


Conflict Resolution, Public Goods and Patent Thickets

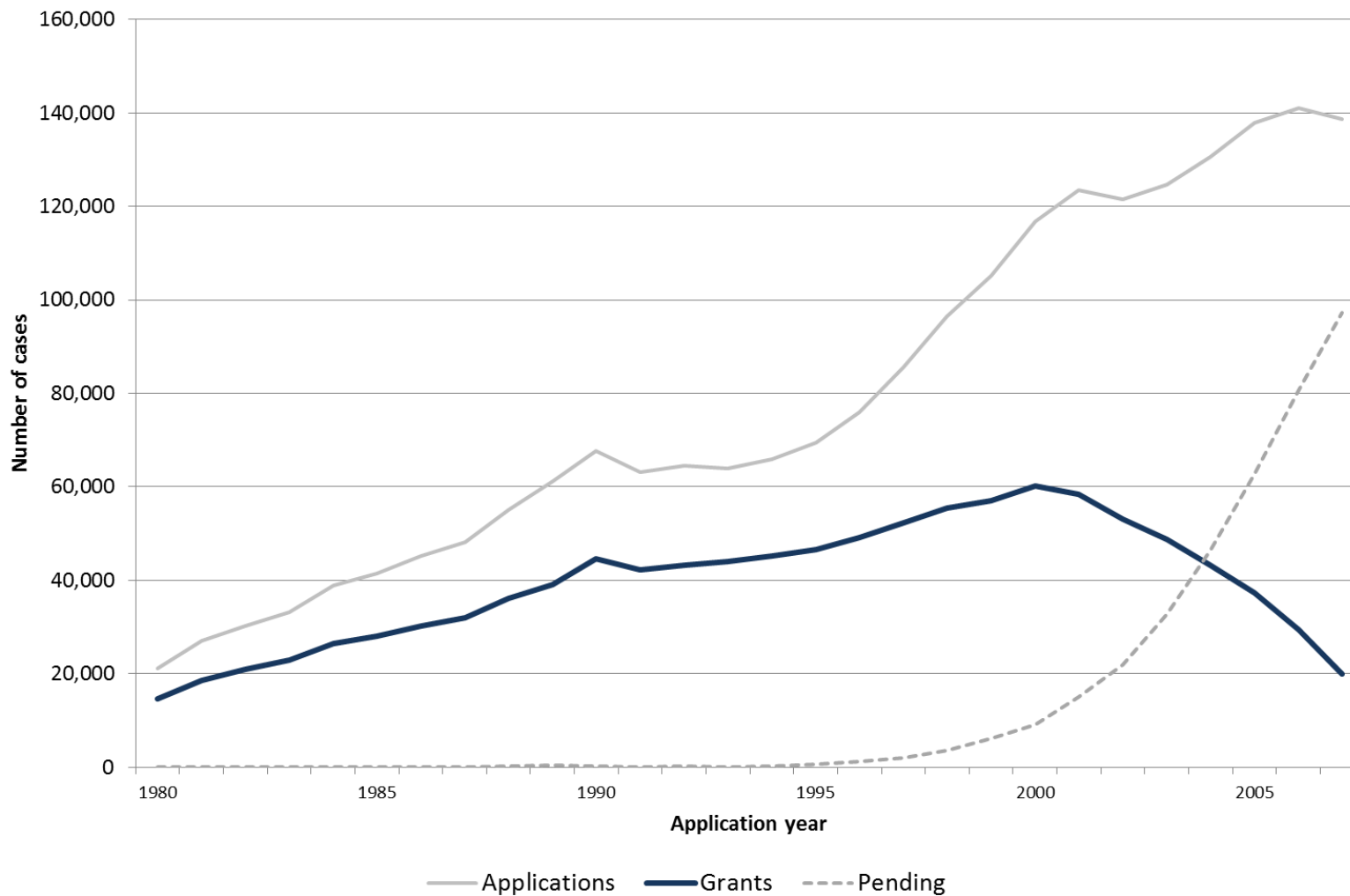


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RIETI Seminar
Tokyo, November 5th, 2014

Context of our study

“Patent explosion” – Filings and grants at the EPO (1980-2007)



Context of our study

Litigation and post-grant validity challenges as a corrective against “weak” patents

- Demand for patent rights has been growing steadily
 - Large portion is “weak” or marginal in terms of their contribution to the state of the art (Jaffe and Lerner 2004, Bessen and Meurer 2008, Lei and Wright 2009)
 - Patent thickets spread (overlapping claims, dispersed ownership) (Cockburn and MacGarvie 2009, Noel and Schankermann 2006, Hall and Ziedonis 2001)

What are patent thickets?

Background – What are patent thickets?

One definition by Carl Shapiro (2001)

"a dense web of **overlapping intellectual property** rights that a company must hack its way through in order to actually commercialize new technology,"

or, in other words,

"an overlapping set of patent rights" which requires innovators to reach licensing deals for **multiple patents from multiple sources.**"

Background – What are patent thickets?

Complex products require access to a multitude of different technologies

An example from smartphones: Apple vs. Samsung (taken from wired.com)

PRODUCTS INVOLVED IN THE TRIAL:

- iPhone 3G
- iPhone 3GS
- iPhone 4**
- iPad 2 3G
- iPod Touch

Photos: El Tiempo/Zuma Press (Galaxy S); Apple (iPhone 4)
The Wall Street Journal
Source: WSJ research

Samsung Says...

...THE IPHONE 4 INFRINGES THESE PATENTS:

PATENT '516
Manages the phone's resources and battery by prioritizing data

PATENT '941
Provides a way to package and transmit data more efficiently

Apple Says...

...THE GALAXY S INFRINGES THESE PATENTS:

PATENTS '087, '677
Ornamental design of the iPhone

PATENT '305
Rounded square icons on interface

PATENT '711
A method allowing multi-tasking while playing music on the phone

PATENT '460
Taking and emailing pictures using a scroll action

PATENT '893
Switching between pictures in a gallery and the camera

PATENT '163
Enlarging documents by tapping the screen

PATENT '915
Distinguishes between single-touch and multi-touch gestures

PATENT '381
'Bounce-back' feature when scrolling beyond the edge of a page

Galaxy S Patent List:

- Captivate
- Continuum
- Droid Charge
- Epic 4G
- Exhibit 4G
- Fascinate
- Galaxy Ace
- Galaxy Prevail
- Galaxy S**
- Galaxy S 4G
- Galaxy S II (AT&T)
- Galaxy S II (i9100)
- Galaxy S II (T-Mobile)
- Galaxy S II (Epic 4G)
- Galaxy S II (Skyrocket)
- Galaxy S Showcase
- Galaxy Tab
- Galaxy Tab 10.1 (WiFi)
- Galaxy Tab 10.1 (4G LTE)
- Gem
- Indulge
- Infuse 4G
- Intercept
- Mesmerize
- Nexus S 4G
- Replenish
- Transform
- Vibrant

▶ **Background – What are patent thickets?**
Fragmented ownership leads to an arms race

The prisoners' dilemma in complex product industries

“There is certainly a level of mutually assured destruction among the big companies.

