

Nationalistic Labor Policies Hinder Innovation

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This paper

- To what extent can domestic firms substitute foreign nationals w/ domestic labor for highly skilled and innovative position?
- Does restricting domestic firms from hiring high-skilled immigrants stifle innovation?
- Exploit Employ American Workers Act (EAWA)
 - ▶ Unexpectedly restricted US financial institutions that entered the TARP program during 2008-2009 Financial Crisis from hiring [new foreign workers](#) until after TARP funds are paid back in full
 - ▶ Cancel "EAWA" allowed banks to [resume](#) foreign hires

Main Findings

- U.S. banks produce a lot of innovation
 - ▶ Cybersecurity, robo advising, data analytics, payment systems
- U.S. banks heavily relied on high-skilled immigrants (i.e., STEM)
 - ▶ Sponsored 15% H-1B visas (2001-2014)
 - ▶ 50% foreign nationals are STEM jobs
- Exploit differential pre-crisis exposure of TARP banks
 - ▶ EAWA reduced quantity & quality of patents
- Banks paid higher wage premia to retain pre-crisis foreign hires
 - ▶ Contrary to EAWA proponent's view: banks did not hire domestic workers
- Unintended negative consequences of nationalistic labor policies on innovation

Plan For the Rest of the Talk

- Data Sources and Summary Statistics
- What is Innovation by Banks?
- EAWA and High-Skilled Immigrants
- Baseline Analysis: Patenting Around EAWA
- Labor Market Outcomes (Wages)

Data Sources

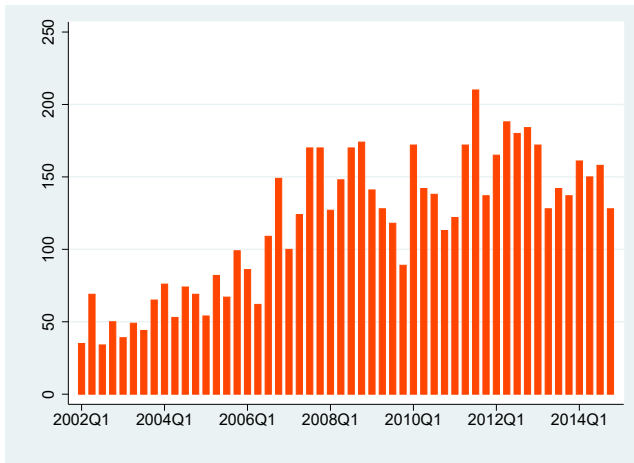
- Patent Data: USPTO filings (Jan. 2002–June 2015)
 - ▶ Extract info on file date, applicant (assignee), outcome
 - ▶ Trace individual inventors' career path
- TARP and EAWA effects: US Treasury
 - ▶ Info on dates entered/exited TARP by financial institutions
- H-1B visa Data: USCIS
 - ▶ Info on H-1B sponsor (firm), beginning/end dates jobs, wage offered, prevailing wage, application outcome
 - ▶ Job codes: STEM vs. non-STEM
- Hurdle: None of these sources includes a common bank-level identifier
 - ▶ Start from list of US commercial banks in Bankscope
 - ▶ Automated script to match (1) patent assignees & (2) H-1B sponsors

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Neglected Fact: U.S. Banks Produce A Lot of Innovation

- Spurring innovation in response to FinTech competition—"disintermediate" incumbent banking systems



Top 20 Patent Classifications

Classification	Description	#Patents
705	Data processing: financial, business practice, management, or cost/price determination	2,440
235	Registers	416
709	Electrical computers and digital processing systems:	231
709	Multi-computer data transferring	
726	Information security	222
707	Data processing: database and file management or data structures	219
382	Image analysis	132
370	Multiplex communications	118
717	Data processing: software development, installation, and management	109
714	Error detection/correction and fault detection/recovery	103
713	Electrical computers and digital processing systems: support	90
398	Optical communications	89
379	Telephonic communications	82
375	Pulse or digital communications	81
715	Data processing: presentation processing of document, operator interface processing, and screen saver display processing	76
455	Telecommunications	75
706	Data processing: artificial intelligence	60
340	Communications: electrical	48
718	Electrical computers and digital processing systems: virtual machine task or process management or task management/control	38
703	Data processing: structural design, modeling, simulation, and emulation	37

