Keeping a Secret: Evidence from Process and Product Innovation

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- Patent system and grand bargain: legal monopoly in exchange for disclosure of information
- Broad literature on optimal design of patent system (and IP policy) to facilitate innovation
- Less work with focus on the "in exchange" part of the grand bargain: patents (disclosure) vs. trade secrecy
- This paper: **What is disclosed? Visible inventions that do not need disclosure or nonvisible inventions for which disclosure is in fact relevant?**

Processes and Products

- What is the value of disclosure of "visible" inventions?
- Processes less "visible" than products – their disclosure more relevant?
- If the system delays disclosure of processes more than products (or fosters disclosure of processes less), then tips balance against invention types for which disclosure most relevant.
- We use trade secret reform to study how change in the patent-secrecy tradeoff affects processes (~nonvisible) relative to products (~visible)

Model

Model

Visibility

- "Visibility" as ability of parties to observe an invention or its use
- Patent-trade secret decisions:
  - Patents: without visibility the patent is not enforceable (visibility needed for detection of infringement) and of little/no value
  - Trade secrets: with visibility invention is easily discoverable and a trade secret of little/no value
- Visibility and processes:
  - Processes are less visible than products
  - For processes, disclosure/documentation necessary for diffusion

Model

- Invention is characterized by (v, ϕ)
- Parameter:
  - $v \geq 0$: value of an invention (value of exclusivity)
  - $\phi \in [0, 1]$: is the visibility of the invention
  - $\lambda \geq 0$: patentee's additional value from potential licensing
  - p and s: potential non-visibility related value of patent and secret
- Party's private value of patenting:

$$V_P(\phi) = \phi\,(v + \lambda) + (1 - \phi)\,[0 + 0] + p$$

- Party's private value of trade secret (with perfect enforcement):

$$V_S(\phi) = (1 - \phi)\,v + \phi \cdot 0 + s$$

$\rightarrow$ higher value of secrecy for less visible invention: $V_S(\phi) \searrow \phi$

Decision to Patent

- Invention (v, ϕ) is patented if private value of patent is higher than private value of secret
- Introduce imperfect trade-secrets protection: $\sigma \in [0, 1]$.
- Apply for a patent if

$$V_P(\phi) \geq \sigma V_S(\phi)$$

- Suppose $v \sim U[0, 1]$: invention (v, ϕ) is patented with probability

$$\Pr(patent|\phi) = \begin{cases} \dfrac{\phi\lambda + p - \sigma s}{\sigma(1-\phi) - \phi} & \text{if } \sigma > \frac{\phi}{1-\phi} \\ 1 & \text{if otherwise} \end{cases}$$

Share of Less Visible Patents

- Suppose visibility ϕ is distributed with density $f(\phi)$.
- Share of patents with visibility $\phi \leq \hat{\phi}$ is

$$\text{Share}(patent|\phi \leq \hat{\phi}) = \frac{\int_0^{\hat{\phi}} \Pr(patent|\phi) f(\phi) d\phi}{\int_0^1 \Pr(patent|\phi) f(\phi) d\phi}$$

