

ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
Master Thesis Financial Economics

The Effect of Common Ownership on Sector-Level Profitability & Innovation Measures

Wessel Caffa (649599)



Supervisor:	Marc Gabarro Bonet
Second assessor:	N.A.
Date final version:	5th July 2024

The content of this thesis is the sole responsibility of the author and does not reflect the view of the supervisor, second assessor, Erasmus School of Economics or Erasmus University.

Abstract

This study explores the effects of increased common ownership on industry-level innovation and profitability metrics within High-Tech sectors. Contrary to expectations that common ownership might lead to reduced competition and thereby increase profitability, the findings indicate that there is no robust positive correlation between common ownership and industry-level profitability. Similarly, common ownership does not exhibit a robust negative correlation with patenting activity or research and development expenditures relative to total assets. Moreover, there is no robust positive correlation between common ownership and the number or value of patent citations, which might suggest a reduction in duplicate R&D expenditures due to cooperative behavior among commonly owned firms. These conclusions hold across multiple specifications and include tests for exogenous variation in common ownership metrics. The study provides no definitive evidence to justify regulatory actions aimed at limiting inter-industry common ownership within the High-Tech sector.

Contents

- 1 Introduction** **3**

- 2 Literature Review** **6**
 - 2.1 Product market competition 6
 - 2.2 Innovation 6
 - 2.3 Common Ownership 7
 - 2.4 Common Ownership & Product Market Competition 7
 - 2.5 Common Ownership & Innovation 10

- 3 Data & Main Formulas** **12**
 - 3.1 Sample Selection 12
 - 3.2 Variable Definitions 12
 - 3.3 Summary statistics 16

- 4 Methodology** **18**

- 5 Results** **21**
 - 5.1 Relation between Common Ownership and Industry-Level Profitability 21
 - 5.2 The impact of Common ownership in High-Tech sectors on innovation 22
 - 5.3 Robustness Check of the Relation between Common Ownership and Industry-Level Profitability & Innovation metrics 23
 - 5.4 Exogenous variation in common ownership metrics 24
 - 5.5 Discussion 25

- 6 Conclusion** **25**

- 7 Limitations** **26**

- A General figures regarding High-Tech and Common Ownership metrics** **27**

- B Tables on Filtering and Summary Statistics** **31**

- C Main regressions employed** **35**

- D Regression Results** **40**

- E Programming code** **57**

1 Introduction

Common ownership refers to the situation of holding shares in firms that are natural competitors. This form of ownership has risen considerably in the last decades as visualized in Figure 2 and Figure 3, attributed to the rise in index funds, institutional ownership, and asset management industry consolidation. Theoretical literature indicates that common ownership may, in specific circumstances, lead to anti-competitive behavior among firms (Azar & Vives, 2021). A clear instance of companies in an industry working together to limit production and maintain stable prices is the Organization of the Petroleum Exporting Countries (OPEC). In a recent article, OPEC+ countries, stated that their aim in cutting production was "balancing the oil market" (EuroNews.com, 2024).

Previous studies have examined the impacts of common ownership levels. The seminal work by Azar et al. (2018), which uncovered a causal link between common ownership and airline ticket prices, has significantly propelled research interest in this domain. Subsequent studies have further explored the relationship between common ownership and product market outcomes: Torshizi & Clapp (2020) and Azar et al. (2022) find evidence suggesting a positive effect on seed prices and deposit rates, respectively, whereas Backus et al. (2021) reports a negative impact on cereal prices. Conversely, Koch et al. (2021) and Kennedy et al. (2017) observe no significant effect on industry-level markups and product prices. One potential explanation for the various findings is the variability in how control is measured across studies. Many rely on voting rights to measure an individual investors influence over a firm; however, this metric has been found to be inconsistently measured over time and among institutions (Gerardi et al., 2023). Another possible explanation is that common ownership only leads to anti-competitive effects in certain sectors and conditions. Therefore, although most recent studies have not shown common ownership causing higher product prices, it is still challenging to determine if it plays a role in firms' anti-competitive behavior.

In building upon the extensive analysis conducted by Koch et al. (2021), this study seeks to test the reproducibility of their conclusions regarding common ownership's negligible effect on product market profitability by applying similar methodologies across different time periods and sector classifications. Previous research focused on asset management consolidation up to Q4 2014. Since then, significant mergers have taken place in the industry, such as Franklin Templeton's acquisition of Legg Mason in 2020, which expanded its equity portfolio from approximately \$270.5 billion to \$432.0 billion according to TradeNews.com (2020). Additionally, Morgan Stanley's acquisition of Eaton Vance in the same year added about \$135.2 billion to the bank's equity assets under management (MorganStanley.com, 2020). Considering the varied findings and recent mergers in the asset management industry, this study aims to reevaluate previous conclusions using updated data from 2001 to 2023. This period is characterized by significant ownership shifts due to mergers and acquisitions in the sector. This study concentrates on industries identified as High-Tech, which have a notably higher percentage of employees in Science, Technology, Engineering, and Math compared to the average. Non-High-Tech sectors are defined by NAICS codes not classified as High-Tech according to Census.gov (2023). The High-Tech industry, characterized by substantial investments in Research and Development (R&D), faces high stakes due to these costs (Dosi & Nelson, 2010). Data confirms that High-

Tech firms have significantly higher R&D expenses as a fraction of total assets, approximately 5 times greater on average than Non High-Tech sectors as can be seen in figure 1, also common ownership tends to be higher for these High-Tech sectors as seen in Figures 4 and 5. Reducing duplicate R&D expenditures could thus offer substantial cost savings and increase profit margins by making R&D spending more efficient. This concept aligns with findings that common ownership in venture capital leads to selective funding practices, especially where R&D costs are higher, aiming to cut redundant expenses (Li et al., 2022). Based on this, I propose the following hypotheses.

