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Intellectual Property Rights and Competition in the Global Digital Sector. What do ICT Firms Gain from Patenting?

Dimitris Exadaktylos[a] Mahdi Ghodsi[b]
Armando Rungi

[a] d.exadaktylos@imtlucca.it
[b] Vienna Institute for International Economic Studies (wiiw)

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Introduction

- Over the last decades, computers play a major role in the production procedure.
- The share of value added in the Information and Communication Technology (ICT) sector in OECD economies has risen from 7.7% in 1995 to 8.3% in 2009 (OECD, 2013).
- The benefits of investing in ICT are anchored in the adoption of new technologies and its complementarity with either the **organizational capital** (Brynjolfsson & Hitt, 2003; Commander et al., 2011; Milgrom & Roberts, 1990) or with **intangible assets** (Khanna & Sharma, 2018; Chen et al., 2016).

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Objectives

1. Assess the impact of patenting on market share.

2. Investigate potential productivity gains through patenting.

3. Investigate any potential direct or indirect connection between patenting and changes in market structure.

Findings:

1. An increase in market share by 11.04% on average after granting patents 2009-2017. The results hold when we control for different ownership linkages.

2. No significant productivity gains from patenting

3. Monopolistic rents do not significantly increase after patenting

4. Production resources are allocated efficiently

Data

Source: Orbis, Bureau Van-Dijk. Balance sheets and patent applications (as reported at the European Patent Office) for 179,660 ICT producers operating in 39 countries for the period 2009-2017.

List of sectors included in the analysis

NACE Rev. 2	Description	
26.1	Manufacture of electronic components and boards	
26.2	Manufacture of computers and peripheral equipment	**ICT manufacturing**
26.3	Manufacture of communication equipment	
26.4	Manufacture of consumer electronics	
58.2	Software publishing	
61	Telecommunications	
62	Computer programming, consultancy and related activities	**ICT services**
63.1	Data processing, hosting and related activities; web portals	
95.1	Repair of computers and communication equipment	

Note: Definition of operational ICT sectors is given by the PREDICT database of the Joint Research Centre of the European Commission (Benages et al., 2018).

Data

Table: List of countries included in the analysis

Austria	France	Lithuania	Slovenia
Belgium	Germany	Luxembourg	South Korea
Brazil	Greece	Malta	Spain
Bulgaria	Hungary	Netherlands	Sweden
Canada	India	Norway	Switzerland
China	Ireland	Poland	Taiwan
Croatia	Israel	Portugal	Turkey
Czech Republic	Italy	Romania	United Kingdom
Denmark	Japan	Russia	United States
Finland	Latvia	Slovakia	

Descriptive statistics

Mean difference in market share and labour productivity between Patentees and non-patentees

	% market share	(log) labour productivity	Obs.
Patentees	0.0271	12.2857	21,097
	(0.0011)	(0.0076)	
Non-patentees	0.0004	11.1316	910,516
	(0.0000)	(0.0014)	
Difference	0.0268***	1.1541***	
	(0.0001)	(0.0093)	

Note: The table denotes the mean difference in (log) labour productivity and the % market share for companies having at least one patent against companies without patents. Standard errors in parentheses. *** denotes significance at 1%

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Empirical strategy

- **Main objective**: Estimate the impact of patenting (in a firm group) on market share and productivity.

- **Econometric strategy**: Difference-in-differences with variation in treatment timing (Callaway and Sant'Anna, 2020) and controlling for pre-treatment trends.

- **Treatment**: publication of the first granted patent observed at the company group during 2010-2017 (we exclude firms with patents in 2009 to have at least one pre-treatment year).

Empirical strategy

Group-time average treatment effect:

$$ATT(g,t) = \mathbb{E}\left[\left(\frac{G_g}{\mathbb{E}[G_g]} - \frac{\frac{p_g(X)C}{1-p_g(X)}}{\mathbb{E}\left[\frac{p_g(X)C}{1-p_g(X)}\right]}\right)(Y_t - Y_{g-1} - m_{g,t}(X))\right] \tag{1}$$