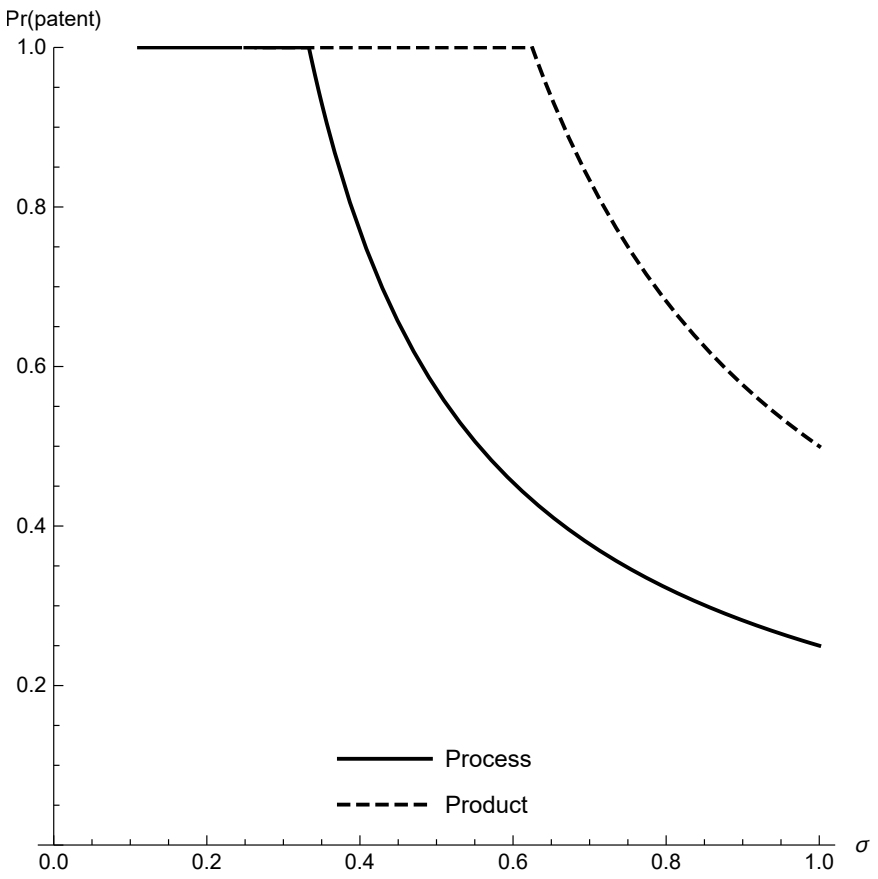
Share of Process Patents

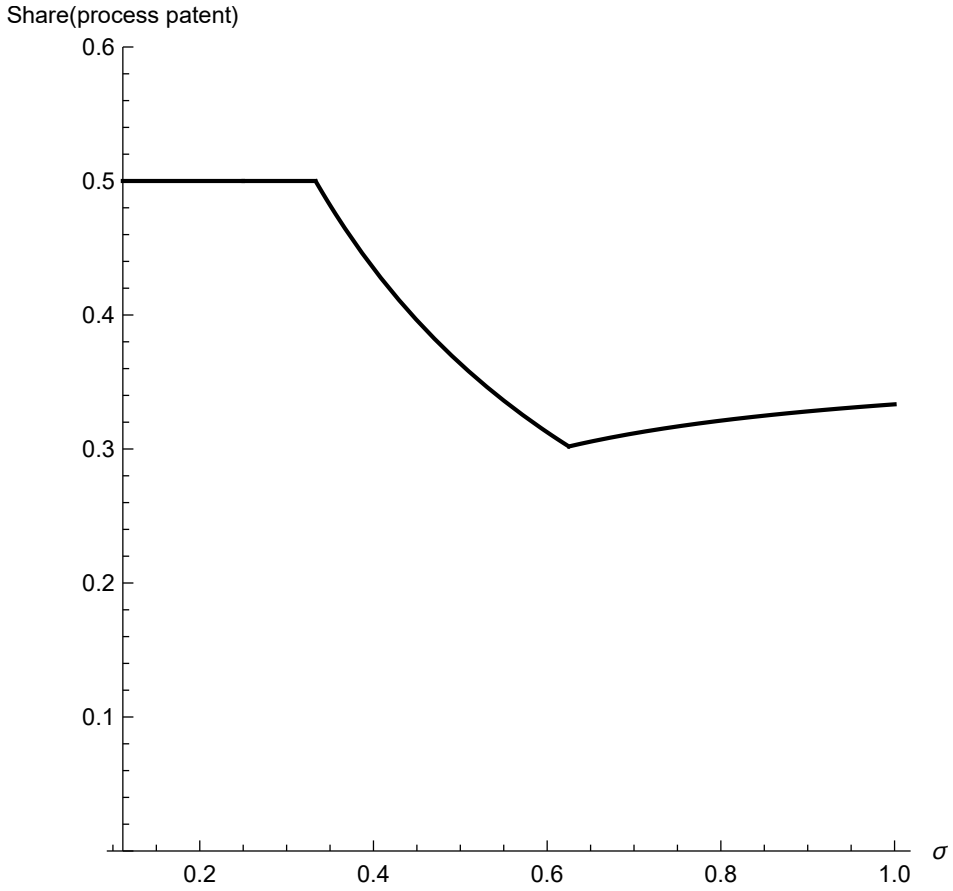
- Suppose low-visibility innovations are processes.
- To illustrate: $\Pr(\phi = \underline{\phi}) = 1/2$ and $\Pr(\phi = \overline{\phi}) = 1/2$
- Share of process patents:

$$\text{Share}(\textit{process patent}) = \frac{1/2 \Pr(\textit{patent}|\phi = \underline{\phi})}{1/2 \Pr(\textit{patent}|\phi = \underline{\phi}) + 1/2 \Pr(\textit{patent}|\phi = \overline{\phi})}$$

$\rightarrow$ Probability that a given patent is a process patent

Stronger Trade-Secrets Protection?