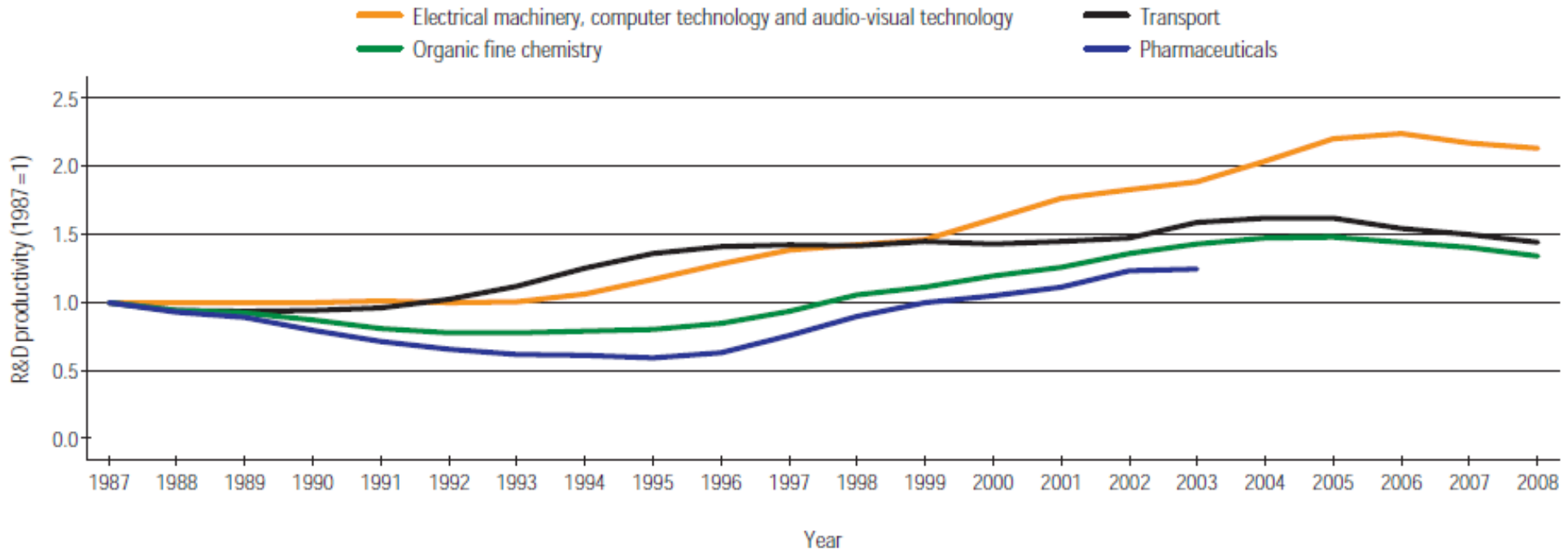
If you build up your patent portfolio, I build up mine—nukes pointing at each other.”

Greg Papadopoulos, CTO at Sun Microsystems

Background – What are patent thickets

The propensity to patent is going up in certain industries, further fuelling the arms race

Number of patents per R&D dollar spent (normalized to 1987)



“Even though we have 3,000 patents [awarded annually in America], if we had to, I could make that number 10,000.” (John Kelly, IBM)

Background – What are patent thickets
 Patent characteristics change?

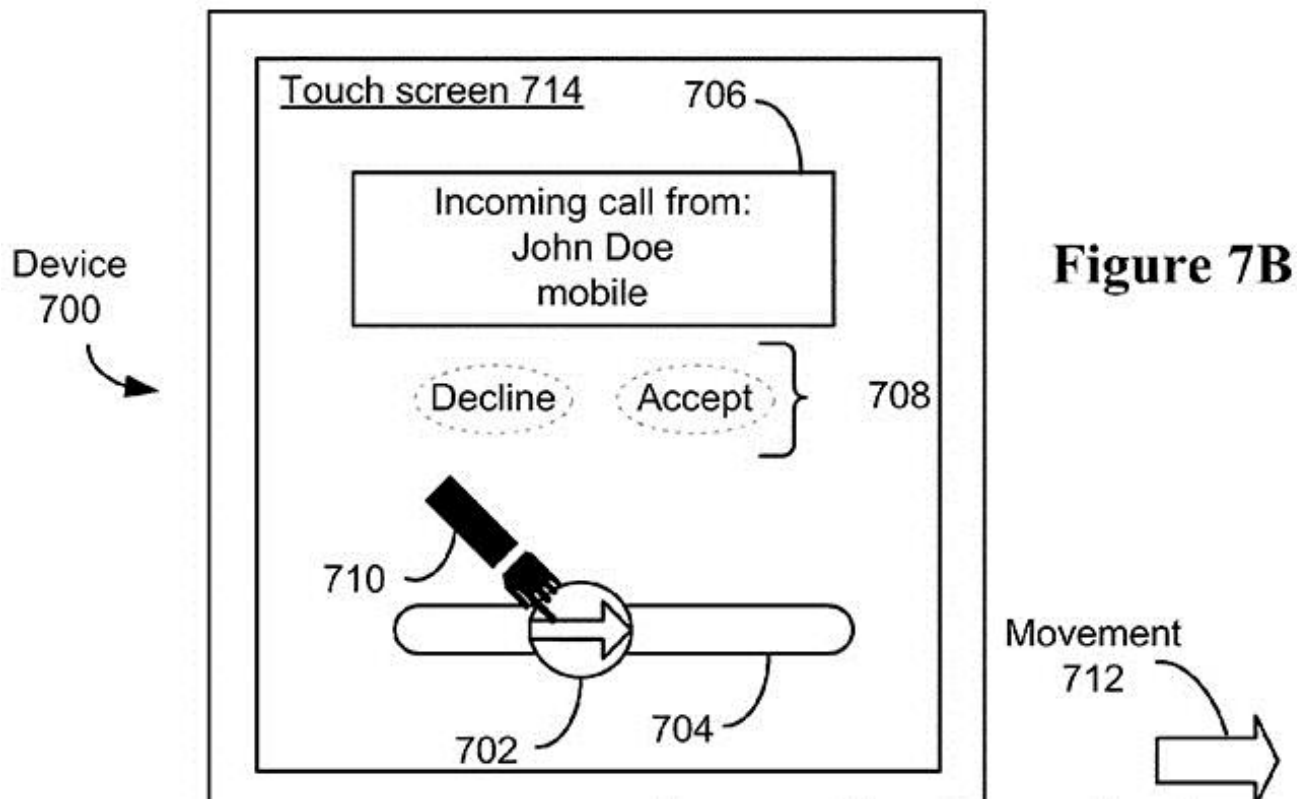
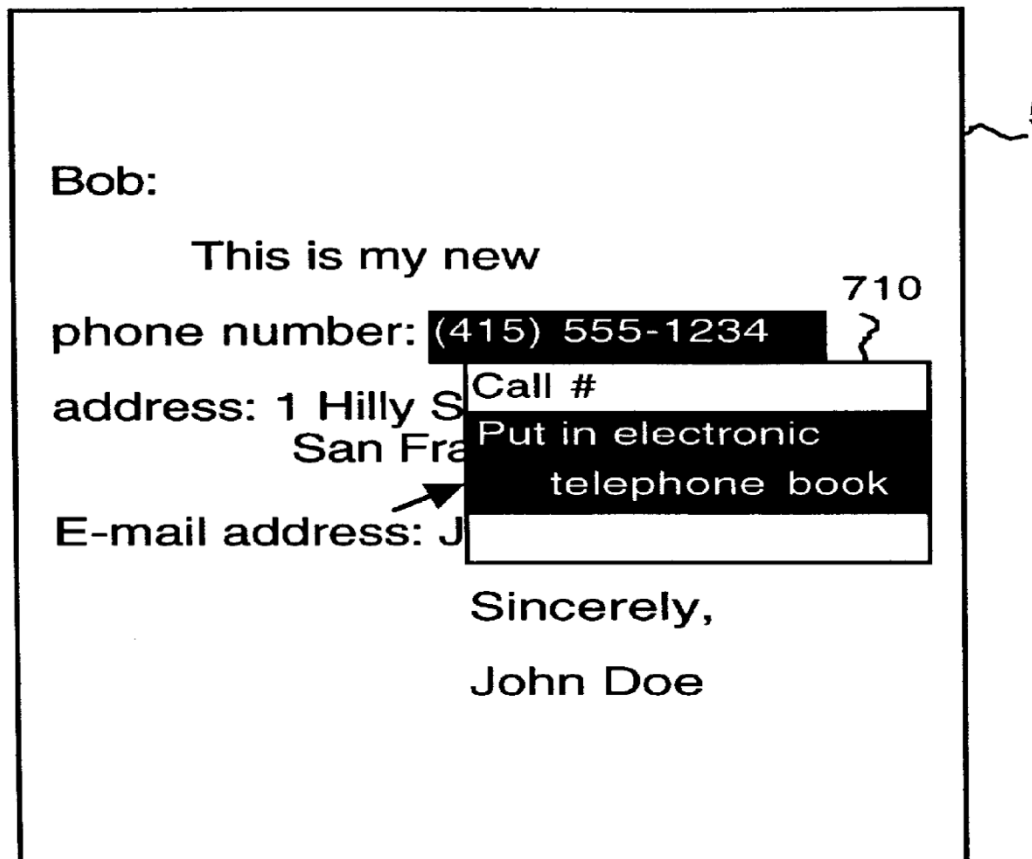


Figure 7B

**US 8,046,721:
 “Unlocking a device
 by performing
 gestures on an
 unlock image”**

Background – What are patent thickets
 Patent characteristics change?



