Common Ownership in Product Markets: The Role of Supply Chains

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Abstract

We investigate the relationship between common institutional ownership of firms in sectors along a supply chain and product market competition. Consistent with industrial organization models, common ownership is associated with lower markups in upstream and intermediate sectors and with higher markups in more downstream sectors. We establish causality by relying on a difference-in-differences approach based on the quasi-natural experiment of financial institution mergers. We conclude that common ownership deserves antitrust attention but eventual restrictions should be designed taking into account the overall portfolio composition of investors and jointly considering horizontal and vertical externalities that firms impose on each other.

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1 Introduction

In the last decades, the trends of portfolio diversification and investors' concentration in the asset management industry led to a rise in the frequency with which large, diversified institutional investors own shares in firms in the same industry (Backus, Conlon, and Sinkinson 2021). While the finance literature has mostly conjectured and debated on whether this additional source of market concentration arising from the ownership structure of firms leads to a reduced competition in markets making them more monopolistic (among others, Azar, Schmalz, and Tecu 2018 and Dennis, Gerardi, and Schenone 2021 in the airline industry, Azar, Raina, and Schmalz 2022 in the banking sector, Koch, Panayides, and Thomas 2021 across industries), in this paper we observe that most of the institutional investors that are common owners of firms in an industry are, at the same time, common owners of firms in vertically related industries. Based on industrial organization models, we hypothesize and provide empirical evidence that common ownership of firms in sectors along a supply chain has pro-competitive effects in upstream and intermediate markets and anti-competitive effects only in more downstream markets.

We derive our theoretical predictions from a model considering a multi-sector economy in which horizontally and vertically related firms impose externalities on each other under common ownership. In a one sector economy, the theory predicts that common ownership of firms pushes the market toward a monopolistic outcome as the competition is discouraged because the benefits of competing aggressively come at the expense of firms that are part of the same investors' portfolio. However, in an economy with two or more sectors having input-output links, this prediction does not hold anymore.

The reason is that common owners are damaged by having consecutive monopolistic markets along a supply chain due to the double marginalization effect (Spengler 1950): a monopolistic outcome in a given market comes with a reduction of the quantity produced and this has a negative impact on the profits of the vertically related sectors (for instance, the underproduction of a good has a negative effect on the quantity produced of its components). By extending the logic of Spengler 1950, we prove that the total profit of a supply chain is maximized when all but one market are competitive and the remaining one is monopolistic. This unique monopoly markup is expected to be generated in the downstream sector (the market for the final good) as the upstream and intermediate sectors are internal markets of the supply chain.

Moreover, the hypothetical exercise of market power in these internal markets of the supply chain would prevent the realization of vertical synergies such as the reduction of hold-up problems which, on the other hand, are hypothesized not to exist in the market for the final good. Hold-up problems among vertically related firms arise when each part is reluctant to invest in the relationship for fear that, once the investments are made, the other party will act opportunistically to capture all relationship rents; in a context of incomplete contracts such situations are likely to arise when either the buyer or seller must make investments that have smaller value in a use outside the bilateral relationship: it is the case when a trading partner enjoys bargaining power stemming from market power, or because the investment is relationship-specific (see Hart 1995). In a monopolistic market, the investments made by a party that interfaces with the monopolist are not encouraged as the lack of outside options provide it with very limited *ex-post* bargaining power. On the other hand, a competitive market features the presence of potential alternative trading partners that provide the part who invests credible outside options that increase the *ex-post* barginging power and, ultimately, the *ex-ante* probability of investing. It follows that the market for the final good, in which downstream firms interface directly with final users and due to its structure has no hold-up problems, must be monopolistic while all the other markets of the supply chain that are more upstream must be competitive.

In the empirical section of the paper, we initially document two facts that suggest the potential high empirical relevance of our theoretical hypotheses: we first measure the extent to which U.S. sectors are connected by input-output links: by using NIPA tables of the year 2007, we observe that 41% of the aggregate sales of one industry are realized with other industries. Secondly, by using a comprehensive sample of U.S. public firms from 1985 through 2017, we document that most institutional investors that are common owners of firms in an industry are, at the same time, common owners of firms in vertically related sectors. In the time-series, the growth in common ownership of firms in industries is mainly driven by institutional investors that are also common owners of firms in vertically related industries and in 2017 they account for around 70% of the average sectorial level of common ownership.

We empirically test our main hypothesis in the sample period 1985-2017 by examining how common ownership of firms in sectors along a supply chain impacts product market performance.

We find that common ownership of firms is associated with lower markups in upstream and intermediate sectors and with higher markups in more downstream sectors. The negative effect on markups in upstream and intermediate sectors suggests that results are driven by our model and do not just reflect the fact that market power can be exercised more easily in downstream sectors; to further rule out this hypothesis, we conduct a placebo test by looking at how common ownership of firms driven by investors concentrated in the single sector impact markup based on the degree of downstreamness of the sector: consistent with our hypothesis, it has a positive effect on markups but the effect does not depend on the degree of downstreamness of the sector.

Endogeneity issues present in traditional regression models relating ownership and competition are not likely to explain why common ownership of the firms in sectors along a supply chain has opposite effect in markets based on their degree of downstreamness but they can bias regression coefficients; to alleviate these concerns and obtain unbiased estimates, we conduct two additional tests: we first use an equally-weighted measure of common ownership instead of the baseline sales-weighted version and we find results in line with the baseline regression but with an increased economic and statistical significance.

To provide plausible evidence of causality, we rely on a quasi-natural experiment in the form of M&As among financial institutions where mergers are considered as sources of plausibly exogenous variation in common ownership (see, e.g., He and Huang 2017; Lewellen and Lowry 2021). In line with multivariate OLS regression results, we find that an exogenous increase in common ownership of firms in industries driven by investors that are also common owners in vertically related industries has a negative effect on the profitability of upstream and intermediate industries while it has a positive effect on the profitability of downstream industries.

Our results confirm the theoretical predictions suggesting that common ownership in vertically linked sectors play a relevant role at shaping horizontal product market effects of common ownership; these findings may be very relevant given that most cross-ownership connections are generated by universal owners and with an expectation that this will be even more so in the future as the trends of portfolio diversification and investors' concentration in the asset management industry are continuing.

From a methodological point of view, this paper is closely related to Koch, Panayides, and Thomas 2021 as we adopt a similar multivariate OLS framework and similar identification strategies, but we depart from them by considering vertical links among sectors and how the diversification of common owners in vertically related sectors impacts product market outcomes.

Our findings are important for both academic researchers and policymakers. Since 2016, increased common ownership is an area of concern with growing consideration by antitrust authorities. To prevent adverse consequences for the economy, Posner, Scott Morgan, and Weyl 2016 proposes a policy limiting institutions' holdings in an industry to small stakes or to only a large stake in a single firm. Our results indicate that product market effects of common ownership depend on the overall portfolio composition of investors and in particular on horizontal and vertical externalities that portfolio firms impose on each other. The focus should especially be on the diversification of common owners in vertically related sectors and the position of the sectors along the supply chain.

The rest of the paper is organized as follows. Section 2 presents a review of the related literature. Section 3 develops the hypotheses. Section 4 describes sample construction and reports summary statistics. Section 5 presents the analysis and results covering the relationship between common ownership and product market outcomes. Section 6 addresses endogeneity concerns. Section 7 concludes.

2 Contribution and related literature

Our paper primarily contributes to the literature investigating the effects of the ownership structure on product market competition.