Probability that a patent is process patent is decreasing / non-monotonic in trade secrets protection σ

Data and Method

Uniform Trade Secrets Act (1979/1985)

- Strengthens protection of trade secrets (relative to common law protection) through:
  - extension of definition of trade secrets
  - extension of circumstances under which trade secrets law has been violated
- Sample (through 1998): 39 states and D.C. enacted the UTSA
- Use staggered introduction (different states and different years) for empirical identification:
  - states that enact are treatment group around adoption year, and
  - control group for other states when not around their adoption year

Uniform Trade Secrets Act (1979/1985)

Png (2017): Strength of Protection

- Calculates index of strength of trade secret protection based on six categories:
  1. continuous use requirement
  2. requirement to take reasonable effort to protect trade secrets
  3. mere acquisition as misappropriation
  4. limitations on whether trade secret owner can take legal action
  5. limitations on injunctions
  6. availability of punitive damages multiplier

- Key variables:
  - Pre-UTSA/Common law strength of protection
  - Effective change in legal protection

▸ UTSA Data

Process and Product Patents

- Novel data set with patent category: *process patent* or *product patent*
- Construction:
  - Patent claims define the scope of protection
  - Claims drafting follows rules and conventions for different types of claims
  - Approach: categorize claims as **process**, **product**, or **product-by-process** using rules/conventions (text analytically)
  - Sample of 10,000 manually categorized claims for quality control
  - Aggregate data to go from claims-level to patent-level data: *process patent if at least one claim is a process or product-by-process claim*

▸ Process Data: Time Series; and by NBER Categories

Other Variables – Control Variables

- Patent scope:
  - number of independent claims (Lerner, 1994)
  - length of first claim (Kuhn and Thompson, 2017)
- Patent complexity:
  - number of figures
  - length of detailed description text
  - ratio of dependent over independent claims
- Patent value/importance (external)
  - number of forward citations (after 5, 10, and 15 years)
  - patent generality and originality (Traijtenberg et al., 1997)
- Patent value/importance (internal):
  - applicant's technology proximity
  - maintenance fee payments (4th year, 8th year, 12th year)
- Applicant, year, and USPC main class fixed effects

Results

Value of Secrecy for Processes

Value of Secrecy: Revealed-Preferences Argument

Graham and Hegde (2015)

- American Inventors Protection Act of 1999:
  - Before: USPTO does not publish pending patent applications
  - After: USPTO publishes pending patent applications 18 months after filing *unless* eligible applicants opt out
  - **Eligibility:** assert not to seek foreign patent protection (U.S.-only applications)
- Given eligibility, do applicants (filing on or after November 29, 2000) opt out of pre-grant publication?
- If value of secrecy for processes higher ($V_S(\phi) \searrow \phi$), then expect more opt-out decisions by process applicants

	Version of Process Patent		
	"Some"	"Predominantly"	"First claim"
Non-Disclosure (Secrecy)	Share	Share	Share
Baseline probability	0.1493	0.1493	0.1447
Process patents	0.1653	0.1577	0.1580
Product patents	0.1331	0.1434	0.1360
Difference	0.0323	0.0143	0.0220
t-value	[31.36]***	[13.67]***	[17.62]***
Observations	477,705	477,705	331,185

▸ Type-Specific Time Series ▸ OLS Results

Results

Strengthening Trade-Secrets Protection

Stronger Effect with Low Common-Law Protection

UTSA Enacted × No Common-Law Protection (pre-UTSA)

LPM: Pr(Process Patent = 1)	(1)	(2)	(3)	(4)	(5)
UTSA Enacted (=1)	0.001	-0.009***	-0.006**	-0.009***	-0.006**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Pre-UTSA: "No" protection (=1)	0.029***	0.019***	0.019***	0.019***	0.019***
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
UTSA Enacted × Pre-UTSA	-0.011***	0.003	0.001	0.002	0.001
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Inventor type controls	N	Y	Y	Y	Y
Patent scope, complexity	N	N	Y	N	Y
Value/Importance	N	N	N	Y	Y
Observations	1019974	617834	617834	617834	617834
$\overline{R^2}$	0.231	0.243	0.279	0.244	0.279

Negative interaction term: stronger (negative) effect for states with zero pre-UTSA protection

Stronger Effect with Low Common-Law Protection

UTSA Enacted × Common Law Protection (pre-UTSA)

LPM: Pr(Process Patent = 1)	(1)	(2)	(3)	(4)	(5)
UTSA Enacted (=1)	-0.006***	-0.006*	-0.004	-0.006*	-0.004
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Pre-UTSA Protection	-0.008	-0.026**	-0.002	-0.025*	-0.004
	(0.009)	(0.013)	(0.013)	(0.013)	(0.013)
UTSA Enacted × Pre-UTSA	0.036***	-0.014	-0.006	-0.014	-0.006
	(0.012)	(0.016)	(0.016)	(0.016)	(0.016)
Inventor type controls	N	Y	Y	Y	Y
Patent scope, complexity	N	N	Y	N	Y
Value/Importance	N	N	N	Y	Y
Observations	1019974	617834	617834	617834	617834
$\overline{R^2}$	0.231	0.243	0.279	0.244	0.279

