Common Ownership in Product Markets: The Role of Supply Chains

Camillo Riva

Finance Department - ESSEC Business School

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Motivation

Rise of few large **Index funds** in the asset management industry
(Backus, Conlon, and Sinkinson 2021)

- Institutional investors with diversified portfolios
- They own shares in **Multiple companies**, also in the same industry

Dark side of portfolio diversification

- Seminal paper by Azar, Schmalz, and Tecu 2018: common ownership of rival airline companies
- Product markets: less competition, high prices for consumers
- Debate in the academic literature

Research question:

- What is the effect of common ownership in the (other) sectors?

In my paper

Two main observations:

1. (Ownership) **Economy-wide** rise in common ownership
   - Not only industry-wide
   - Driven by "universal owners"
   - This type accounts for 70% of the level of common ownership in 2017
   - Global portfolio value maximization

2. (Firms) Input-output links among sectors
   - In 2007: 41% are inter-sector sales
   - Production decisions in one sector have an impact on the supply chain
   - Reduced competition: Underproduction of a good
   - Effect on the supply chain? Underproduction of its inputs
   - Need to jointly consider the sectors

Summary theoretical predictions

Model:

- Sectors along a supply chain
- Under common ownership

Product market policies that **maximize the aggregate profit**

1. Reduced competition in **one sector**, the remaining are competitive
   - Double marginalization (Spengler 1950)
2. Competition should be reduced in the **sector selling to final users** (downstream sector)
   - The others are internal sectors of the supply chain
   - Market power in these sectors would prevent other vertical synergies (for instance, reduction of hold-up problems (Hart 1995))

Summary empirical findings

Industry-level analysis (U.S) for the sample period 1985-2017

New facts on common ownership:

- Most common owners in the industries are also vertically diversified
- They drive the time-series growth in common ownership

Empirical results:

- Common ownership in sectors along a supply chain:
  1. **Higher markups** in more downstream sectors
  2. **Lower markups** in upstream and intermediate sectors

- **Causality** is established with two additional tests
  1. Alternative measure of common ownership
  2. A quasi-natural experiment of mergers among institutional investors

Literature review - Theoretical

Economy under common ownership

- Mainly **one sector** economy

1. Partial Equilibrium models (Azar 2011, Azar 2020)
2. General Equilibrium models (Azar and Vives 2021a)
    - Owners of the firms are also consumers
    - But consumers-owners differ in portfolio composition and demand curves (Hansen and Lott 1996)

In this paper:

- Multi-sector economy: Sectors along a supply chain
- Jointly considered horizontal and vertical externalities
- Prediction of anti-competitive effects only in downstream sectors

Theoretical framework - Multi-sectors economy

Multi-sectors economy with **Input-output** links among sectors

1. Firms
   - N firms distributed among S industries
   - Firms impose externalities on each other: $\pi_n = \pi_n(x_n, x_{-n})$ where x_n is the policy of firm n

2. Ownership structure
   - A continuum G of shareholders of measure one.
   - Shareholder g holds θ_n^g shares in the firm n
   - Shareholders get utility from income (the sum of profits from all their shares):

$$U^g(x_n, x_{-n}) = u^g\left(\sum_{m=1}^{N} \theta_m^g \pi_m(x_m, x_{-m})\right) \quad (1)$$

   - The utility function u^g increasing in income

Simplified case: Two-sector economy (S = 2)

Two-sector economy with **Input-output** links among sectors

1. Upstream sector
   - $u = 1, 2, ..., U$ upstream firms
   - Each upstream firm incurs in a constant unit ($=$ marginal) cost of production c to produce the intermediate good
   - They supply downstream firms at a price p_u

2. Downstream sector
   - $d = 1, 2, ..., D$ downstream firms
   - They sell the product to final users at a price p_d
   - Final demand: $Q_d = p_d^\epsilon$ where Q_d is the quantity demanded, p_d the final price and ϵ the constant price elasticity of demand

- Firms in both sectors have a production function with constant return to scale (CRS)

