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Rising Markups, Common Ownership, and Technological Capacities

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Common Ownership

Common Ownership Overlapping institutional investors owning shares of competing companies

- Strategic incentives change due to rival profit internalisation through shareholder value maximisation
  - Anti-competitive tendencies: Cartelisation effect (Azar et al., 2018, JF)
  - Theory predicts positive effects on innovation (López and Vives, 2019, JPE)
- Recent interest by academics and policy makers
- Institutional investors held on average around 40% of Western European countries' GDP in assets under management in 2018 (OECD, 2019)
  - Anecdotal evidence: Common owners urged pharma to defend pricing (Shekita, 2022)
- Simultaneous sharp rise of firm markups (De Loecker et al., 2020, QJE)

Research Question, Empirical Results & Contribution

What is the effect of common ownership by institutional investors on firm-level markups and innovation?

- Cartelisation effect
  - Common ownership increases firm markups
  - ranging up to 3.4% in high-spillover industries.
- Positive effect on citation-weighted patents
  - for firms directly affected by common ownership up to 9.5% in high-spillover industries.

Contribution

- Large scale study of common ownership in European manufacturing markets.
- Differentiation: Firms directly and indirectly affected by common ownership.
- Heterogeneous effects: Different degrees of technological capacities and spillovers.
- Rising markup pattern.

Related Literature (not exhaustive)

Theory

- Common ownership measures (Rotemberg, 1984, Bresnahan and Salop, 1986, Salop and O'Brien, 2000, Azar, 2012)
- Positive effects on innovation (López and Vives, 2019) Theory

Empirical studies

- Industry studies: Banking (Azar et al., 2016); Airline (Azar et al., 2018), Pharma (Newham et al., 2018), RTE cereal (Backus et al., 2021)
- Broader firm panel
  - Common ownership creates incentives to innovate (Antón et al., 2021)
  - Estimated markup calibration of S&P 500 firms (Backus et al., 2019)
  - Product differentiation, investment, markups of publicly quoted US firms (Kini et al., 2019)

Not in this paper: Mechanism of influence,
(see Antón et al., 2022, managerial incentives channel and Shekita, 2022, common owners' interventions)

Theoretical Predictions by López and Vives (2019, JPE)

Overlapping Ownership and Innovation

1. Profit internalisation through common ownership Theory

- Non-negative weight on the profits of rival firm
- Cartelisation effect decreases output
  → Lower overall gain of (cost-reducing) innovation with fewer units of output

2. Spillover effects

- Cost-reducing investment in R&D benefits rivals
  → Lower incentives to innovate without profit internalisation

Combined: Spillover effects with profit internalisation

- Innovating firms internalise competitors' *spilled over* marginal cost reduction
  → Sufficiently high spillovers: Positive internalisation effects of common ownership on innovation outweigh reduced incentives to innovate due to lower output.

Theoretical Predictions by López and Vives (2019, JPE)

Predictions

- Low spillover industries:
  - Lower output, higher prices, lower incentives to innovate (mc stay the same)
  - Cartelisation effect (higher markups)
- High spillover industries:
  - Lower output, higher prices, but higher incentives to innovate (mc decrease)
  - Cartelisation effect and positive effect on innovation

Data

Amadeus by Bureau van Dijk

- Listed and non-listed European manufacturing firms
  - Large firms, more than 250 employees and over EUR 50 million in turnover
  - Market definition: Three-digit NACE industry and country-level
- Firm-level panel data, annual 2005-2016
  - Balance sheet data: Sales, employment, tangible fixed assets (capital stock), material costs
  - Patent data: Amount, citations
  - Ownership data: Investor information, shares held

Technological spillovers from Bloom et al. (2013, ECMA)

- Pre-sample average at three-digit industry-level:
  Sum of firms' competitors' R&D stock, weighted with pairwise technology field overlap (proximity between firms in patent classes)

Method

1. **Structural production function estimation** (Ackerberg et al., 2015, ECMA) Method
   - Recovering markups from material elasticities and material expenditure shares (De Loecker and Warzynski, 2012, AER)