The literature mostly analyzes the impact of common ownership of firms in an industry on product market outcomes, by focusing either on single-industry studies (for instance, Azar, Schmalz, and Tecu 2018 and Dennis, Gerardi, and Schenone 2021 in the airline industry and Azar, Raina, and Schmalz 2022 in the banking sector) or across-industry studies (Koch, Panayides, and Thomas 2021). There is no consensus on the product market effects of within industry common ownership: some papers find that common ownership has anti-competitive effects while other papers find no or weak effects. This paper provides a potential explanation on why the literature found mixed effects and attributes this to the fact that these papers did not consider that most of cross-ownership linkages in industries are driven by investors that are, at the time time, common owners in vertically related industries; the existence of well-known externalities among vertically related sectors led us to hypothesize and provide empirical evidence that common ownership of firms in sectors along a supply chain is associated with lower markup in upstream and intermediate sectors while with higher markup in sectors more downstream. The results of this paper are more in line with the recent working paper of Azar and Vives 2021b in which they revisit the effects of common ownership in the airline industry and they show that intra-industry common ownership is associated with higher ticker prices and inter-industry common ownership is associated with lower ticket prices. While both papers find empirical evidence that the product market outcomes in an industry also depend on whether the owners of the firms have portfolio holdings in other industries (in our case, in vertically related sectors), our paper focuses on how common ownership of firms in sectors along a supply chain affects its product markets outcomes and we prove that common ownership has opposite effects in sectors based on whether they interface with end users or not. To the best of our knowledge, we are the first paper in the common ownership literature to focus on supply chains and to show that common ownership of firms in sectors along a supply chain reduces markup in sectors that are more upstream and intermediate and increases markup in downstream sectors.

Our paper is also related to the theoretical literature that studies an economy under common ownership. On one side, the partial equilibrium models in Azar 2011 and Azar 2020 predict that common ownership of firms in an economy leads to a reduction of competition while Azar and Vives 2021a adopt a general equilibrium perspective where owners are also consumers in a one period model and show that, under some conditions, common ownership does not have negative effects in product markets. Our theoretical framework is based on partial equilibrum models but, under some conditions, it may well be compatible with general equilibrium models; this may be the case when there is hetereogeneity among consumers-owners in terms of portfolio composition and demand curves (as in Hansen and Lott 1996).

To the best of our knowledge, our paper is the first in the theoretical literature of common ownership to focus on supply chains and to hypothesize that common ownership by vertically diversified common owners is expected to reduce markups in upstream sectors and to generate a monopoly markup in more downstream sectors.

3 Theory and hypothesis development

We elaborate optimal product market policies in an economy with input-output links among sectors under common ownership.

In the basic model, each sector has multiple firms producing the same product or service; a sector is upstream [1] if it supplies other sectors while it is downstream if it sells its output to end users. In each sector, firms are rivals in the product market and they impose negative externalities on each other. We then introduce in the model relationship-specific investments among vertically related firms in a context of incomplete contracts.

3.1 Theoretical framework

A multi-sectors economy consist of N firms distributed among S industries with input-output links. As there is no uncertainty, firm n's profits only depend both on its own policies x_n and on the policies of the other firms, x_{-n}:

$$\pi_n = \pi_n(x_n, x_{-n}) \tag{1}$$

The product market policies of the firms can be prices, quantities, investment decisions, or in general any decision variable that the firm needs to choose.

There is a continuum G of shareholders of measure one. Shareholder g holds θ_n^g shares in the firm n. The total number of shares of each firm is normalized to 1. Each firm holds its own election to choose the board of directors, which controls the firms' policies. Shareholders get utility from income which is the sum of profits from all their shares:

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

with the utility function u^g increasing in income and non-increasing marginal utility.

In each firm's election, shareholders vote for the party whose policies maximize their utilities, given the equilibrium policies in all the other firms.

The maximization takes into account the effect of the policies of firm n on the profits that share-

[1] With the term upstream, we refer to sectors that are not downstream i.e. upstream and intermediate sectors

holders get from every firm, not just firm n. Thus, when the owners of a firm are also the residual claimants for other firms, they internalize some of the pecuniary externalities that the actions of the first firm generate for the other firms that they hold.

By assuming that all shareholders are completely diversified i.e. they hold the market portfolio, they are unanimous in their support for joint profit maximization as the objective of the firm:

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

In the rest of the theoretical part, we consider which product market policies maximize the objective function on the basis of the externalities imposed between firms.

3.2 Two-sector economy (S = 2)

3.2.1 The basic model. The N firms in the economy are distributed among two sectors $S \equiv \{UP, DOWN\}$ where *UP* and *DOWN* are, respectively, the upstream and downstream sector. To simplify the notation, the $n = 1, 2, ..., N$ firms in the economy are denoted with $u = 1, 2, ..., U$ if they belong to the upstream sector and with $d = 1, 2, ..., D$ if they belong to the downstream sector; obviously, their sum $U + D$ is equal to N.

The two sectors are fully vertically related as the U firms in the upstream sector produce an intermediate good and supply it to the D firms in the downstream sector, as shown in Figure 1.

More specifically, each upstream firm incurs in a constant unit (= marginal) cost of production c to produce the intermediate good. Upstream firms are the only producers of this good and they supply downstream firms at a price p_{UP}. Downstream firms sell the product to final users at a price p_{DOWN}. Firms in both sectors have a production function with constant return to scale (CRS).

The consumers' downward-sloping demand function is denoted $Q_{DOWN} = p_{DOWN}^{\epsilon}$ where Q_{DOWN} is the quantity demanded, p_{DOWN} the final price and ϵ the constant price elasticity of demand.

The objective function entails joint profit maximization and can be represented as the sum of profits of the upstream and downstream sectors:

$$\max_{\{x_n\}_{n=1}^{N}} \sum_{m\in UP} \pi_m(x_m, x_{-m}) + \sum_{m\in DOWN} \pi_m(x_m, x_{-m}) \tag{4}$$

Unlike the one sector economy in which aggregate profit of the corporate sector is maximized when firms act in a monopolistic manner as the benefits of competing aggressively come at the expense of rival firms, this logic does not hold in an economy with more than one sector and with input-output links among sectors. The reason is that monopolistic pricing implies a reduction of the quantity produced and this has a negative externality on the vertically related sector; this phenomenon is known as double marginalization and it has been firstly proved by Spengler 1950. Instead, the maximization of the aggregate profit of the economy requires considering the effects of product market decisions in one sector on vertically related sectors. This leads to our first result, by applying the logic of Spengler 1950.

Proposition 1. *The joint profit of the two sectors $\pi_{UP+DOWN}$ is maximized if the N firms act as a single integrated monopolist. The same maximum joint profit is also obtained when the market for the intermediate (final) good is perfectly competitive and the market for the final (intermediate) good is monopolistic.*

Joint profit is maximized when the N firms in the economy, distributed across the upstream and downstream sectors, act as if they were a single integrated monopolistic firm. Apart from this theoretical case of integration, the same maximum payoff can also be obtained when one market is perfectly competitive while the other is monopolistic.

In Appendix A we computed how the total profits of the supply chain depend by the level of competition in markets. The results are summarized in the table below:

Type of competition in good markets	**Total Profit**
Single integrated monopolist	$\Pi_{UP+DOWN} = (cM)^{\epsilon} c(M-1)$
Intermediate MP – Final PC	$\Pi_{UP+DOWN} = (cM)^{\epsilon} c(M-1)$
Intermediate PC – Final MP	$\Pi_{UP+DOWN} = (cM)^{\epsilon} c(M-1)$
Intermediate MP – Final MP	$\Pi_{UP+DOWN} = (cM)^{\epsilon} c(M-1)M^{\epsilon}(1+M)$

where MP stands for monopolistic and PC for perfectly competitive. M is the Markup defined as the ratio of the final price to the marginal cost i.e. $M = \frac{p_{DOWN}}{Marginal\, cost} = \frac{1}{1+\frac{1}{\epsilon}}$.
Given that $\epsilon < -1$, the markup is $M > 1$ and it follows that the multiplicative factor $f = M^{\epsilon}(1+M)$ is always less than 1: the total profit of the supply chain is lower when both the market for the intermediate good and the market for the final good are monopolistic compared to the case in which only one market is monopolistic while the other is perfectly competitive. The economic magnitude of double marginalization is relevant: total profit is from 5% to 27% lower depending on the price elasticity of demand; if $\epsilon = -1.01$ then $f \approx 0.96$ while for $\epsilon \to -\infty$ then $f \approx 0.73$ indicating lower profit when the demand is more elastic (monopolistic pricing requires to give up more quantities when demand is more elastic).
Based on these results, common ownership of firms allows to achieve a profit equivalent to vertical integration by promoting competition in market for the intermediate (final) good and by reducing competition in the market for the final (intermediate) good.