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Employ American Worker Act

- Oct 3, 2008, U.S. President George W. Bush signed into law the Troubled Asset Relief Program (TARP)
 - ▶ Allowed government to purchase toxic assets from banks
- Feb 17, 2009, President Obama signed the Employ American Workers Act (EAWA) into law
 - ▶ H-1B petitioning under EAWA much costlier
 - ▶ Applies to [new foreign employee](#) hires
 - ▶ Did NOT apply to workers seeking to [extend](#) H-1B visa
 - ▶ Foreign workers cannot carry H-1B visa from one company to other
 - ▶ Valid until November 17, 2011

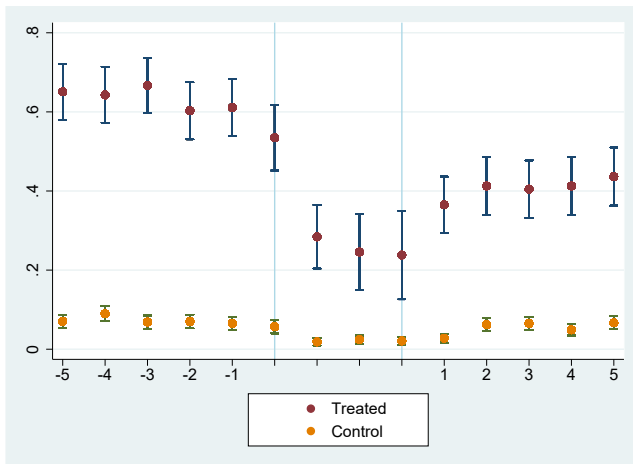
Staggered Timing EAWA Binding

	TARP begins	TARP ends	EAWA begins	EAWA ends
JPMorgan Chase	Oct 28, 2008	Dec 16, 2009	Feb 17, 2009	Dec 16, 2009
Bank of America	Oct 28, 2008	Mar 9, 2010	Feb 17, 2009	Mar 9, 2010
Citigroup Inc	Oct 28, 2008	Jan 31, 2011	Feb 17, 2009	Jan 31, 2011
Capital One	Nov 14, 2008	Dec 9, 2009	Feb 17, 2009	Dec 9, 2009
American Express	Jan 9, 2009	July 29, 2009	Feb 17, 2009	Jul 29, 2009

- Banks enter TARP in waves
- EAWA in effect *after* most banks had already accessed TARP
 - ▶ Most banks did not know EAWA would have been imposed when they decided to enter TARP
- EAWA stops to bind when bank exits TARP
 - ▶ EAWA period does not capture same business cycle for all banks

EAWA and H-1B Hiring

- Prob of filing H1B petitions to sponsor STEM
 - ▶ Treated: TARP banks hired at least 1 STEM 2004-06
 - ▶ Control: TARP not hired any STEM (2004-06) or non-TARP banks



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Sample Descriptive Statistics

- Bank-Year-Month Panel: Jan 2007–Dec 2014
- 123 US banks, 33 TARP banks

	N	Mean	St.dev.
Patent Filed	11,808	0.083	0.276
FinTech	11,808	0.040	0.196
Business Methods	11,808	0.056	0.230
Non-Business Methods	11,808	0.057	0.231
STEM	11,808	0.111	0.314
Ln(#STEM)	11,808	0.229	0.753
STEM% ₀₄₀₆ > 0	11,808	0.382	0.486
STEM% ₀₄₀₆	11,808	0.208	0.318
EAWA	11,808	0.039	0.193
Post	11,808	0.139	0.346
First Filer	11,808	0.054	0.226
First Filer & Lead Inventor	11,808	0.029	0.169

Extensive Margin of Patenting: Jan 2007-Dec 2014

$$\text{Patent Filed}_{i,s} = \alpha + \beta_1 \times \text{EAWA}_{i,s} + \beta_2 \times \text{EAWA}_{i,s} \times \text{Treated}_i + \beta_3 \times \text{Post}_{i,s} \\ + \beta_4 \times \text{Post}_{i,s} \times \text{Treated}_i + X_i' \times \theta + \eta_i + \eta_t + \epsilon_{i,s}.$$

- $\text{Patent Filed}_{i,s}$: if bank i files patents (granted) in month s
- $\text{EAWA}_{i,s}$: if bank i subject to EAWA in month s
- Treated
 - ▶ Banks' pre-crisis exposure to EAWA ban
 - ▶ version 1: # STEM as a percentage of # H-1B visas
 - ▶ version 2: # STEM hired > 0
- η_i , η_t : bank, time fixed effects

