Empirical Data on Patents and Standards - Existing Databases, Promising Additional Datasources, and Gaping Holes

Justus Baron

September 2, 2020

NORTHWESTERN
UNIVERSITY

Outline

1. Existing Databases: SEP Declarations and the Searle Center Database

2. Promising Additional Sources of Information
   - 2.1 Non-patent literature citations to SDO documents
   - 2.2 Matching patent inventors and SDO meeting attendees

3. Gaping Holes: Bring the Economics Back into Empirical Innovation Economics

SEP Declarations and the Searle Center Database

Most empirical research on declared SEP focuses on the patent number and declaration date to study the "patent side" of declarations; e.g.

- **Patent citations** (Rysman and Simcoe, 2008)
- **Patent litigation** (Simcoe et al., 2009; Contreras, 2016; Contreras et al., 2017; Lemley and Simcoe, 2018)
- **Patent transfers** (Baron and Ciaramella, 2018)
- **Patent renewals** (Baron and Delcamp, 2011)
- **Patent prosecution** (de Rassenfosse and Gaiteri, 2018; Bekkers et al., 2020; Righi and Simcoe, 2020)
- **Patent value** (Pohlmann et al., 2016, Hussinger and Schwiebacher, 2015)

SEP Declarations and the Searle Center Database

Many important policy questions are on the "standard side" of declarations, e.g.

- Effect of SEP declarations on standard implementation
- Relationship between SEP declarations and contributions/R&D investments related to the standard
- Correlation between SEP declarations and measures of quality, value, and success of standards

Even more promise if we combine "patent" and "standard" side, i.e. relate characteristics of declared SEP to characteristics of the underlying standard

SEP Declarations and the Searle Center Database

- Standards are a less orderly population than patents
  - No uniform criteria and bibliographic conventions; overlap in subject matter; less regulated duration and international scope
- Specific challenges for match of patents to standards
  - Declarations at "project", specification, or section level
  - Attributing declarations to specific versions of a specification
  - International and other cross-SDO equivalences (e.g. ISO/IEC 14496.10 & ITU H.264)
  - Normative and informative references among specifications

SEP Declarations and the Searle Center Database

- We match SEP declarations to standards on the standard document (specification) level
  - Different definitions of match depending on whether the declaration is version-specific
    - *slevelmatch*: A standard document is matched to a SEP declaration if the SEP was declared to this standard (this or previous version) before this version's expiration date
    - *vlevelmatch*: The declaration specifically designates a standard version (or there only is one version)

- Match to the Searle Center Database for additional information on standard documents
  - Information on publication date, issuing body, ICS classification, number of pages..
  - Database of normative and informative references (backward and forward)
  - International and other cross-SDO equivalencies
  - Version history and direct replacements

SEP Declarations and Normative References

Many standard documents are *indirectly* subject to SEP declarations

TABLE 4 Number of standards and share of standards directly or indirectly (via references to other standards) subject to declared SEPs

	N	Directly (%)	Indirectly (%)	Indirectly (only normative, %)	Any (%)
All standard documents	797,749	2.51	4.71		5.02
Active standard documents	354,454	1.81	4.98		5.36
ICT standard documents	124,283	15.97	29.28		31.14
Mobile communication	29,026	56.44	83.76		86.50
ETSI	46,994	36.70	61.81	60.86	63.90
IETF	7,531	10.41	39.42	29.44	40.82

Figure: Source: Baron, Justus, and Tim Pohlmann. "Mapping standards to patents using declarations of standard-essential patents." Journal of Economics & Management Strategy 27.3 (2018): 504-534.