Average effect of patenting on market share (or labour productivity):

$$\theta_s^O = \sum_{g=2}^{T} \theta_s(g) P(G=g) \tag{2}$$

where,

$$\theta_s(g) = \frac{1}{T-g+1} \sum_{g=2}^{T} 1\{g \leq t\} ATT(g,t)$$

Appendix A

Patenting and market share

Impact of first patenting on market share

Dep variable: (log) market share	(1) All patents	(2) Parents' patents	(3) Subsidiaries' patents	(4) Subsidiaries' patents of the same sector	(5) Subsidiaries' patents of a different sector
θ_s^O	0.1047***	0.0989***	0.1022**	0.1109*	0.0635
	(0.0272)	(0.0350)	(0.0434)	(0.0613)	(0.0659)
No. of treated firms	546	327	173	77	68
No. of untreated firms	24,506	24,506	24,506	24,506	24,506

Note: The table illustrates aggregate treatment effects under the assumption of parallel trends conditional on the number of employees, capital intensity, age (in logs), 2-digit sector and regional dummies. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

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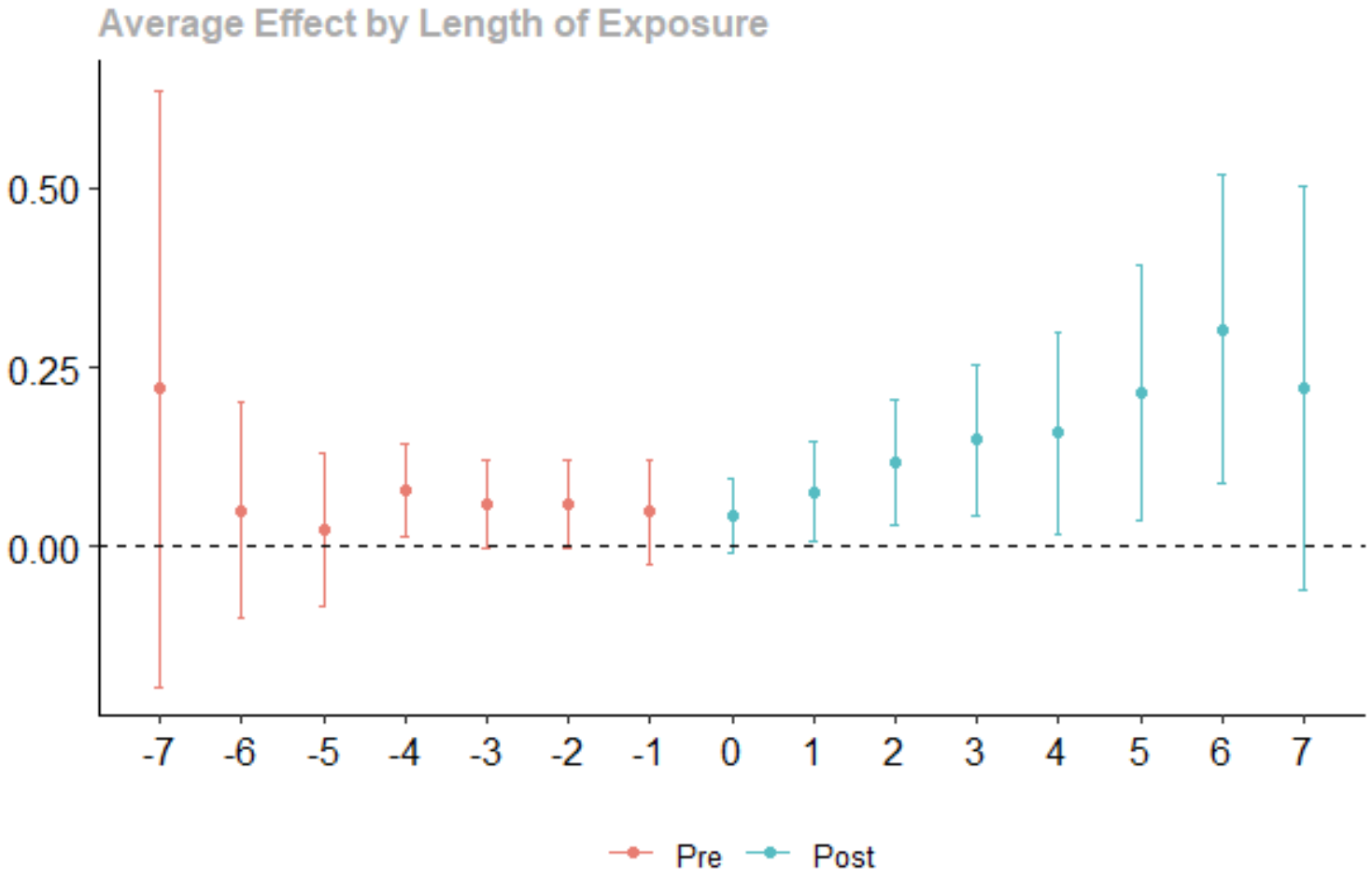
Patenting and market share



