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**INNOVATION IN CLEAN/GREEN
TECHNOLOGY:
CAN PATENT COMMONS HELP?**

Questions

- ◎ What is a patent commons?
 - A set of patents pledged for use by others with minimal restrictions
 - Not necessarily for joint use
 - Why do firms allow third parties royalty-free use of patented inventions?
- ◎ Broader issues:
 - What is the role of patents in environmental and possible climate change mitigation?
 - How do firms influence appropriability regimes in certain sectors/technologies?

Argument (Hall-Helmers 2010)

- ◎ Double externality
 - Green technology policy needs diffusion as well as innovation
- ◎ Green technology is highly varied, draws from many scientific and engineering disciplines
 - Much is complex
 - Some is low tech; highly substitutable
 - Some requires standard-setting
- ◎ Patents may raise TC and slow diffusion

The question

- Can a patent commons help to encourage the development and diffusion of environmental and climate change-related technology?

The eco-patents commons

- ⦿ Created **January 2008** by **IBM** at World Business Council For Sustainable Development (WBCSD)
- ⦿ First **green** patent commons
- ⦿ Firms can pledge patents related to green technology (defined by IPC subclasses, but flexible)
 - 12 firms have done so (from the “triad”)
- ⦿ Available to third parties for climate-change related activities with auto royalty-free license
 - ownership remains with firm
 - not a donation, and not tax deductible
 - defensive termination right

A small puzzle

- ⦿ Why a patent commons?
- ⦿ Why not use defensive publication?
 - Keeping these patents in force requires paying fees (which the firms apparently do)
 - Royalty-free license to all comers with no contracting means they don't even know who uses the technology
 - Is defensive termination that valuable?

Some critical views

[I]t is clear that the donating company did not find the patent to have compelling com-petitive advantage for them, or they would not have donated it to begin with, so why would any other company necessarily find value in the donated patent?

Nancy Cronin, Greenbizz 2008

Why would a patent owner contribute a patent, continue to sustain the maintenance costs, yet have the patent commonly available to all having under-taken to not enforce the patent?

Duncan Bucknell, Think IP Strategy - 2008

IBM view

[P]ledging patents for free use by others [...] can be a win for innovators in other parts of the world, who might look at these ideas and further them and use them as the basis of additional solutions. And it can be a win for those who pledge because **it could open up opportunities to collaborate with people that you might not otherwise have collaborated with.**

(Wayne Balta, Vice President of Environmental Affairs, IBM)

Our study

- Analyze 94 unique priority/publn authority combinations (total of 238 equivalents) listed on the Ecopatent Commons website.
 - What do firms contribute?
 - Why do firms contribute?
 - Can we learn something about patents and the diffusion of climate-change mitigating technologies?

Data

- Unit of analysis: patent
- 121 patents contributed to the EcoPC by the 12 firms, listed on WBCSD website
- April 2010 edition of EPO's PATSTAT:
 1. EcoPC: 94 unique priority/publication authority with priority years between 1989 and 2005 plus their equivalents (238 total)
 2. Control (1) sample: all patent applications worldwide by the 12 EcoPC firms
 3. Control (2) sample: all patent applications worldwide in same IPC class (which also share the same priority year and authority as EcoPC patent)

Age, legal status, and “green character” of sample patents

- ◎ Age measured as commons entry date minus priority date
 - Ranges from 3 to 20 with a median of 9.5 years
- ◎ About half of these patents are in force (80% unique priorities)
 - 11% are pending or status unknown
 - 34% are withdrawn, rejected, expired
- ◎ 35% green according to OECD definition

Patents & equivalents contributed compared to firm portfolios

	<i>Date entered</i>	<i>Eco-patents</i>	<i>Total patents</i>	<i>Share</i>
DuPont	Jan-08	43	40,761	0.105%
IBM	Jan-08	53	100,099	0.053%
Mannesmann	Jan-08	2	7,027	0.028%
Nokia	Jan-08	3	51,621	0.006%
PitneyBowes	Jan-08	7	4,589	0.153%
Sony	Jan-08	4	184,093	0.002%
Bosch	Sep-08	52	92,142	0.057%
Xerox	Sep-08	56	28,491	0.197%
Ricoh	Mar-09	1	109,978	0.001%
Taisei	Mar-09	2	6,924	0.029%
Dow	Oct-09	9	14,629	0.062%
FujiXerox	Oct-09	6	43,001	0.014%
Total		238	683,155	0.035%