SEP Declarations and Normative References

TABLE 5 Standards subject to declared SEPs, by SSO, and number of declaring firms[32]

	Number of standards by number of declaring firms									
	Directly					Any				
SSO	1	2 to 3	4 to 10	11 to 25	More than 25	1	2 to 3	4 to 10	11 to 25	More than 25
ANSI	44	38	41	26	6	66	54	54	29	8
ATIS	1	0	0	0	0	1	0	0	0	0
DVB	2	4	6	0	0	2	4	6	0	0
EIA	1	0	0	0	0	1	0	0	0	0
ETSI	3,661	3,944	5,870	3,169	603	1,340	2,859	5,060	8,285	12,462
IEC	215	120	106	13	37	691	602	475	197	449
IEEE	162	105	121	46	46	447	320	351	190	460
IETF	582	131	13	0	0	726	942	970	178	99
INCITS	9	8	7	0	0	9	8	7	0	0
ISO	211	56	79	20	42	733	334	314	178	379
ITU	415	188	154	44	17	626	490	547	232	175
TIA	0	0	0	0	0	0	0	0	0	0
Sum	5,303	4,594	6,397	3,318	751	4,642	5,613	7,784	9,289	14,032
All	5,303	4,597	6,397	3,318	751	4,361	5,386	7,484	9,317	13,708

Figure: Source: Baron, Justus, and Tim Pohlmann. "Mapping standards to patents using declarations of standard-essential patents." Journal of Economics & Management Strategy 27.3 (2018): 504-534.

Non-Patent Literature Citations to SDO Documents

SSO	Number citations	Percentage
3GPP	81,383	23.75
ANSI	8,551	2.49
ATIS	843	0.25
Broadband Forum	227	0.07
CEN	1,061	0.31
DMTF	303	0.09
DVD Forum	55	0.02
ECMA	2,684	0.78
ETSI	61,353	17.9
IEC	27,173	7.93
IEEE	38,500	11.23
IETF	29,963	8.74
ISO	38,744	11.3
ITU	26,946	7.86
OASIS	2,620	0.76
OMA	3,484	1.02
SMPTE	5,934	1.73
TIA	4,196	1.22
VESA	1,064	0.31
W3C	7,642	2.23
Total	**342,726**	**100**

Figure: NPL Citations from US Patents to SDO Documents, by SDO

Non-Patent Literature Citations to SDO Documents

Analysis of NPL-citations: 3GPP

- 81,383 patents citing 3GPP documents, including
  - 26,702 citations to technical specifications (TS)
  - 29,603 citations to technical contributions
  - 9,249 citations to meetings (meeting minutes?)
  - 5,969 citations to technical reports (TR)

Non-Patent Literature Citations to SDO Documents

Document Type	Citations	Cited docs	Number Docs
Change request	2,803	1,245	146,231
Discussion document	2,371	915	41,787
Liaison	235	122	26,369
Report/Proposal/Study	18,150	6,365	66,517
Withdrawn document	96	26	2,349
Void			113
Not matched	5,984	2,216	
	29,639	10,889	283,366

Figure: NPL Citations to 3GPP Technical Contributions, by Type

NPL Citations and SEP Declarations

Innovation economists have made fruitful use of noisy indicators when studying patents

Table 1. Correlation Structure of Indicators

	Claims	*Family*	*Fwd5*	*Fwd610*
Family	0.103			
Fwd5	0.138	0.098		
Fwd610	0.115	0.099	0.390	
Bwd Cites	0.143	0.044	0.093	0.083

Notes: Entries are correlation coefficients for the pooled sample. All are statistically significant at the 1% level. Variables are in logarithms.

Figure: Correlation Structure Between Patent Characteristics. Source: Lanjouw, Jean O., and Mark Schankerman. "Patent quality and research productivity: Measuring innovation with multiple indicators." The Economic Journal 114.495 (2004): 441-465.

NPL Citations and SEP Declarations

Despite uncertainties, standard characteristics seem to carry at least as much informational content

Table 4
Correlation between TS rankings based on counts of references, patent citations, change requests, and declared standard-essential patents.

	Standard references	Patent citations	Change requests	Declared SEPs
Standard references	1.0000			
Patent citations	0.5482 (0.0000)	1.0000		
Change requests	0.3600 (0.0000)	0.4189 (0.0000)	1.0000	
Declared SEPs	0.4658 (0.0000)	0.7336 (0.0000)	0.4709 (0.0000)	1.0000

Figure: Correlation Structure Between Standard Characteristics. Source: Baron, Justus. "Counting standard contributions to measure the value of patent portfolios-A tale of apples and oranges." Telecommunications Policy 44.3 (2020): 101870.