US 5,946,647:
**“System and method
 for performing an
 action on a structure
 in computer-
 generated data”**

FIG. 7

Background – What are patent thickets Enforceable?

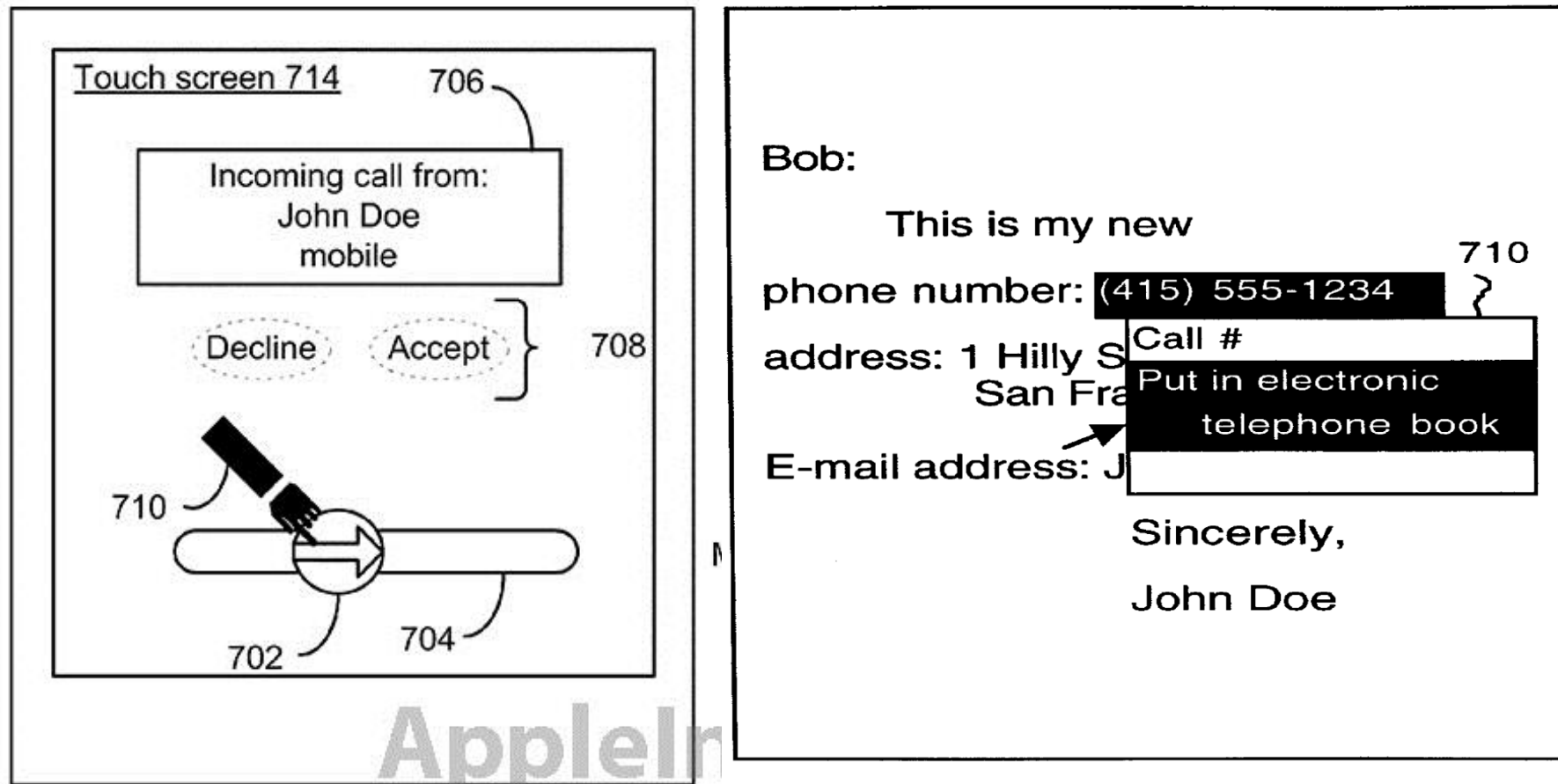


FIG. 7

Back to our study:

Litigation and post-grant validity challenges as a corrective against “weak” patents

- Demand for patent rights has been growing steadily
 - Large portion is “weak” or marginal in terms of their contribution to the state of the art (Jaffe and Lerner 2004, Bessen and Meurer 2008, Lei and Wright 2009)
 - Patent thickets spread (overlapping claims, dispersed ownership) (Cockburn and MacGarvie 2009, Noel and Schankermann 2006, Hall and Ziedonis 2001)
- Litigation and post-grant validity challenges at patent offices provide effective and welfare enhancing mechanisms to correct erroneous issue of patents (Farrell and Merges 2004, Hall and Harhoff 2004, Levin and Levin 2002)
- USPTO is currently introducing a process somewhat similar to the opposition procedure at the European Patent Office (EPO)
- Post-grant validity challenges work only if third parties have a large enough incentive to pursue them