Simplified case: Two-sector economy (S = 2)
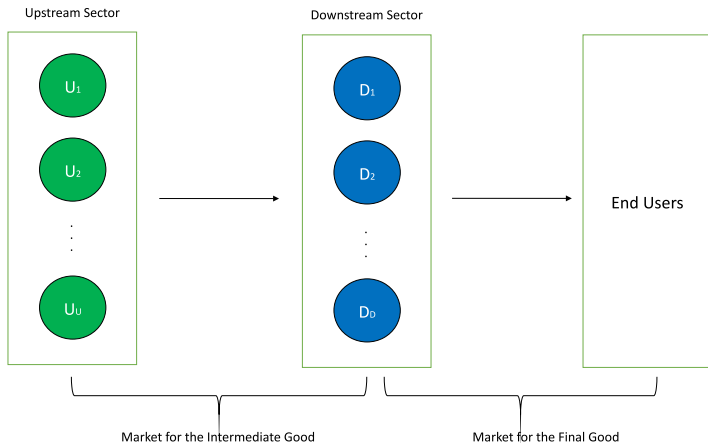
Common Ownership of the firms

Ownership structure of the firms

- A continuum G of shareholders of measure one.
- Shareholder g holds θ_n^g shares in the firm n
- Shareholders get utility from income (the sum of profits from all their shares):

$$U^g\left(x_n, x_{-n}\right) = u^g\left(\sum_{m=1}^{N} \theta_m^g \pi_m(x_m, x_{-m})\right) \tag{2}$$

- The utility function u^g increasing in income

Assumption on the ownership structure:

- All shareholders are completely diversified (market portfolio)
- There is **Common ownership** in the economy

Shareholders maximize their utility functions

- Unanimous support for **joint profit maximization**:

$$\max_{\{x_n\}_{n=1}^N} \sum_{m=1}^N \pi_m(x_m, x_{-m}) \tag{3}$$

Situation: Not integrated firms under common ownership

- Shareholders choose the **set of product market policies in the sectors** that maximizes the objective function
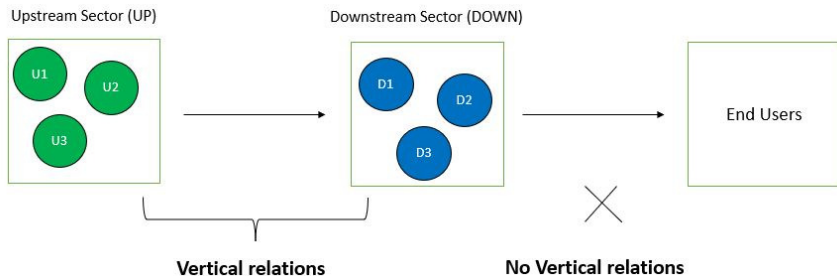
Model solution:

Proposition

The joint profit of the two sectors $\pi_{UP+DOWN}$ is maximized if:

- *Competition is reduced in **one sector***
- ***The other sector** is competitive*

- Same profit as if the N firms were acting as a single integrated monopolist
- By applying Double marginalization of Spengler 1950
- Generalization (N-sectors): Competition is reduced in **one sector**, the other **N-1 sectors** are competitive

Extension: Relationship specific investments

Two-sector economy with **Input-output** links among sectors

- Additional part: Upstream and downstream firms can make relationship-specific investments

- Investments (*cost reducing* or *demand enhancing*) with a **positive return**

Model solution

Model solution (**Proposition 2**):

- Idea: Market power in a sector damages vertical relationships
- Vertical relationships do not to exist in the market for the final good
- Competition should be reduced in the downstream sector

Solution details:

1. Stage 0: a trading partner makes a relationship-specific investment
   - Incomplete contracts: a clear division of the surplus cannot be specified *ex-ante*

2. Stage 1: *ex-post* bargaining among trade partners to split the surplus

- Underinvestment: once the investments are made, the other party will act opportunistically to capture all relationship rents
- Competition solves hold-up problems

1. Common ownership in sectors along a supply chain
   - Anti-competitive effects only in more downstream sectors (higher markups)
   - Pro-competitive effect in the other remaining sectors (lower markups)

