

# Patent Pools and Patent Inflation

An empirical analysis of contemporary patent pools

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# Introduction

## Joint licensing in patent pools

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- **Patent Pool:** “...an agreement between two or more patent owners to license one or more of their patents to one another or third parties.” (USPTO)
- **Single license** contract for a bundle of patents “one-stop shopping”
- Patents must be **complementary** and necessary for implementing a technology
- Standards only include patents which are complementary (**essential patents**)

# Introduction

## ICT standards and essential patents



- **Standard Setting in ICT:**
  - ICT standards = **innovative** technologies
  - In the last decades standardization evolved towards a **joint development** of complex technology platforms (e.g. GSM, UMTS, WiFi, MPEG)
  - Technology components and functionalities originating from **various contributing firms**
  - Firms contributing to this joint effort can **patent** their contributions; **“essential patents”**
  - **fragmented IPR ownership** may raise transaction costs, royalty stacking and the risk of hold-up

# Introduction

## Effects of patent pools



- Patent pools are designed to **mitigate patent thicket problems** (Shapiro, 2001)
- Pools may reduce **multiple marginalization** and transaction costs and facilitate patent enforcement
- But **royalty sharing** mechanisms based upon the number of patents further exacerbate **incentives for strategic patenting**
  - *Increasing use of continuations and **divisionals** (Nagaoka et al., 2009)*
  - *Patents are increasingly narrow and **incremental** (Baron and Delcamp, 2011)*
  - *Holders of **valuable patents** tend not to join these pools (Layne-Farrar and Lerner, 2011)*

# The Policy Change

## 100 years of patent pooling

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- Many patent pools in very **different technological** areas until World War II (subject to **substitute** or **non-necessary** patents)
  - End of WWII → Stricter enforcement of **competition law** impeded any pool creation
- 1997 and 1999, the European and American antitrust authorities **authorized** a new model of patent pooling:
  - **Favorable business** review with important safeguards against anti-competitive abuses
  - **Legal certainty** of pooling patents: Patents have to be complementary and necessary!

# Literature

## Patent pool effects on innovation

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- Theoretical Literature:
  - Patent pool have **positive** effect on the incentives to **invest** in related **R&D** (Lerner and Tirole, 2004; Aoki and Schiff, 2007)
  - **Patent race** in view of a patent pool (Dequiedt and Versaevel, 2012)
- Empirical Literature:
  - **Negative** effect of patent pools on **innovation** and **patenting** (Lampe and Moser, 2010; Joshi and Nerkar, 2011)
  - It is difficult to confront the **empirical** evidence with **theoretical** predictions



- *How can we assess effects of patent pooling before and after the pool is launched?*
- *What is the effect of patent pooling on patenting around standardized technologies?*

