Speed of Protection, Pace of Technology Evolution and Optimal Patenting Strategy:

Evidence from USPTO and SIPO patent applications

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The Problem Caused by Long Patent Pendency

DELAYS PATENT GRANT

CREATES UNNECESSARY UNCERTAINTY

in the market for businesses and innovators

NEGATIVE IMPACT

on research and innovation

Existing Studies related to Patent Pendency

Firms opt for short total patent pendency because:

- buildup of patent portfolio, cross-licensing negotiation, defense against litigation (Cohen, Nelson and Walsh 2000, Lemley 2000)
- forming licensing contracts with downstream manufacturers (Gans, Hsu and Stern 2008)
- meeting venture capitalists' milestones (Kortum and Lerner 2000)

Firms are willing to accept long patent pendency because:

- it takes time to refine claims, to fight examiners. But they can get stronger patent protection or even avoid rejections (Hegde, Mowery and Graham 2009)

Research Question

WHAT FACTORS

DETERMINE

CHOICE OF EARLY PATENTING?

Inter-temporal patterns of invention's value flow

"FRONT-LOADED" VALUE FLOW:

brings commercial value to patent applicant shortly after its discovery but the value exists only for a relatively short period of time.

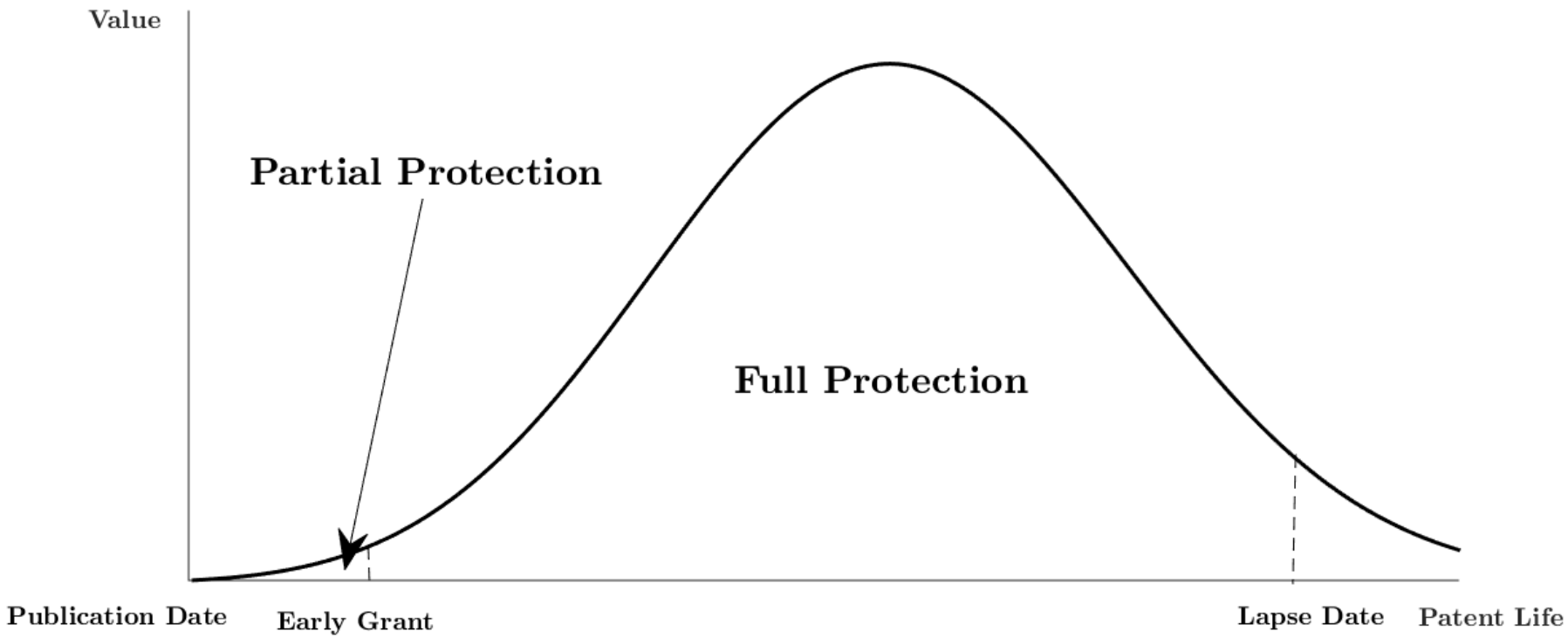
"BACK-LOADED" VALUE FLOW:

inventions becomes valuable only after a number of years following the discovery.