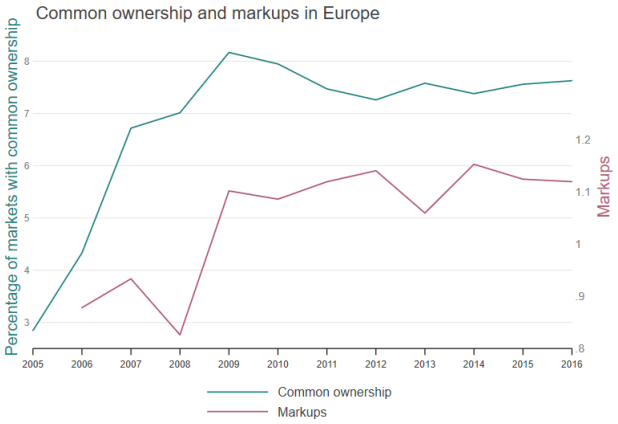
2. **Propensity score reweighting estimator** (Guadalupe et al., 2012, AER) Robustness

Treatment definition	Markets' first exposure to common ownership
▷ Directly affected	Firms that directly share an investor with a rival firm (insider firms)
▷ Indirectly affected	No direct ownership links, but competing in same market (outsider firms)
Control group	Markets that never have common ownership links

   - Treatment intensity using MHHI percentiles
   - Heterogeneous effects with degree of technological spillovers

1. Markup Estimation

Evolution of Markups and Common Ownership



Full sample

2. Propensity Score Reweighting

First Stage (Guadalupe et al., 2012, AER)

Probit regression

- Outcome variable: $= 1$ if the market experiences the first occurrence of common ownership in the following year, 0 otherwise
  - Pre-treatment: markups, TFP, firm age, patent citations, labour, capital, output, institutional ownership, HHI, technological spillovers, technological gap, year trend.
  - Two separate probit models for firms in low-tech and high-tech industries Classification
  - Only observations that fulfil common support condition
- Estimate probability of being treated $\hat{p}$ in period $t + 1$.

Inverse probability weights

Treated firms are assigned weights of $\frac{1}{\hat{p}}$, and weights for the control observations are $\frac{1}{1-\hat{p}}$.

$\rightarrow$ Sample balanced in means and distribution of covariates after reweighting Balancing

2. Propensity Score Reweighting

Average Treatment Effect (Guadalupe et al., 2012, AER)

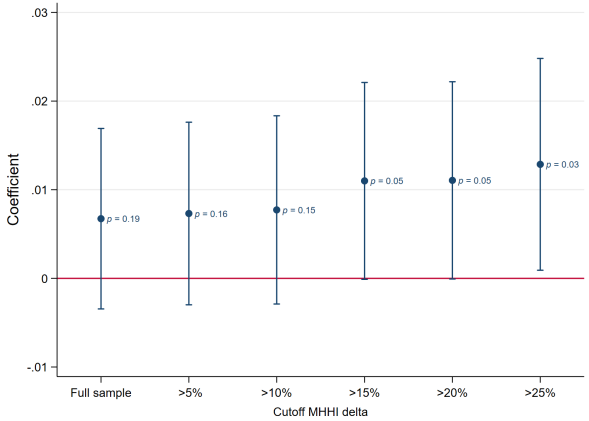
Baseline Regression Specification

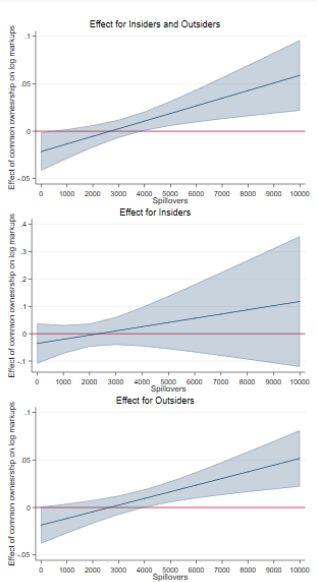
$$ln(\mu)_{jmt} = \beta_1 \mathbf{1}[\text{MHHI delta} > 0]_{mt} + \beta_2 \text{HHI}_{mt} + \beta_3 \text{Inst}_{jt} + \nu_j + \tau_t + \epsilon_{jmt}$$