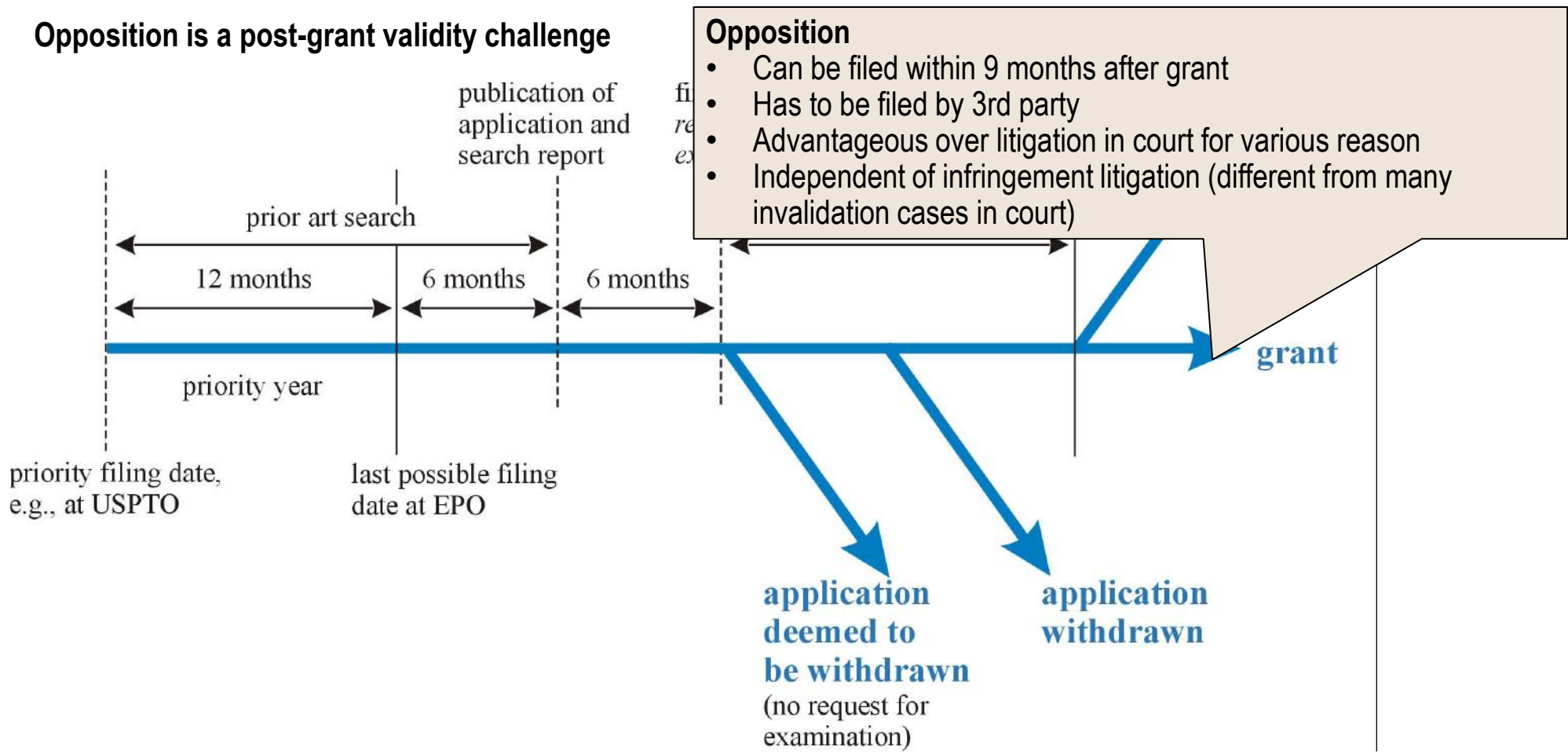
► Contribution of our analysis

- Most studies of the determinants of litigation and opposition focus on case/patent level determinants
- We extend this line of research and relate **characteristics of technology areas** to the likelihood of opposition taking place and show that
 - Public goods effect reduces incentives to engage in opposition in fragmented areas
 - Patent thickets with mutual blocking of patentees lower opposition activity
 - Patentees who are directly affected by thickets (insiders) are less likely targets for validity challenges
- We show that these predictions hold *within* and *across* technologies using a broad set of European patent grants
- Contribute to a refined understanding of the functioning of post-grant validity challenges under different conditions

Opposition mechanism at the European Patent Office

Institutional background

Opposition is a post-grant validity challenge



▶ **Determinants of litigation and post-grant validity challenges** Insights from previous studies

- Recent theoretical work stresses the negative effect of a public goods effect due to overlapping patent portfolios and fragmentation on the incentives to engage in post-grant validity challenges (Choi 2005, Farrell and Merges 2004)
- Lanjouw and Schankerman (2001, 2004) empirically study patent litigation in the U.S. and find (among others)
 - More valuable patents are more likely to be litigated
 - Parties with large portfolios are attacked less often
 - Significant cross-industry differences
- Similar empirical findings for opposition cases at the EPO in Harhoff and Reitzig (2004)

► Determinants of opposition

Patents thickets might lower private incentives to engage in opposition

- ‘Arms race’ to build large (overlapping) patent portfolios in patent thickets (FTC 2003, Hall and Ziedonis 2001, Hall 2005)
 - Challenging a single patent does not resolve potential infringement if multiple patents with overlapping claims exist (lowers benefits of opposition)
 - Unilateral hostile action may trigger counter attacks (increases costs if retaliation happens)

H1: Patents granted to firms active in technologies characterized by **patent thickets** are less likely to be opposed than patents of firms without such involvement.

H3: **Patent portfolio size amplifies the negative effect of patent thickets** on the likelihood of opposition.

- A patentee might be directly affected because its patents are part of the thicket (*insiders*) or indirectly if he is active in an area characterized by a thicket but its patents not being part of it (*outsiders*)
 - Reciprocity of hostile actions less likely for outsiders

H2: Patents granted to patent thicket **insiders** will be opposed less frequently than patents granted to patent thicket **outsiders**.

► Determinants of opposition

The public goods problem

- (Weak) patents might affect the pay-offs of more than one potential infringer
- In cases where more than one potential infringer is affected by a (weak) patent, litigation by one of the parties becomes a public good (Farrell and Merges 2004, Harhoff and Reitzig 2004)
- Incentives to invest in litigation will be strong only when a small number of firms benefits from the public good and relatively weak when a large number of firms benefit from it

H4: Patents granted to firms whose rivals' patent portfolios are more **concentrated** are more likely to be opposed.

Empirical analysis of the determinants of opposition

Sample construction and variables

Sample construction

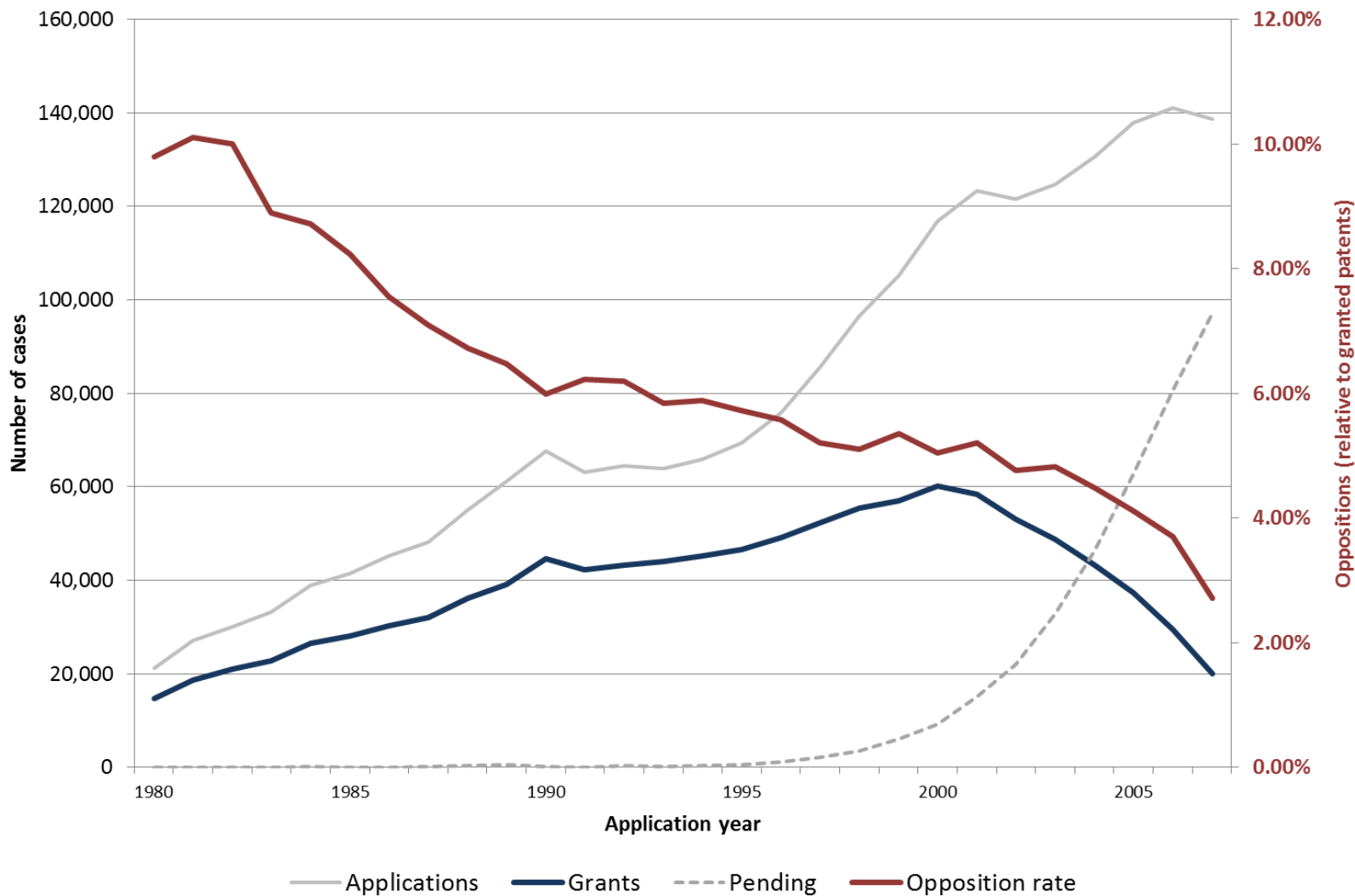
- Sample contains all EPO patent filings with application dates between 1980 and 2007 (data sources PATSTAT and EPASYS)
- Analysis of oppositions is based on the subset of patent grants before mid of 2010
- For these patent grants we observe whether an opposition has been filed by the end of the first quarter 2011