3.2.2 Vertical relations and hold-up problems. We introduce in the previous model direct vertical externalities among firms that are in product-market relationships. One example is the presence of holdup costs i.e. each part is reluctant to invest in the relationship for fear that, once the investments are made, the other party will act opportunistically to capture all relationship rents; this happens when there are large amounts of surplus to be divided *ex-post* and the *ex-ante* contract does not specify a clear division of the surplus because of the impossibility of writing a complete, contingent contract. As specified by Hart 1995, such situations are likely to arise when either the buyer or seller must make investments that have a smaller value in a use outside their own relationship than within the relationship: it is the case when a trading partner enjoys bargaining power stemming from market power, or because the investment is relationship-specific.
These investments in innovation can be characterized as either *cost reducing* or as *demand enhancing*: when innovation allows a firm to reduce its marginal cost, then that firm tends to set prices lower and produce higher quantities of output such as to increase profits; on the other hand, innovation that increases the perceived value of the final product can be characterized as demand enhancing because it tends to increase the number of customers willing to purchase at a given price. These investments must be made by the supplier or the buyer or both sides.

We introduce hold-up problems in our model by focusing, for simplicity, on investments that are *demand enhancing*. The demand function becomes $Q_{DOWN} = \left(p_{DOWN}\frac{1}{h}\right)^{\epsilon}$ with the parameter $h \in (0,1]$ that denotes the perveiced quality of the product and a higher value of h indicates that for a given price p_{DOWN} the final users demand more quantity Q_{DOWN}.

Each downstream firm D_d (with $d = 1,2,...,D$) decides whether to invest at cost α_d ($I_d = 1$), or not ($I_d = 0$). Exploiting the investment moreover requires an indivisible input which each upstream firm U_u (with $u = 1,2,...,U$) can supply at no cost; we will refer to this input as ”support”.

Without investments or support, the final demand has the parameter $h = h_1$ while if all the downstream firms make the investments in innovation then $h = h_2$ with $h_2 > h_1$. In this last case, the aggregate profit of the supply chain increase by $\left[\left(\frac{1}{h_2}\right)^{\epsilon} - \left(\frac{1}{h_1}\right)^{\epsilon}\right]F$ that is always greater than 0 where $F = (cM)^{\epsilon}c(M-1)$.

We assume that an investment by D_d generates a return $\left[\left(\frac{1}{h_2}\right)^{\epsilon} - \left(\frac{1}{h_1}\right)^{\epsilon}\right]\frac{F}{D}$ that always covers the cost α_d:

$$\alpha_d < \left[\left(\frac{1}{h_2}\right)^{\epsilon} - \left(\frac{1}{h_1}\right)^{\epsilon}\right]\frac{F}{D} \tag{5}$$

Contracts are incomplete and we assume away the possibility of contracting *ex-ante*, before investment decisions are made.

We solve the following game:

- Stage 0 (*investment*): downstream firms make their investment decisions that are publicly observed;
- Stage 1 (*ex-post*): each U_u offers each D_d a profit-sharing rule $\gamma_{ud} \in [0,1]$; each D_d then chooses its supplier.

The solution of the model described above leads us to the following result:

Proposition 2. *The joint profit of the two sectors $\pi_{UP+DOWN}$ is maximized if the N firms act as a single integrated monopolist. The same maximum joint profit is also obtained when the market for the intermediate good is perfectly competitive and the market for the final good is monopolistic.*

Joint profit is maximized when the N firms in the economy, distributed across the upstream and downstream sectors, act as if they were a single integrated monopolistic firm; this result is not surprising since vertical integration does not only prevent double-marginalization problems but it is also a natural solution for hold-up problems.

However, the same total profit of the supply chain is also achieved when the market for the intermediate good is perfectly competitive and the market for the final good is monopolistic. From Proposition 1, we know that the aggregate profit of a supply chain with two sectors is maximized when one market is competitive and the other one is monopolistic. By introducing hold-up problems into the model, it allows us to prove that the market for the final good must be monopolistic and the market for the intermediate good must be competitive.

This result is derived based on two observations:

1. The hold-up problem occurs between firms that are in trade relationships. While vertical relationships are present among firms that are in the market for the intermediate good (between upstream and downstream firms), these vertical relationships are assumed not to exist in the market for the final good given that downstream firms interface directly with final users.
2. The hold-up problem depends on the level of competition in the market. The *ex-post* bargaining game is affected by the value of the investment in a use outside the bilateral relationship: if the party who made the investment can easily switch to new alternative equally efficient trading partners, any attempt by the trading partner to haggle for an increased share of surplus would fail.
   (a) Competitive upstream sector with independent upstream firms U_u with $u = 1, 2, ..., U$: if the downstream firm D_d invests in stage 0 then, *ex-post*, Bertrand competition among upstream firms yields them to offer the profit-sharing rules $\gamma_{1d} = \gamma_{2d} = ... = \gamma_{Ud} = 1$ in stage 1. Anticipating this, all downstream firms invest in stage 0 and each D_d obtains the full return on its investment $\left[\left(\frac{1}{h_2}\right)^{\epsilon} - \left(\frac{1}{h_1}\right)^{\epsilon}\right]\frac{F}{D} - \alpha_d$.
   (b) Monopolistic upstream sector with the upstream firms U_u acting as a single integrated monopolist: if the downstream firm D_d invests in stage 0 then, *ex-post*, upstream firms can propose sharing rules which do not allow downstream firms to cover the cost of their investments $\gamma_{ld} = \gamma_{2d} = ... = \gamma_{Ud} < \frac{\alpha_d}{\left[\left(\frac{1}{h_2}\right)^{\epsilon} - \left(\frac{1}{h_1}\right)^{\epsilon}\right]\frac{F}{D}}$ in stage 1. Anticipating this, all downstream firms do not invest in stage 0.

It follows that the market for the final good must be monopolistic as it does not come with the cost of missed investments which reduce the total profit of the supply chain. Instead, the market for the intermediate good must be competitive as competition between alternative partners makes it possible to eliminate hold-up problems and therefore the efficient level of investments is achieved.

3.3 Extensions of the model

3.3.1 Economy with S sectors. We generalize the theoretical predictions by considering an economy with N firms distributed among S fully vertically related sectors $s = 1, 2, ..., S-1, S$. Firms in sector 1, the most upstream sector, incur a constant unit cost of production c to produce an intermediate good and they supply firms in sector 2 at a price p_1. More generally, firms in sector s supply firms in sector $s+1$ at a price p_s. The firms in sector S, the most downstream, interface with final users. Firms in all sectors have a production function with constant return to scale (CRS). The consumers' downward-sloping demand function is denoted $Q_S = p_{DOWN}^{\epsilon}$ where Q_S is the quantity demanded, p_{DOWN} the final price and ϵ the constant price elasticity of demand.
As before, hold-up problems may be present among vertically related firms.
The objective function entails joint profit maximization and can be represented as the sum of profits of the sectors along the supply chain:

$$\max_{\{x_n\}_{n=1}^{N}} \sum_{m\in 1} \pi_m(x_m, x_{-m}) + \sum_{m\in 2} \pi_m(x_m, x_{-m}) + ... + \sum_{m\in S} \pi_m(x_m, x_{-m}) \tag{6}$$

By extending the logic of Spengler 1950 in a supply chain with S sectors and considering the role of competition at solving hold-up problems, we obtain the following result:

Proposition 3. *The joint profit of the sectors $\pi_{1+2+...+S}$ is maximized if the N firms act as a single integrated monopolist. The same maximum joint profit is also obtained when the market for the final good is monopolistic and all other markets are perfecly competitive.*

Proof:

1. In Appendix B we prove that the aggregate profit of a supply chain is maximized when all but one market are competitive and the remaining one is monopolistic.
2. Given that hold-up problems occur between firms that are in trade relationships and depend on the level of competition in the market, the market for the final good must be monopolistic

given that vertical relationships do not exist in that market.

3.3.2 Compatibility with General Equilibrium models.

Shareholders might also be consumers of the products that their firms produce. In a monopolistic market, firms maximize their value by choosing an output such that the marginal revenue equals the marginal cost. Consumer-shareholders have utility increasing in consumption and, given that the marginal cost is below the price, they are better-off with higher quantities as their marginal utility is positive. As illustrated by Hansen and Lott 1996 and Azar and Vives 2021a, if each consumer holds the same number of shares and has the same demand curve for the product and there are no non-shareholding consumers, there is unanimity that firms must produce the competitive output.