μ	Outcome Variable: Markups, patent citations
$\mathbf{1}[\text{MHHI delta} > 0]_{mt}$	Common ownership treatment indicator variable
HHI_{mt}	Market concentration
$Inst_{jt}$	Institutional holdings
ν_j, τ_t	Firm and year-fixed effects
Weights	Treated $\frac{1}{\hat{p}}$, Control $\frac{1}{1-\hat{p}}$

Markups

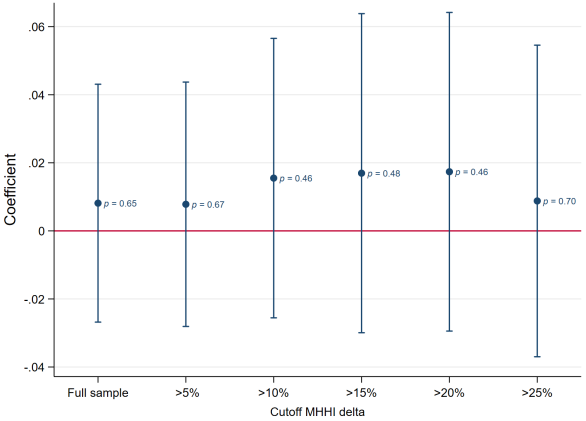
Treatment Intensity and Spillovers

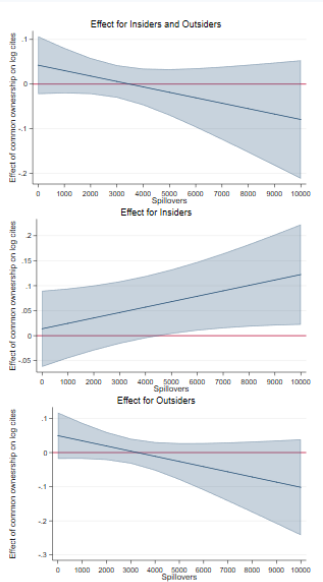




Innovation

Treatment Intensity and Spillovers





Conclusion

- Addressing common ownership, innovation, and firm-level markups using broad European manufacturing sample
  - Anti-competitive effect on markups, increasing in technological spillovers.
  - Positive effects on innovation, increasing in technological spillovers: Common ownership increases patent citations for firms directly commonly owned.
  - Contribution to recent findings of rising markups.
- Competition authorities need to consider possible anti- and pro-competitive consequences of overlapping ownership structures as well as for mergers between financial institutions.
- More theoretical and empirical evidence necessary for welfare effects.

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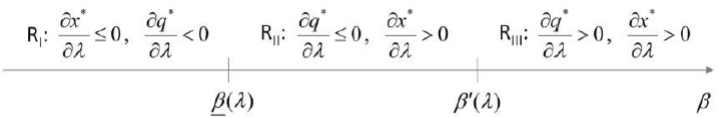
APPENDIX

Theoretical Background

Symmetric Cournot model by López and Vives (2019, JPE)

- Quantity competition (q)
- Investment in marginal cost reducing R&D (x)
- Spillover effects (β)
- Profit internalisation through common ownership (λ)



back

Theoretical Framework

Model setup

Cournot model

- n symmetric firms
- Three additional features:
  - Overlapping ownership λ,
  - Investment in marginal cost reducing R&D x_j,
  - Spillover effects β
- Firms simultaneously choose strategic variables output q_j and R&D x_j

back

Theoretical Framework

Overlapping Ownership

Firm j's profit maximisation problem

$$\phi_j = \pi_j + \lambda \sum_{k \neq j} \pi_k$$

Degree of profit internalisation λ

- $\lambda = 0$: Firms independently maximise profits
- $\lambda = 1$: Cartel or full merger

back

Theoretical Framework

R&D and Spillovers

Firm j's profit function

$$\pi_j = f(Q)q_j - c(x_j + \beta \sum_{k \neq j} x_k)q_j - \Gamma(x_j)$$

Investment in marginal cost reduction

- R&D level x_j with fixed investment $\Gamma(x_j)$
- Marginal cost c, decreasing in R&D efforts x_j