2. Common ownership in one sector
   - Anti-competitive effects (higher markups) in the sector

Literature review - Empirical

Common ownership within an industry

1. Competition and product prices
   - Single industries: Airline industry (Azar, Schmalz, and Tecu 2018,Dennis, Gerardi, and Schenone 2019, Azar, Schmalz, and Tecu 2022), Banking sector (Azar, Raina, and Schmalz 2022), Cereal industry (Backus, Conlon, and Sinkinson 2021), Agricultural seeds (Torshizi and Clapp 2021)
   - Across sectors (Koch, Panayides, and Thomas 2021, He and Huang 2017)
   - Firm-level (Lewellen and Lowry 2019, Bindal and Nordlund 2022)

2. Other effects in product markets
   - Entry (Xie and Gerakos 2020), Innovation (Xie and Gerakos 2020, Kostovetsky and Manconi 2018)

Literature review - Empirical

Other types of common ownership

- Trade partners (Freeman 2021, Chen 2021), Portfolio-level (Azar et al. 2021, Azar and Vives 2021b)

In this paper:

- Sectors along a supply chain:
    - Different effects across sectors
    - Higher markups only in downstream sectors

Dataset at the **quarterly** level for the **sample period 1985-2017**

1. **Institutional holdings** from Thomson-Reuters Institutional Holdings (13F)
2. Portfolio firms' financial statement data from the merged CRSP/Compustat database (US firms)

Data are aggregated at **industry level** (unit of analysis):

- Portfolio firms are grouped into industries based on their historic **four-digit NAICS codes**
- Industry requirement: at least twenty consecutive quarters with at least two firms (Similar to Koch, Panayides, and Thomas 2021)
- All regression variables are constructed at industry-level

Starting point: Common ownership in a sector

MHHI Delta: traditional common ownership measure

- MHHI Delta of industry i in a given quarter t is defined as:

$$MHHI\ Delta = \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_n \gamma_{nj} \beta_{nk}}{\sum_n \gamma_{nj} \beta_{nj}} \qquad (4)$$

1. Level of common ownership generated by each institution
   - **Firms** in the industry i are indexed with j and k index firms
   - s is the firm's market share, β and γ are the fraction owned and of voting rights controlled by the institution
2. MHHI Delta sums the level of common ownership across all institutions
   - **Institutions** are indexed with n

Simplified example: Common ownership measure

Consider a sector with two companies:

- Airline A and Airline B

There are three investors:

- BlackRock (it has 7% ownership share in both companies)
- Vanguard (it has 5% ownership share in both companies)
- An hedge fund (it has 5% ownership share in Airline A)

$$MHHI\ Delta = 7\% * 7\% + 5\% * 5\% + 5\% * 0\% \tag{5}$$

- Not standardized, not accounting for the size of the firms

My Contribution: Common ownership decomposition

I **decompose the MHHI Delta** of an industry i

For each institution: check if it is common owner also in **vertically related sectors**

$$n_i \in \begin{cases} VertCo & \text{if common owner in sectors vertically related to i} \\ NoVertCo & \text{if not common owner in sectors vertically related to i} \end{cases} \quad (6)$$

The MHHI Delta of industry i in a quarter t as the sum of two components:

$$MHHI\ Delta = MHHI\ Delta|_{VertCo} + MHHI\ Delta|_{NoVertCo} \quad (7)$$

with:

- $MHHI\ Delta|_{VertCo} = \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_{n \in VertCo} \gamma_{nj} \beta_{nk}}{\sum_n \gamma_{nj} \beta_{nj}}$
- $MHHI\ Delta|_{NoVertCo} = \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_{n \notin VertCo} \gamma_{nj} \beta_{nk}}{\sum_n \gamma_{nj} \beta_{nj}}$

Identify vertically related sectors

Notion of **cost share**:

- the extent to which a given sector is purchasing inputs from other sectors

Steps to determine if two sectors are **vertically related**:

1. Define the **cost share**
   - Dollar flows among NAICS 4-digit sectors (net of Imports) from BEA Input-Output tables
   - Cost share: Dividing purchases with total sector costs