Final sample

- Contains 1,044,069 patent grants which led to a total of 64,946 opposition filings (6.22%)
- Covers the patenting activities of 229,696 patenting entities
- Allows us to compute variables on the technology area, applicant as well as patent level

Empirical analysis of the determinants of opposition

Filings, grants and the rate of opposition at the EPO (1980-2007)



► Empirical analysis of the determinants of opposition

Measuring the public good provided by the opponent

- We distinguish 30 different technology areas (OST-INPI/FhG-ISI technology classification, OECD 1994)
- Patenting activities of firms split across the 30 areas
- Overall concentration of patent ownership is measured as the **Herfindahl index** of a firm's rivals granted patents in a given technology area in a given year
- We use this firm-area-year level variable as an independent measure of the public goods effect

► Empirical analysis of the determinants of opposition

Measuring the existence and density of patent thickets

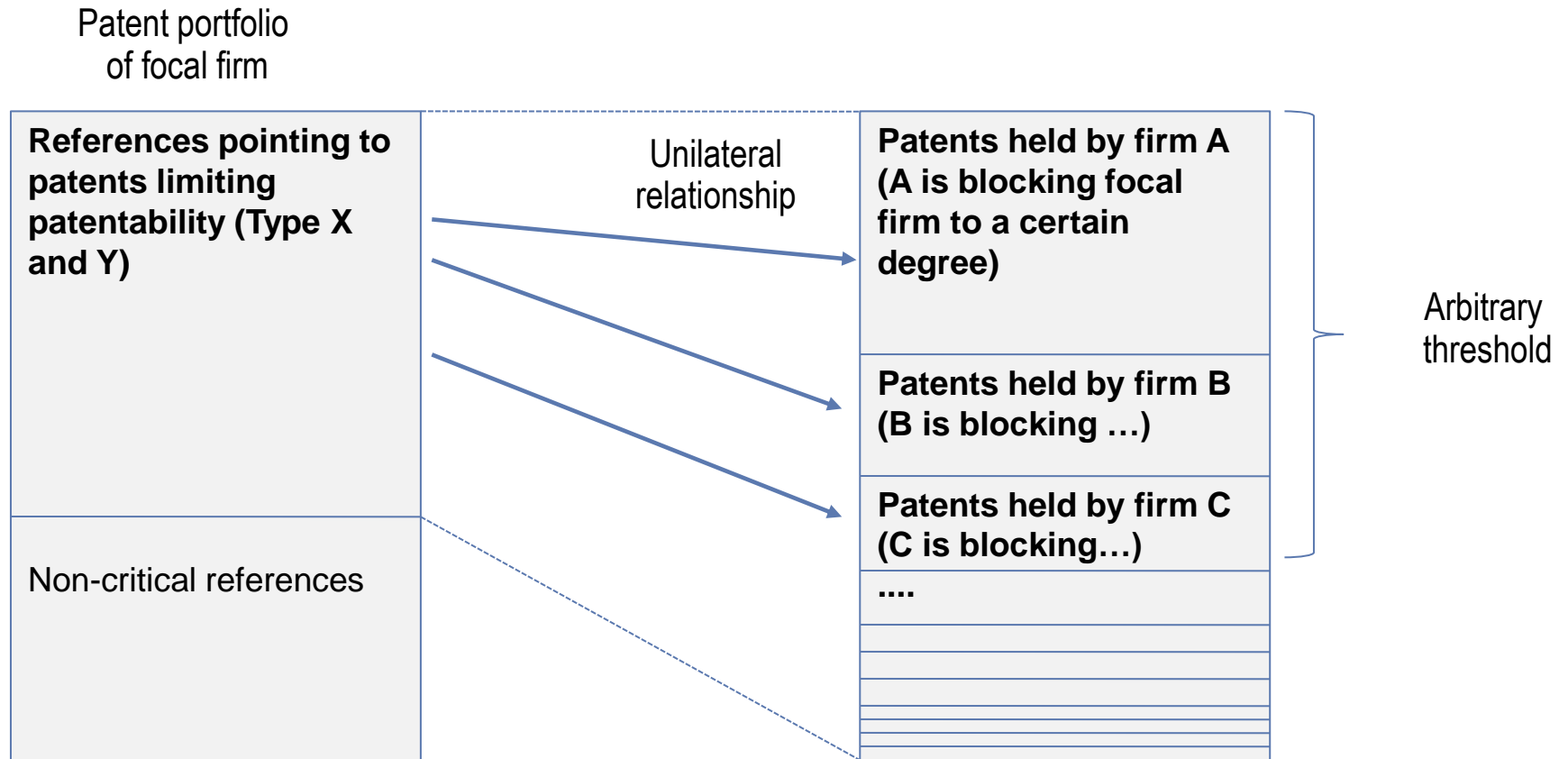
Making use of EPO's practice of classifying references in a patent's search report

- Thickets increase the likelihood that IP is held by several parties and therefore also increases the likelihood that patentees can block each other
- References in firms' patent applications allow us to determine mutual blocking relations between firms (details in von Graevenitz/ Wagner/ Harhoff 2011 a,b)
- Identification of blocking relationships exploiting patent references:
 - Patents' search reports contain references to prior art (previous patents)
 - References are classified by patent office in different categories
 - Particularly relevant for our study are references which limit the patentability of the invention under examination (type X and type Y references)

Measuring complexity of a technology area

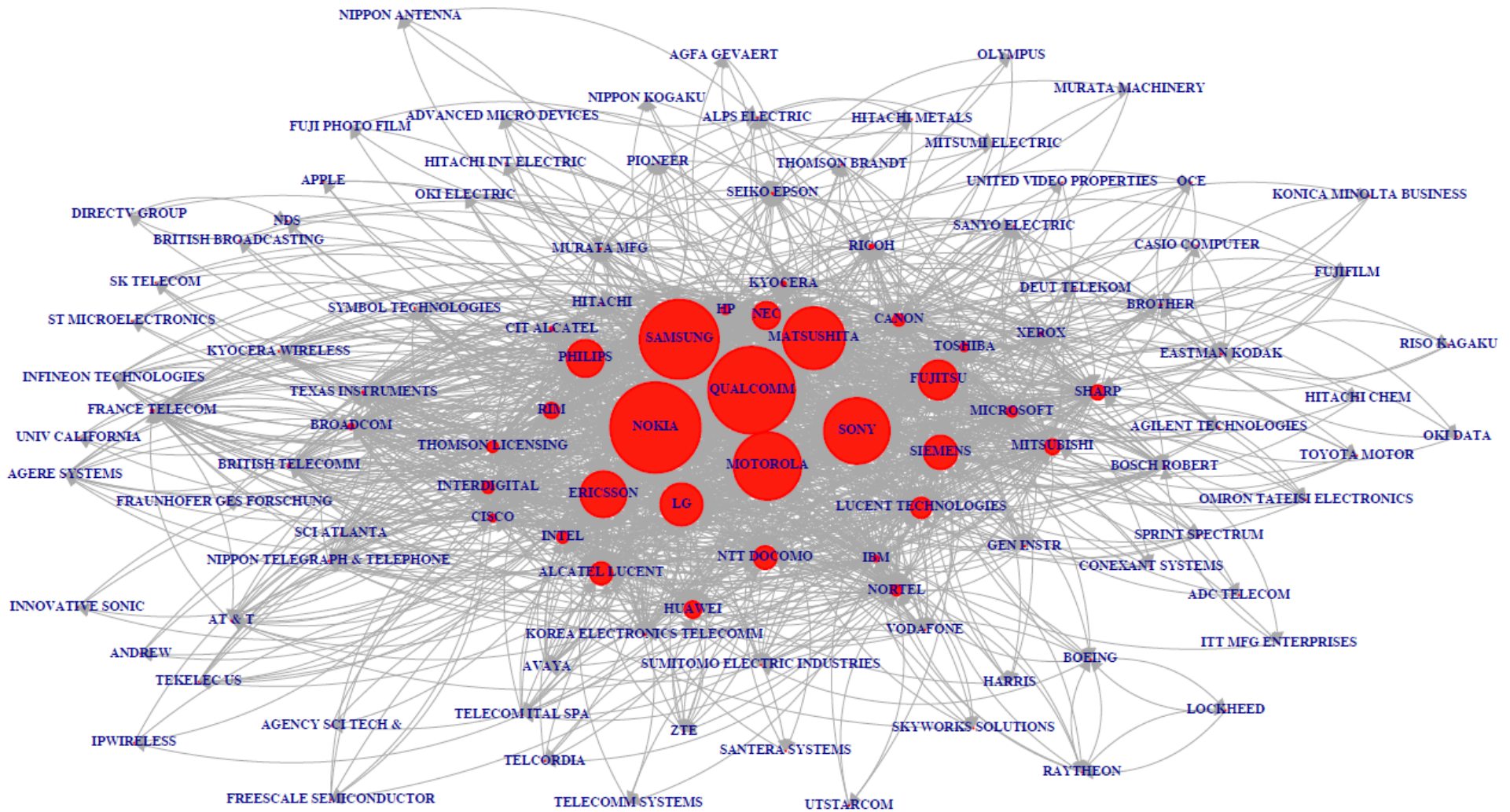
We proposed a measure built on patent references