In reality, there is heterogeneity among consumer-shareholders on the dimensions just mentioned and these divergences can lead to equilibria where the quantities produced are between those of monopoly and those of perfect competition.

3.3.3 Common ownership network that does not cover the entire economy.

In the basic model, we considered an economy where the production sector is under common ownership. Although this hypothesis is consistent with the trends of portfolio diversification and investors' concentration that are underway in the asset management industry, an important part of the economy is made up of private firms that have concentrated ownership structures and they represent a significant part of the wealth of their owners. Furthermore, in open economies, firms interface with foreign firms that are mainly owned by foreign investors who have portfolio holdings concentrated in their country.

The propositions set out above can be adapted in a context of an open economy or when the common ownership network does not cover the entire economy. In these cases, downstream sectors are expected to be monopolistic but also sectors that interface with firms outside the common ownership network, namely with private and foreign firms.

4 Data and summary statistics

Our theoretical framework yields testable implications for the relationship between common ownership of firms in sectors along a supply chain and product market outcomes. To test our prediction that common ownership has pro-competitive effects in sectors that are more upstream and intermediate and it has anti-competitive effects only in in downstream sectors, we require data on industry profitability, ownership of the firms and also a robust definition of what constitutes industries and the measurement of their vertical links.

4.1 Sample selection

Following the procedure of Koch, Panayides, and Thomas 2021, we obtain quarterly institutional holdings for the sample period starting with the first quarter of 1985 and ending with the fourth quarter in 2017 from the 13F filings in the Thomson Reuters database. We obtain portfolio firms' quarterly financial statement data from the merged CRSP/Compustat database. We require firms to have total assets of at least 1 million USD, net sales of at least 250,000 USD and net sales greater than EBIT.

We group portfolio firms into industries based on their historic four-digit NAICS codes. Compustat assigns firms NAICS codes (NAICSH) starting in 1985. To ensure that the measures of common ownership can be calculated for a meaningful series of industry quarters, we require each industry to have a series of at least twenty consecutive quarters with at least two firms. There are 269 industries that meet the sample screens. In papers with other aims, e.g., investigating firm performance relative to rivals or calculating diversification discounts, it is common to require more firms in an industry for inclusion; however, given that fewer firms in an industry facilitates coordination among the firms including punishment for deviations, we set our screen at the minimum number of firms that allows us to calculate industry averages.

4.2 Variable descriptions

To carry out our empirical analysis, we first decompose cross-ownership linkages within the industries to understand the extent to which they are driven by institutional investors that, at the same time, are also cross-owners of firms in vertically related industries.

We start from MHHI Delta, the traditional common ownership measure used in the literature. MHHI Delta has been developed by Bresnahan and Salop 1986 and O'brien and Salop 1999, it reflects the extent to which firms in an industry are connected by common ownership and voting rights among institutional investors and can be interpreted as the marginal increase in industry concentration attributable to common ownership and voting control of the firms in the industry by institutional owners.

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

$$MHHI\ Delta = \sum_{j} \sum_{k \neq j} s_j s_k \frac{\sum_n \gamma_{nj} \beta_{nk}}{\sum_n \gamma_{nj} \beta_{nj}} \tag{7}$$

where j and k index firms in the industry i, n indexes institutions, s is the firm's market share, γ is the fraction of voting rights controlled by the institution, and β is the fraction owned. In calculating MHHI Delta, voting rights are based on the sum of the institution's shared and sole voting shares. Furthermore, only institutions' positions (the sum of shared, sole, and non-voting shares) greater than 0.5% are considered, and positions are rescaled to add up to 100%.

In this paper, we decompose MHHI Delta of a given industry i based on whether institutions cross-own firms in industries that are vertically related to i.

Each institution can either belong to $VertCo$ or $NoVertCo$:

$$n_i \in \begin{cases} VertCo & \text{if it is cross-owner in sectors vertically related to i} \\ NoVertCo & \text{if it is not cross-owner in sectors vertically related to i} \end{cases} \tag{8}$$

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

$$MHHI\ Delta = MHHI\ Delta|_{VertCo} + MHHI\ Delta|_{NoVertCo} \tag{9}$$

with:

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

As it can be seen from the variable construction:

- MHHI Delta$|_{VertCo}$ is the part of MHHI Delta of industry i that can be attributed to institutions n that are, at the same time, common owners in sectors vertically related to i
- MHHI Delta$|_{NoVertCo}$ is the part of MHHI Delta of industry i that can be attributed to institutions n that are not common owners in sectors vertically related to i

To compute the measures above, we need to define when two sectors are considered vertically related. Following the literature, we rely on the notion of cost share that represents the extent to which a given sector is purchasing inputs from other sectors. From the BEA Input-Output tables of the year 2007, we construct dollar flows among NAICS 4-digit sectors (net of Imports). We standardize flows by dividing purchases with total sector costs to obtain the cost share. Two sectors are considered vertically related when the cost share is at least 8% in one direction (this threshold is in line with the literature, e.g., Duran-Micco and Perloff 2020). In our dataset, the 269 industries defined at NAICS 4-digit levels generate 666 pairs of vertically related sectors.

Our main dependent variable, that ultimately will reflect product market outcomes, is industry profitability that we propose in two versions.

The first measure, Markup, is computed from quarterly, firm-level Compustat information. We calculate Markup at industry level as the ratio of revenues over costs:

$$Markup_{it} = \frac{Sales_{it}}{Sales_{it} - EBIT_{it}} \tag{10}$$

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

The second measure, price-cost margin (PCM), is also computed from quarterly, firm-level Compustat information. In particular, following Domowitz, Hubbard, and Petersen 1987 and Phillips 1995, for each industry i for each period t, PCM_{it} is defined as:

$$PCM_{it} = \frac{Sales_{it} - COGS_{it}}{Sales_{it}} \tag{11}$$

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

Finally, we construct a downstreamness measure to capture the extent to which a sector is interfacing with final users or selling to firms outside the common ownership network. Our downstreamness measure is computed as follows:

$$Downstream_{it} = \frac{PrivateCons_{it} + PrivateInv_{it} + Exports_{it}}{Sales_{it}} \tag{12}$$

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

4.3 Summary statistics

Table 1a presents summary statistics, at the industry level, for the institutional common ownership measures and their two components.

On average, about 60% of the level of common ownership of firms in industries is generated by investors who are, at the same time, common owners of firms in vertically related industries. In addition, as it can be seen from Figure 2a, the growth of common ownership of firms in the industries in the last decades has been mostly driven by common owners that were also common owners in vertically related industries: while in 1985 the level of common ownership in industries was equally driven by vertically diversified and not vertically diversified common owners, in 2017 vertically diversified common owners constituted around 70% of the level of industry common ownership. This dynamic is not surprising and it is consistent with the ongoing trends of portfolio diversification and investors' concentration in the asset management industry.

Table 1b reports summary statistics for the industry-level variables used in our analyses, starting from the two profitability measures that are our main dependent variables.

Markup and PCM, have averages 1.125 and 0.306, respectively, with a correlation coefficient of 0.43. They differ in the costs they include: while Markup considers all operating costs, PCM includes only the *direct* costs of producing the good sold by the firms in the sector.

The average level of downstreamness is 0.40 and there is high variation in the sample.

The remaining variables in Table 1b include industry-level control variables such as the investment ratio, advertising expenses, measures of industry concentration, industry size and growth, leverage and capital and R&D intensity in the industry and the ownership variable Firm with Blocks, as detailed in Appendix C.

Firm-level scaled financial variables are winsorized at the 1st and 99th percentiles, before computing industry level variables.

Since we use the same dataset as the paper Koch, Panayides, and Thomas 2021, albeit with a slightly longer time coverage, and we have many variables in common, we record very similar summary statistics; this happens specifically for MHHI Delta as our summary statistics and the time-series evolution are very similar and also for the two profitability measures.

5 Results

5.1 Baseline regression results

We estimate multivariate regressions explaining industry-level profitability, proxied by Markup and PCM, based on the type of common ownership of firms in the industries and on the level of downstreamness of the sectors, controlling for other aspects of institutional ownership and for differences in industry structure. All specifications include quarter and industry fixed effects. Standard errors are robust to heteroscedasticity and clustered at the industry level.