Positive interaction term: stronger (negative) effect for states with weaker pre-UTSA protection

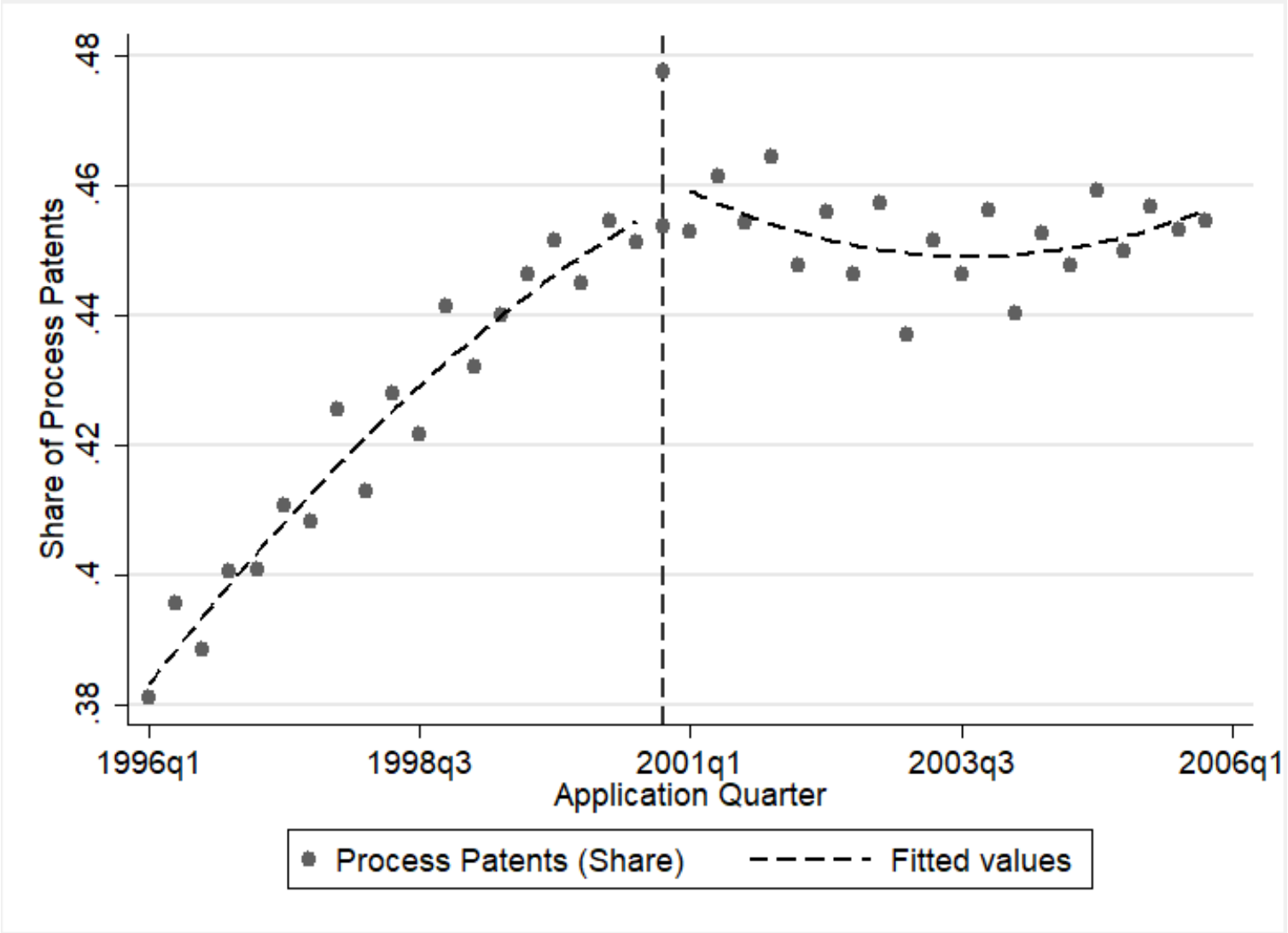
Results

Weakening Patents

AIPA: Reminder

- Publication of patent applications (18 months) with option to opt out for eligible applicants (no foreign protection)
- Note: foreign patent offices publish pending applications after 18 months!
- If 18-months rule effective, and if foreign disclosure with same effect as USPTO disclosure, then passage of AIPA should not drive patenting decisions
  - applicants who have valued secrecy pre-AIPA did not file for foreign protection, and can post-AIPA opt out (no foreign protection)
  - applicants who have not valued secrecy pre-AIPA may have filed for foreign protection ($\rightarrow$ foreign disclosure), and will post-AIPA not be affected by USPTO disclosure
- However, ineffective 18-months or differences in foreign vs. USPTO disclosure $\Rightarrow$ weakening of patent protection