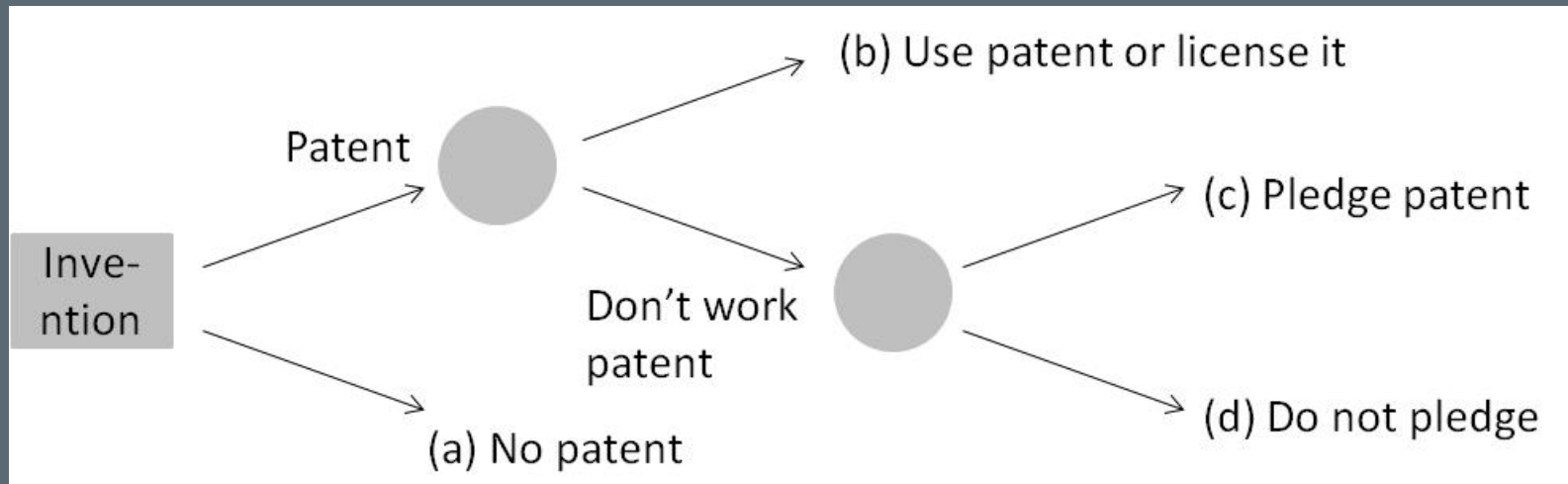
Technologies

<i>Technology</i>	<i>Not OECD classes</i>	<i>OECD classes</i>	<i>Total</i>
Not clear	1.8%	0.0%	1.1%
Clean manufacturing	40.4%	6.1%	27.8%
Clean up soil & groundwater	0.0%	48.5%	17.8%
Electric auto related	1.8%	3.0%	2.2%
Energy efficiency (mostly autos)	21.1%	6.1%	15.6%
Global warming (fluorocarbons)	8.8%	0.0%	5.6%
Pollution	12.3%	24.2%	16.7%
Detect environmental damage	8.8%	0.0%	5.6%
Recycling (mostly disks)	5.3%	12.1%	7.8%

Legal status of EcoPC and Control patents

	<i>Eco patents</i>		<i>Controls</i>	
<i>Legal status</i>	<i>Number</i>	<i>Share</i>	<i>Number</i>	<i>Share</i>
In force	117	49%	194	41%
Nonpayment of fees	37	16%	94	20%
Expired	19	8%	5	1%
Withdrawn	23	10%	70	15%
Rejected	16	7%	25	5%
Unexamined/pending	4	2%	32	7%
Published in national office	2	1%	14	3%
NA	20	8%	39	8%
Total	238		473	

1. Firm decision



We cannot observe the first two decisions. We look at pledge conditional on patenting and not working.

Not worked: less valuable, or far from firm's competency

Pledged: far from firm's competency, does not threaten firm, is relevant for clean tech

More green, further from portfolio - more or less valuable (?)

Variable	Coefficient	Std error
Log num of inventors	-0.043	0.100
Log family size	0.166	0.092
Log forward cites to 2011	-0.050	0.029
Log backward cites	0.035	0.028
Log NPL cites	0.023	0.039
Log number of IPCs	-0.125	0.101
Log grant lag	-0.003	0.048
D (patent granted)	0.177	0.202
D (similar IPC)	-2.440	0.561
D (OECD green tech)	1.034	0.093
Pseudo R-squared	0.247	

Probit for the probability a patent from the firm's portfolio is pledged (mean = 0.035%)

Standard errors robust and clustered on firm.

Priority year (17), 1 digit IPC (6), and firm dummies (5) included.