We start by replicating the main result of Koch, Panayides, and Thomas 2021 using the full sample: common ownership of the firms in an industry, measured by MHHI Delta, does not have effects on industry profitability. In line with the results of their paper, Columns (1) and (2) of Table 2 show that the coefficient of MHHI Delta is positive but neither economically nor statistically significant. This paper attributes the lack of a significant relationship to the fact that they did not consider that most of cross-ownership linkages in industries are driven by investors that are, at the time time, common owners in vertically related industries; this is relevant because there exist well-known externalities among vertically related sectors.

Before fully testing our hypothesis, we regress industry profitability on the two components of MHHI Delta, MHHI Delta$|_{VertCo}$ and MHHI Delta$|_{NoVertCo}$ as shown in Columns (3) and (4); we find that both coefficients are positive but not statistically significant. In general, the coefficient of MHHI Delta$|_{VertCo}$ is consistent with our main hypothesis: common ownership of firms in industries by vertically diversified investors is expected to increase profitability in some sectors and to decrease profitability in other sectors; the coefficient shows that, on average, the net effect across sectors is positive. The coefficient of MHHI Delta$|_{NoVertCo}$ is positive and also statistically significant in some specifications; the lack of stronger statistical significance can be justified on the basis that these common owners constitute a minority part of MHHI Delta, as illustrated by the summary statistics of Table 1a, and they have relatively limited voting power to influence the decisions of portfolio companies.

Our main prediction, derived by the model in Section 3, is that common ownership of firms in sectors along a supply chain is expected to decrease the profitability of upstream and intermediate sectors and to increase the profitability of downstream sectors. The prediction is tested in the following regression model:

$$Profitability_{it} = \beta_1 MHHI\ Delta|_{VertCo} + \beta_2 MHHI\ Delta|_{VertCo} \times Downstream + X_{it}\lambda + \alpha_t + \theta_i + \epsilon_{it}$$

where i indexes industries and t indexes quarters. Profitability is either Markup or PCM. MHHI Delta$|_{VertCo}$ is the part of MHHI Delta of industry i that can be attributed to common owners that are diversified in industries vertically related to i and $Downstream$ captures the extent to which a sector is interfacing with final users; X_{it} is a vector of controls, α_t is the quarter fixed effect while θ_i is the industry fixed effect. Variables are defined in Appendix C.

Our main results are reported in Table 3. Consistent with our theoretical framework, the coefficient β_1 is negative, albeit not statistically significant, and the coefficient β_2 is positive and statistically significant. These results suggest that common ownership of firms in industries driven by vertically diversifed investors, measured with MHHI Delta$|_{VertCo}$, is associated with pro-competitive effects in upstream and intermediate markets along a supply chain, captured through a reduction in industry profitability, and with anti-competitive effects in markets that are more downstream, captured through an increase in industry profitability.

5.2 Placebo test

One concern is that regression results may just reflect the fact that common ownerhip is having anti-competitive effects and these effects are likely to be stronger in downstream markets (for instance, the structure of these markets with many small and dispersed end users may make easier the exercise of market power); this explanation is in contrast with the negativity of the coefficient β_1 that associates common ownership with pro-competitive effects in upstream markets.

To further rule out this explanation and to show that the empirical results are driven by our model, we look at how common ownership generated by concentrated common owners affects markets based on their degree of downstreamness: unlike vertically diverisified common owners, they are expected to promote anti-competitive effects in markets, irrespective of their degree of downstreamness; the results of this placebo test are shown in Columns (3) and (4) of Table 3 where the coefficient of the interaction term MHHI Delta$|_{NoVertCo}$ * Downstream swings between being positive and negative and is neither statistically nor economically significant. This allows us to conclude that regression results are in line with our predictions and they do not reflect a situation which common ownership has anti-competitive effects that are just stronger in downstream markets.

6 Endogeneity concerns

In general, regression models relating ownership and competition may not be well-specified; it is possible that some omitted variable may be correlated with both common ownership and profitability in such a way that its omission obscures the true relation between common ownership and competition or that results are driven by reverse-causality.

In our setting, endogeneity concerns are relatively limited: the main contribution is to show how common ownership driven by vertically related investors affects profitability based on the degree of downstreamness of the industries: we expect a negative coefficient of MHHI Delta$|_{VertCo}$ and a positive coefficient of the interaction term MHHI Delta$|_{VertCo}$ * Downstream; our concern would be of eventual omitted variables affect the profitability of industries based on their level of downstreamness and are also correlated with the level of common ownership in the industry.

In order to further alleviate these concerns and, above all, to obtain unbiased estimates of regression coefficients, we propose two main additional tests based on different logics. Firstly, we address the intrinsic endogeneity concern of this empirical model since both profitability and common ownership depend by industry-sales by using an equally-weighted common ownership variable. Secondly, we consider the effects of plausibly exogenous changes in common ownership on industry profitability by relying on quasi-natural experiments of financial institutions M&As.

6.1 Equally-weighted common ownership measures

Both our dependent and independent variables contain industry-sales: they are used to construct profitability measures but, at the same time, they enter in the common ownership measures (the s term in MHHI Delta is the firm's market share). In this regard, we use C as a common ownership measure that differs from MHHI Delta only for giving equal weight to the firms in the industry. More specifically, we consider the average across all pairs of firms in an industry of the "common ownership incentive term" which equals $\frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}$ for the *jk* firm-pair. C can be defined as:

$$C = \sum_j \sum_{k \neq j} \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}} \tag{13}$$

Compared to MHHI Delta, this alternative measure does not depend on the respective market shares of firms in the industry.

Specularly, the same decomposition can be applied for the C measure:

$$C = C|_{VertCo} + C|_{NoVertCo} \tag{14}$$

Reported results in Table 4 are in line with our baseline estimates and the statistical significance has increased. Now, the coefficient of $C|_{VertCo}$ is negative with statistical significance in some specifications and the coefficient of $C|_{VertCo}$ * Downstream is positive with high statistically significance. These results further confirm that common ownership by vertically diversifed investors, measured by $C|_{VertCo}$, is associated with pro-competitive effects in upstream and intermediate sectors, captured through a reduction in industry profitability, and with anti-competitive effects in downstream sectors, captured through an increase in industry profitability.

6.2 Plausibly exogenous changes in common ownership

Our theoretical predictions postulate a casual effect of common owners on industry profitability. To further rule out the possibility that estimated correlation were spurious or driven by reverse causality, we rely quasi-natural experiments of financial institutions M&As;

Following Koch, Panayides, and Thomas 2021 and Lewellen and Lowry 2021, we form a sample of financial institution mergers and we identify a list of 64 financial institution mergers that satisfy selection criteria as outlined in Lewellen and Lowry 2021.

To identify changes in common ownership, we compare actual measures of common ownership in the quarter prior to a given merger announcement to counterfactual measures computed under the assumption that the two institutions had already merged. Table 5 summarizes the implied changes in common ownership defined as the difference between the counterfactual and the actual measures. There are positive implied changes in MHHI Delta in roughly 25% of the industries while we observe high changes in MHHI Delta$|_{VertCo}$ due a transition effect from MHHI Delta$|_{NoVertCo}$: some common owners become vertically diversified after the merge. This also explains why MHHI Delta$|_{NoVertCo}$ decreases in more than 10% of the cases.

We define industries with positive implied changes in MHHI Delta$|_{VertCo}$ or above a given percentile as treated industries ; there remaining are assigned to the control group. We compare industry outcomes in the three years prior the announcement to those in the three years after the effective date in the treatment and control group, based on the following difference-in-difference specification:

$$Profitability_{it} = \beta_1 Treat \times Post \times Down + \beta_2 Treat \times Post + X_{it}\lambda + \alpha_t + \theta_i + \epsilon_{it} \tag{15}$$

where i indexes industries and t indexes time. Profitability is either Markup or PCM. Treat is a dummy equal to one for industries with positive implied changes in MHHI Delta$|_{VertCo}$, Post is a dummy equal to one for quarters after the merger, X_{it} is a vector of controls, α_t is the quarter fixed effect while θ_i is the industry effect.