Process Patents Before and After AIPA



Negative Effect of AIPA on Process Patents

LPM: Pr(Process Patent = 1)	(1)	(2)	(3)	(4)	(5)
Post-AIPA	0.009***	0.010***	0.004	0.011***	0.005*
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Post-AIPA × Year	-0.010***	-0.007***	-0.004***	-0.006***	-0.003**
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Inventor type controls	N	Y	Y	Y	Y
Patent scope, complexity	N	N	Y	N	Y
Value/Importance	N	N	N	Y	Y
Observations	1779210	1588143	1500031	1439666	1371394
$\overline{R^2}$	0.182	0.299	0.330	0.301	0.332

Negative interaction term: AIPA slows positive time trend (also captured by AIPA)

Summary

- What is more often disclosed (patenting)? Processes (~nonvisible) or products (~visible)?
- We use the UTSA to show that stronger trade-secrets protection reduces probability that given a patent (application) is a process
- Stronger protection distorts disclosure of processes (~nonvisible inventions for which disclosure is more relevant) more than of products
- Policy: "more patenting" is only part of the story

Thank you!

Comments and suggestions are greatly appreciated!
Please send to

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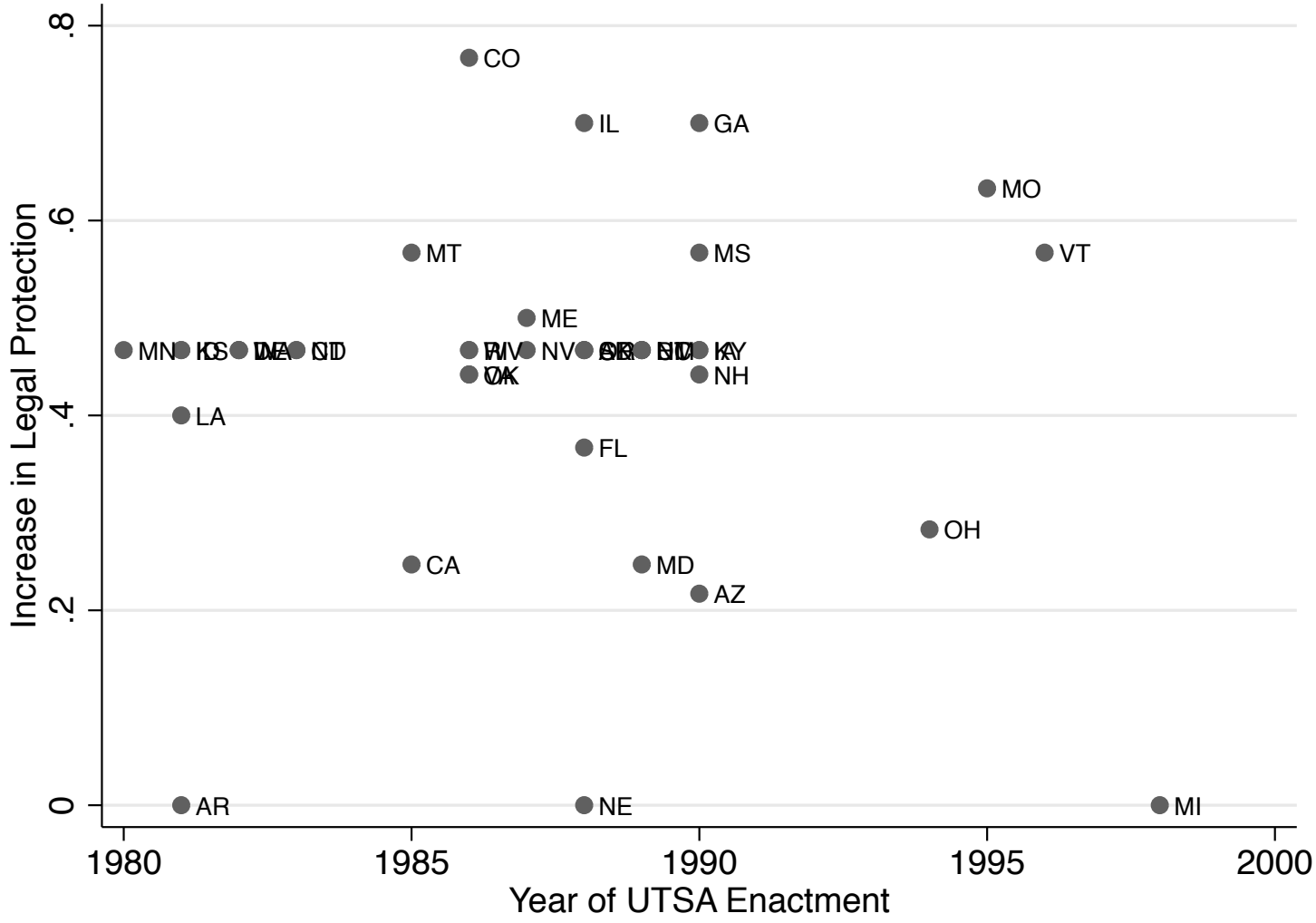