The first hypothesis is formulated as follows: The null hypothesis (H_0) suggests that common ownership does not significantly impact industry-level profitability in High-Tech sectors, while the alternative hypothesis (H_a) asserts that common ownership significantly enhances industry-level profitability in High-Tech sectors.

Additionally, the subsequent hypothesis addresses the influence of common ownership on innovation within the High-Tech sector, suggesting that common ownership may optimize R&D processes, resulting in fewer but more impactful patents. By solely funding the most promising projects, firms are likely to generate patents that are more significant and garner more citations.

The second hypothesis proposed in this paper is articulated as follows: The null hypothesis (H_0) states that common ownership has no effect on R&D investment, nor does it impact the quantity, value or citation rate of patents in high-tech sectors. Conversely, the alternative hypothesis (H_a) posits that higher common ownership is associated with reduced R&D intensity and a decreased number of patents issued in high-tech sectors. Moreover, it suggests that such patents tend to receive a higher number of citations and possess greater value.

This research investigates the impact of common ownership on industry profitability and innovation, with innovation measured through patenting and citations. The study employs panel regression methods, utilizing data on institutional ownership, firm-level patenting, accounting, and stock market variables. The aim is to identify correlations between various common ownership metrics and several dependent variables: the average industry markup, Price-Cost Margin (PCM), the number and value of patents, the citations received by these patents, and the industry R&D intensity. The analysis focuses on industries as units, encompassing all North American Industrial Codes (NAICS) that have a minimum of 10 consecutive data points for at least two firms, totaling 216 unique NAICS codes. Following the guidelines recommended by Koch et al. (2021), the filtered dataset comprises 3,886,206 firm-manager-level observations. Key variables include firm-manager-level ownership, firm-level patenting and accounting information. Ownership data is sourced from the Thomson Reuters 13-F database, patenting data is retrieved from the work by Kogan et al. (2017), accounting figures are retrieved from the Compustat database, and outstanding stock adjustment factors are obtained from the Center for Research in Security Prices (CRSP) via Wharton Research Data Services (WRDS).

I anticipate that common ownership will not influence product market prices or competition, since most institutional investors diversify their holdings across various sectors. The gains from increased margins in one sector are offset by higher input costs in another sector within their portfolio, leading to no overall advantage at the portfolio level for institutional investors (Azar & Vives, 2021). However, environments with a higher concentration of less diversified

owners, such as private equity firms, may yield different outcomes due to their distinct incentive structures compared to publicly traded equities. If the empirical evidence robustly supports reduced competition due to common ownership, it may justify the introduction of new antitrust legislation, as proposed by Posner et al. (2016); Elhauge (2020). However, if this relationship proves to be spurious, the need for new antitrust laws in the forms previously suggested is less unambiguous. Instead, adopting a more pragmatic approach, as recommended by Rock & Rubinfeld (2017), could be more appropriate.

2 Literature Review

2.1 Product market competition

Product market competition has been studied extensively in the empirical literature. The most notable proxies are the Herfindahl-Hirschman (HHI) index, the price-cost margin (also known as Lerner Index), the number of competitors and the cross price-price elasticity of demand. The HHI is computed as the sum of the squares of all product shares, and its concept of measuring market concentration dates back to the book by Hirschman (1945). The Price-cost margin is computed as sales minus cost over sales, measuring the ability of firms to price their goods higher than their costs. The number of firms competing in a single product market reflects the intensity of competition; a higher number of firms indicates lower entry barriers and thus more competition. Finally, cross-price elasticity reflects how much demand for a product will change as a result of a change in the price of a competitor's product (Fresard & Phillips, 2022).

In this paper, product market competition is measured using a proxy for industry profitability, which refers to the average profitability within an industry. This profitability is measured based on firm-level accounting data that is aggregated to the industry level. It serves as an economic metric to evaluate the competitive environment of the specific industry's product market (Dou et al., 2021). In order to achieve an accurate proxy for industry-level profitability, two measures are used markups and price-cost margins (PCMs) following the work by Koch et al. (2021).

The origin of the Price-cost margin, also known as the Lerner Index, stems from the seminal work by Lerner (1934). He identified that there can be a social loss (a less efficient market to the detriment of consumers) resulting from firms with monopolistic characteristics deviating from a social optimum. In his paper, he argued that the larger the difference between the price a company charges for its good and the marginal cost of that good, expressed as a ratio of the price, the stronger the monopoly power of that firm. Lerner's work is based on the standard of a "hypothetical competitive equilibrium," where there are constant returns to scale and the marginal costs are equivalent to those of the firms whose monopoly power he measures (Elzinga & Mills, 2011). Thus, rather than measuring the absolute power of monopoly or oligopoly, it measures market imperfection (Scitovsky, 1955).

2.2 Innovation

The vast attention innovation has garnered from researches has resulted in a wide literature, based on a abstract definition of innovation. Nowadays there is not a widely accepted theory that fully explains all aspects of innovations (Damanpour, 1992; Gatignon et al., 2002; Johannessen et al., 2001). The first mention in the literature to formulate innovation was a book by Schumpeter (1934), he defined innovation in economics broadly as any novel way of doing things.