Making use of EPO's practice of classifying references in a patent's search report



Empirical analysis of the determinants of opposition

Example – Mutual blocking relations in the Telecommunications industry (2005)

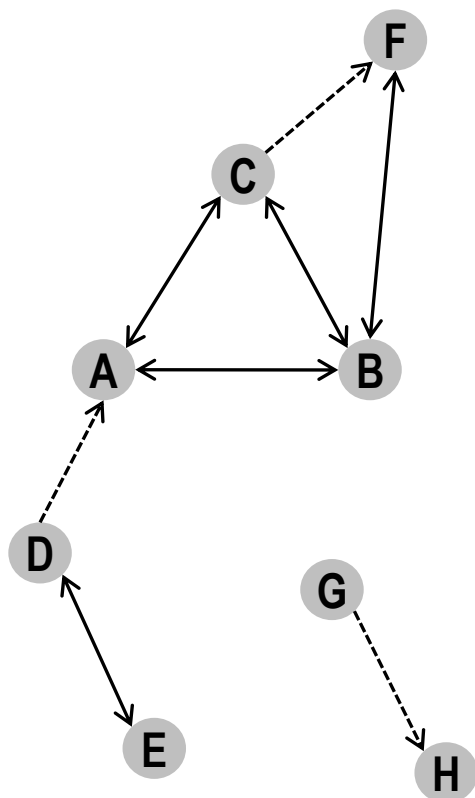


Empirical analysis of the determinants of opposition

Existence and density of patent thickets - the number of Triples of mutually blocking firms

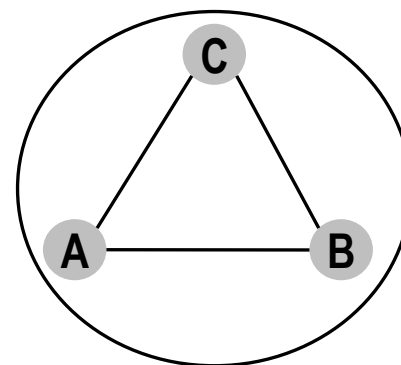
Existing Structure

-----> unilateral blocking relation
 <-----> bilateral blocking relation



Identified Structure

———— mutual blocking relation

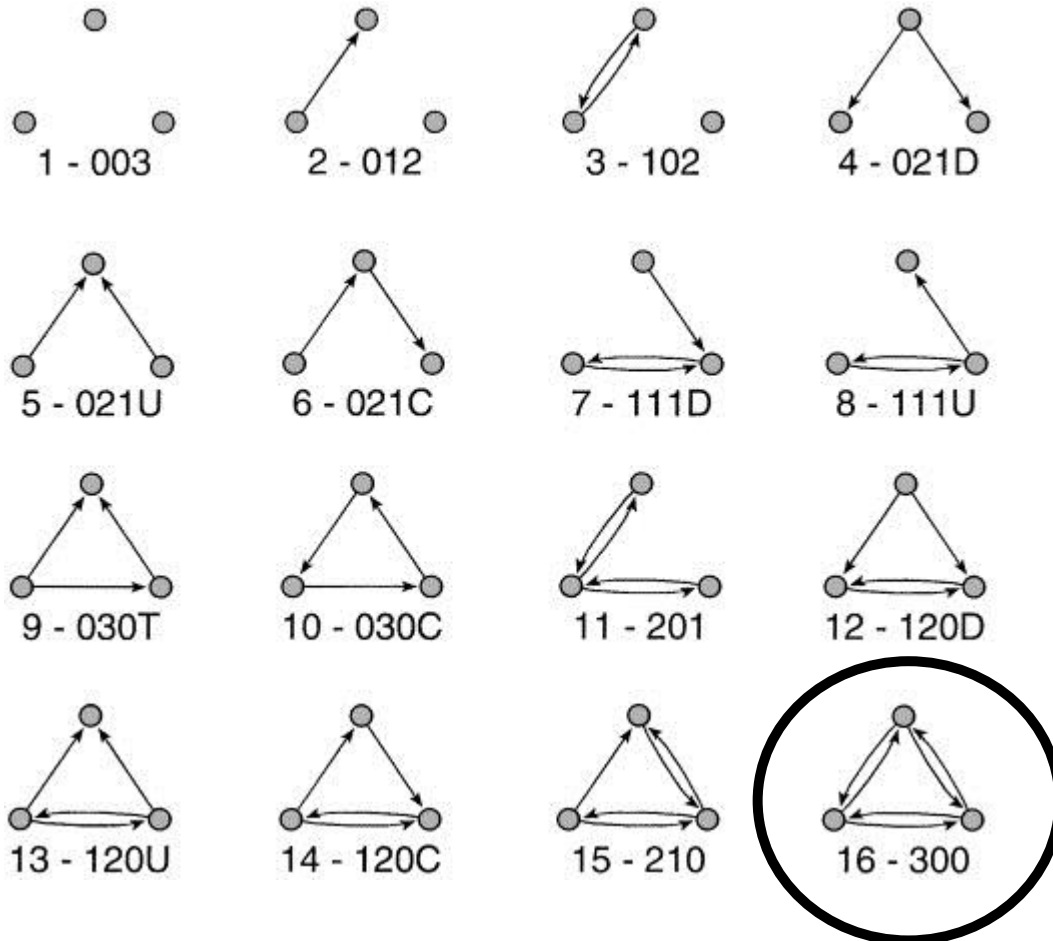


○ identified triples
 ● x firm x

Empirical analysis of the determinants of opposition

Existence and density of patent thickets - the number of Triples of mutually blocking firms

The link to social network analysis – or: Why only fully closed triads?