# Method

## Database construction

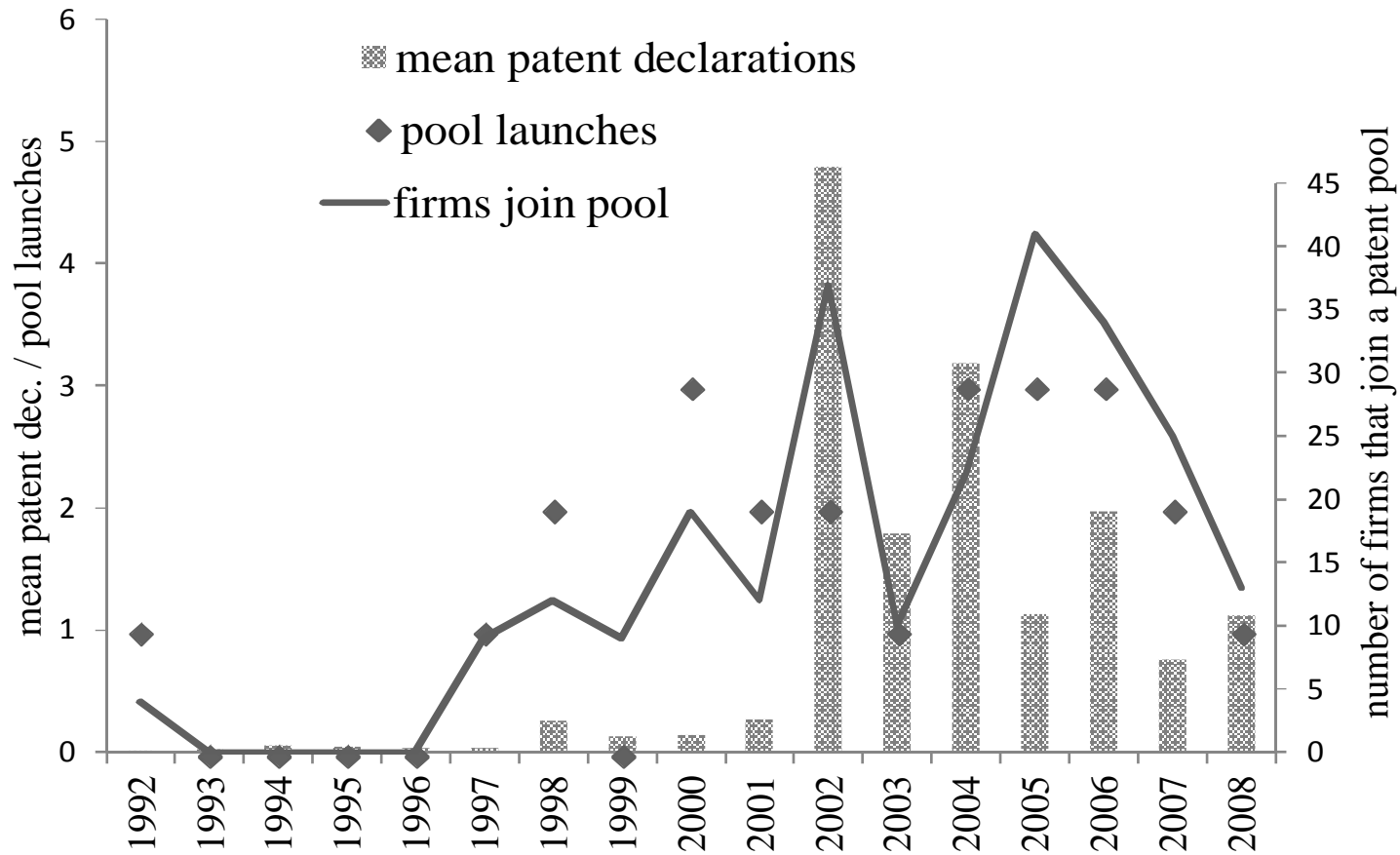


- **Essential patents** → 9,000 declared essential patents made by **150 companies**
- **700 standards** (ISO, IEC, JTC1, ETSI, ITU, IEEE)
  - PERINORM: standard version updates, standard amendments, the number of pages, the technical classification and the year of release
- Count of patents filed by 150 sample companies per year in the standard relevant IPC classes
  - Standard **relevant IPC classes** identified with essential patents
  - **Company assignee match** using merging methods by Thoma et. al. (2010)
  - **Company – Standard pairs** (1992-2008)
- Publically available data on **28 patent pools**, pool licensors, pooled patents and relevant technology standard