Innovation can be defined as any type of change, enhancement, or new development, regardless of whether it targets a product, process, system, or method, as long as it has been effectively implemented or utilized in the market. This concept of innovation involves a multistage process where initially, novel ideas are generated and tested. Following this, these ideas need to be developed into actual products or systems and ultimately introduced into the market, impacting

individuals, businesses, and society as a whole (Schumpeter, 1939; Thompson, 1965; Ven, 1986).

Due to this broad definition, it is important for research to focus on a narrow subdivision of the term. Most of the work as a result has focused on technological innovation, precisely in the product market, due to the focus of R&D as a prerequisite for innovation, as it increases firms ability to innovate, thus is used as a starting point for analyzing innovation (Balkin et al., 2000; Dalziel et al., 2011; Kor, 2006).

Furthermore, varying parts related with R&D are used in the literature as innovation indicators as described by Bustos & Hernandez-Lara (2016). Some examples are, R&D (R&D expenses over total assets) intensity and R&D expenditures which are seen as the investment effort firms make into generating innovations as is done in Smith et al. (1998); Hitt et al. (1991). The number of patents is used as an outcome variable, resulting from innovation activities (Alegre-Vidal et al., 2004).

2.3 Common Ownership

For the purpose of this study, a clear understanding of common ownership is required, because this definition will define how we measure it. According to Cambridge dictionary, Common ownership describes a situation in which several related companies are owned by one person or organisation . The academic definition is similar: "one institutional investor owning a sizeable number of publicly traded shares in two (or more) rival firms" (Hennig et al., 2022). Common ownership can be viewed as an example of a market structure, which has risen sharply in recent decades due to the rise in index funds and diversification (Backus et al., 2021). Measuring common ownership empirically is often derived from ownership shares of institutional investors in companies, Bresnahan & Salop (1986) came up with a measure to express the strength of cross relations in institutional holdings called Modified Herfindahl-Hirschman Index (MHHI), O'Brien & Salop (2000) updated and extended this metric.

The theory of profit maximization for homogeneous shareholder interests stems from the work of Fisher (1930). Which established the foundation for economic theory, assuming that firms are price takers in product and asset markets. Following these assumptions, firms choose to maximize shareholder value of the investors in their firms. However, firms do not exist in a vacuum, they interact with other firms through their participation in product markets. These relationships in product markets underlie the competitive dynamics (or their absence) and often receive significant consideration from policymakers due to the societal importance of maintaining fair competition in markets. The primary aim of regulation to sustain competition is to prevent businesses from disadvantaging consumers (or competitors) by setting prices significantly above (or below) the cost of production (Fresard & Phillips, 2022).

2.4 Common Ownership & Product Market Competition

The view that shareholder diversification might cause firms to consider the effects of their policies on other firms is therefore theoretically examined, with the theoretical literature of common ownership's effect on product market competition coming from two theoretical papers Rubinstein & Yaari (1983); Rotemberg (1984). The papers share the assumption of a perfectly competitive stock market, in which investors trade the securities of natural competitors. Rubinstein &

Yaari (1983) differs in their assumptions, as their work assumes perfectly competitive product markets. Shareholders trade with the goal of reallocating payoffs and maximizing the total combined payoffs. Resulting from this shareholder behavior, the equilibrium outcome is a scenario in which there is collusion in the underlying product markets of these firms and lower output. Rotemberg (1984) differs in their assumption for the desire to trade of investors, they assume that investors desire a properly diversified portfolio. Resulting from portfolio optimization, they end up owning shares in natural competitors who operate in the same product markets, firm managers respond to these allocations by setting output levels which maximize portfolio level returns for the shareholders, based on their proportional ownership. Both papers predict lower output in equilibrium. Continuing on this premise Azar (2011) introduces a new theoretical paper. This paper presents a model where oligopolistic firms compete, investors exhibit risk neutrality and vote on all policy decisions, and firm policies are determined through majority votes by shareholders, which managers then implement. Shareholders thus determine firm decisions, in term leading to an equilibrium in which managers maximize the portfolio return of investors proportional to their ownership share. According to the theory presented, the level of competition would be best quantified by the modified Herfindahl index (MHHI), under which managers incorporate shareholders objective of maximizing portfolio returns. The paper proposes a trilemma, that perfect shareholder level portfolio diversification, perfect alignment of managers and owners, and perfect competition are not simultaneously attainable. Only two out of three are attainable, this trilemma indicates a core attribute common across all theoretical models anticipating common ownership resulting in anti-competitive actions: firm managers do not maximize their own firms profit, but rather maximize portfolio level returns of investors.

Following this theoretical literature empirical studies test the hypothesis set forth, that common ownership leads to incentives to compete less aggressively in product markets, evidence is presented in the seminal study of the airline industry by Azar et al. (2018). The study analyzes the effect of common ownership on airline ticket prices, the author finds that when firms have reduced incentive to compete resulting from common ownership, the prices in that market are higher and the output is lower. The authors argue that this effect might result from shareholders not agreeing on profit maximization of the firm (but rather seeing portfolio return maximization), when these firms are not price takers, as noted earlier in the theoretical paper by Hart (1979). The findings from Azar et al. (2018) garnered a lot of attention and sparked significant interest in the discussion about the costs and benefits of common ownership. This includes debates on whether such concerns justify the enforcement or creation of antitrust legislation against financial institutions to protect consumers in product markets. The study by Posner et al. (2016) advocates for the introduction of new regulations, whereas Elhauge (2020) explores the feasibility of enforcing existing antitrust laws. On the other hand, Rock & Rubinfeld (2017) adopts a more cautious stance concerning the empirical findings presented by Azar et al. (2018). The authors assert that the behavior of diversified institutional shareholders does not violate the Clayton Act's antitrust provisions, thereby negating the need for any policy interventions. Consequently, it is necessary to review current empirical studies and conduct further research to examine the strength and validity of the anti-competitive effects of common ownership, which will be discussed in the sections that follow.