Road Map

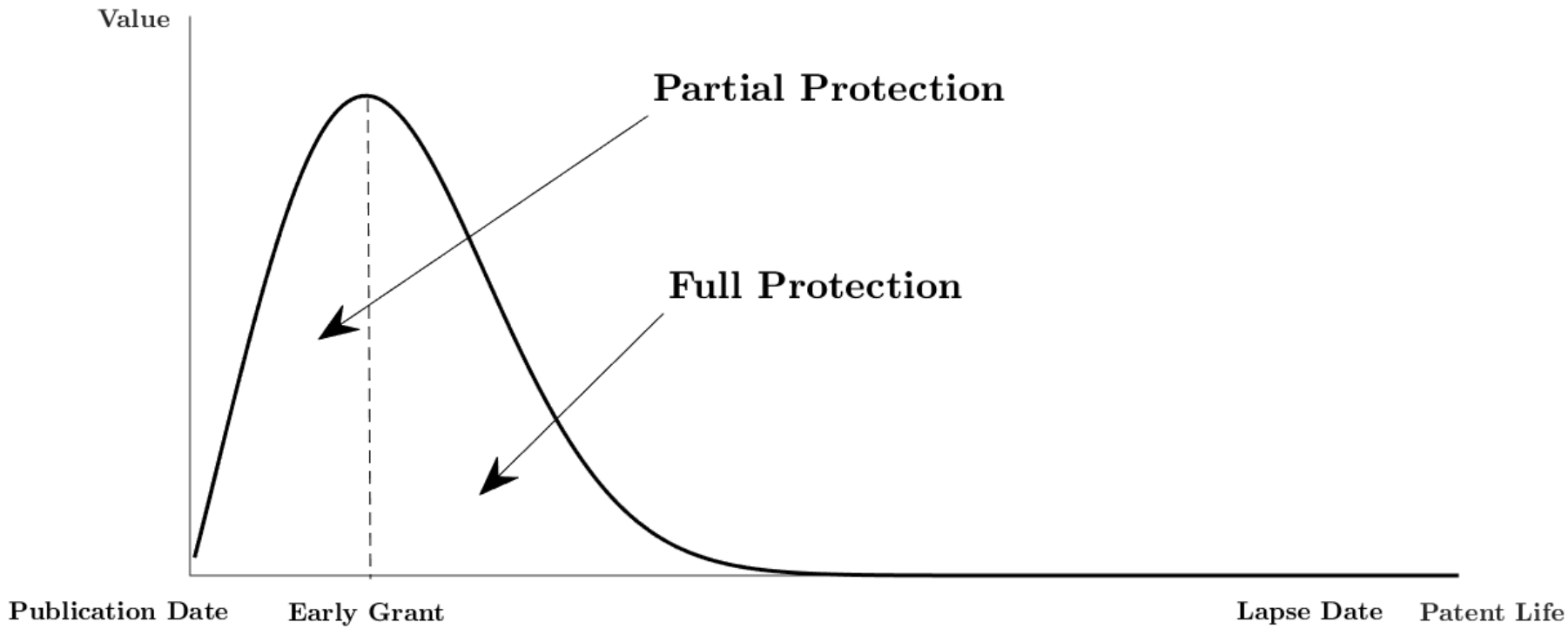
1. Theory
2. Sample construction and Econometrics
3. Empirical Results
4. Concluding Remarks

A Typical Patent's Expected Value Flow Over Time



Early Patent Grant won't give the applicant a particular advantage if the majority of value flow is already under full protection.

A Typical Patent's Expected Value Flow in a Fast Technology Changing Field



Faster technology progress shifts the majority of the value flow towards early period of patent life. The benefit acquired by delaying patent grant becomes more unlikely to outweigh the loss due to partial protection in early periods.

