Analyzing R&D investment in standard setting: How to use patent data

Tim Pohlmann
D-10623 Berlin Germany, Müller-Breslau-Straße 15 VWS 2, Tel: +49 (0) 30 314 76624, E-Mail: tim.pohlmann@tu-berlin.de

Berlin Institute of Technology
Faculty of Economics and Management
Chair of Innovation Economics

Cerna, Centre d'économie industrielle. MINES ParisTech

Justus Baron
60 Boulevard Saint Michel, 75272 Paris Cedex 06 – France, Tel. : 33 (1) 40 51 92 27, E-Mail: justus.baron@ensmp.fr.

Introduction:

The Phenomenon Explored

- The match of patent classes (IPC) to individual standards, to classes of standards (ICS) and to formal Standard Setting Organizations (SSO) to test different methods of measuring standard-specific R&D investment
- The use of patent data to study the coherence of a firm's R&D investment related to the characteristics and dynamics of standard setting

The Methods and Data Employed

- The goal is to identify the technological footprint of a standardized technology in the area of ICT (733 standards respectively)
- We gather more than 8.000 patents declared essential to technology standards. Essential patents help to identify all relevant IPC classes for the observed standard (in total 1405 classes at the 7-digit IPC level)
- **The Problem**: Essential patents only represent a very small share of patents that are technologically related to standards

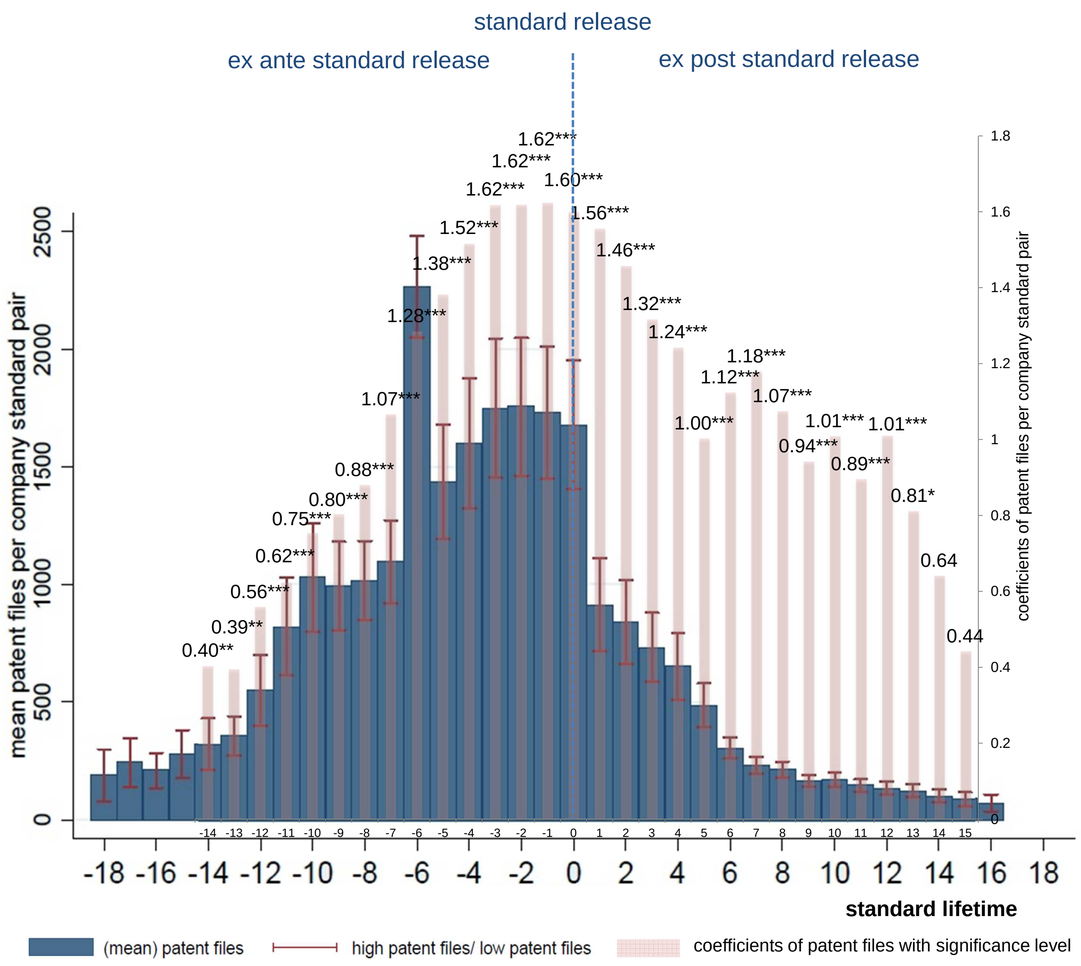
➢ **Approach:** We retrieve all patents filed by participating firms in the standard relevant IPC classes at the major patent offices (EPO, USPTO, JPO) over the last twenty years