Empirical analysis of the determinants of opposition

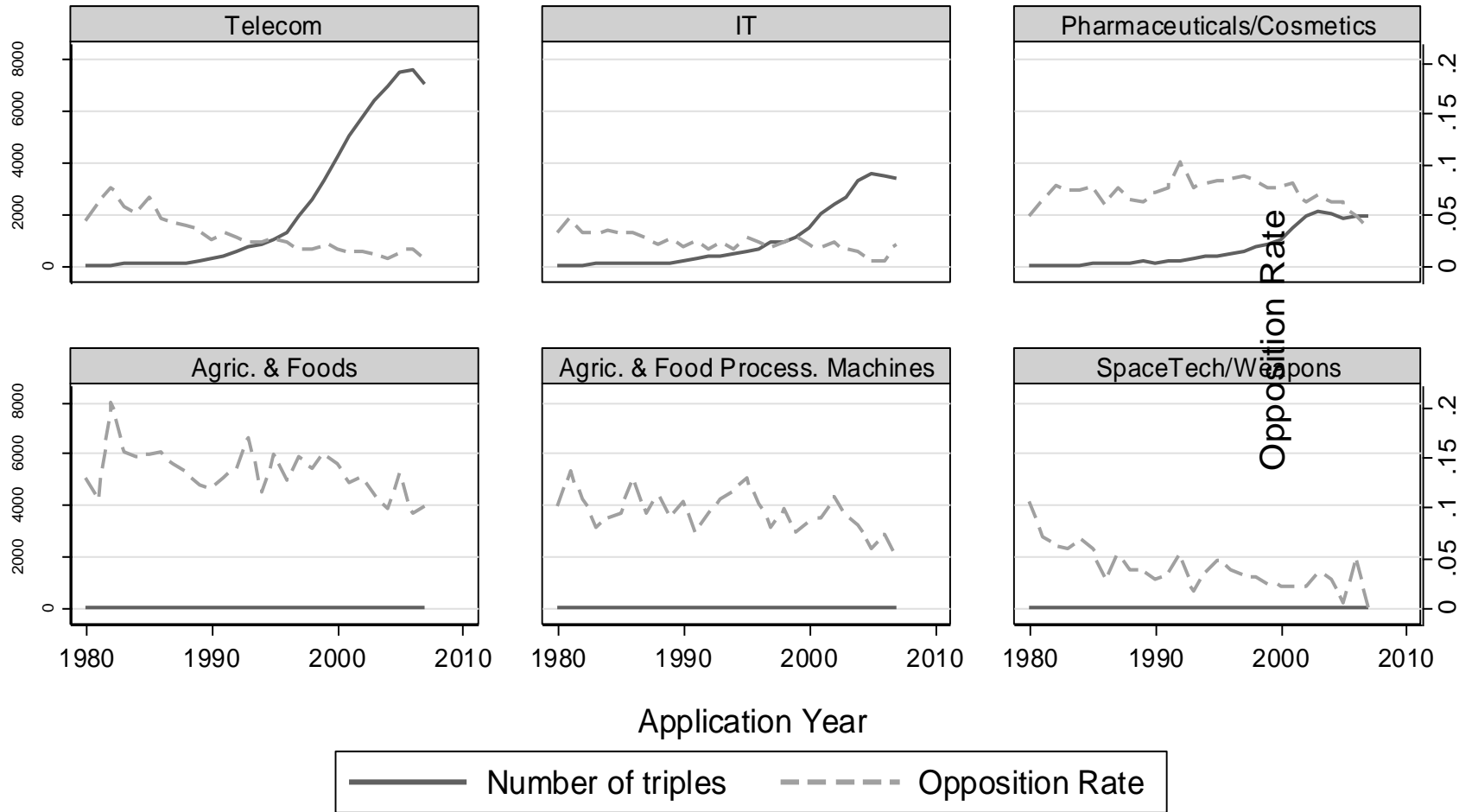
Triples count for selected technology areas

Highest Triple counts			Lowest Triple counts		
	Mean	Oppos		Mean	Oppos
Telecom	4,726	2.25%	Thermal Processes	16.07	7.30%
IT	1,877	2.08%	Construction Tech	10.79	5.93%
Pharma/Cosmetics	1,164	7.44%	Agric. & Foods	10.23	13.47%
Audiovisuals	987	3.17%	Agric. & Food Process-Machings	4.36	9.47%
Transportation	840	5.17%	Nuclear Techn.	3.27	5.48%
Semiconductors	745	2.21%	Space Techn./ Weapons	0	3.72%

Note: Statistics computed on the technology area/year level and are not weighted by patent counts.

Empirical analysis of the determinants of opposition

Opposition rates, concentration and thickets for selected technology areas (1980-2007)



Graphs for selected technology areas

Multivariate Probit estimations

Likelihood of opposition against a granted patent modeled in a Probit regression

Reduced form estimation of $\text{Prob}(\text{Opposition} | \dots) =$

$$\Phi \left(\beta_0 + \beta_C C_{f,a,ta} + \beta_{Tr} Tr_{f,a,t-2} + \beta_{Fr} Fr_{f,a,t-2} + \beta_S S_{a,ta} + \beta_X' X_i + \beta_F' F_{f,t} + \Psi_a + \Gamma t \right)$$

Dependent variable

- Opposition against a granted patent (0/1)

Independent variables

- **C**: Concentration - size of the public good provided by opponent to other patentees in the same technology area
- **T**: Triples - Existence and density of patent thicket (count of Triples) (lagged by two periods)
- **TR**: Triples formed by rivals portfolios, **TO**: Triples including own portfolio, (both lagged by two periods)
- **X**: Ziedonis' fragmentation, applicant characteristics (origin, type, size of patent portfolio), Patent characteristics (number and composition of backward references, forward citations, equivalents, claims, PCT application)
- **Dt, Da**: Time (application year) and technology area (30 OST-INPI areas) fixed effects

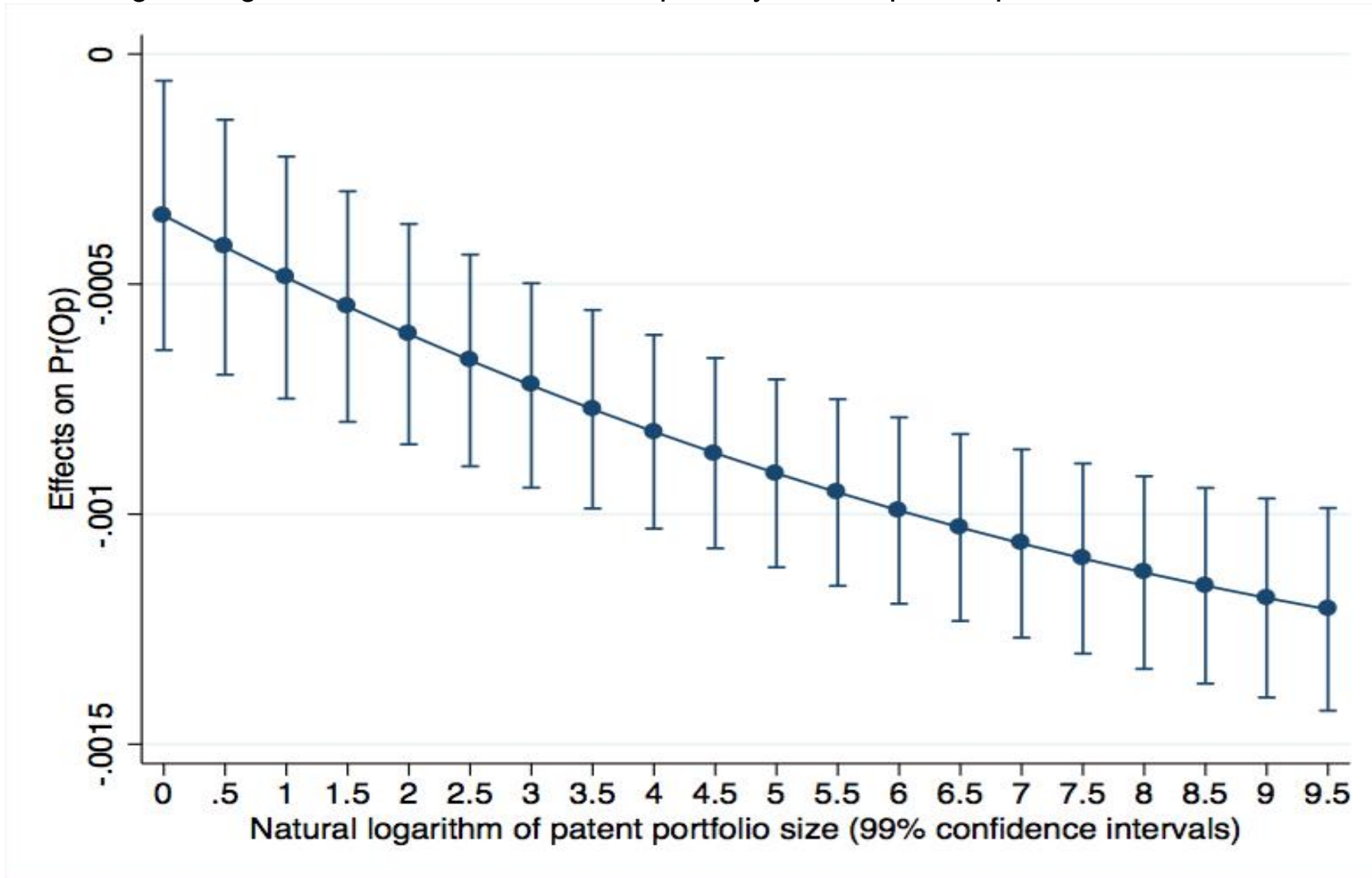
Multivariate Probit estimations – selected results