Results for PCM are presented in Table 6. While column 1 is meant to replicate the result of Koch, Panayides, and Thomas 2021 showing that, common ownership has a weak effect on profitability in the average industry, columns 2 to 4 assign industries to treatment based on MHHI Delta$|_{VertCo}$, using different thresholds. While Column 2 consider implied changes in MHHI Delta$|_{VertCo}$ above the percentile 90, changes above percentiles 95 and 97 are considered for columns 3 and 4, respectively. Consistent with baseline results, a plausibly exogenous increase in common ownership driven by diversified investors has positive effect on the profitability of sectors that are more downstream and it has a negative effect on the profitability of upstream and intermediate sectors.

7 Conclusion

In this paper, we hypothesize and provide empirical evidence that common ownership of firms in sectors along a supply chain has pro-competitive effects in more upstream and intermediate markets and anti-competitive effects only in downstream markets.

Our theoretical predictions are derived from a model considering a multi-sector economy in which horizontally and vertically related firms impose externalities on each other under common ownership. By extending the logic of Spengler 1950, we firstly prove that the aggregate profit of a supply chain is maximized when all but one market are competitive and the remaining one is monopolistic. Then we prove that it is the market for the final good that is expected to be monopolistic: the reason is that hold-up problem occurs between firms that are in trade relationships and competition among potential trading partners increases the value of an investment in a use outside the bilateral relationship and then the probability of investments. It follows that it is the downstream market that must be monopolistic given that due to its structure it has no hold-up problems and monopolistc outcomes in this market do not come with the cost of missed investments.

We empirically test our main hypothesis in the sample period 1985-2017 by examining how common ownership of firms in sectors along a supply chain impacts product market performance. We find that common ownership of firms is associated with lower markup in upstream and intermediate sectors and with higher markup in more downstream sectors.

Regression results and a further placebo test allowed us to rule out the possibility that results may just reflect the fact that common ownership may be likely to have stronger effects in downstream sectors.

Although endogeneity issues are not likely to explain our results, we conduct two additional tests: we first use an equally-weighted measure of common ownership instead of the baseline sales-weighted version and, secondly, we rely on a quasi-natural experiment in the form of M&As among financial institutions where mergers are considered as sources of plausibly exogenous variation in common ownership. Both tests deliver results in line with the baseline regression but with an increased economic and statistical significance.

Our paper suggests the importance of taking into account the overall portfolio composition of investors to study the effect of common ownership and to jointly consider horizontal and vertical externalities that firms impose on each other. In light of our results, antitrust restrictions should be designed after carefully considering both these dimensions.

References

Azar, J. (2011). "A new look at oligopoly: Implicit collusion through portfolio diversification". In: *Available at SSRN 1993364*.

Azar, J. (2020). "The common ownership trilemma". In: *The University of Chicago Law Review* 87.2, pp. 263–296.

Azar, J., S. Raina, and M. Schmalz (2022). "Ultimate ownership and bank competition". In: *Financial Management* 51.1, pp. 227–269.

Azar, J., M. C. Schmalz, and I. Tecu (2018). "Anticompetitive effects of common ownership". In: *The Journal of Finance* 73.4, pp. 1513–1565.

Azar, J. and X. Vives (2021a). "General equilibrium o". In: *Econometrica* 89.3, pp. 999–1048.

Azar, J. and X. Vives (2021b). "Revisiting the Anticompetitive Effects of Common Ownership". In: *Available at SSRN 3805047*.

Backus, M., C. Conlon, and M. Sinkinson (2021). "Common ownership in America: 1980–2017". In: *American Economic Journal: Microeconomics* 13.3, pp. 273–308.

Bresnahan, T. F. and S. C. Salop (1986). "Quantifying the competitive effects of production joint ventures". In: *International Journal of Industrial Organization* 4.2, pp. 155–175.

Dennis, P. J., K. Gerardi, and C. Schenone (2021). "Common ownership does not have anti-competitive effects in the airline industry". In: *Journal of Finance, forthcoming*.

Domowitz, I., R. G. Hubbard, and B. C. Petersen (1987). "Oligopoly supergames: Some empirical evidence on prices and margins". In: *The Journal of Industrial Economics*, pp. 379–398.

Duran-Micco, E. and J. M. Perloff (2020). "How Large Are Double Markups? By". In.

Hansen, R. G. and J. R. Lott (1996). "Externalities and corporate objectives in a world with diversified shareholder/consumers". In: *Journal of Financial and Quantitative Analysis* 31.1, pp. 43–68.

Hart, O. (1995). *Firms, contracts, and financial structure*. Clarendon press.

He, J. J. and J. Huang (2017). "Product market competition in a world of cross-ownership: Evidence from institutional blockholdings". In: *The Review of Financial Studies* 30.8, pp. 2674–2718.

Koch, A., M. Panayides, and S. Thomas (2021). “Common ownership and competition in product markets”. In: *Journal of Financial Economics* 139.1, pp. 109–137.

Lewellen, K. and M. Lowry (2021). “Does common ownership really increase firm coordination?” In: *Journal of Financial Economics* 141.1, pp. 322–344.

O’brien, D. P. and S. C. Salop (1999). “Competitive effects of partial ownership: Financial interest and corporate control”. In: *Antitrust LJ* 67, p. 559.

Phillips, G. M. (1995). “Increased debt and industry product markets an empirical analysis”. In: *Journal of financial Economics* 37.2, pp. 189–238.

Posner, E. A., F. M. Scott Morgan, and E. G. Weyl (2016). “A proposal to limit the anticompetitive power of institutional investors”. In: *Antitrust LJ* 81, p. 669.

Spengler, J. J. (1950). “Vertical integration and antitrust policy”. In: *Journal of political economy* 58.4, pp. 347–352.

Figure 1. Economy with Input-Output links among sectors

This graph represents an economy with two sectors: an upstream sector of U firms ($u = 1, 2, ..., U$) and a downstream sector with D firms ($d = 1, 2, ..., D$). Upstream firms produce an intermediate good that supply to downstream firms. Downstream firms sell the product to final users.

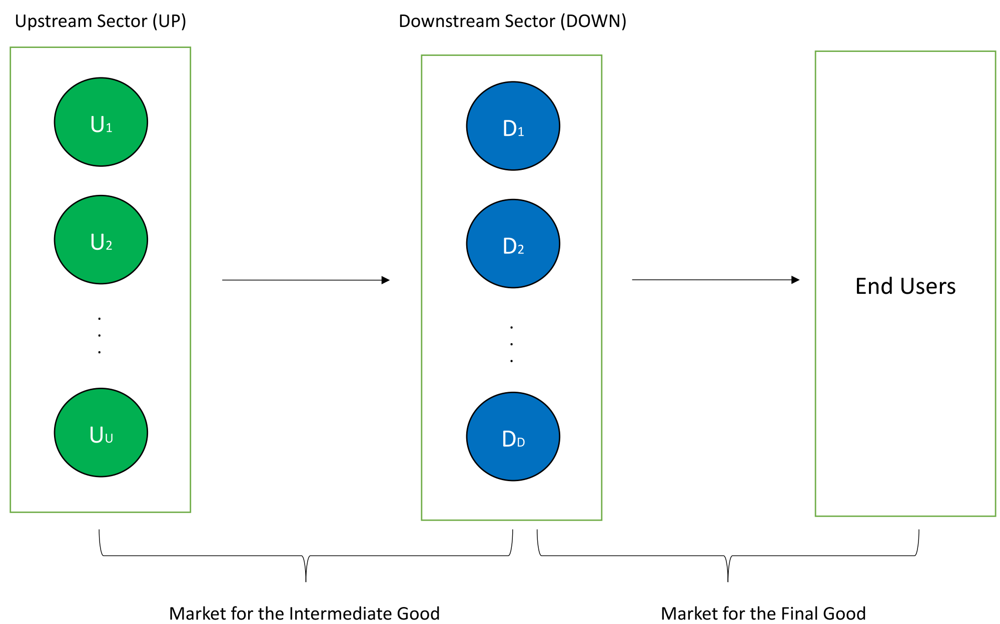
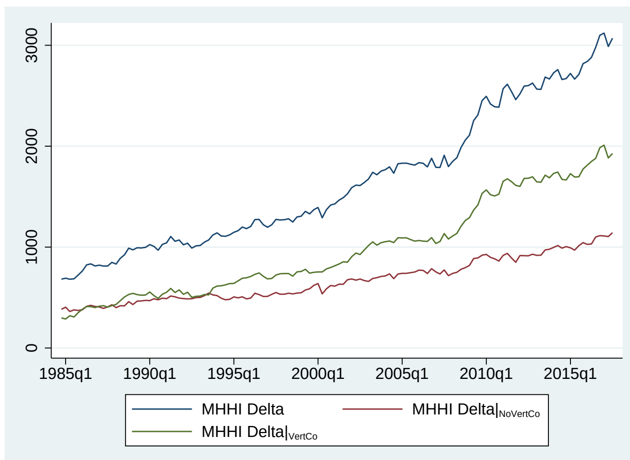


Figure 2. Common Ownership Decomposition Time Series

Data are from Thomson Reuters 13F and CRSP/Compustat Merged Database for the period starting with the first quarter of 1985 and ending with the fourth quarter of 2017. Common ownership measures are computed at industry level using 4-digit NAICS codes. Variables are defined in Appendix C. Figure (a) presents cross-sectional average MHHI Delta and its components over time. Figure (b) presents cross-sectional average C and its components over time.