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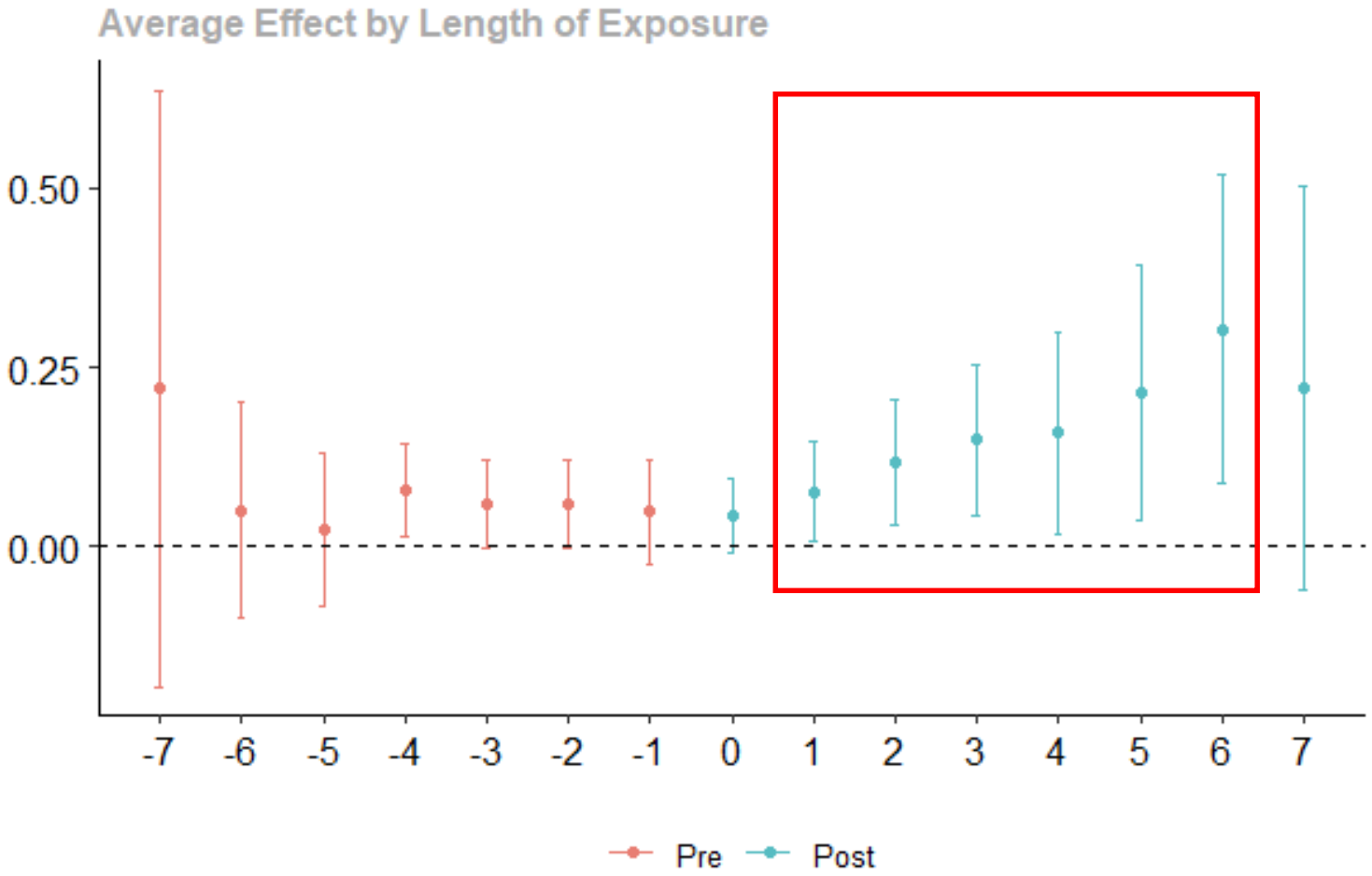