The effect of patent thickets and public goods

	(1)		(2)	
	Coef.	dx/dy	Coef.	dx/dy
Number of triples in area (H1)	-0.0027*** [0.001]	-0.009*** [0.000]		
Number of rivals' triples (H3) <i>(outsider)</i>			-0.0070*** [0.001]	-0.0008*** [0.000]
Number of own triples (H3) <i>(insider)</i>			0.0178 [0.059]	0.0065 [0.003]
Concentration of rivals' patents (H4)	4.6593*** [0.590]	0.5008*** [0.064]	4.1175*** [0.585]	0.4425*** [0.063]
Size x Triples (H3)	-0.0012*** [0.000]		-0.00107 [0.007]	
Comprehensive controls	YES	YES	YES	YES

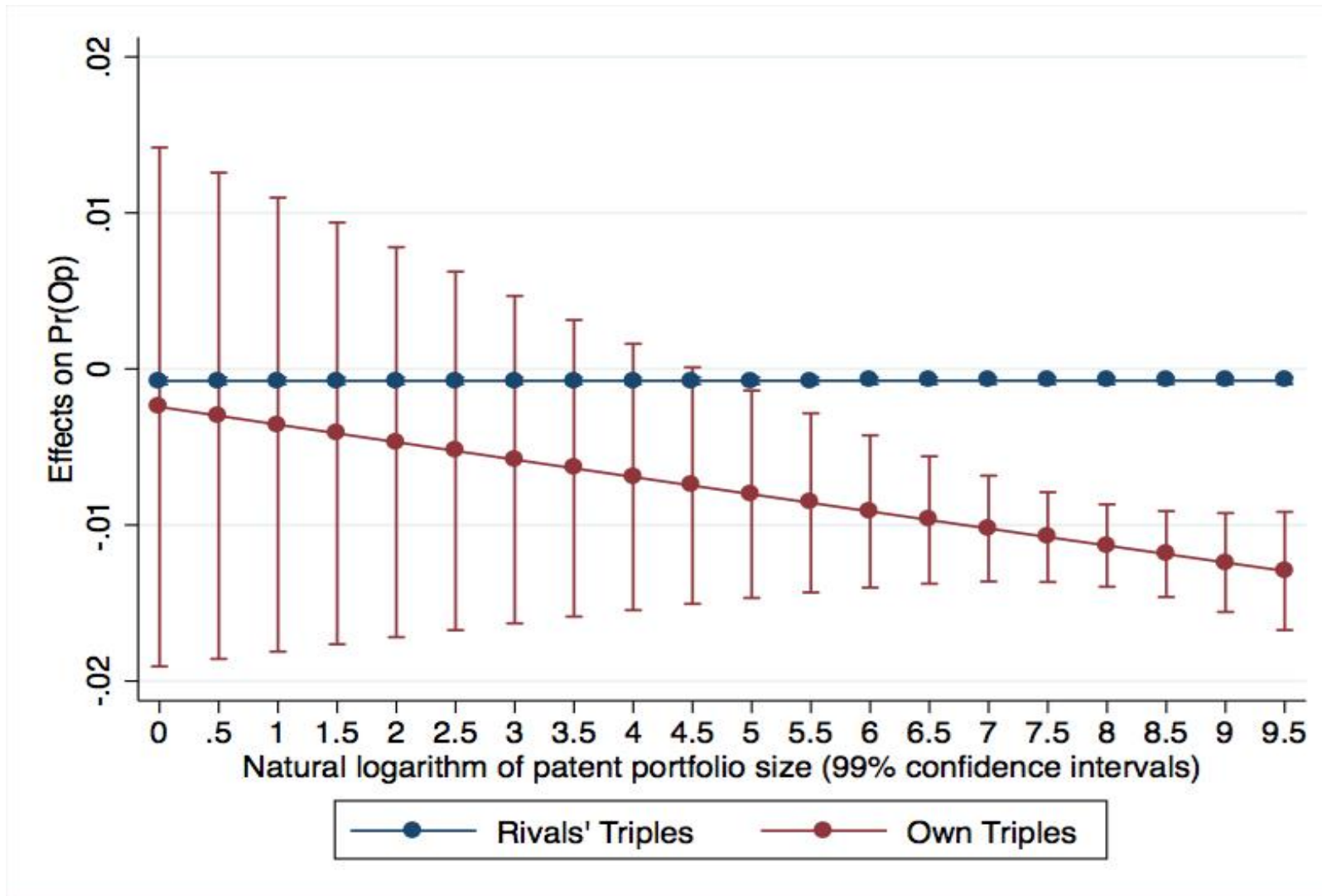
Multivariate Probit estimations

Average marginal effects of additional triples by size of patent portfolio



Multivariate Probit estimations

Average Marginal Effect of Additional Own/Rivals Triples by Size of Patent Portfolio



Discussion

Interpretation and further findings

- Existence and growth of **patent thickets significantly lower opposition activity**
 - Increasing the number of triples by a half standard deviation from its mean reduces the incidence of opposition 22.2% relative to the average unconditional probability of opposition (5.90%)
 - Insiders significantly more affected
- **Public goods effect is important in its magnitude**, too (1 SD increase in concentration increases likelihood of opposition by 8.1%)
- Further results consistent with previous findings (Harhoff and Reitzig 2004, Lanjouw and Schankermann 2001, 2004)
 - Value related variables increase the likelihood of opposition
 - Applicants with larger portfolios experience lower incidence of opposition
 - Non-European applicants and some applicant types (individuals, universities, public research institutions) characterized by lower risk of opposition

Summary and conclusion

An analysis of opposition focusing on patent thickets and the public goods problem

- We investigate how the likelihood of opposition is affected by patent thickets and a fragmented ownership
- We find that the incentives to use the opposition mechanisms are lowered by patent thickets (particularly for thicket insiders) and increasing fragmentation (public goods problem)
- These results have important implications for the understanding of litigation and post-grant validity challenges
 - Potentially welfare improving effect of these institutions might not become fully effective in areas where private incentives for entering these procedures are lowered
 - Our analysis suggests that in areas in where „weak“ patents constitute a comparably large fraction of all filings incentives for adversarial procedures are dampened most

Further work

The application of social network analysis opens up further opportunities for research projects

- So far, we related only the number of fully closed triads in a technology area to the outcomes within the patent system (number of patent applications, von Graevenitz, Wagner and Harhoff 2013, and the occurrence of opposition, this paper)
- Extensions possible to generalize the measure of patent thickets beyond using fully closed triads
 - Complete census of network motifs (done, currently in the documentation stage)
 - Measures of centrality and embeddedness (done, currently in the analysis stage)
- Related extended set of measures describing the technology space for more general analyses
 - Market for corporate control (M&A)
 - Outcomes of observed transactions (data collected, currently in the analysis stage)
 - Determinants of target selection (data needs to be collected....)

The text "Thank you!" is written in a bold, black, sans-serif font. To the left of the text is a small graphic element consisting of a yellow chevron pointing to the right, followed by a dark blue square.A decorative graphic element in the top left corner of the main content area, consisting of a dark blue square with a yellow chevron pointing to the right.

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