2. **Threshold**: Cost share is **at least 8%** in one direction (this threshold is in line with the literature, e.g., Duran-Micco and Perloff 2020)

   - 269 NAICS 4-digit industries, 666 pairs of vertically related sectors

Decomposition of MHHI Delta
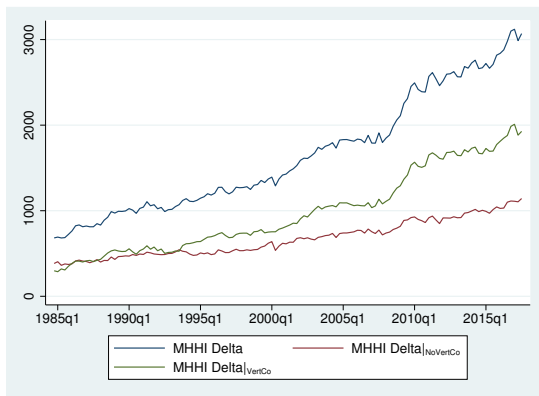
- The growth of common ownership has been mostly driven by vertically diversified common owners

The extent to which a sector is **selling to final users**

- The downstreamness measure is computed as follows:

$$Downstream_{it} = \frac{PrivateCons_{it} + PrivateInv_{it} + Exports_{it}}{Sales_{it}}$$

(8)

- where $PrivateCons_{it}$, $PrivateInv_{it}$ and $Exports_{it}$ are sales of sector i in quarter t for, respectively, personal consumption expenditures, private fixed investments and export of goods and services (BEA Input-Output tables)

- $Sales_{it}$ are the total revenues for industry i at time t

Dependent variable: Industry Profitability

Two alternative measures of market power:

1. Markup as the ratio of revenues over operating costs:

$$Markup_{it} = \frac{Sales_{it}}{Sales_{it} - EBIT_{it}} \qquad (9)$$

- where $Sales_{it}$ and $EBIT_{it}$ are, respectively, the total revenues and the earnings before interest and taxes for industry i at time t

2. Price-cost margin (PCM):

$$PCM_{it} = \frac{Sales_{it} - COGS_{it}}{Sales_{it}} \qquad (10)$$

- where $COGS_{it}$ are the costs of goods sold for industry i at time t

Summary statistics: Common ownership measure

Common ownership and its decomposition:

Variable	Mean	S.D.	P25	Median	P75	N
MHHI Delta	1,596.996	1,323.514	558.182	1,300.979	2,358.985	30,671
MHHI Delta$|_{NoVertCo}$	654.109	1,019.07	13.946	139.225	904.557	30,671
MHHI Delta$|_{VertCo}$	942.653	1,268.292	0.000	368.086	1,496.403	30,671

Summary statistics: Industry variables

Variable	Mean	S.D.	P25	Median	P75	N
Markup	1.125	0.255	1.047	1.091	1.151	30,671
PCM	0.306	0.546	0.120	0.294	0.398	30,671
Downstream	0.409	0.293	0.165	0.356	0.657	28,831
Downstream Alt	0.355	0.312	0.067	0.303	0.637	28,831
Net CAPX	0.078	0.231	-0.006	0.020	0.094	30,671
Advertising	0.168	0.114	0.084	0.153	0.236	30,671
Firms with Blocks	0.658	0.246	0.500	0.667	0.840	30,659
1 / No. Firms	0.163	0.144	0.050	0.111	0.250	30,671
HHI	3,566.184	2,235.415	1,847.696	3,020.080	4,968.997	30,671
Vertical Integrated	0.022	0.068	0.000	0.000	0.000	30,659
ln(Assets)	8.971	2.145	7.642	8.894	10.344	30,671
Sales Growth	0.066	0.988	-0.047	0.020	0.089	30,511
CapitalIntensity	5.730	8.178	2.637	3.741	5.732	30,671
R&D Intensity	0.002	0.006	0.000	0.000	0.001	30,671
R&D Missing	0.000	0.000	0.000	0.000	0.000	30,671
Leverage	0.284	0.187	0.139	0.247	0.393	30,671
Concentrated	0.272	0.445	0.000	0.000	1.000	30,671