Source: Png (2017), Table 1

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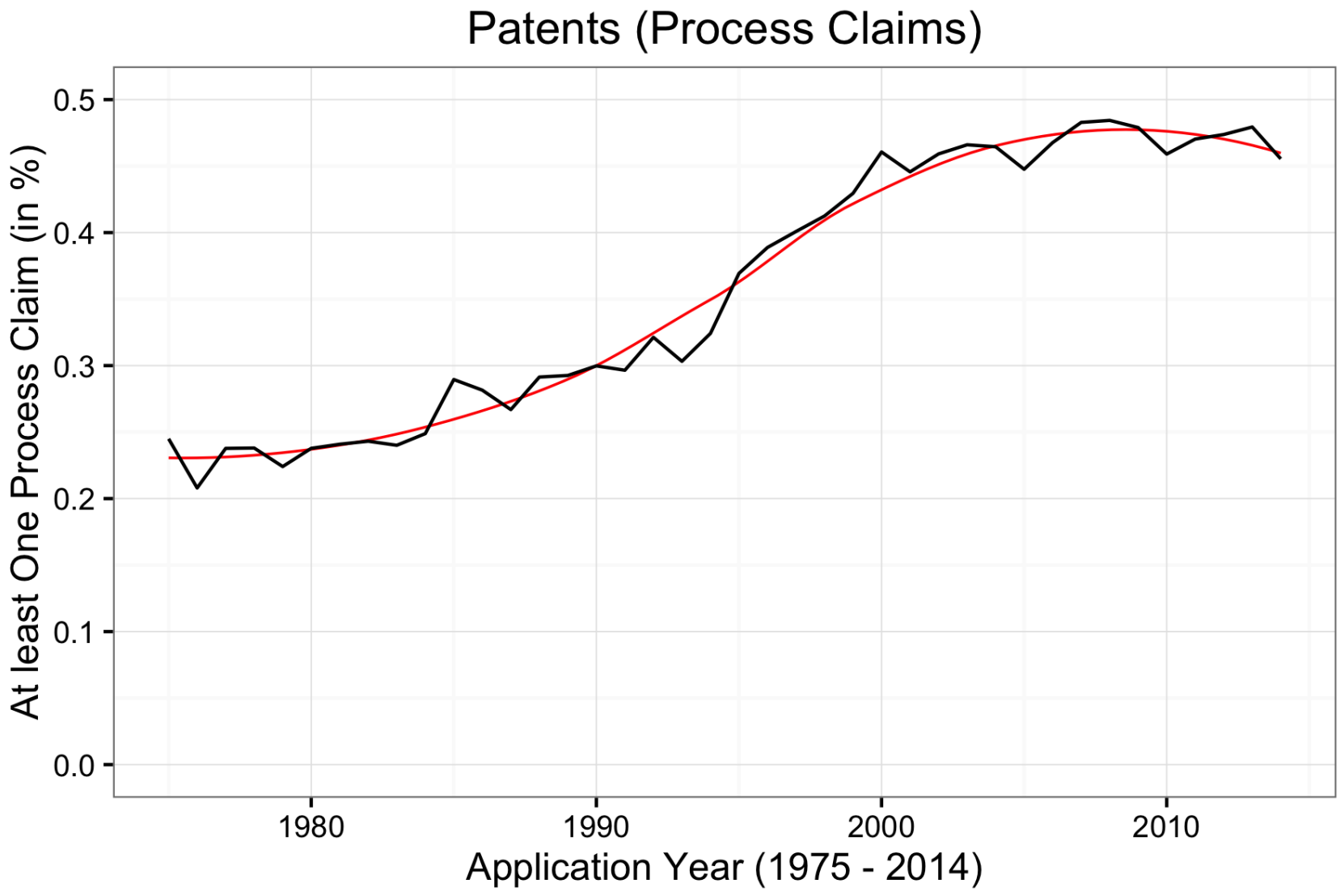
Patents (Process Claims)
At least One Process Claim (in %)
0.0
0.1
0.2
0.3
0.4
0.5
1980
1990
2000
2010
Application Year (1975 - 2014)