Patenting and labour productivity

Impact of first patenting on labour productivity

Dep variable: (log) labour productivity	(1) All patents	(2) Parents' patents	(3) Subsidiaries' patents	(4) Subsidiaries' patents of the same sector	(5) Subsidiaries' patents of a different sector
θ_s^O	0.0361*	0.0297	0.0499	0.0486	0.0264
	(0.0197)	(0.0263)	(0.0354)	(0.0506)	(0.0522)
Treated firms	546	327	173	77	68
Untreated firms	24,506	24,506	24,506	24,506	24,506

Note: The table illustrates aggregate treatment effects under the assumption of parallel trends conditional on the number of employees, capital intensity, age (in logs), 2-digit sector and regional dummies. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

Results

- Patenting leads to higher market shares and the effect is increasing over time. A potential mechanism is the introduction of new products that lead to higher revenues (Balasubramanian and Sivadasan, 2011).

- The distribution of innovative activities across subsidiaries. Specialization of economic activities within company groups leads to a further increase in market shares.

- Weak evidence on productivity gains from patenting (in line with Balasubramanian and Sivadasan (2011) and Andrews et al. (2014)). Secrecy is usually more effective in process innovation than product innovation (Levin et al., 1987).

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Further Analysis: IPR and competition

We further explore competition effects, applying the following 2 exercises:

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We further explore competition effects, applying the following 2 exercises:

1. Assess the impact of patenting on markups.
   Results: No significanct effects. IPR do not allow firms to increase monopolistic rents. Appendix B

2. Investigate how production resources are allocated over time.
   Results: Resources are allocated towards productive firms and firms with low markups. Appendix C

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Conclusion

We take advantage of firm-level data with information on balance sheets and granted patents for the period 2009-2017, to study the effect of IPR on competition in the ICT sector. Our results suggest:

- Firms increase market share after patenting, by 11.04% on average.
- The results are robust when we consider heterogeneity across ownership linkages.
- Relatively weak evidence regarding the effect of patenting on labour productivity.
- IPR do not increase market power in the ICT sector.
- Productive firms and firms with competitive pricing strategies become the market leaders over time.

Thank you!

Appendix

Variables:

$G_g = 1$ if a firm is first treated at time g

$C = 1$ for firms that do not participate in the treatment at any time period

Y_t: firm's i outcome at time t (market share or labour productivity)

$p_g(X)$ is the probability of being first treated in period g conditional on pre-treatment covariates X

$m_{g,t}(X) = \mathbb{E}[Y_t - Y_{g-1}|X, C = 1]$ is the population outcome regression for the control group

X: vector of pre-treatment covariates (capital intensity, size, age, 2-digit sector categoricals, regional categoricals)

main

Patenting and Markups

Markups: Price-marginal cost ratio $\rightarrow$ proxy for market power

Following De Loecker and Warzynski (2012):

$$\hat{\mu}_{it} = \hat{\beta}_m \left(\frac{P_{it}^M M_{it}}{P_{it} Q_{it}} \right)^{-1} \tag{3}$$

where,

$\hat{\beta}_m$: output elasticity of intermediate inputs obtained by the estimation of a "gross output" production function (Ackerberg et al., 2015)

$\frac{P_{it}^M M_{it}}{P_{it} Q_{it}}$: expenditure share of intermediate inputs.

Patenting and Markups

Impact of first patenting on markups

Dep variable: (log) markups	(1) All patents	(2) Parents' patents	(3) Subsidiaries' patents	(4) Subsidiaries' patents of the same sector	(5) Subsidiaries' patents of a different sector
θ_s^O	0.0314	0.0135	0.0649	0.0545	0.1230
	(0.0285)	(0.0368)	(0.0469)	(0.0666)	(0.0696)
Treated firms	352	225	97	44	44
Untreated firms	16,701	16,701	16,701	16,701	16,701

Note: The table illustrates aggregate treatment effects under the assumption of parallel trends conditional on the number of employees, capital intensity, age (in logs), 2-digit sector and regional dummies. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

main

Reallocation of resources

We want to observe whether production resources are allocated towards efficient (in terms of productivity and markups) firms over time.