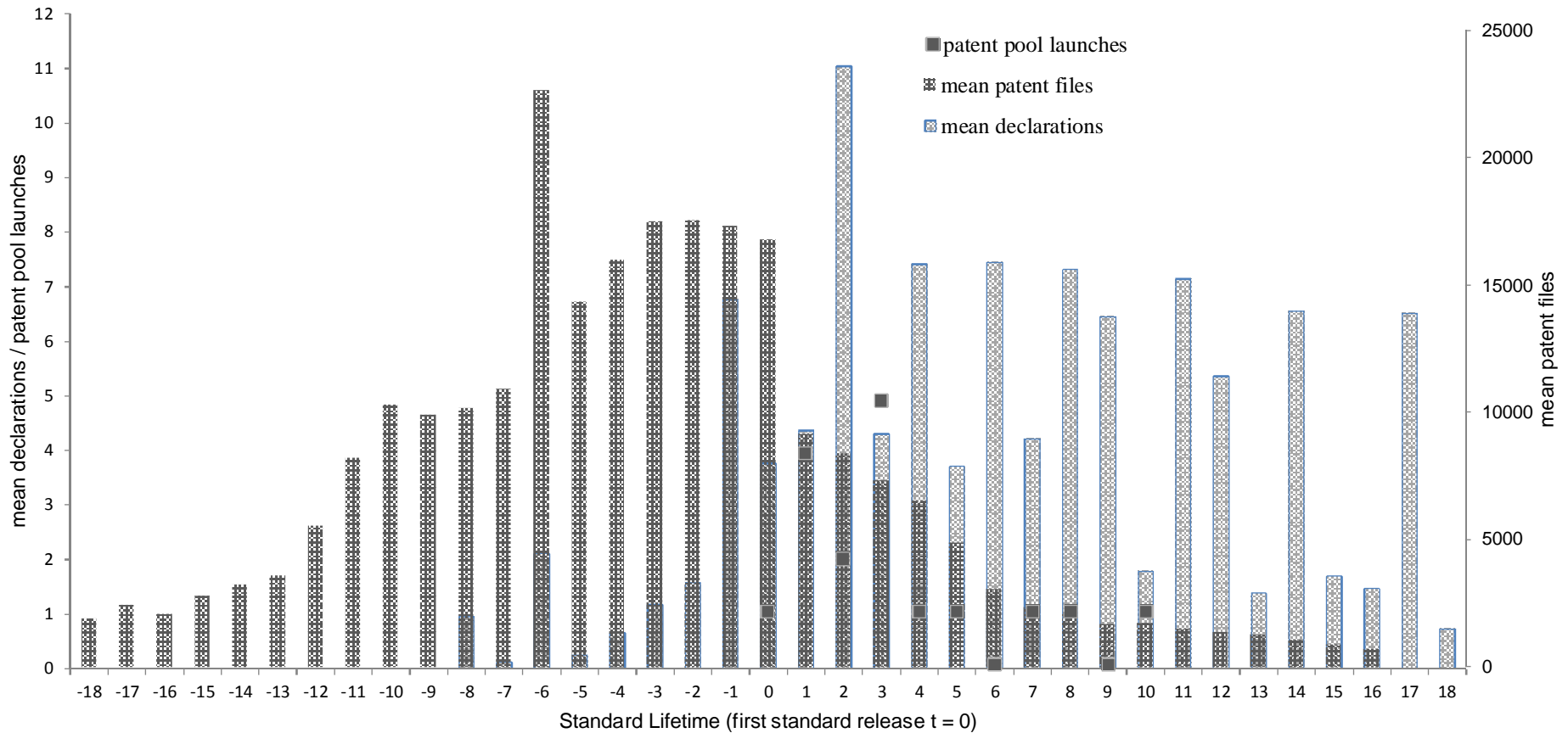
# Descriptive

## Two decades of patent pooling



# Descriptive

## Patenting as to standard lifetime



# Method

## The baseline technology development

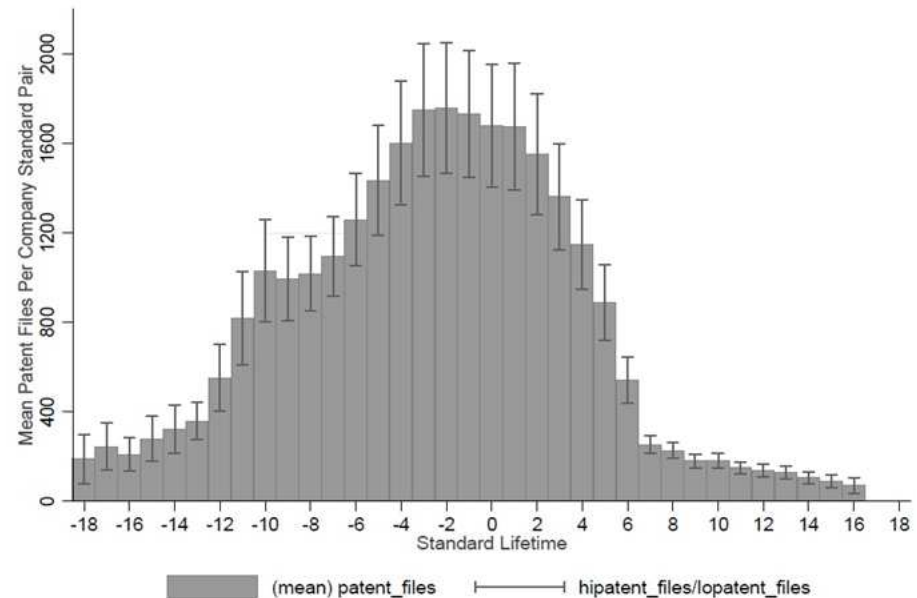


### Challenge of analysis:

- Is comparing patenting before and after pool creation a good counterfactual?
  - Only if technology development is constant over time!
  - Only if pool creation comes as a surprise!