Extensive Margin of Patenting: Jan 2007-Dec 2014

$$\text{Patent Filed}_{i,s} = \alpha + \beta_1 \times \text{EAWA}_{i,s} + \beta_2 \times \text{EAWA}_{i,s} \times \text{Treated}_i + \beta_3 \times \text{Post}_{i,s} \\ + \beta_4 \times \text{Post}_{i,s} \times \text{Treated}_i + X'_i \times \theta + \eta_i + \eta_t + \epsilon_{i,s}.$$

	Continuous Treatment				Discrete Treatment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EAWA	0.0178 (0.93)	0.0192 (1.06)	0.0182 (1.01)	0.0157 (0.87)	0.0220 (1.03)	0.0274 (1.43)	0.0251 (1.31)	0.0225 (1.19)
EAWA × Treated	-0.1700*** (-2.83)	-0.1877*** (-3.13)	-0.1849*** (-3.05)	-0.1877*** (-3.07)	-0.0914** (-2.43)	-0.1069*** (-3.19)	-0.1035*** (-3.05)	-0.1045*** (-3.06)
Post		0.0024 (0.20)	0.0004 (0.03)	-0.0010 (-0.08)		0.0085 (0.95)	0.0024 (0.28)	0.0011 (0.12)
Post × Treated		-0.0262 (-0.49)	-0.0067 (-0.13)	-0.0062 (-0.12)		-0.0235 (-0.88)	-0.0066 (-0.27)	-0.0064 (-0.26)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Year-Month FE	No	No	No	Yes	No	No	No	Yes
N	11,808	11,808	11,808	11,808	11,808	11,808	11,808	11,808
adj. R ²	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57

- A std ↑ in Treated → drop in likelihood of filing patents 5.5%
- 14.5% of a std of likelihood of filing patents

Financial vs. Labor Constraint: Only TARP Banks

- TARP participants' deteriorated balance sheet?
 - ▶ Firms lose talents when approaching bankruptcy
- Does labor constraint still matter by controlling financial condition?
 - ▶ *TARP Fund* $\%_i$ – amount of “troubled assets” purchased by U.S. Department of the Treasury over total assets in 2009
- Horse-race test by only including TARP participants

Financial vs. Labor Constraint: Only TARP Banks

$$\text{Patent Filed}_{i,s} = \alpha + \beta_1 \times \text{EAWA}_{i,s} + \beta_2 \times \text{EAWA}_{i,s} \times \text{Treated}_i + \beta_3 \times \text{EAWA}_{i,s} \\ \times \text{TARP Fund\%}_i + \beta_4 \times \text{Post}_{i,s} + \beta_5 \times \text{Post}_{i,s} \times \text{Treated}_i \\ + \beta_6 \times \text{Post}_{i,s} \times \text{TARP Fund\%}_i + X'_i \times \theta + \eta_i + \eta_s + \epsilon_{i,s}.$$

	Continuous Treatment				Discrete Treatment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EAWA	-0.0059 (-0.22)	-0.0073 (-0.23)	-0.0126 (-0.37)	-0.0468 (-1.40)	-0.0029 (-0.09)	0.0002 (0.00)	-0.0054 (-0.15)	-0.0397 (-1.20)
EAWA × Treated	-0.1694*** (-2.89)	-0.1862*** (-3.17)	-0.1861*** (-3.04)	-0.1895*** (-2.98)	-0.0914** (-2.46)	-0.1071*** (-3.27)	-0.1050*** (-2.97)	-0.1055*** (-2.94)
EAWA × TARP Fund%	0.4727 (0.87)	0.6541 (1.58)	0.6543 (1.56)	0.7018* (1.71)	0.5399 (0.91)	0.7116 (1.46)	0.7144 (1.45)	0.7655 (1.58)
Post		-0.0007 (-0.04)	-0.0117 (-0.51)	-0.0332 (-1.29)		0.0067 (0.35)	-0.0060 (-0.22)	-0.0274 (-0.91)
Post × Treated		-0.0257 (-0.47)	-0.0122 (-0.23)	-0.0126 (-0.24)		-0.0241 (-0.88)	-0.0130 (-0.47)	-0.0127 (-0.46)
Post × TARP Fund%		0.2872 (0.75)	0.2912 (0.76)	0.2843 (0.74)		0.2720 (0.70)	0.2827 (0.71)	0.2760 (0.70)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Year-Month FE	No	No	No	Yes	No	No	No	Yes
N	2,976	2,976	2,976	2,976	2,976	2,976	2,976	2,976
adj. R ²	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59

Why Are New (Foreign) Hires So Relevant?