Kennedy et al. (2017) responds to the paper by Azar et al. (2018), by replicating their dataset of airline price data to test the robustness of the relationship between common ownership and airline ticket prices. The paper finds no evidence that common ownership leads to higher prices in the airline industry. The authors attribute this to differences in methodology, suggesting that investment decisions are not exogenously determined; firms with higher markups are likely to receive more investment, leading to higher common ownership of firms capable of charging higher prices. Koch et al. (2021) examines the relationship between common ownership of firms within an industry and competition in the product market. The authors find no convincing evidence that higher common ownership shares in firms result in higher product market prices. Their analysis focuses on product market prices within the industry and shows that the results are not due to low-power tests, as the bounds of their estimates are tight. This allows them to reject even modest economic effects, suggesting that common ownership does not lead to anti-competitive pricing behavior. Torshizi & Clapp (2020) examines the impact of common ownership on prices in the seed market. The authors investigate the relationship between common ownership and seed prices, focusing on soy, corn, and cotton seeds. Their analysis reveals significantly higher prices for these seeds due to increased levels of common ownership. They explain this effect through their theoretical model, which suggests that common ownership modifies competitive incentives among firms, leading to an inferior outcome characterized by a lower equilibrium level of production and a higher price level. Backus et al. (2021) investigates the effect of common ownership on the prices of ready-to-eat cereal. The authors find that the modeled impact of common ownership suggests significant potential changes in cereal prices. However, they caution that despite finding evidence of a potential increase in prices, their data aligns more with the hypothesis of firm-level profit maximization. They note that the pricing system suggested by the common ownership hypothesis is inconsistent with the observed pricing behavior. Azar et al. (2022) investigate the effects of changes in common ownership of banks on branch-level deposit interest rates and account terms. Their findings reveal that an increase in common ownership leads to wider deposit interest rate spreads, resulting in less competitive rates for depositors and higher pricing for banking products. The authors interpret these results as banks prioritizing the financial interests of shareholders, while overlooking potential antitrust issues, informational asymmetries, and conflicts of interest between shareholders and management. Gibbon & Schain (2023) studies the relationship of common ownership on firm level markups. They measure markups differently from previously named literature instead of measuring them directly from firm level accounting data they follow the work by De Loecker & Warzynski (2012) using a measure of elasticity of output relating to materials and revenue shares of material expenditures. A positive relationship between common ownership and markups is identified. According to the authors this suggests that common ownership may result in higher product market prices, especially for the top 10 percent of companies. Gibbon & Schain (2023) explores the influence of common ownership on firm-level markups. Unlike previous studies, Gibbon does not rely directly on firm-level accounting data for measuring markups. Instead, following the methodology of De Loecker & Warzynski (2012), Gibbon employs a measure based on the elasticity of output concerning material usage and the revenue shares of material expenditures. The study identifies a positive correlation between common ownership and markups. The authors interpret this

finding as an indication that common ownership could lead to higher market prices, particularly among the top 10 percent of companies.

2.5 Common Ownership & Innovation

Given that the primary focus of common ownership literature has been on product market outcomes and pricing, there has been relatively little exploration into the relationship between common ownership and innovation outcomes. The earliest theoretical paper I found on this topic examines how cross holdings influence the extent to which firms within an industry can support each other in internalizing technological spillovers from their innovations. The authors propose an interesting testable implication, which is the focus of this research: they suggest that industry profits should rise with increased levels of common ownership due to the internalization of innovation benefits shared among firms with common owners (Vives, 2020). The empirical literature divides into two sub-groups: one examining the effect of common ownership on venture capital (VC) held private firms, and the other focusing on its impact on listed firms. Both approaches share a similarity they analyze the effect of common ownership at the firm level.

The VC sector is particularly interesting due to two key characteristics not typically observed in public firms: VCs tend to hold a larger share of control rights in the firms and generally do not diversify as extensively as index funds do (Gerardi et al., 2023). The research focusing on the relationship between common ownership and private firm innovation sharing hypothesis is researched by Gonzalez-Uribe (2020). In her study she investigates the effects of VCs ties on companies access to strategic alliance partners. By analyzing the VCs investment and syndication actions, the study finds that VCs ties significantly improve companies' ability to form strategic alliances. Moreover, alliances are more common between companies that are indirectly linked through VC syndication networks. Li et al. (2022) investigates the relationship between common ownership and innovation using project-level data from pharmaceutical startups and data from VC investors. The study finds that common ownership leads VC firms to suppress innovation in lagging firms by withholding funding and reallocating resources from these lagging startups to leading ones. This effect is more pronounced where R&D costs are higher and technological similarities are greater, indicating efforts to reduce duplicate costs and enhance market power for their successful firms.