Spillover effects β

- $\beta = 0$: No spillovers, R&D efforts are only of use for the respective firm
- $\beta = 1$: R&D fully benefits competitors in the market, Research Joint Venture
- $\beta = 1$ with $\lambda = 1$: Cartelised Research Joint Venture

back

Theoretical Framework

Overlapping Ownership, R&D and Spillovers

Degree of profit internalisation λ

- Cartelisation effect increases own and rivals' profits
- Firms *reduce output*

R&D x_j

- Production cost reduction
- Firms *increase output*

Spillover effects β

- Internalisation of R&D efforts benefits rivals
- Firms *increase output*

$\Rightarrow$ How do these effects interact with each other?

back

Theoretical Framework

How do R&D and output levels vary with the degree of internalisation of rivals' profits?

Comparative statics with respect to λ

- *High spillovers:*
  Positive effect of R&D outweighs cartelisation effect on output
- *Low spillovers:*
  Cartelisation effect outweighs positive effect of R&D on output
- *Intermediate spillovers:*
  Ambiguous, R&D increases, but output decreases

back

Method

Market definition:
Three-digit NACE code-country level (median: 64 firms)
Common ownership measure:
Modified Herfindahl-Hirschman Index

$$\text{MHHI} = \sum_j \sum_k s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}} = \underbrace{\sum_j s_j^2}_{\text{HHI}} + \underbrace{\sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}}_{\text{MHHI delta}}$$

Markup measure:

$$\mu_{jt} = \frac{\hat{\beta}_m}{\alpha_{jt}}, \quad \alpha_{jt} = \frac{\text{material costs}_{jt}}{\text{sales}_{jt}}$$

back

Production Function Estimation

- Cobb-Douglas production function in logarithms:

$$q_{jt} = \beta_0 + \beta_k k_{jt} + \beta_l l_{jt} + \beta_m m_{jt} + \omega_{jt} + \epsilon_{jt}$$

- Material demand:

$$m_{jt} = f\left(\omega_{jt}, k_{jt}, l_{jt}, \text{MHHI delta}_{t-1}\right)$$

- Inverted Material demand:

$$\omega_{jt} = f^{-1}\left(m_{jt}, k_{jt}, l_{jt}, \text{MHHI delta}_{t-1}\right)$$

- Law of motion:

$$\omega_{jt} = g(\omega_{jt-1}, \text{MHHI delta}_{t-1}) + \xi_{jt}$$

- Moment conditions:

$$E\left[\epsilon_{jt}\left(\beta_k, \beta_l, \beta_m\right) Z_{jt}\right] = 0$$

back

Basic ACF Estimation Procedure:

CD Function rewritten:

$$sales_{jt} = \beta_k k_{jt} + \beta_l l_{jt} + \beta_m m_{jt} + f^{-1}\left(m_{jt}, k_{jt}, l_{jt}, \text{MHHI delta}_{t-1}\right) + \epsilon_{jt}$$

$$\iff sales_{jt} = \Phi_{jt} + \epsilon_{jt}$$

Obtain $\hat{\Phi}_{jt}$ *

- Use OLS results as starting values for β_k, β_l, β_m
- Calculate $\omega_{jt} = \hat{\Phi}_{jt} - \beta_k k_{jt} - \beta_l l_{jt} - \beta_m m_{jt}$
- Regress: $\omega_{jt} = g(\omega_{jt-1}, \text{MHHI delta}_{t-1}) + \xi_{jt}$
  $\rightarrow$ and obtain residuals $\hat{\xi}_{jt}$
- Find coefficients for β_k, β_l, β_m that minimize

$$\frac{1}{NT} \sum_{jt} \xi_{jt}\left(\beta_k, \beta_l, \beta_m\right) \begin{pmatrix} i_{jt-1} \\ l_{jt} \\ m_{jt-1} \end{pmatrix}$$

