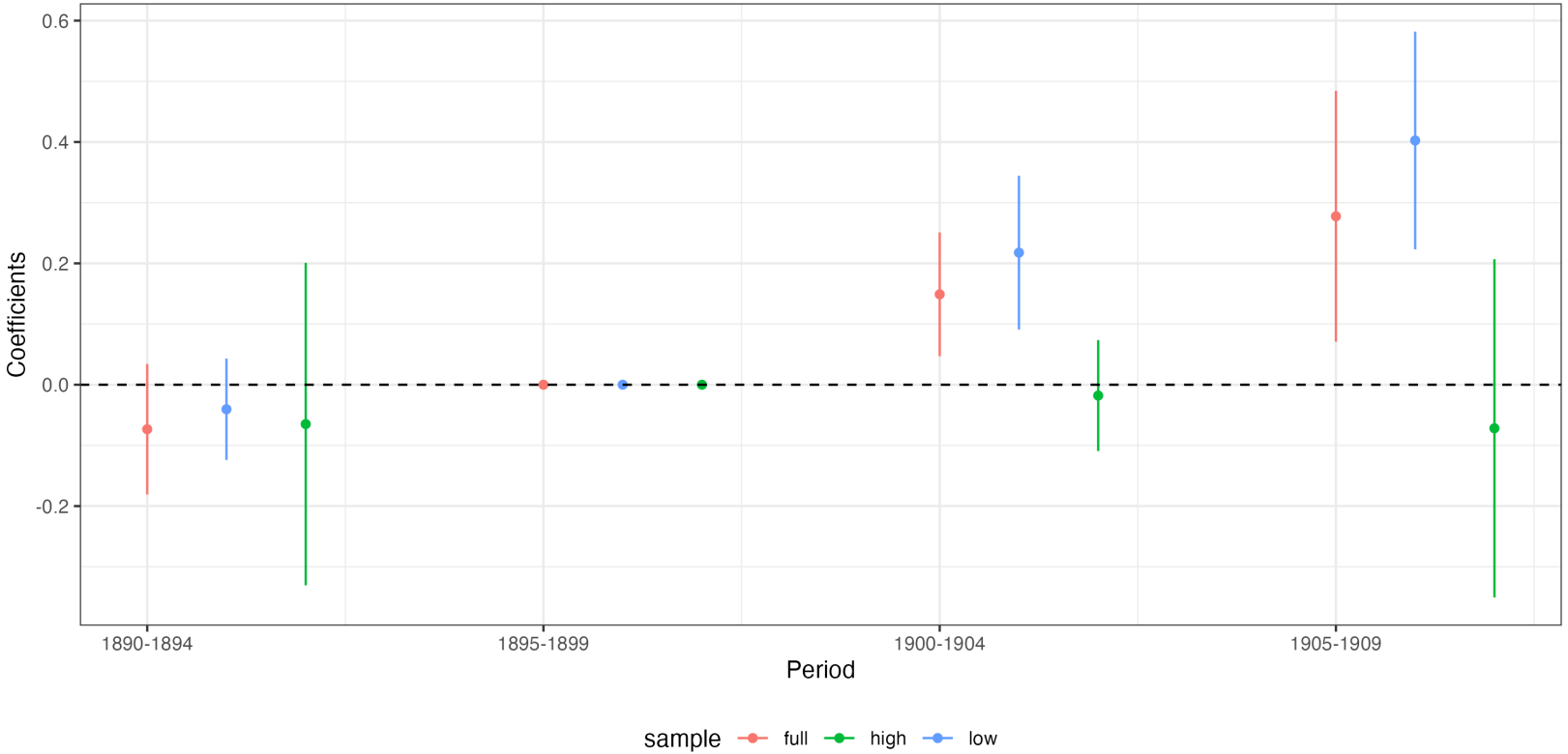
Procedure:

- Take all counties in control states
- Match to counties in treatment states using CEM
- Do this separately for states with high or low exemptions
- Keep all counties that were matched (to) and their weights
- Construct synthetic states as weighted average of selected counties
- Give each synthetic state an equal weight

Robustness:
Voluntary - Synthetic states using CEM



Robustness: Involuntary - Synthetic states using CEM



A bankruptcy code has two key elements that can spur innovation

1. Debtor protection: provide risk sharing in bad states of the world
2. Creditor protection: penalize fraud

Theory: debtor protection is beneficial, but must not be too generous

- Tighter credit constraints would dominate risk sharing
- Makes penalizing fraud less effective

Empirics: consistent with the theory

- More lenient debtor protection and more stringent creditor protection both stimulate innovation
- These positive effects disappear, or may even turn negative, if exemptions are relatively high (and tighter credit constraints dominate)