Empirical results: Common ownership decomposition

	(1) Markup	(2) PCM	(3) Markup	(4) PCM
MHHI Delta	0.0506	0.0405		
	(1.54)	(1.64)		
MHHI Delta$\vert_{VertCo}$			0.0418	0.0449
			(1.22)	(1.50)
MHHI Delta$\vert_{NoVertCo}$			0.0378*	0.0216
			(1.72)	(0.74)
Controls	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
Quarter FEs	YES	YES	YES	YES
N	28,685	28,685	28,685	28,685

- Replication of Koch, Panayides, and Thomas 2021: MHHI Delta has no effect on markups
- MHHI Delta and its components
- The two components of MHHI Delta have limited effect on markups

Baseline regression results

	(1) Markup	(2) PCM	(3) Markup	(4) PCM
MHHIDelta$|_{VertCo}$	-0.0262	-0.0303	-0.0258	-0.0304
	(-0.41)	(-0.69)	(-0.41)	(-0.69)
MHHI Delta$|_{VertCo}$ * Downstream	0.126**	0.0956**	0.125**	0.0957**
	(2.09)	(2.00)	(2.08)	(2.01)
MHHI Delta$|_{NoVertCo}$	0.0631**	0.0210	0.0765**	0.0179
	(2.53)	(0.71)	(2.16)	(0.38)
MHHI Delta$|_{NoVertCo}$ * Downstream			-0.0178	0.00409
			(-0.67)	(0.10)
Controls	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
Quarter FEs	YES	YES	YES	YES
N	28,685	28,685	28,685	28,685

- *MHHI Delta$|_{VertCo}$* increases markups but only in more downstream sectors
- *MHHI Delta$|_{NoVertCo}$* increases markups regardless of the degree of downstreamness

Results Interpretation

The literature:

- On average, MHHI Delta does not have a statistically significant effect on markups (Koch, Panayides, and Thomas 2021)

My results:

- I decompose the MHHI Delta in two components:
  1. MHHI Delta$|_{VertCo}$ (predominant part): increases markups but only in more downstream sectors
  2. MHHI Delta$|_{NoVertCo}$: increases markups

Explain the non-effect in the literature: MHHI Delta$|_{VertCo}$ has an effect in some sectors but not in others

Results are consistent with theoretical predictions

Endogeneity concerns

General regression models relating ownership and competition

- Omitted variables, reverse-causality

In my specific setting:

- Concerns are relatively limited
- Eventual omitted variables that affect industry profitability based on the degree of downstreamness
- Unbiased estimates of regression coefficients

Main additional test:

- Plausibly exogeneous changes in common ownership
- Quasi-natural experiment in the form of financial institution M&As

Other additional test (Appendix):

- Equally-weighted common ownership measure
- Intrinsic endogeneity: both MHHI Delta and Industry Profitability contain industry-sales

Equally-weighted Common Ownership measure

C as an alternative common ownership measure

- Only difference with MHHI Delta: equal weight to the firms in the industry
- C of industry i in a given quarter t is defined as:

$$C = \sum_j \sum_{k \neq j} \frac{\sum_n \gamma_{nj} \beta_{nk}}{\sum_n \gamma_{nj} \beta_{nj}} \qquad (11)$$

I decompose the C of industry i in a quarter t as the sum of two components:

$$C = C|_{VertCo} + C|_{NoVertCo} \qquad (12)$$

Baseline regression results - Alternative CO measure

	(1) Markup	(2) PCM	(3) Markup	(4) PCM
$C|_{VertCo}$	-0.0332	-0.0674**	-0.0332	-0.0674**
	(-1.11)	(-2.52)	(-1.11)	(-2.52)
$C|_{VertCo}$ * Downstream	0.0909**	0.0988***	0.0908**	0.0987***
	(2.11)	(3.19)	(2.11)	(3.18)
$C|_{NoVertCo}$	0.0183	-0.00527	0.0151	-0.0121
	(1.14)	(-0.24)	(0.68)	(-0.39)
$C|_{NoVertCo}$ * Downstream			0.00423	0.00917
			(0.28)	(0.28)
Controls	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
Quarter FEs	YES	YES	YES	YES
N	28,685	28,685	28,685	28,685