(a) Decomposition of MHHI Delta



(b) Decomposition of C measure

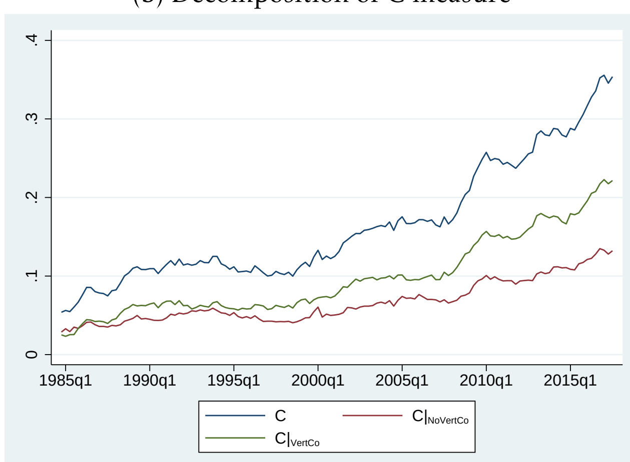


Table 1. Summary statistics

This table presents summary statistics for quarterly industry-level common ownership variables and their decompositions, profitability and other variables used in our analysis. Variables are defined in Appendix C. Industries are defined using 4-digit NAICS codes.

(a) Common Ownership variables

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
C	0.158	0.128	0.073	0.129	0.212	30,671
C$\|_{NoVertCo}$	0.064	0.107	0.002	0.013	0.090	30,671
C$\|_{VertCo}$	0.093	0.120	0.000	0.054	0.149	30,671

(b) Profitability and other 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

Table 2. Panel Regressions of Industries' Markup on Common Ownership Decomposition

This table reports the results of multivariate OLS regressions explaining industry-level Markups with the components of MHHI Delta and controls for differences in industry structure. All specifications include quarter and industry fixed effects. Standard errors are robust to heteroscedasticity and clustered at the industry level. Variables are defined in Appendix C. t-statistics are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) Markup	(2) PCM	(3) Markup	(4) PCM
MHHI Delta	0.0506	0.0405		
	(1.54)	(1.64)		
MHHI Delta$\|_{VertCo}$			0.0418	0.0449
			(1.22)	(1.50)
MHHI Delta$\|_{NoVertCo}$			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

Table 3. Panel Regressions of Industries' Markup on Common Ownership Decomposition with Downstream interaction

This table reports the results of multivariate OLS regressions explaining industry-level Markups with the components of MHHI Delta, interacted with the downstream variable, and controls for differences in industry structure. All specifications include quarter and industry fixed effects. Standard errors are robust to heteroscedasticity and clustered at the industry level. Variables are defined in Appendix C. t-statistics are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) Markup	(2) PCM	(3) Markup	(4) PCM
MHHIDelta$\vert_{VertCo}$	-0.0262	-0.0303	-0.0258	-0.0304
	(-0.41)	(-0.69)	(-0.41)	(-0.69)
MHHI Delta$\vert_{VertCo}$ * Downstream	0.126**	0.0956**	0.125**	0.0957**
	(2.09)	(2.00)	(2.08)	(2.01)
MHHI Delta$\vert_{NoVertCo}$	0.0631**	0.0210	0.0765**	0.0179
	(2.53)	(0.71)	(2.16)	(0.38)
MHHI Delta$\vert_{NoVertCo}$ * 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

Table 4. Alternative Panel Regressions of Industries' Markup on Common Ownership Decomposition with Downstream interaction

This table reports the results of multivariate OLS regressions explaining industry-level Markups with the components of C, the alternative common ownership measure, interacted with the downstream variable, and controls for differences in industry structure. All specifications include quarter and industry fixed effects. Standard errors are robust to heteroscedasticity and clustered at the industry level. Variables are defined in Appendix C. t-statistics are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(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

Table 5. The Implied Effects of M&As on Common Ownership

This table summarizes the implied changes in the common ownership measures and their components resulting from 64 mergers of institutional investors. The implied change is the counterfactual measure computed under the assumption that the merger has already taken place minus the actual common ownership measure in the quarter prior to the merger announcement. Variables are defined in Appendix C.

	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$\vert_{NoVertCo}$	-959.609	-11.196	-1.008	-0.162	0	0	0	0.067	5.242	54.218	540.386
MHHI Delta$\vert_{VertCo}$	-95.087	-4.422	-0.152	0	0	0	0	2.515	15.743	112.563	1051.306

Table 6. Difference-in-Difference Regressions of Industries' Markup on Common Ownership Decomposition with Downstream interaction

This table presents results of difference-in-difference regressions. The sample includes 12 quarters prior to each of the 64 institutional merger announcements and 12 quarters after each merger is completed. In Column (1), Treat is a dummy set to one if the implied change in common ownership is positive for that industry, zero otherwise. Instead, Columns (2), (3) and (4) consider implied changes in MHHI Delta$|_{VertCo}$ above, respectively, the percentiles 90, 95 and 97. Post is a dummy set to one for the post-merger period. Variables are defined in Appendix C. All specifications include controls for differences in industry structure and quarter and industry fixed effects. Standard errors are clustered at the industry level. t-statistics are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) PCM	(2) PCM	(3) PCM	(4) PCM
Treat$_{MHHI_Delta}$× Post	0.000760			
	(0.55)			
Treat$_{MHHI_Delta_{VertCo}}$× Post		-0.00917**	-0.0147**	-0.0134*
		(-1.99)	(-2.07)	(-1.93)
Treat$_{MHHI_Delta_{VertCo}}$× Downstream × Post		0.0181*	0.0336*	0.0281*
		(1.84)	(1.75)	(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

Table 7. Panel Regressions of Industries' Markup on Common Ownership Decomposition with Downstream interaction - Vertical Cost Share 9%

This table reports the results of multivariate OLS regressions explaining industry-level Markups with the components of MHHI Delta, interacted with the downstream variable, and controls for differences in industry structure. Two sectors are considered vertically related when the cost share is at least 9% in one direction. All specifications include quarter and industry fixed effects. Standard errors are robust to heteroscedasticity and clustered at the industry level. Variables are defined in Appendix C. t-statistics are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

	(1) Markup	(2) PCM	(3) Markup	(4) PCM
MHHI Delta$\|_{VertCo}$	-0.0236	-0.0296	-0.0231	-0.0300
	(-0.41)	(-0.69)	(-0.41)	(-0.69)
MHHI Delta$\|_{VertCo}$ * Downstream	0.127**	0.0897*	0.126**	0.0901*
	(2.06)	(1.86)	(2.05)	(1.87)
MHHI Delta$\|_{NoVertCo}$	0.0618**	0.0294	0.0763**	0.0163
	(2.42)	(1.00)	(2.07)	(0.33)
MHHI Delta$\|_{NoVertCo}$ * Downstream			-0.0192	0.0174
			(-0.65)	(0.41)
Controls	YES	YES	YES	YES
Industry FEs	YES	YES	YES	YES
Quarter FEs	YES	YES	YES	YES
N	28,674	28,674	28,674	28,674

Appendix A. Proof for the two-sector economy

- **Single integrated monopolist**: the U firms in the upstream sector and D firms in the downstream sector, by acting as an integrated monopolist, maximize their joint profit $\Pi_{UP+DOWN} = p_{DOWN}Q_{DOWN} - cQ$ by choosing the quantity Q_{DOWN} with $Q_{DOWN} = Q^{a_d+a_u} = Q$ with the last equality due to constant return to scale: the final demand for the good is $Q_{DOWN} = (cM)^{\epsilon}$, the final price is $p_{DOWN} = cM$ and the total profit is $\Pi_{UP+DOWN} = (cM)^{\epsilon}c(M-1)$ with M that is the markup[2]
- **Market for the intermediate good perfectly competitive and market for the final good monopolistic**: the downstream firms, acting as an integrated monopolist in their output market, maximize their joint profit $\Pi_d = p_{DOWN}Q_{DOWN} - p_{UP}Q_{UP}$ by choosing the quantity $Q_{DOWN} = Q_{UP}^{a_d} = Q_{UP}$: the final demand for the good is $Q_{DOWN} = (Mp_{UP})^{\epsilon}$ and the final price is $p_{DOWN} = p_{UP}M$.