### Solution:

- We account for the baseline timing of patenting by controlling for the evolution of the technology standard (standard age, version upgrades)



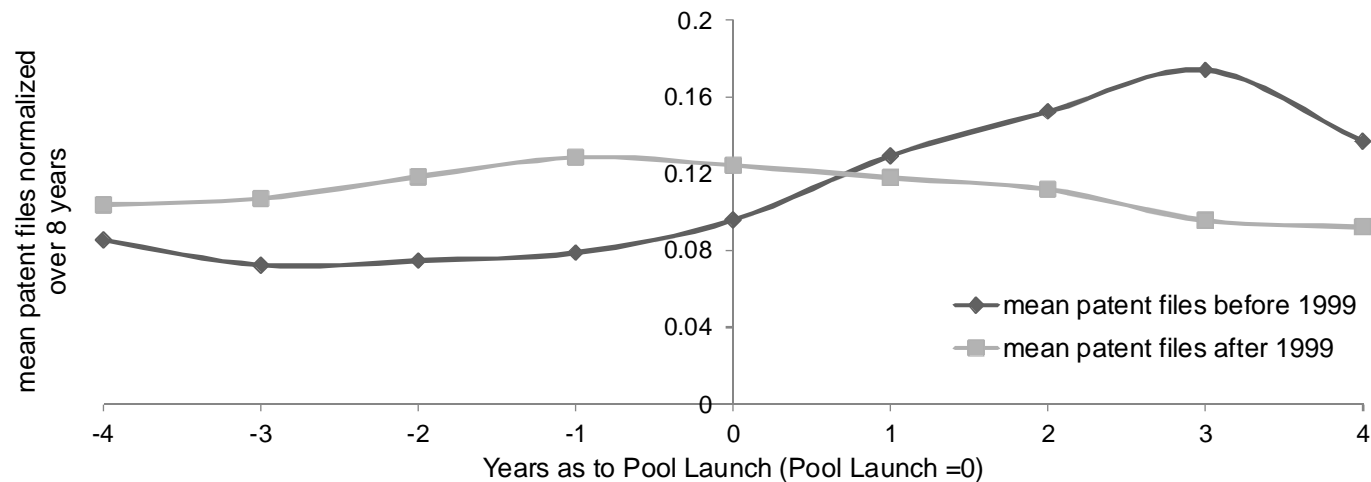
# Method

## The counterfactual



### Solution:

- We distinguish between **expected** and **unexpected** patent pools
- Using the favorable **business review** of patent pools from **1997 to 1999** as an exogenous policy change:
- Comparing standards released before and after 1999



# Estimation

## Equation of a poisson estimation



$$st\ patents_{ijt} = \exp(\alpha_1 st\ patents_{ijt-1} +$$

	❖ Standards before 1999	❖ Standards after 1999
❖ 4 Years prior pool launch	❖ $\beta_1$ prior pool active * standards before 1999	❖ $\beta_2$ prior pool active * standards after 1999
❖ 4 Years past pool launch	❖ $\beta_3$ past pool active * standards before 1999	❖ $\beta_4$ past pool active * standards after 1999

$$\beta_5 ICT\ patent\ count_t + \beta_6 standard\ activity_{jt-1} + c_t + \varepsilon )$$

- ❖ **Unit of Observation:** Firm-Standard Pair
- ❖ Only **standards** where **patents are pooled**
- ❖ **Fixed-effects poisson** estimator with robust **clustered standard errors** (reported in parentheses, **clustering by firm**).