Sample size is 683,393 with 238 eco patents

More green, narrower, less valuable more derivative

Variable	Coefficient	Std error
Log num of inventors	0.088	0.110
Log family size	-0.137	0.076
Log forward cites	-0.089	0.037
Log backward cites	0.050	0.028
Log NPL cites	-0.053	0.036
Log number of IPCs	-0.469	0.103
Log grant lag	-0.038	0.047
D (patent granted)	0.472	0.197
D (OECD green tech)	0.497	0.125
Pseudo R-squared	0.137	

Probit for the probability a patent in an EcoPC class is pledged (mean = 0.21%)

Standard errors robust and clustered on firm.

Priority year (17), 1 digit IPC (6), and firm dummies (5) included.

Sample size is 114,150 with 238 eco patents

Summary

- ⦿ Green patents by OECD definition are indeed more likely to be pledged
- ⦿ Pledged patents tend to be narrower
- ⦿ Pledged patents appear to be less valuable than the typical patent in the class
- ⦿ Pledged patents appear to be indistinguishable from the other patents in a firm's portfolio, except
 - they are more green
 - less likely to match the IPC pattern of the firm, suggesting that they are not central to firm strategy

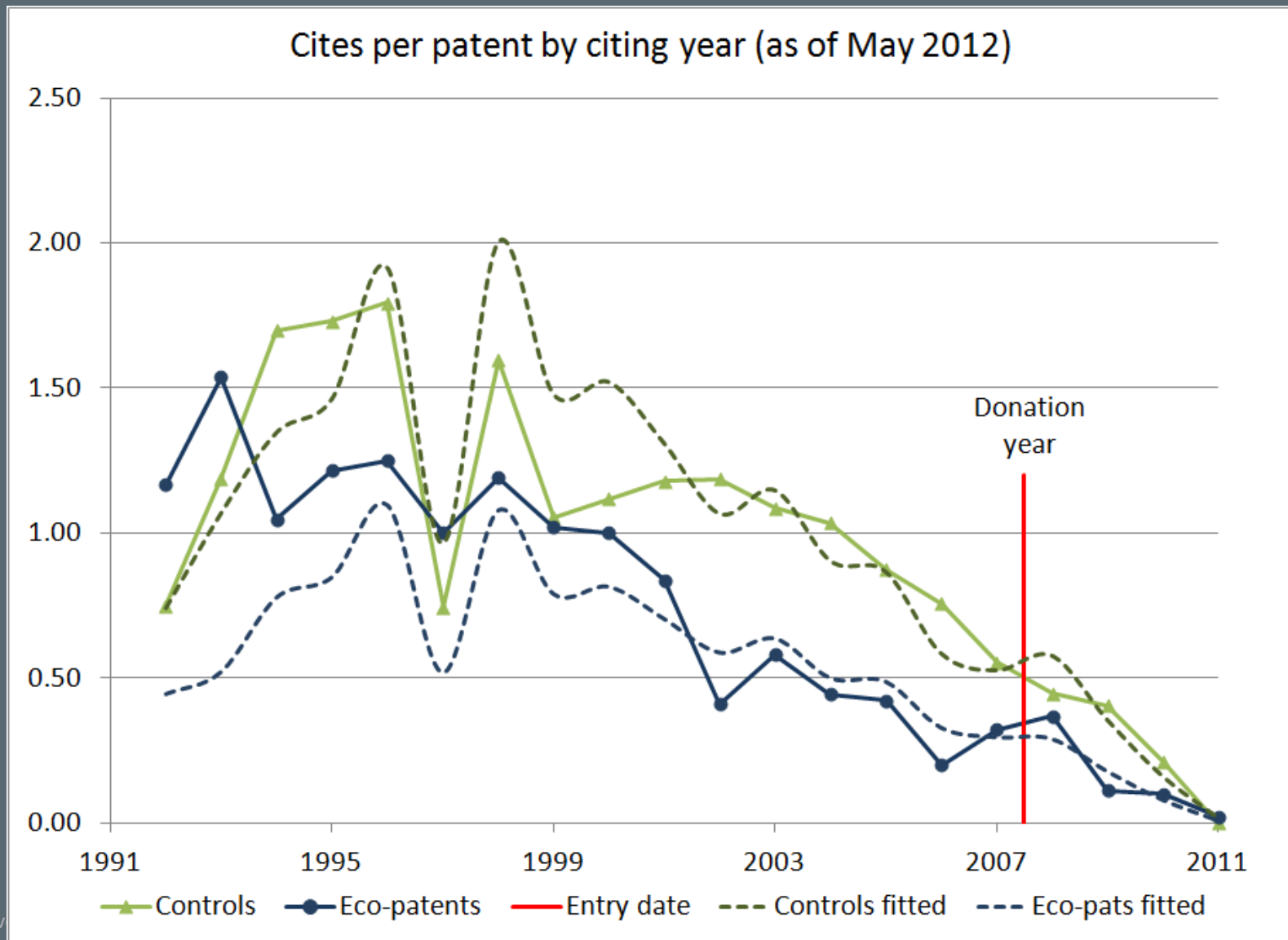
Patents and diffusion

- ⦿ Can we learn something about patents and diffusion of climate-change mitigating technologies?
 - Cannot tell whether inventions protected by pledged inventions are used
 - Look at diffusion by analyzing forward patent citations (also have webhits)
 - Short period of time — at best since **Jan 2008**
- ⦿ Chose a **94** patent control sample
 - matched on priority year, 4-digit IPC, and priority authority