Hypothesis

Based on the above argument, our hypothesis is:

Faster technology progress creates stronger incentives for patent applicants to secure earlier patent right.

Chinese Invention Patent vs. Chinese Utility Model

Chinese Patent Policy for Product Innovation:

- Invention Patent: examination required, granted after a lag, 20 years of protection.
- Utility Model: substantial examination not required, granted quickly, 10 years of protection.

Why do firms file utility model? Summary of interviews with private firms

- Fast grant, low cost, low difficulty.
- especially useful in certain industries such as telecommunication and software security.
- meeting the requirements for patent subsidy and tax exemption policies.
- useful in expanding patent portfolio.

Invention patents v.s. Utility models: Validity (Cont.)

Controversial opinions on the validity of utility models:

- Attorney:
  1. A utility model patent cannot be easily invalidated: disputes between two parties is never easy.
  2. Invalidation proceeding rates for utility model 30%, slightly higher than that invention patents (25%)
  3. Enforceability is similar to invention patent.
     - the scope of protection is almost same as invention patent.
     - the bases for claiming damages caused by patent infringement are same as invention.

Invention patents v.s. Utility models: Validity

Controversial opinions on the validity of utility models:

- Medium Supreme Court Judge:
  1. Validity of utility models are assumed to be lower, but applicants can request an examination report as a validity proof (an additional $370).
  2. A very small percentage (0.6%) of utility models have been requested for validity proof.
  3. Report prepared by examiners selected comprehensively from all technology areas, but do not represent the most qualified ones.
  4. Prior art search is limited to Chinese patents, no access to academic journals and online sources.
  5. three weeks of report preparation period.

Compared to Chinese invention patent, Chinese utility model is a faster, shorter and possibly less secure IP protection.

Using the choice of utility model as a proxy of demand for fast patent protection

The choice of utility model reflects a combination of various advantages.

- fast patent grant
- almost 100% grant rate
- low cost

Disadvantages:

- shorter patent life
- less secure protection

Sample Selection

Chinese–US product patent dyads between 2001-2006:

- Directly compare the technical quality of invention patents and utility models by examining the grant rates in the United States.
- High filing and maintenance costs in U.S compared to China implies minimum *ex-ante* values of the inventions and helps to weed-out low quality patents (Rassenfosse and Jaffe 2014).

Measuring pace of technology progress: average forward citation lag

We use average forward citation lag to measure the pace of technology progress:

- Duration of citation reflects the life-time of technical knowledge embedded in the patent (Bilir 2014).
- Aggregate individual patent's average forward citation lag (first 10 year-window only) at technology-cohort level.

- Cited patents are US granted patents between 2001-2006.
- Citing patents are US granted patents between 2001-2016.

Econometric Model

$$D(UM_{ijt}) = \beta + \beta_1 \cdot MeanSTP_{it} + \Gamma \cdot X_i + \theta_t + \sum_{j=1}^{n} S_j^{it} + \epsilon_{ijt} \qquad (1)$$

- $D(UM_{ijt})$: dummy variable that equals one if the applicant has chosen utility model in China for patent i in technology field j during year t.
- $MeanSTP_{it}$: Speed of Technology Progress in year t.
- X_i: control variables at patent level.
- θ_t: cohort dummy.
- $\sum_{j=1}^{n} S_j^{it}$: technology dummies, 3-digit United States Patent Classification.

  Note: Because patent can have more than one technology field, there are multiple technology dummies that affect the outcome.

Control Variables

- USPTO final grant disposition.
- Patent Quality controls: Number of inventors (both Chinese and Foreign), claims, applicant (Lanjouw and Schankerman 2004).
- PCT (Patent Cooperation Treaty) dummy.
- US continuation dummy.

- R&D competition (Number of distinct firms that file a patent with identical title and in the same year as the focal patent)
- Patent Portfolio Size. (Number of invention patent and utility models of the firm before filing the focal patent)

$H_\alpha : \beta_1 < 0$: when technical advance is faster, applicants should have higher propensity of selecting utility model.