# Estimation

## Regression of patent files



DV= patent_files	M1a	M1b	M1c	M2
Variable	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)
3-4 y. before pool launch (later 1999)	<b>0.122***</b> (0.027)	<b>0.151***</b> (0.028)	<b>0.149***</b> (0.027)	<b>0.162***</b> (0.028)
1-2 y. before pool launch (later 1999)	<b>0.122***</b> (0.035)	<b>0.136***</b> (0.029)	<b>0.127***</b> (0.031)	<b>0.114**</b> (0.045)
1-2 y. after pool launch (later 1999)	-0.006 (0.045)	0.043 (0.036)	0.027 (0.04)	<b>0.122*</b> (0.066)
3-4 y. after pool launch (later 1999)	-0.074* (0.044)	-0.076* (0.04)	-0.071* (0.041)	0.039 (0.064)
3-4 y. before pool launch (earlier 2000)	0.071 (0.066)	0.078 (0.062)	0.090 (0.064)	0.024 (0.064)
1-2 y. before pool launch (earlier 2000)	0.032 (0.083)	0.075 (0.062)	0.091 (0.063)	0.04 (0.068)
1-2 y. after pool launch (earlier 2000)	<b>0.350***</b> (0.128)	<b>0.330***</b> (0.12)	<b>0.340***</b> (0.116)	<b>0.468***</b> (0.109)
3-4 y. after pool launch (earlier 2000)	0.159 (0.108)	-0.023 (0.056)	-0.019 (0.056)	0.055 (0.085)
Dummies (patent files, ICT patents, standard upgrades)	1 dummy included	2 dummies included	3 dummies included	<b>Members only</b>
Observation /Groups/ Log likelihood	3,928 / 247 / -476,922	3,928 / 247 / -446,830	3,928 / 247 / -445,701	1,473 / 93 / -190,429

# Estimation Robustness

## Regression of patent files



- ❖ **Whole sample** of standards where at least one patent has been declared essential, consisting in **1,704 firm standard pairs**
- ❖ M4-2, firms are dropped if their **technological focus differs** strongly from the average focus of other firms
- ❖ We identify positive or **negative shocks** to the number of **employees** of firms (M4-3)
- ❖ As to our **PSM sampling** method, we exclude firm standard pairs that were not matched and estimate another model (M4-4)

DV= patent_files	M3-1	M3-2	M3-3	M3-4
Variable	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)
3-4 y. before pool launch (later 1999)	<b>0.177***</b> (0.064)	<b>0.177**</b> (0.084)	<b>0.159*</b> (0.096)	<b>0.057</b> (0.05)
1-2 y. before pool launch (later 1999)	<b>0.220***</b> (0.061)	<b>0.209***</b> (0.076)	<b>0.197**</b> (0.092)	<b>0.116*</b> (0.065)
1-2 y. after pool launch (later 1999)	0.071 (0.052)	0.037 (0.061)	0.043 (0.078)	0.069 (0.074)
3-4 y. after pool launch (later 1999)	-0.186 (0.127)	-0.244** (0.119)	-0.233* (0.123)	-0.006 (0.087)
3-4 y. before pool launch (earlier 2000)	-0.115** (0.055)	-0.084 (0.079)	-0.043 (0.067)	0.035 (0.077)
1-2 y. before pool launch (earlier 2000)	-0.112* (0.067)	-0.047 (0.089)	-0.009 (0.085)	0.026 (0.1)
1-2 y. after pool launch (earlier 2000)	<b>0.347*</b> (0.184)	<b>0.428**</b> (0.185)	<b>0.446***</b> (0.172)	<b>0.452***</b> (0.148)
3-4 y. after pool launch (earlier 2000)	-0.014 (0.055)	0.025 (0.074)	0.103 (0.102)	0.106* (0.063)
Sample restrictions	<b>None</b>	<b>Tech outsider</b>	<b>Employee shock</b>	<b>PSM</b>
Observation / Groups / Log likelihood	27,147 / 1,704 / - 25,596	19,560 / 1,227 / - 13,682	13,197 / 972 / - 7,310	6,675 / 482 / - 2,185

# Discussion

## Effects of patent pools on patenting

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- Periods around pool creation → exceptionally high levels of patenting:
  - Standard before 1999 → Patenting peaks immediately after pool creation
  - Standard after 1999 → Patenting peaks prior to pool creation
- Direction of causality: → It is plausible that periods of unusually strong **patenting** lead to **launches of patent pools**?
- **However:**
  - Immediate reaction to **policy change** is followed by an **increase in patenting**
    - Our results confirm a response to an exogenous policy chock
    - Evidence for a **positive effect of patent pools** on firms' patenting



# Limitations

## Effects of patent pools on patenting

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- ❖ We do **not directly observe** firms' expectations with respect to future pool creation
  - We only observe actual pool creation on some standards and assume that at least some firms expected the pool
  - Future research may estimate dynamic expectations over time
- ❖ Even though we find evidence for unusually high patenting in reaction to pool creation
  - **The overall effect is yet unclear**
- ❖ Patents may not reflect **innovation** but may be subject to **strategic patenting**:
  - Do we measure substantial innovation or opportunistic patenting?