Matching Patent Inventors and SDO Meeting Attendees

- Meeting attendees and patent inventors are publicly available, potentially providing a source of systematic information
- Kang and Motohashi (2015) document correlation between inventor participation and declaration as SEP

- Ongoing work: Match Patent Inventors with SDO Meeting Attendees
  - I use OECD triadic patent family filings (TPF), and only focus on those patents applied at EPO, JPO, and USPTO.
  - Match with SEP declaration data to identify declared SEPs and the technological field of these declared SEP
  - Match of inventor names with attendees at 3GPP, IETF, IEEE-SA 802.11, and OneM2M

Matching Patent Inventors and SDO Meeting Attendees

- In some SDOs, most individual participants are inventors
- Patent inventorship strongly correlates with measures of SDO participation

Table: Descriptive Statistics by SDO

	3GPP	802.11	IETF	ONEM2M
Attendees	13,607	1,652	29,411	811
Among which: Inventors	5,175	748	5,007	161
Inventor share (pct)	37.89	45.28	2.54	19.85
Attendance records	202,451	15,595	108,234	13,970
Among which: Inventors	117,882	10,015	29,598	6,317
Inventor share (pct)	58.22	64.22	27.33	45.22
Number of patents per attendee	11.44	10.86	1.35	4.13
Number of SEPs per attendee	5.86		0.09	
Pw correlation #patents/attendance	0.1876	0.2591	0.1099	0.1546
	(0.0000)	(0.0000)	(0.0000)	(0.0000)

The Merits and Perils of Exploratory Empirical Research

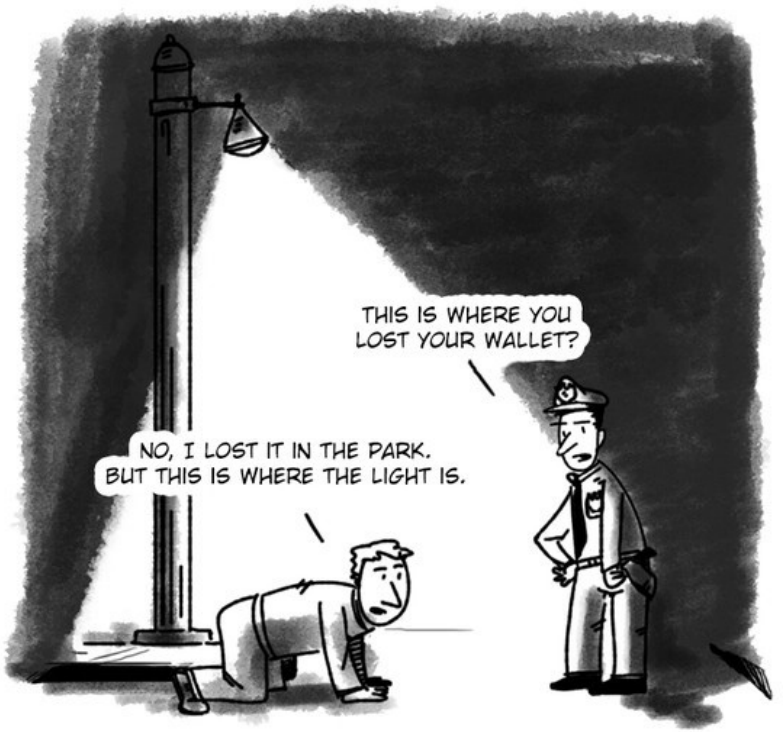

Figure: Innovation Economists at Work

Things we would want to know

- We have limited sensible measures of value and cost to inform fundamental questions regarding
  - the economic efficiency of different processes
  - profitability of different strategies and investments
  - the appropriate redistribution of returns among inventors and implementers
- Danger of over-emphasizing the visible tip of the iceberg (e.g. transaction costs related to declarations & litigation)
- Need to collect systematic data on
  - product market implementations of standards and their value
  - value decomposition into different components
  - observations of payments (e.g. licensing) and profits
  - measures of economic investments in standard development
- Put $ signs on observable magnitudes