Allocative efficiency (Olley and Pakes, 1996):

$$\sum_{i=1}^{N} \Delta s_{it} \Delta p_{it} = \sum_{i=1}^{N} s_{it} p_{it} - \bar{p}_t \tag{4}$$

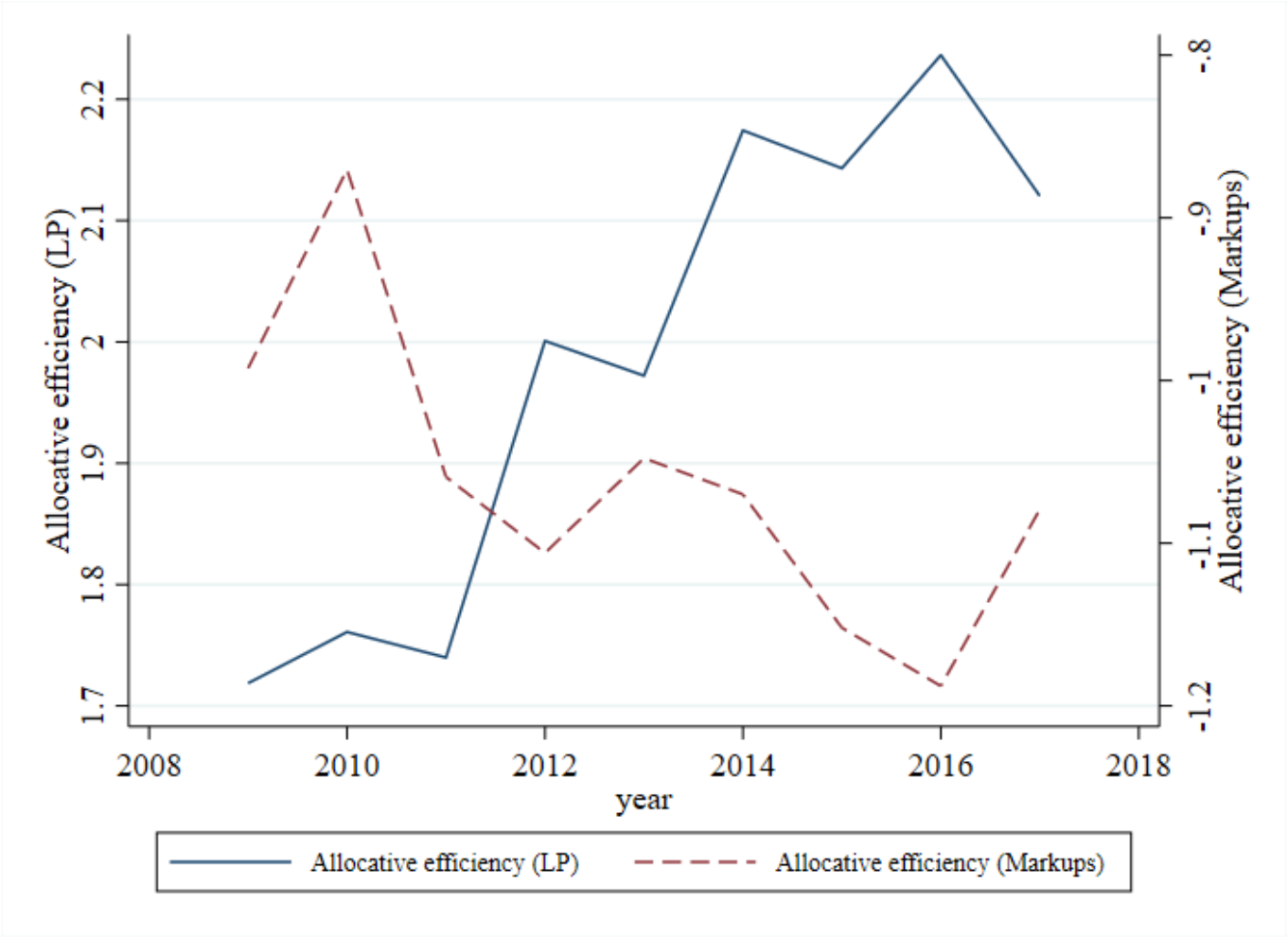
where,

s_{it}: market share of firm i at time i

p_{it}: labour productivity (or markups)

Reallocation of resources

Allocative efficiency of labour productivity and markups



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