  The upstream market is perfectly competitive, the price-taking assumption implies that $p_{UP} = c$ given that the marginal cost is constant; the intermediate demand for the good is $Q_{UP} = (cM)^{\epsilon}$ and total profit of the joint profit of the upstream firms $\Pi_u = 0$. This implies that the final price is $p_{DOWN} = cM$ and $Q_{DOWN} = (cM)^{\epsilon}$ resulting in a joint profit of the downstream sector equal to $\Pi_d = (cM)^{\epsilon}c(M-1)$, coincident with the total profit of the supply chain $\Pi_{UP+DOWN} = (cM)^{\epsilon}c(M-1)$.
- **Market for the intermediate good monopolistic and market for the final good perfectly competitive**: The downstream market is perfectly competitive, the price-taking assumption implies that $p_{DOWN} = p_{UP}$; the final demand for the good is $Q_{DOWN} = (p_{UP})^{\epsilon}$ and joint profit of the downstream firms $\Pi_d = 0$.

  The upstream firms, acting as an integrated monopolist in the market for intermediate goods, maximize their profit $\Pi_u = p_{UP}Q_{UP} - cQ$ by choosing the quantity $Q_{UP} = Q$. By substituting $Q_{DOWN} = (p_{UP})^{\epsilon}$, the maximization problem is solved with $Q_{UP} = (cM)^{\epsilon}$ and the intermediate price $p_{UP} = cM$ resulting in a total profit for the upstream firms equal to $\Pi_u = (cM)^{\epsilon}c(M-1)$, coincident with the total profit of the supply chain $\Pi_{UP+DOWN} = (cM)^{\epsilon}c(M-1)$.
- **Market for the intermediate good and final good both monopolistic**: as before, the monopolistic downstream market delivers a final demand for the good $Q_{DOWN} = (Mp_{UP})^{\epsilon}$ and a final price $p_{DOWN} = p_{UP}M$. The U upstream firms, acting as an integrated monopolist in the market for intermediate goods, maximize their profit $\Pi_u = \sum_{n=1}^{L}\pi_n = p_{UP}Q_{UP} - cQ$ by choosing the quantity $Q_{UP} = (Mp_{UP})^{\epsilon}$; the maximization problem is solved with $Q_{UP} = (cM^2)^{\epsilon}$ and the intermediate price $p_{UP} = cM$ resulting in a total profit for the upstream firms equal to $\Pi_u = (cM^2)^{\epsilon}c(M-1)$. Instead the total profit for the downstream firms becomes $\Pi_d = (cM^2)^{\epsilon}cM(M-1)$ leading to a total profit of the supply chain $\Pi_{UP+DOWN} = (cM)^{\epsilon}c(M-1)M^{\epsilon}(1+M)$.

[2]The Markup M is defined as the ratio of the final price to the marginal cost i.e. $M = \frac{p_{DOWN}}{Marginal\ Cost} = \frac{1}{1+\frac{1}{\epsilon}}$

Appendix B. Proof for the N-sector economy

We generalize the theoretical predictions by considering an economy with N firms distributed among S fully vertically related sectors $s = 1, 2, ..., S-1, S$. Firms in sector 1, the most upstream sector, incur a constant unit cost of production c to produce an intermediate good and they supply firms in sector 2 at a price p_1. More generally, firms in sector s supply firms in sector $s+1$ at a price p_s. The firms sector S, the most downstream, interface final users. Firms in all sectors have a production function with constant return to scale (CRS).

The consumers' downward-sloping demand function is denoted $Q_{DOWN} = p_{DOWN}^{\epsilon}$ where Q_{DOWN} is the quantity demanded, p_{DOWN} the final price and ϵ the constant price elasticity of demand.

We show how the final price, quantities produced and profits of the supply chain vary according to the level of competition in product markets by defining P as the number of monopoly markets within the supply chain while the remaining (S-P) markets are perfectly competitive.

By extending the proof in Section 3 to S sectors, it can be shown that the final price, the quantity produced and the total profit of the supply chain are respectively:

$$\begin{cases} p_S = cM^P \quad \text{if } P >= 0 \end{cases} \tag{16}$$

$$\begin{cases} Q = (cM^P)^{\epsilon} \quad \text{if } P >= 0 \end{cases} \tag{17}$$

$$\Pi_{1+2+...+S} = \begin{cases} 0 & \text{if } P = 0 \\ (cM)^{\epsilon} c(M-1) \sum_{p=1}^{P} M^{\epsilon(P-1)^2} & \text{if } 0 < P <= S \end{cases} \tag{18}$$

Given that $\epsilon < -1$, the markup is $M > 1$; the final price increases with the number of monopolistic markets P while the quantity produced Q decreases with the number of monopolistic markets. The highest quantity is produced when $P = 0$ i.e. all the S markets are perfecly competitive.

On the other side, the total profit of the supply chain is 0 when all the S markets are perfectly competitive; the total profit becomes positive for $P > 0$ but decreases as P increases. It follows that the maximum profit is achieved when $P = 1$: one market along in the supply chain is monopolistic while all the remaining $S-1$ are perfectly competitive.

Appendix C. Variable Definitions

Variable	Definition
MHHI Delta	MHHI Delta is the marginal increase in HHI attributable to common institutional ownership, common institutional voting control, and the market shares of the firms in the industry.
MHHI Delta$\|_{VertCo}$	MHHI Delta$\|_{VertCo}$ is the part of MHHI Delta driven by common owners with holdings in vertically related sectors.
MHHI Delta$\|_{NoVertCo}$	MHHI Delta$\|_{NoVertCo}$ is the part of MHHI Delta driven by common owners with no holdings in vertically related sectors.
C	Common ownership incentive term reflects the extent to which firms in an industry are connected by common ownership and voting control among institutional owners but does not depend on the respective market shares of firms in the industry.
C$\|_{VertCo}$	C$\|_{VertCo}$ is the part of C driven by common owners with holdings in vertically related sectors.
C$\|_{NoVertCo}$	C$\|_{NoVertCo}$ is the part of C driven by common owners with no holdings in vertically related sectors.
Markup	Markup is the average of an industry's firms' ratios of revenues over costs.
PCM	The price cost margin is the sum of sales minus cost of goods sold and the change in inventories divided by the sum of sales and the change in inventories.
Downstream	Downstream is the proportion of industry sales made directly with final users or exported.
Downstream Alt	Downstream is the proportion of industry sales made directly with final users.
Net CAPX	Total capital expenditures net of depreciation scaled by industry total assets.
Advertising	Total advertising expenditures scaled by industry total sales.
Firms with Blocks	The fraction of firms in the industry that have at least one institution that owns more than five percent of the firm.
1/No. Firms	The reciprocal of the number of firms in the industry.
HHI	The sum of squared market shares of the firms in the industry.
Vertical Integrated	The proportion of industry sales from secondary activities of companies carried out in vertically related sectors with respect to the industry to which they belong
ln(Assets)	The natural logarithm of the total assets for the industry.
Sales Growth	The percent change in total industry sales in quarter t from the total industry sales in quarter t-1.
Capital Intensity	Total industry assets divided by total industry sales.
R&D Intensity	Total industry R&D expenditures divided by total industry assets.
Leverage	Industry total debt divided by the sum of total debt and total market equity.
Concentrated	Industry-level indicator variable set to one if the industry's time-series average HHI is in the top tercile.