- Can lack of new hires be so important for patenting activities?
 - ▶ EAWA only restricted on sponsoring **new** H-1B visas
 - ▶ Renewal of visas not affected
- “Pre-invention assignment agreement”
 - ▶ Assigns to employers ownership of inventions created by employees

$$\text{First Filer}_{i,s} = \alpha + \beta_1 \times \text{EAWA}_{i,s} + \beta_2 \times \text{EAWA}_{i,s} \times \text{Treated}_i + \beta_3 \times \text{Post}_{i,s} \\ + \beta_4 \times \text{Post}_{i,s} \times \text{Treated}_i + X_i' \times \theta + \eta_i + \eta_t + \epsilon_{i,s},$$

- **First Filer**: if at least one inventor files for the first time
- **First Filer&Lead Inventor**: first inventor + lead inventor
 - ▶ 58% patents have non-alphabetical name orders

Why Are New (Foreign) Hires So Relevant?

$$\text{First Filer}_{i,s} = \alpha + \beta_1 \times \text{EAWA}_{i,s} + \beta_2 \times \text{EAWA}_{i,s} \times \text{Treated}_i + \beta_3 \times \text{Post}_{i,s} + \beta_4 \times \text{Post}_{i,s} \times \text{Treated}_i + X_i' \times \theta + \eta_i + \eta_t + \epsilon_{i,s}.$$

	Continuous Treatment		Discrete Treatment	
Panel A. First Filer				
	(1)	(2)	(3)	(4)
EAWA \times Treated	-0.1565*** (-3.14)	-0.1583*** (-3.18)	-0.0976*** (-3.51)	-0.0985*** (-3.51)
N	11,808	11,808	11,808	11,808
adj. R ²	0.48	0.48	0.48	0.48
Panel B. First Filer & Lead Inventor				
	(1)	(2)	(3)	(4)
EAWA \times Treated	-0.1275* (-1.86)	-0.1294* (-1.89)	-0.0668** (-2.36)	-0.0678** (-2.39)
N	11,808	11,808	11,808	11,808
adj. R ²	0.40	0.40	0.40	0.40
Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
Year-Month FE	No	Yes	No	Yes

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Labor Market Outcomes (Wages)

- Labor market dynamics for foreign STEM workers
 - ▶ Foreign workers cannot carry H-1B visa from one company to the other
 - ▶ TARP banks retain existing foreign workers hired before crisis

$$\overline{\text{Wage Premium}}_{i,l,s} = \alpha + \beta_1 \times \text{EAWA}_{i,s} + \beta_2 \times \text{EAWA}_{i,s} \times \text{STEM}_{i,l,s} \\ + \beta_3 \times \text{Post}_{i,s} + \beta_4 \times \text{Post}_{i,s} \times \text{STEM}_l + \beta_5 \times X' + \eta_l + \eta_i + \eta_s + \epsilon_{i,l,s},$$

- Average wage premium at bank-month-STEM/non-STEM level
- Wage data from H1B visas

Wage Premia to Foreign STEM Workers

	(1)	(2)	(3)	(4)
EAWA \times STEM	0.1335*** (3.80)	0.1428*** (3.56)	0.1449*** (3.64)	0.1403*** (3.56)
STEM	-0.0115 (-1.04)	-0.0203** (-2.22)	-0.0209** (-2.30)	-0.0198** (-2.19)
EAWA	-0.0530*** (-3.17)	-0.0424 (-1.42)	-0.0427 (-1.43)	-0.0371 (-1.27)
Post \times STEM		0.0269 (1.16)	0.0269 (1.16)	0.0263 (1.15)
Post		0.0069 (0.24)	0.0080 (0.27)	0.0069 (0.24)
Constant	1.2638*** (242.50)	1.2616*** (145.78)	1.4167*** (7.29)	1.4575*** (7.62)
Control	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Yearmonth FE	No	No	No	Yes
N	3,189	3,189	3,189	3,189
adj. R ²	0.18	0.18	0.18	0.18

Conclusion

- Restrictions in the ability of domestic companies to hire specialized foreign workers
 - ▶ Detrimental to traditional banks' ability to produce innovation and stay at the frontier of global banking
- Banks relying on foreign STEM workers reduce and worsen innovation activity following EAWA
- Open the black box of [bank innovation](#)