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Thanks for your attention!

**Any Questions / Ideas / Thoughts ?**

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# T-test

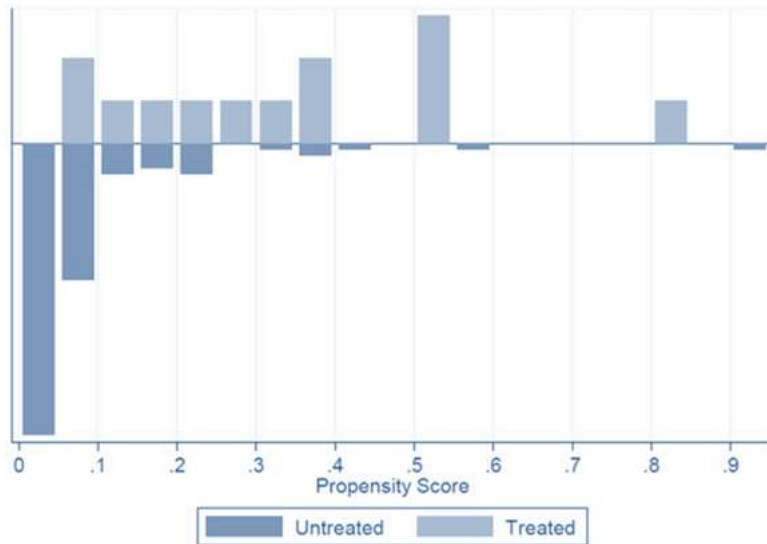
## Mean patents for standard with and without pools



Standard Updates						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
St. without Pool	567	0.360	0.057	1.361	0.248	0.472
St. with Pool	17	<b>3.647</b>	0.818	3.372	1.914	5.381
t = -9.1848 Pr( T  >  t ) = 0.0000						
Number Pages						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
St. without Pool	567	89.280	7.504	178.681	74.541	104.019
St. with Pool	17	159.882	37.181	153.301	81.061	238.703
t = -1.6111 Pr( T  >  t ) = 0.1077						
Accompanying Standards Consortia						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
St. without Pool	568	0.132	0.022	0.526	0.089	0.175
St. with Pool	17	<b>1.941</b>	0.466	1.919	0.954	2.928
t = -12.0743 Pr( T  >  t ) = 0.0000						
Declaring Companies						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95 %ConfInterval]	
St. without Pool	568	7.273	0.652	15.527	45.99	8.553
St. with Pool	17	<b>55.882</b>	18.521	76.366	16.61	95.146
t = -9.9426 Pr( T  >  t ) = 0.0000						
NPE on Standard Dummy						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
St. without Pool	568	0.276	0.019	0.448	0.240	0.313
St. with Pool	17	<b>0.824</b>	0.095	0.393	0.621	1.026
t = -4.9816 Pr( T  >  t ) = 0.0000						

# PSM

## Nearest neighbor matching method



Probit Regression			
DV= Pool Exists	Coef.	(SE)	z
Standard Updates	0.099*	(0.055)	1.81
Standard Consortia	0.259**	(0.114)	2.28
NPE Share	-4.188*	(2.257)	-1.86
Constant	-0.882	(0.444)	-1.99
Observations	102		
Pseudo R	0.3038		
Log likelihood	-27.091		

Sample statistics, matched and unmatched samples							
Variable	Sample	Mean		% bias	% reduct bias	t-test	
		Treated	Control			t	p>t
Standard Updates	Unmatched	4.384	1.303	101	7.6	3.68	0.000
	Matched	4.384	7.230	-93.3		-1.59	0.124
Standard Consortia	Unmatched	2.231	0.404	113.5	45.2	5.03	0.000
	Matched	2.231	1.231	62.1		1.23	0.230
NPE Share	Unmatched	0.139	0.271	-85.3	91.4	-2.28	0.025
	Matched	0.139	0.127	7.4		0.47	0.642