Test the Method:

- We apply three approaches to test our method of measuring standard specific R&D investment:

1. Timing:

- We measure the correlation of patent filing behavior and one year periods of a standard's life time (see figure below)
- We compute for each company-standard pair (n=1587 pairs):
  - the **mean number of patents** filed in one year periods ex ante and ex post standard release (t=0)
  - the **standard derivation** for high and low values
  - **coefficients** of standard age year dummies from a fixed effect regression explaining patent files, controlling for year effects and dynamics of standardization over time (as to the regression in table 1 with standard age dummies)



2. Size:

- We estimate the correlation of our proposed measure of patent files with dynamic attributes of standards such as **size** (number pages),**versions** (releases), **amendments** and **age**

➢ *Table 1: Panel regression of company standard pairs*

Fixed effects poisson regresssion with robust standard errors

DV: patent files	Coef.		Std. Err.
release (standard versions)	3.86	**	1.63
size (no. pages)	-0.15		0.15
release*size	0.01	*	0.01
amendments	-1.63		2.09
amendments*size	0.02	***	0.01
standard age	6.17	***	0.41
standard age sq	-0.01	***	0.00
standard age*size	0.00		0.00

22,225 observations (1587 groups); Log likelihood = -26,390,885

Equation of coefficients to explain
$P_{CS,Y}$ = patent files per **c**ompany **s**tandard pair per **y**ear (1992-2009):

$$P_{CS,Y} = \alpha R_{CS,Y} + \beta S_{CS,Y} + \alpha RS_{CS,Y} + \gamma A_{CS,Y} + \gamma AS_{CS,Y} + \delta Y_{CS,Y} + \delta YQ_{CS,Y} + \delta YS_{CS,Y} + \varepsilon$$

*Notes. *** implies significance at the 99% level of confidence, **at the 95% level and * at the 90% level. R. SE indicates robust standard errors. Year dummies are not reported. All models are estimated with Stata/SE 11.*

3. Technology Space:

- We compare standard pairs by IPC class overlaps in a t-test and correlation analysis. We group standards with the same / different ICS or SSOs and compute the time distance of first release

➢ *Table 2: T-test mean comparison of IPC class overlaps per standard pair*

t-test of IPC class overlaps by standard pairs in same and different SSOs and standard pairs with same or different ICS classification

Group	Obs.	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
different SSO	56,193	1.389	0.003	0.659	1.383	1.394
same SSO	35,110	1.772	0.005	0.979	1.762	1.783
	t = -70.759; Ha: diff > 0 Pr(T > t) = 1.0000					
different ICS	78,307	1.473	0.003	0.749	1.468	1.479
same ICS	12,996	1.915	0.009	1.080	1.896	1.933
	t = -57.914; Ha: diff > 0 Pr(T > t) = 1.0000					

➢ *Table 3: Pairwise correlation with significance level*

		1		2		3		4
1	same ics	1						
2	same ipc	0.21	***	1				
3	same sdo	0.47	***	0.23	**	1		
4	release distance	-0.21	***	-0.09	**	-0.22	**	1

Findings and Results:

Performance of the method

- **Timing:** The number of a firm's standard specific patent files constantly increases in periods before the standard release and constantly decreases afterwards
- **Size:** There is a positive correlation between standard size and our count of patent files
- **Technological Space:** Standards from the same SSO, classified in the same ICS classes and released in a close distance of years have a higher IPC overlap compare to others

Insights to the Community

- We propose several matching methods by comparing different aggregation levels for patent (IPC) and standard (ICS) classes following Benner & Waldfogel 2008 and Jaffe et al., 2000
- We assess various factors influencing R&D investment in standards e.g. patent pools or standards consortia as to Baron & Pohlmann 2011 and Baron et al. 2011
- We apply analyses of the interplay between standard dynamics and the surrounding technological change (aggregation of patent files per technology) as to Baron et al., 2011
- **Future Application:** → Analyze the firm level direction of R&D investment (specific versus general investment). → Illustrate technical proximities between standards and SSOs