- In line with baseline results, more pronounced results for $C|_{VertCo}$

Exogenous changes in common ownership

- Quasi-natural experiment in the form of financial institution M&As
- Use changes in common ownership that are driven by mergers of financial institutions (as in Koch, Panayides, and Thomas 2021, He and Huang 2017, etc.)
- Plausibly exogenous changes in common ownership
- Identifying assumption: any changes in common ownership due to the mergers were incidental in the decisions to merge
- 64 mergers occurring during the sample period are identified (following Lewellen and Lowry 2019)

DiD approach

For each merge, in the **quarter prior the merger announcement**, I compare:

1. **Actual measure** of common ownership
2. **Counterfactual measure** of common ownership assuming the two institutions already merged

Implied changes in common ownership can be computed:

- ΔMHHI Delta = Counterfactual MHHI Delta - Actual MHHI Delta

- The sample includes 12 quarters prior to each of the 64 institutional merger announcements and 12 quarters after each merger is completed

Implied changes in common ownership resulting from 64 mergers of institutional investors:

	Min	P1	P5	P10	P25	P50	P75	P90	P95	P99	Max
MHHI Delta	-95.087	-6.265	-0.459	-0.009	0	0	.006	9.386	27.077	158.385	686.346
MHHI Delta$|_{NoVertCo}$	-959.609	-11.196	-1.008	-0.162	0	0	0	0.067	5.242	54.218	540.386
MHHI Delta$|_{VertCo}$	-95.087	-4.422	-0.152	0	0	0	0	2.515	15.743	112.563	1051.306

- In 25% of industries in affected quarters, there is an **increase in MHHI Delta**
- In addition, **transition effect from MHHI Delta$|_{NoVertCo}$ to MHHI Delta$|_{VertCo}$** as some merging institutions become common owners in vertically related sectors

DiD results

	(1) PCM	(2) PCM	(3) PCM	(4) PCM
Treat$_{MHHI\_Delta}$ $\times$ Post	0.000760 (0.55)			
Treat$_{MHHI\_Delta_{VertCo}}$ $\times$ Post		-0.00917** (-1.99)	-0.0147** (-2.07)	-0.0134* (-1.93)
Treat$_{MHHI\_Delta_{VertCo}}$ $\times$ Downstream $\times$ Post		0.0181* (1.84)	0.0336* (1.75)	0.0281* (1.84)
Controls	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
Quarter FEs	YES	YES	YES	YES
N	176,071	162,956	162,956	162,956

- Replication of Koch, Panayides, and Thomas 2021: $Treat_{MHHI\_Delta}$ has no effect on markups
- $Treat_{MHHI\_Delta_{VertCo}}$ increases markups in more downstream sectors and decreases markups in other sectors
- Consistent with baseline results

Conclusion

Context:

- **Growth of common ownership** in industries recent decades
- Ongoing debate on the **effects** in a controversial literature

In my paper:

- The growth of common ownership in the industries is of a **specific kind**, generated by **vertically diversified investors**
- Prediction and evidence of anti-competitive effects only in **consumer-facing sectors**
- Generally consistent with the **mixed evidence** in the literature

Policy Implications:

- **Antitrust attention** should be focused primarily on these sectors

Appendix

Camillo Riva

Finance Department - ESSEC Business School

Literature review - Corporate Governance

Potential corporate governance mechanisms of common ownership:

1. Doing nothing
   - Not insist on expansion strategies (Azar, Schmalz, and Tecu 2018

2. Engagement
   - Interventions by common owners (Shekita 2022, Condon 2020, Elhauge 2015)

3. Common directors
   - Nili 2019, Increase in likelihood (Azar 2022), Effects (Barone, Schivardi, and Sette 2022, Eldar, Grennan, and Waldock 2020)

4. Voting
   - Agenda items (Hshieh, Li, and Tang 2021)

5. Management compensation
   - Less performance-sensitive (Antón et al. 2022)