Hits on EcoPC website

Statistic	April 2011
Total hits	6,267
Average number of hits for those with hits>0	216
Share of patents with hits>0 and forward cites>0 post Jan 2008	11%
Share of patents on the website with no hits	65%
Share of patents on the website with hits>0	35%

EcoPC cites decline earlier than those for the controls



EcoPC patents are more likely to be cited by non-firms

<i>Type of Citer</i>	<i>Eco-patents</i>	<i>Control sample</i>
Firm	82.5%	91.9%
University or institute	5.1%	2.6%
Individual only	11.5%	4.2%
Both firm & university	0.3%	0.6%
Unknown	0.6%	0.7%
Share of self-cites	15.4%	12.6%

Suggests non-profit motives for using the technology

Also seems to be more feedback to the firm than for the control patents

Two models for citation distribution

1. Semi-parametric, estimated by Poisson – full set of priority year and citation lag dummies (citation year dummies implied)
 - Add dummies for eco-patents and eco-patents after donation
2. Jaffe-Trajtenberg parametric model of diffusion and obsolescence of knowledge
 - Allow different patterns for eco-patents

Semi-parametric model for cites

Poisson model for forward cites c_{it} :

$$c_{is} \sim \frac{\lambda_{is}^{c_{is}} e^{-\lambda_{is}}}{c_{is}!}$$

$$\lambda_{is} = \exp \left[\sum_{t=1}^T \alpha_t I(\text{year} = t) + \sum_{s=0}^S \gamma_s I(\text{lag} = s) + \delta_{eco} D_{is}^{eco} + \delta_{after} D_{is}^{after} \right]$$

D_{after} = Dummy=1 after donation

Full set of time dummies for priority year and citation lag (citation year implied).

Estimation results for semi-parametric Poisson model

Variables	Coefficient	s.e.
EcoPC patent	-0.57	(0.12)
EcoPC patent after donation	-0.09	(0.30)
Citation lag dummies	Yes (0-18)	
Priority year dummies	Yes (1989-2005)	

2214 observations on 184 = 90+94 equivalent groups.
Standard errors are robust and clustered on patents.

Jaffe-Trajtenberg model

$$c_{st} = \beta_0 f(t) e^{-\beta_1 s} (1 - e^{-\beta_2 s}) + \varepsilon_{st}$$

c_{st} = average number of cites received by patents with priority year t and citation lag s ($c_{st} = C_{st}/P_{st}$).

β_1 = decay parameter

β_2 = diffusion parameter

$f(t)$ is an arbitrary function of the patent's priority year (in our case, dummies).

Estimation results for J-T model (NLLS)

Variable	Coefficient (S.E.)		
EcoPC patent	-0.28	(0.12)	**
EcoPC patent after donation	-0.28	(0.15)	*
Decay parameter	0.24	(0.06)	***
Diffusion parameter	0.47	(0.34)	
Priority year dummies	Yes (1989-2005)		

Dependent variable = cites per patent; 380 observations on priority year-cite lag combinations. Standard errors are robust and clustered on patents.

Decay parameter for EcoPC patents insignificantly different from controls; separate diffusion parameter not identified.

Conclusion

- ⦿ EcoPC patents are cited significantly less *before* donation.
- ⦿ Suggests that they are not that important for follow-on innovation.
- ⦿ Post-donation coefficient still imprecise (only 3 years of data)

Further comments on the commons

- ⦿ Some issues with setup – 12 patent numbers (10%) wrong on website
- ⦿ One quarter of EcoPC patent applications have expired, been rejected, or withdrawn
- ⦿ One quarter are not yet granted
- ⦿BUT legal status distribution for controls is similar with even fewer in force

Legal status as of March 2011

Legal status	Eco-patents	Controls	Eco-patents	Controls
Granted	173	288	72.7%	60.9%
of which, in force	117	194	67.6%	67.4%
Withdrawn, rejected, expired	95	194	39.9%	41.0%
Unknown	26	85	10.9%	18.0%
Total	238	473		

Summary findings

- ◎ What do firms contribute?
 - Relatively narrow green patents
 - Far from firm's core technology
 -maybe less valuable
 - No longer useful?
- ◎ Do these patents contribute to the diffusion of environmental technologies?
 - Not clear – wait for longer cite history
 - Hard to tell if there is actual use of inventions