The literature on publicly listed firms includes Anton et al. (2024), who examines the relationship between innovation and common ownership. The authors argue that firms have insufficient incentives to innovate when competitors benefit from their innovation through knowledge spillovers. They suggest that common ownership allows the benefits of knowledge spillovers to be internalized by the innovating firm, thereby creating an incentive to innovate when spillovers are significant. Conversely, when knowledge spillovers are absent, innovation in commonly owned firms would merely result in market share stealing, thus reducing the incentives to innovate. Kostovetsky & Manconi (2020) examines the relationship between common ownership and the spread of innovation by studying firms in the Russell 1000 and Russell 2000 indices. The authors find that firms with the same common owners exhibit a higher level of patent citations. Additionally, they discover that when a firm moves from one index to the other, it receives more citations from firms within the new index. This suggests that common ownership leads

to increased citations from firms sharing the same owners, thereby enhancing the dispersion of technology due to shared ownership.

3 Data & Main Formulas

3.1 Sample Selection

The institutional ownership data to be utilized in this research originate from the 13-F filings from the Thomson Reuters database, only including the common shares share-code (10,11) following the work of Torshizi & Clapp (2020). These quarterly filings are obtained for the period ranging from the first quarter of 2001 until the fourth quarter of 2023. Financial statement data for firms covered in the 13-F filings is obtained from the merged Compustat-CRSP (Center for Research in Security Prices) database. The dataset containing firm-level patent data, initially presented by Kogan et al. (2017), encompasses data up to 2010. The dataset has been expanded to include information up to the year 2022, using the same methodology as the initial paper, through an online GitHub file by Zheng et al. (2024).

The next step is to merge the 13-F dataset with the Compustat dataset, using SAS-Studio from Wharton Research Data Services (WRDS). The GitHub file by Palacios et al. (2009) was very helpful for this process. To accurately compute the key variables such as total shares outstanding, ownership shares, and market equity, it was necessary to follow a series of intermediate steps as recommended by the guidelines from WRDS for utilizing the CRSP database shares outstanding data. Specifically, shares outstanding (shrout) should be adjusted by multiplying it with the cumulative adjustment factor for shares (CFACSHR) and then further scaling up by a factor of 1000. This adjustment ensures that the number aligns properly with the variables for shares owned. This process was supported by the JupyterHub environment in WRDS, and the Python file by Drechsler (2020).

The calculation for total adjusted shares held involves summing the sole voting shares, shared voting shares, and non-voting shares, and then multiplying the result by the cumulative factor shares (CFACSHR). Following the completion of these and the above mentioned steps I filter the combined dataset on the following criteria in table 1, if met the files can be kept in our dataset if not they will be excluded. Both of these approaches closely mirror the actions performed by Koch et al. (2021), with minor adjustments to the consecutive observations (from at least 20 consecutive data points to 10) to account for a significantly shorter data range in this analysis.

3.2 Variable Definitions

As described by Gilje et al. (2018), researchers have not reached a consensus on which measure most accurately quantifies common ownership due to the varying benefits and shortcomings of the available measures. In response this paper uses five metrics to quantify common ownership.

The first measurement of common ownership is the modified Herfindahl-Hirschman index, specifically the revised version expanded by O'Brien & Salop (2000). This model is useful as it can be split up into the HHI (industry concentration) and MMHI-Delta term (common ownership).

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

s_j refers to the market weight of firm j 's revenue in the tech sector for that period, and k indexes firm j 's competitors which will be weighted by their respective market shares. Where β_{ij} is the ownership share of firm j accruing to shareholder i , y_{ij} is the control share of firm j exercised by shareholder i , and k indexes firm j 's competitors. To compute the formula, I followed the steps outlined by Lambert & Sykuta (2018), using the simplified assumption that ownership shares are equivalent to control shares as is prescribed by Gibbon & Schain (2023). This allows the formula for MHHI-delta to be expressed as follows:

$$\underbrace{\sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \beta_{ij} \beta_{ik}}{\sum_i \beta_{ij}^2}}_{\text{MHHI Delta}}$$

The second metric, C , measures the mean level of common ownership links between firms within an industry. This metric is similar to the revised MHHI-Delta term but simpler as it does not account for the size of the firms in terms of relative market share. Described by Kennedy et al. (2017), C is expressed as:

$$\frac{\sum_i y_{ij} \beta_{ik}}{\sum_i y_{ij} \beta_{ij}} \quad (1)$$

This equation illustrates the relationship between an asset manager i and firm j , along its competitors indexed by k . C underscores the degree to which firms are interconnected through common ownership and voting power within the industry, without considering the size of the firms.

The third term, referred to as density, aligns closely with a measure of common ownership described in Azar (2011). Density quantifies the proportion of firm pairs that are interconnected within an industry relative to the total possible firm pairs. A pair of firms is considered related if there is a common owner holding at least 5% of the shares in each firm, referred to as a blockholder. The threshold of 5% ownership is chosen because it supports reasonable assumptions that these owners have sufficient incentives to influence the firms' corporate policy actions.

The fourth metric Percentage of Common Funds (PCF) is defined as the ratio of blockholders who own stakes in two or more companies within the same industry to the total number of blockholders in that industry. If there are no blockholders in the industry, the PCF is set to zero. This metric of common ownership is similar to interpretations found in Cohen & Frazzini (2008); Anton & Polk (2014), where the authors employ the PCF metric to assess the extent and likelihood of blockholders maintaining substantial stakes in competing companies within the same industry.

The fifth metric is referred to as the percentage of common stocks (PCS). This metric is calculated as the ratio of stocks in an industry that have at least one common blockholder (a manager who owns at least a 5% stake in that firm and a 5% stake in another firm within the same industry) to the total number of stocks within that industry. This metric measures the strength of links in an industry, originating from institutional common block ownership. This metric was also used by Koch et al. (2021).