Contribution to the literature - revisited

- ***U.S. variation in homestead exemptions between states*** *(Gropp, Scholz and White 1997, Fan and White 2003, Berkowitz and White 2004, Berger, Cerquiero and Penas 2011, Cerquiero and Penas 2016, Cerqueiro et al. 2017)* – ***mixed / negative effect***
  - Our contribution: large change in bankruptcy regime at different (existing) protection levels
  - Our finding: increasing debtor protection can have positive effects if pre-existing protection not too high

- ***Cross-country variation in bankruptcy protection*** *(Cumming et al. 2024)* – ***positive effect***
  - Our contribution: more homogeneity across U.S. states
  - Our finding: positive effect depends on pre-existing protection levels

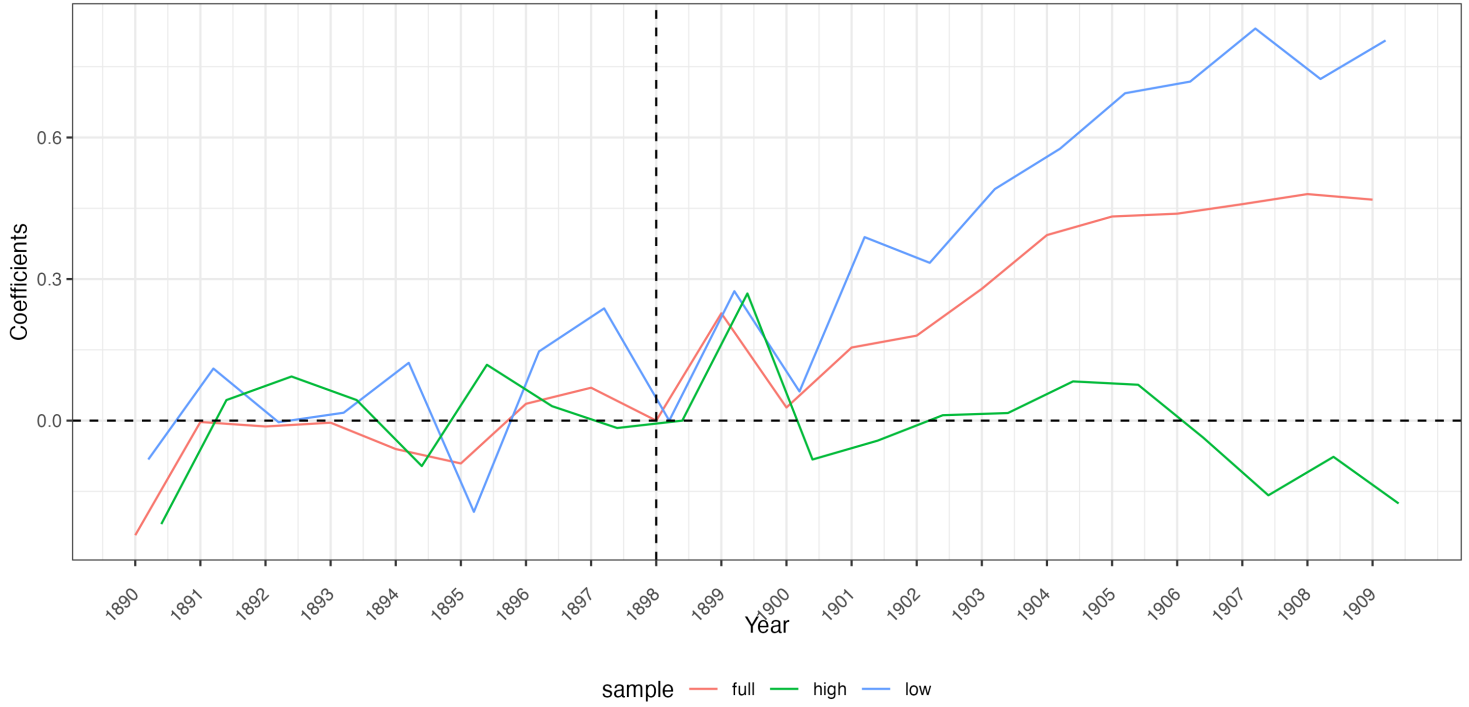
- ***Marriage laws in 1840s*** *(Koudijs and Salisbury 2020)* – ***non-linear effect***
  - Our contribution: entire U.S. in a more industrialized economy & focus on entrepreneurial risk-taking
  - Our finding: evidence consistent with a non-linear effect

- ***Creditor protection*** *(De la Porta et al. 1998, Djankov, McLeish and Shleifer 2007, Acharya and Subramaniam 2009, Acharya, Amihud and Litov 2011, Vig 2013, Lilienfeld-Toal, Mukherjee and Visaria 2013, Mann 2018)* – ***mixed effects***
  - Our contribution: interaction of creditor and debtor protection
  - Our findings: effect credit protection depends on level of debtor protection

Voluntary – annual

Including Mfg. Added Value / Capita * 5-year period dummies

Involuntary – annual



Including Mfg. Added Value / Capita * 5-year period dummies