Summary Statistics

Rate of Technical Obsolescence 2001-2006

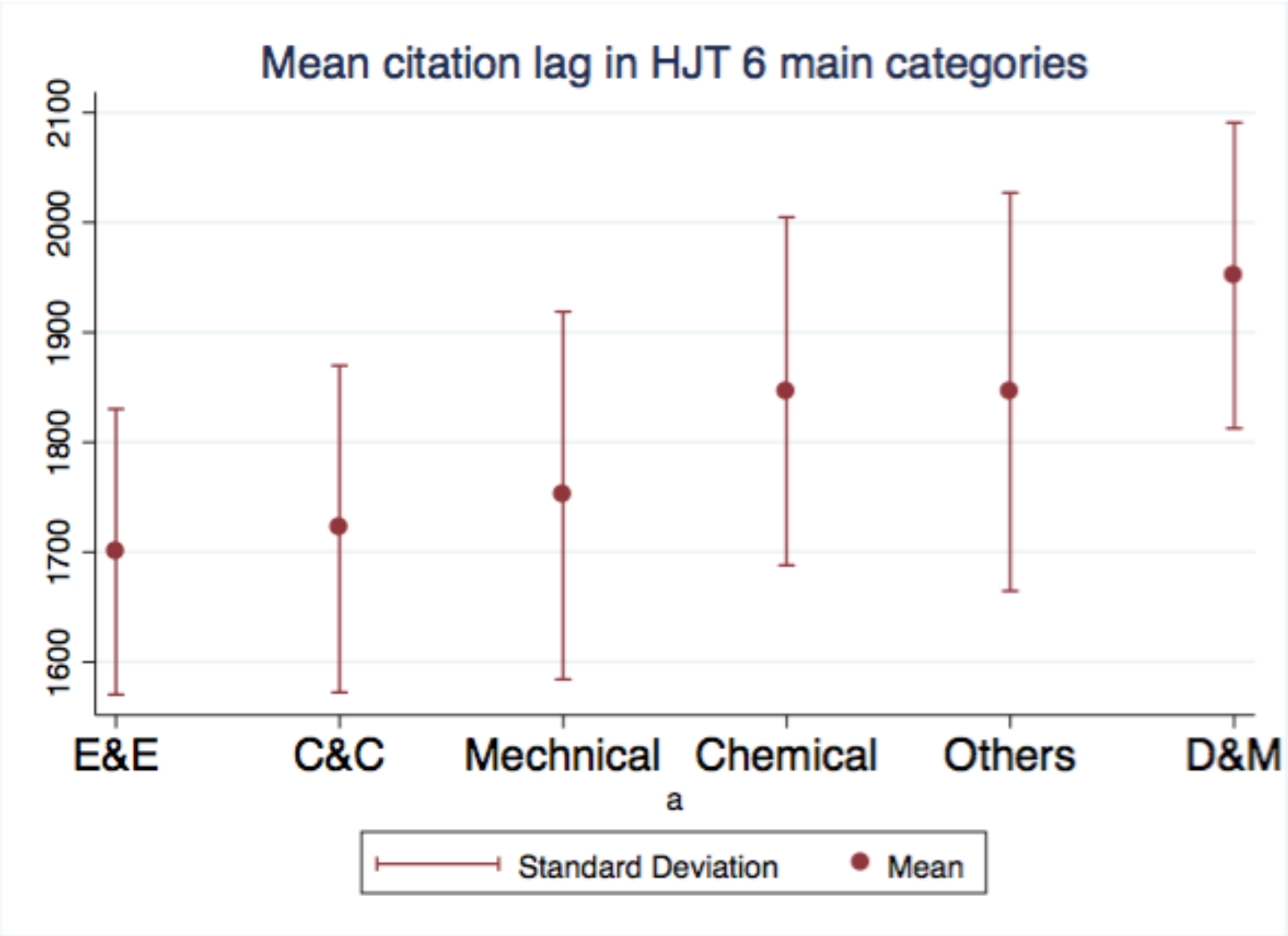
Measures (days):	Mean	Std. Dev	Min	Max
USPTO mean forward citation lag (10-year)	1777.66	167.28	1234.18	2275.29