The two main dependent variables for industry level profitability are Markup and PCM, Markup and PCM are industry level variables. Markup is calculated by using firm-level data aggregated to the industry level, these inputs are then used to compute the industry level Markup levels. This approach for calculating markup is similar but not identical to the approach in the paper by Azar (2011) & Koch et al. (2021) as those approaches are approximated at the firm level and then aggregated. However, due to those measures being approximated at the firm level outliers seem to skew the averages of these measures, resulting in a measure which is less closely related to industry level profitability. Thus by calculating the measure at the industry level the effect of outliers is minimized.

The two main dependent variables for industry-level profitability are Markup and PCM. Markup and PCM are variables at the industry level. Markup is calculated using firm-level data that is aggregated to the industry level. These inputs are then used to compute the industry-level Markup levels. This approach to calculating markup is similar, but not identical, to the approach described in the papers by Azar (2011) and Koch et al. (2021), where the measures are approximated at the firm level and then aggregated. However, because these measures are approximated at the firm level, outliers can skew the averages of these measures, resulting in a measure that is less closely related to industry-level profitability. By calculating the measure at the industry level, the effect of outliers is minimized.

$$Markup_{i,t} = \frac{Sales_{i,t}}{Sales_{i,t} - EBIT_{i,t}},$$

In this equation, $EBIT_{i,t}$ represents the earnings before interest and taxes for the industry i at time t , and $Sales_{i,t}$ reflects the level of sales for industry i at time t . The markup is defined as the industry-level ratio of firms' revenues to their costs.

The second industry profitability metric, the PCM (Price-Cost Margin) is calculated using firm-level quarterly Compustat data, which is subsequently aggregated to the industry level to determine the PCM at this level. For each unique combination of date and industry, the total sum of all sales, COGS, and inventories is calculated, where i represents the industry and t denotes the period in which the estimation of the Price-Cost Margin is calculated. In this model, changes in inventory are reintegrated into margins to account for variations in input prices that are not yet reflected in current sales. Following the work by Domowitz et al. (1987); Phillips (1995).

$$PCM_{i,t} = \frac{Sales_{i,t} - Cost\ of\ goods\ sold_{i,t} + \Delta Inventories_{i,t}}{Sales_{i,t} + \Delta Inventories_{i,t}},$$

After aggregating the main variables for testing the first hypothesis, attention shifts to generating the variables necessary for examining the second hypothesis related to patent data. The main dependent variables for the second hypothesis are R&D intensity (R&D expenditures over total assets) at the industry level, the natural log of the average patents in the industry, the natural log of the average citations of that industry, and the natural log of the real value (inflation adjusted value) of a patent. Since the dataset includes industry-level observations, while the patent data is at the firm-level, it is necessary to first match this data at the firm level before aggregating it to the industry level. The first step in firm-level matching involves aggregating the data by firm-date, because holdings data is recorded only at the end of each quarter. Merging then takes place based on the relevant date when a patent is issued, which is subsequently transformed into the corresponding year-quarter format. Following this transformation, the data is aggregated by each firm, as indicated by its unique firm identifier, PERMNO, and by date-quarter combinations. This aggregation captures the number of patents issued during this period and the citations received for each patent up to 2022. After merging this data with the firm-level data using PERMNO and date-quarter variables, it is then aggregated to the industry level (NAICS) by calculating the average number of patents, the citations, and the inflation-adjusted real value of the patents. Following this aggregation, the natural logarithms of these three variables are computed to facilitate analysis. Finally, R&D intensity is calculated as outlined below and is employed as a control variable in the analysis of the first hypothesis and as a dependent variable in the second hypothesis.

Important control variables included in the regressions are the following: Ln(Assets), which is simply the natural logarithm of the industry's total assets; 1 / No. Firms, which is simply 1 divided by the number of firms present per NAICS date combination; Capital Intensity, which is calculated as the ratio of total industry assets to total industry sales; Sales Growth, which is the percentage growth in the industry's sales compared to the previous quarter; R&D Intensity, which measures the ratio of total industry R&D expenditures relative to total assets of that industry; R&D Missing, which is a dummy variable that equals one if the total industry-level R&D expenditures are missing; and finally, Leverage, which is simply the industry level total debt to the sum of total debt and total market equity. Based on the insights provided by Elhauge (2020), this research has excluded the control variables 'off degree' and 'firms with blocks' from the analysis, which were used in the work by Koch et al. (2021) in comparable regressions. Elhauge notes that 'off degree' which measures the connections between firms sharing common block owners but not classified under the same North American Industry Classification System (NAICS) code and the firms with blocks ratio of firms in an industry with at least one blockholder (at least 5% ownership by an asset manager) to the total firms in the industry, are suspected to be strongly correlated with the amount of horizontal shareholding. This significant correlation introduces a risk of misattribution due to the effects of multicollinearity (Elhauge, 2020).