back

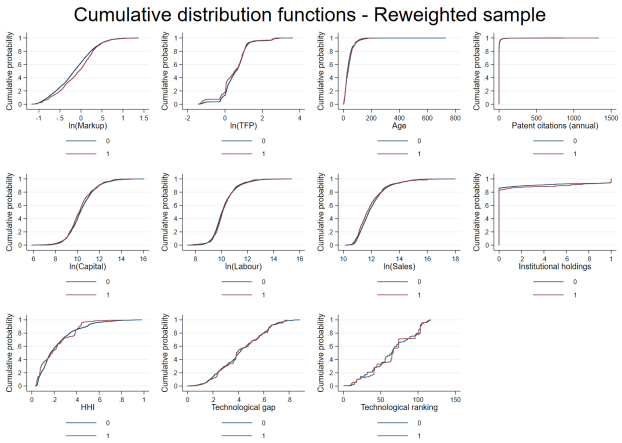
Markup Estimation

NACE code	Industries	β_k	β_l	β_m	N	Median μ_{jt}	Median ω_{jt}
10, 11, 12	Food, beverages, tobacco	0.106	0.442	0.300	5452	0.996	1.175
13, 14, 15	Textiles, wearing apparel, leather	0.015	0.406	0.614	1405	1.166	0.620
16, 17, 18	Wood, paper, print	0.150	0.404	0.412	2024	0.888	1.666
19, 20, 21	Coke, chemicals, pharmaceuticals	0.134	0.538	0.314	4568	1.146	1.123
22, 23	Rubber, plastic, minerals	0.117	0.170	0.568	4293	1.172	1.864
24, 25	Basic, fabricated metals	0.048	0.376	0.596	5319	1.176	1.278
26, 27	Computer, electronic, electrical eq.	0.076	0.437	0.478	4443	1.182	1.256
28, 29, 30	Machinery, motor, transport	0.124	0.342	0.448	10058	1.167	0.947
31, 32, 33	Furniture, other manufacturing	0.012	0.361	0.660	1004	1.242	1.661

back

2. Propensity Score Reweighting

Balancing



Sample	Balancing	
	Unweighted	Weighted
ln(Markup)	0.149**	0.076
	(0.058)	(0.096)
ln(TFP)	-0.152	-0.076
	(0.136)	(0.147)
Age	1.635	1.469
	(2.174)	(2.681)
Patent citations	3.424**	0.181
	(1.483)	(0.993)
ln(Capital)	-0.284***	-0.038
	(0.104)	(0.193)
ln(Labour)	0.107*	0.043
	(0.059)	(0.076)
ln(Sales)	-0.123*	-0.056
	(0.065)	(0.142)
Inst. Holdings	0.021**	0.023
	(0.010)	(0.020)
HHI	-0.070***	-0.013
	(0.025)	(0.043)
Techn. gap	0.024	0.019
	(0.027)	(0.036)
Techn. ranking	4.746	1.513
	(4.906)	(6.022)

back

Class	NACE 2 digit	NACE 3 digit	Description
High-technology	21		Basic pharmaceutical products and pharmaceutical preparations
	26		Computer, electronic and optical products
		30.3	Air and spacecraft and related machinery
Medium-high-technology	20		Chemicals and chemical products
		25.4	Weapons and ammunition
	27		Electrical equipment
	28		Machinery and equipment not elsewhere classified
	29		Motor vehicles, trailers and semi-trailers
	30	(excl. 30.1, 30.3)	Other transport equipment
		32.5	Medical and dental instruments and supplies
Medium-low-technology	19		Coke and refined petroleum products
	22		Rubber and plastic products
	23		Other non-metallic mineral products
	24		Basic metals
	25	(excl. 25.4)	Fabricated metal products, except machinery and equipment
		30.1	Building of ships and boats
Low-technology	10		Food products
	11		Beverages
	12		Tobacco products
	13		Textiles
	14		Wearing apparel
	15		Leather and related products
	16		Wood and products of wood and cork
	17		Paper and paper products
	31		Furniture
	32	(excl. 32.5)	Other manufacturing