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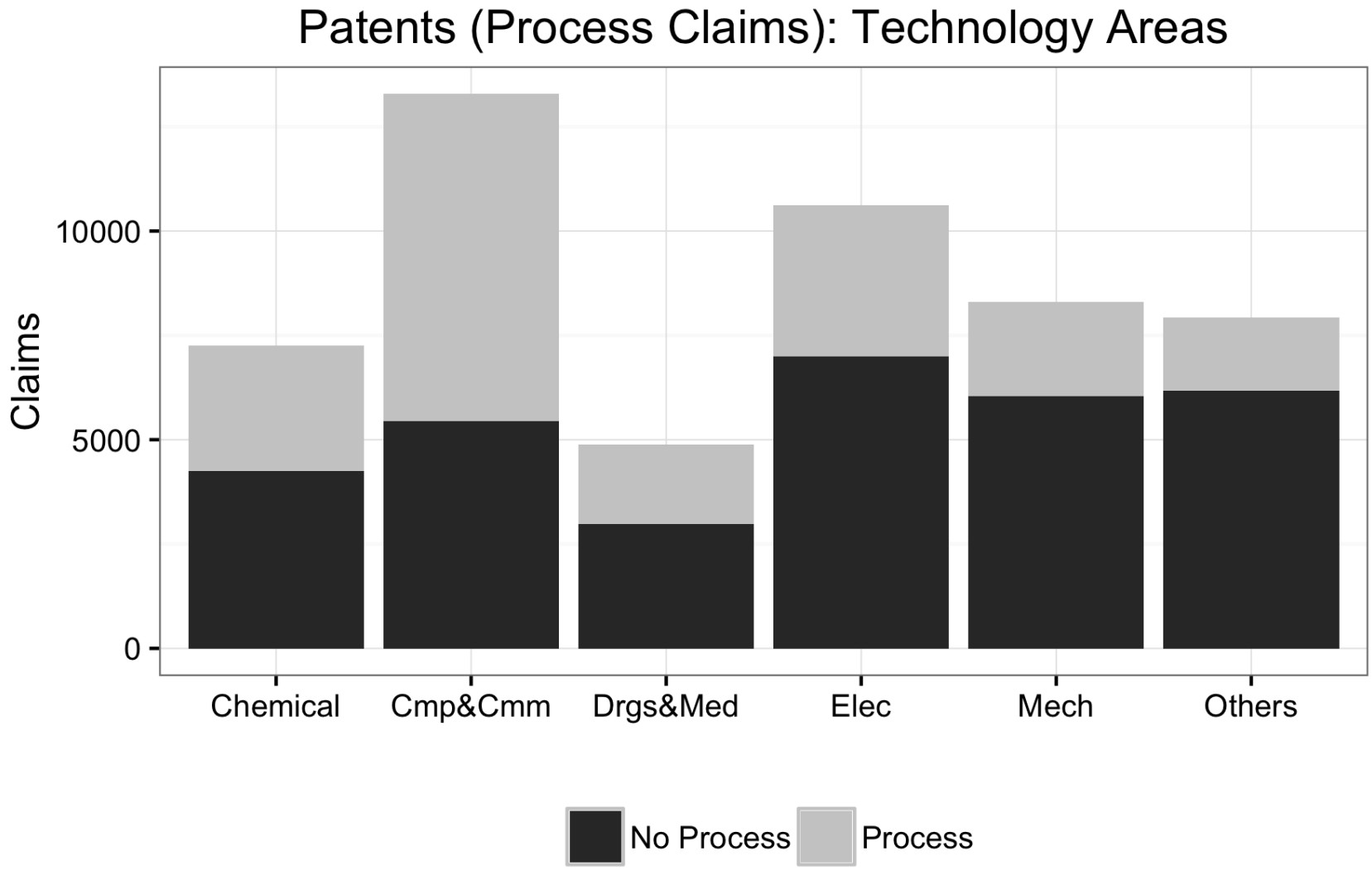
Patents (Process Claims): Technology Areas
Claims
10000
5000
0
Chemical
Cmp&Cmm
Drgs&Med
Elec
Mech
Others
No Process
Process