3.3 Summary statistics

For the summary statistics my main variables are reported for my 4 subsections of data, MHHI-Delta, C and the Density measure could not be calculated efficiently in stata due to the size of the dataset, and the reshaping requirement of the data in order to calculate pairwise relationships. Therefore I incorporated python in combination with a unique identifier I created in stata (subgroup_id) which sorts the data on naics and date and gives all unique combinations their own identifier, following this I ran a loop over each unique combination of date and naics. I verified a few examples by hand in excel to ensure the accuracy of my measure. In the table 2 are the main summary statistics, aggregated at the industry level, the first 5 measurements are common ownership metrics, following variables start of with the two metrics for profitability, the last column of other industry variables are the control variables included in the regressions. Variables based on accounting data are winsorized at the 1st and 99th percentile. PCM and Markup average in this sample on 0.345 and 1.089 respectively. The average of MHHI_Delta, C, PCF, PCS and density are 1932.333, 0.177, 0.186, 0.486 and 0.233. These measures have increased significantly from previous analyzed periods, (e.g. 1985Q1-2012Q4 where MHHI_Delta on average was reported as 1359, implying an increase of roughly 42% on average of the MHHI_Delta measure between that period and the current 2001Q1-2023Q4 period (Koch et al., 2021)). The correlations between the different metrics for quantifying common ownership are displayed in table 6, these correlations range from 0.0121 to 0.9726, these greatly varying correlations reflect differences between the common ownership metrics. The correlation between Markups and PCMs is 0.2418 when the Markup variable is calculated at the firm level, and the average is taken for each industry (NAICS) and date (Quarter) combination. When aggregating the inputs for Markup at the industry level and subsequently calculating the markup measure, the correlation increases to 0.5548 as seen in Table 7. This deviating form of aggregation limits the impact of outliers on the industry markup levels. This is why I choose to modify this metric and calculate markups directly at the industry level.

This paper mainly analyzes two sub-samples of the data the part classified as High-Tech and the part classified as Non-High-Tech. These are chosen as the relationship with common ownership has not yet been researched before using accounting data for Markups and PCMs, and because firms in a highly competitive industry with larger R&D expenditures, could benefit more from reducing duplicate R&D expenditure. For further reference, this paper relies on the classification from the Business Dynamics Statistics of U.S. High Tech Industries (BDS-HT). These industries are classified as High Tech due to their intensity in Science, Technology, Engineering, and Math (STEM). Sectors are classified as BDS-HT if, over eleven years of data, they have at least six observations where STEM employment exceeds the mean by a factor of five. The following sectors met these criteria in 2019 (Census.gov, 2023). A dummy variable is created to track whether a firm is classified as High.Tech according to the classification, with a value of 1 if the sector classification (NAICS) is in Table 8 and 0 otherwise. Additional summary statistics for industries classified as High-Tech are included in Table 3. As can be clearly observed in this sub-sample is that common ownership levels are significantly higher within these industries. For instance, the average MHHI Delta for High-Tech industries is 3307, compared to an overall sample average of 1946. This pattern is consistent across other common

ownership metrics, except for Density, which is notably lower in the High-Tech sub-sample.

Furthermore, the variables used for estimating the regressions to answer the second hypothesis form their own sub-sample, identified by the presence of at least one firm in the industry that has filed a patent in that quarter. These summary statistics are shown for the full sample in Table 4 and for the High-Tech sub-sample in Table 5. The main dependent variables in the full sample: natural log of patents, citations, real value of patents and R&D intensity have mean values of 1.797, 1.916, 2.362, 0.005 respectively. In the High-Tech sub-sample these main dependent variables: natural log of patents, citations, real value of patents and R&D intensity have mean values of 2.544, 2.223, 2.223, 0.012 respectively.

Significantly, the summary statistics reveal that High-Tech sectors exhibit higher common ownership measures, such as MHHI Delta, suggesting an ownership structure with more cross-holdings compared to the general sample. This concentration is hypothesized to influence innovation outcomes, such as patent issuance and its subsequent citations, evidenced by higher mean values in the log of patents, citations, and R&D Intensity within these sectors. Which is what would be expected, from industries classified as High-Tech, quite surprising is that the log of the real value of patents is lower for the High-Tech sub-sample.

4 Methodology

This study employs multivariate regressions to examine the first hypothesis regarding the relationship between industry-level profitability measures, Markups and Price-Cost Margins (PCMs), and metrics of common ownership. To account for industry structure, control variables such as the logarithm of assets and the reciprocal of the number of firms in the industry are included. This approach allows an assessment of how various common ownership measures relate to different profitability metrics at the industry level.

The analysis utilizes multivariate regressions, analyzing multiple dependent variables (Markup and PCM) simultaneously. This method is chosen to effectively evaluate the impact of common ownership on these distinct profitability variables. The regression models incorporate both time (quarterly) and industry fixed effects to control for unobserved heterogeneity and ensure more accurate estimates. The main models for the panel regressions analyze the effects of common ownership variables MHHI Delta, C, PCF, PCS, and density and the interaction terms of these common ownership measures with the High_Tech classification on the profitability measures, Markup and PCM.

In the first specification of the markup profitability model in regression 1, I examine the variation in profitability measured by markup across different industries (i) and over time (t). The regression model simplified is as follows:

$$\text{Markup}_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} + \beta_3\text{High Tech}_{it} \\ + \beta_4\mathbf{Control\ Variables}_{it} + \mathbf{\Gamma\ Quarter\ effects} + \mathbf{\Theta\ Industry\ effects} + u_{it}$$

The variable $\beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it})$ indicates the additional effect on the dependent variable for profitability margins for the Common ownership measure when the firms industry is classified as High Tech. $\beta_2\text{MHHI Delta}_{it}$ quantifies the impact of common ownership on profitability variations. $\beta_3\text{High_Tech}_{it}$ indicates the expected difference in profitability when a firm is classified as High_Tech. Additionally, industry control variables ensure that the observed variations in profitability attributed to common ownership are not confounded by other structural industry factors. All other specifications vary only based on the common ownership measure and the profitability metric (Markup or PCM) used. Detailed descriptions of these specifications can be found in Appendix C: Main Regressions Employed.