Technological Classification of Industries

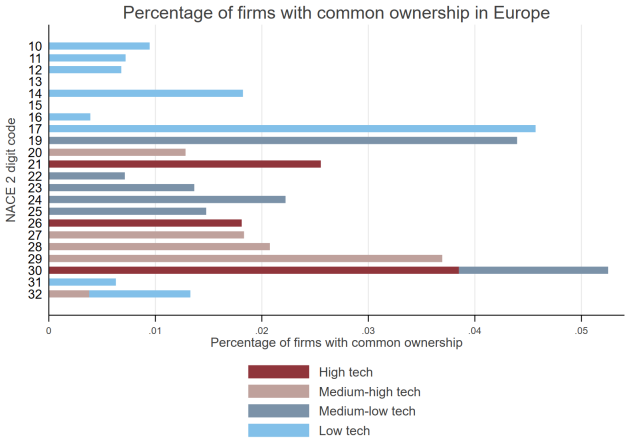
European Commission (2019)

	Patents	Patents before 2005	Percent innovating firms	Technological spillovers
High-tech	13.7	7.4	41.0	6014.7
Medium-high-tech	6.4	3.1	35.0	4148.1
Medium-low-tech	2.1	1.6	24.2	3231.9
Low-tech	0.8	0.6	11.7	2037.7
Observations	38566	38566	38566	37842

Table: Technology classification characteristics

back

Common Ownership across Industries



back

Technological Capacities Markups

Dep. Variable:	**ln(Markup)**			
	(1)	(2)	(3)	(4)
Technology	Low	Medium-Low	Medium-High	High
$1_{(MHHIdelta>0)}$	0.017**	0.005	-0.006	0.021**
	(0.008)	(0.011)	(0.009)	(0.009)
HHI	0.114**	0.037	0.041	-0.029
	(0.057)	(0.047)	(0.039)	(0.051)
Inst. Holdings	-0.033**	0.048***	0.006	-0.028
	(0.014)	(0.017)	(0.023)	(0.047)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.98	0.92	0.95	0.94
N	3633	4978	5117	1664
Market clusters	120	138	158	52

Note: Standard errors in parentheses and clustered at the three-digit industry-country level. * p¡0.10, ** p¡0.05, *** p¡0.01 Market definition: HHI and MHHI delta calculated at the three-digit industry-country level. HHI and MHHI delta are rescaled by division by 10,000, such that the HHI ranges from 0 to 1.

back

Technological Capacities Innovation

Dep. Variable:	**ln(Patent Citations)**			
	(1)	(2)	(3)	(4)
Technology	Low	Medium-Low	Medium-High	High
$1_{(MHHIdelta>0)}$ × Insider	-0.008	-0.016	0.169**	0.201***
	(0.025)	(0.058)	(0.073)	(0.069)
$1_{(MHHIdelta>0)}$ × Outsider	-0.014	-0.009	0.040	-0.016
	(0.018)	(0.027)	(0.054)	(0.060)
HHI	-0.012	-0.117	0.054	-0.425*
	(0.065)	(0.138)	(0.150)	(0.219)
Inst. Holdings	-0.025	0.334**	0.018	-0.065
	(0.040)	(0.158)	(0.068)	(0.142)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	0.58	0.77	0.79	0.87
N	3633	4978	5117	1664
Market clusters	120	138	158	52

Note: Standard errors in parentheses and clustered at the three-digit industry-country level. * p<0.10, ** p<0.05, *** p<0.01 Market definition: HHI and MHHI delta calculated at the three-digit industrycountry level. Insiders are defined as directly commonly owned firms. Outsiders are non-commonly owned competitors in the same market. We control for HHI at the three-digit industry country level, ln(TFP), market size measured by average sales at the market level, capital intensity, 1-Lerner index, and age, share of institutional holdings, a dummy for zero citations, firm and year-fixed effects. Zero patent citations are set to one. HHI and MHHI delta are rescaled by division by 10,000, such that the HHI ranges from 0 to 1.

back

Robustness Checks

Regression specification

- Polynomial function of TFP as marginal cost proxy
- Governmental policy shocks (country-time specific FE)
- Industry-specific cost shocks (industry-time specific FE)

Production function specification

- Translog specification for more variation in markups
- Logarithm of wages De Loecker and Scott, 2017

Propensity score procedure

- Propensity score matching with difference-in-differences

back