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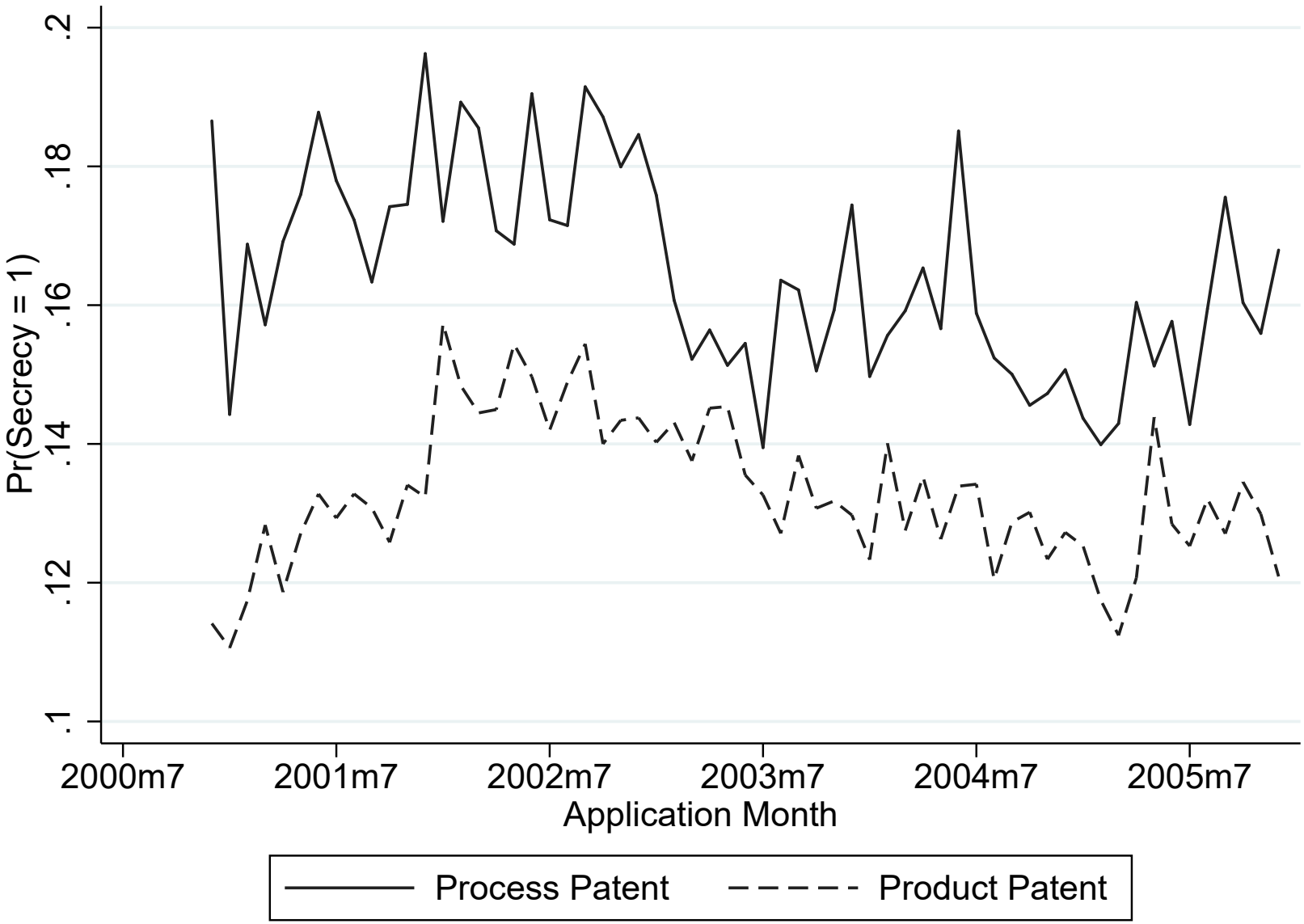
Pr(Secrecy = 1)
.1
.12
.14
.16
.18
.2
2000m7
2001m7
2002m7
2003m7
2004m7
2005m7
Application Month
Process Patent
Product Patent

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LPM: Pr(secrecy=1)	(1)	(2)	(3)	(4)	(5)	(6)
Process Patent	0.005***	-0.003	-0.021	0.004	0.011***	0.003
	(0.001)	(0.006)	(0.016)	(0.004)	(0.002)	(0.003)
Process × Non-Individual		0.008				
		(0.006)				
Process × log(First Claim)			0.005			
			(0.003)			
Process × log(Figures)				0.001		
				(0.001)		
Process × Citations (5 Yrs)					-0.002***	
					(0.001)	
Process × 4th Year Renewal						0.002
						(0.004)
Observations	386911	386911	386911	386911	386911	386911
$\overline{R^2}$	0.518	0.518	0.518	0.518	0.518	0.518

Includes control variables as well as applicant, year, and USPC main class fixed effects

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	Relative Effect	Estimate	Pr(Secrecy=1) Subcategory
Top 5 Subcategories			
14: Organic Compounds	.548	.018	.034
31: Drugs	.431	.014	.033
67: Pipes & Joints	.430	.058	.136
15: Resins	.304	.010	.034
39: Miscellaneous	.250	.024	.096
Bottom 5 Subcategories			
53: Motors & Engines + Parts	.039	.004	.105
65: Furniture, Housing Fixtures	.028	.006	.207
42: Electrical Lighting	.027	.003	.123
68: Receptacles	.005	.001	.185
12: Coating	-.067	-.007	.100

Estimates for Process × NBER subcategory interactions. Includes control variables, applicant, year, and USPC main class fixed effects

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