SIPO-USPTO patent application dyads 2001-2006

Patent Information:	All	Invention Patent	Utility Model
No. of Observations	5574	4027	1547
As of June 2016:			
% of Applications *issued* at USPTO	61.03%	61.10%	60.84%
% of Applications *abandoned* at USPTO	38.06%	37.75%	39.02%
% of Applications *pending* at USPTO	0.90%	1.15%	0.13%
% of PCT Applications	32%	37%	18%
Number of Claims per Patent (USPTO)	15.65	16.19	13.99
Number of Inventors per Patent (USPTO)	2.50	2.66	1.97
Number of Assignee per Patent (USPTO)	1.04	1.06	1.01
% of Continuing Patent Application (USPTO)	6%	6%	6%

Assignee Information:				
Patent Portfolio	942.4568	1731.386	0	16263
Invention Patent Portfolio	782.3534	1728.026	0	16260
Utility Model Portfolio	160.1033	509.1309	0	2994

Market information:				
R&D Competition	1.5758	6.1980	0	50



This picture shows both cross- and within-technology variations in mean citation lag.

Main Results

Dependent Variable:	Patenting choice		
	(1)	(2)	(3)
Mean STP$_{it}$	-0.13	-0.13	-0.14
	(0.06)**	(0.06)**	(0.70)**
Grant	-0.03	-0.01	-0.01
	(0.07)	(0.06)	(0.07)
R&D Competition		0.02	0.02
		(0.01)***	(0.01)***
Portfolio Size			-0.00
			(0.00)*
	*: p<0.10; **:	p<0.05; ***:	p<0.01.

Heterogeneity Across Technology Fields

Dependent Variable:	Patenting choice		
	Com. & Com. and Elec. & Elec.		
	(1)	(2)	(3)
Mean STP$_{it}$	-0.23	-0.25	-0.27
	(0.14)*	(0.13)**	(0.13)**
Grant	-0.09	-0.05	-0.05
	(0.10)	(0.08)	(0.09)
R&D Competition		0.02	0.02
		(0.01)***	(0.01)***
Portfolio Size			-0.00
			(0.00)*
	*: p<0.10; **:	p<0.05; ***:	p<0.01.

Heterogeneity Across Technology Fields

Dependent Variable:	Patenting choice		
	Mechanicals		
	(1)	(2)	(3)
Mean STP$_{it}$	-0.67	-0.64	-0.60
	(0.33)**	(0.33)*	(0.31)*
Grant	0.33	0.32	.036
	(0.24)	(0.24)	(0.25)
R&D Competition		0.07	0.11
		(0.05)	(0.05)**
Portfolio Size			-0.00
			(0.00)**
	*: p<0.10; **:	p<0.05; ***:	p<0.01.

Heterogeneity Across Technology Fields

Dependent Variable:	Patenting choice		
	Chemicals and Drugs & Medical		
	(1)	(2)	(3)
Mean STP$_{it}$	0.31	0.30	0.29
	(0.16)*	(0.16)*	(0.16)*
Grant	-0.49	-0.50	-0.49
	(0.19)***	(0.19)***	(0.20)***
R&D Competition		0.02	0.02
		(0.01)**	(0.01)**
Portfolio Size			-0.00
			(0.00)*

*: p<0.10; **: p<0.05; ***: p<0.01.

Empirical findings Summary

Technology	$\Delta UM/\Delta STP_{it}$	% *UM*	SD. of STP_{it} (days)
Overall	-5.5%	28.7%	174
C&C and E&E	-8.0%	28.4%	136
Mechanical	-6.8%	43.96%	153
Others	-2.82%	55.69%	183
Chem and D&M	5.5%	16%	149

Note: This table summarizes our empirical finding. Column (2) reports the marginal effect of one standard deviation change in the speed of technology progress on applicant's probability to choose utility model. Column (3) presents USPTO patent applications with Chinese utility model priority as a percentage of USPTO patent applications with Chinese priority during 2001-2006. Column (4) shows the standard deviation of average citation lag measured in days.

Conclusion and Policy Implication

- Empirical analysis provides evidences supporting our hypotheses in all technology fields except Chemicals and Drugs&Medical.
- The results suggest that demand for early patent grant could also depend on the nature of innovation. (Discrete tech. innovation vs. Complex tech. innovation)
- Flexibility of patent policies contributes to efficiency gains in the patent regime.

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