The analysis utilizes a fixed effects panel regression model. The selection of fixed effects is aimed at controlling for unobserved heterogeneity, such as differences across sectors (NAICS) that might influence the outcomes, or variations across different time periods that could affect the results. Employing fixed effects helps to reduce the bias from unmeasured variables that remain constant over time but may be correlated with the variables of interest (Farkas, 2005).

However, to test the second hypothesis a different approach is required. Given that innovation in respect to common ownership has only been analyzed at the firm-level a novel approach is required. Following the fact that the data for innovation is now aggregated at the industry-level it is possible to make a similar estimation as was done for determining the relationship between common ownership and profitability metrics, however now it should exclude control

variables that are mainly relevant for profitability. The basic multivariate regression for the first innovation model out of 20 models is as follows:

$$\ln(\text{patents})_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} + \beta_3\text{High Tech}_{it} \\ + \beta_4\mathbf{Control\ Variables}_{it} + \mathbf{\Gamma}\text{ Quarter effects} + \mathbf{\Theta}\text{ Industry effects} + u_{it}$$

The full specification of this regression can be found in regression 11. Different models differ based on their metric for measuring innovation the natural log of patents, the natural log of citations, the natural log of the real value of patents and the R&D intensity (for the model with this dependent variable the control variable R&D intensity is dropped as independent variable). Furthermore they differ based on the common ownership metric either MHHI Delta, C, PCS, PCF and density and their respective interaction terms with High-Tech. The definitions for the common ownership and interactions terms are the same.

Furthermore, to verify and interpret the results obtained from the initial regression models, it is important to address a major issue recognized in the literature: endogeneity. The shares held by institutional shareholders are most likely not randomly determined and could be influenced by the future prospects of the industry these firms operate in. For example, there is the possibility of reverse causality: if a sector's future prospects improve, institutional shareholders might increase their allocation to this sector. As a result, common ownership increases, and later on, profit margins follow through on their prospects. This potential endogeneity issue necessitates caution in interpreting the effects of common ownership metrics on profitability and innovation metrics.

Therefore, to measure a causal relation, this paper follows He & Huang (2016); Azar et al. (2018); Koch et al. (2021), who use changes in the metrics of common ownership driven by the merger of financial institutions. The underlying reasoning is that changes in the common ownership metrics as a result of large financial entities merging are incidental. Given that most mergers have emerged from consolidation in the financial industry, it is improbable that the underlying holdings played a significant role in the motivation for entities to merge.

Thus, if common ownership results in anti-competitive actions, higher markups, PCMs, citations, and the value of patents, along with a lower number of patents and R&D intensity, would be expected in High-Tech sectors as a result of higher common ownership.

This paper identified 9 relevant mergers at the beginning of our dataset, showcased in Table 9. The relevant manager-level identifiers are given in Table 10, from the paper by He & Huang (2016). To determine if a merger affected the common ownership measure for the first quarterly date before the merger was announced, the following process was followed: first, a baseline of common ownership in the sectors in which the acquiring entity held stock at the first date before the merger announcement was calculated. Following these estimates, the acquiring and acquired firms were hypothetically combined in the dataset as one entity and the common ownership metric was recalculated. The sectors for which the acquiring manager did not hold any positions were not analyzed, as the shifting of stock from one entity to another would not alter the common ownership measures in sectors where no stock was held by the acquiring entity.

Following this process, the change in common ownership from merging was calculated. If

this number was positive, it would be noted as treated. If the date was after the date of the announcement but within 3 years after, it would be marked as post. Following He & Huang (2016); Koch et al. (2021), the industry outcomes are compared using a difference in difference (DiD) specifications:

$$Profitability_{j,t} = \beta_1 Treat \times Post + X_{j,t}\lambda + \alpha_t + \theta_j + \epsilon_{j,t}, \quad (2)$$

$$Innovation_{j,t} = \beta_1 Treat \times Post + X_{j,t}\lambda + \alpha_t + \theta_j + \epsilon_{j,t}, \quad (3)$$

where j indexes industries and t indexes time. Profitability is either Markup or PCM. Innovation is either the natural log of patents, citations, the real value of patents, or the R&D intensity of that industry. *Treat* is a dummy equal to one for industries with positive implied changes in MHHI delta, *Post* is a dummy equal to one for the 12 quarters after the merger, $X_{j,t}$ is a vector of controls, α_t is a quarter fixed effect, and θ_j is an industry effect. To analyze the effect of this exogenous variation, only the subsample of data from sectors classified as High-Tech is examined.

5 Results

When analyzing the results, an initial examination, based on the comparable study conducted by Koch et al. (2021), will focus on whether common ownership positively correlates with industry-level profitability within High-Tech sectors and will assess the robustness of this first hypothesis. Following these estimations, the second hypothesis will be tested to determine whether common ownership in High-Tech sectors leads to a reduction in the number of patents and duplicate R&D expenditures, and whether it enhances the citations and real value per patent as a result of increased common ownership in these sectors.

5.1 Relation between Common Ownership and Industry-Level Profitability

The model was estimated using a fixed effects regression. Since both the dependent variables for profitability (Markup and PCM) and most of the independent variables are measured without transformation, we can interpret the coefficients directly. Specifically, a change of 1 unit in an independent variable (e.g., MHHI Delta or High Tech) results in a change of the same magnitude in the dependent variable. However, for the natural logarithm of assets, the interpretation differs: a 1% increase in assets is associated with a change in the dependent variable equal to the coefficient of the logarithm of assets.

The results from the panel regression models are presented in Appendix D: Regression Results. These Tables 11 and 12 display the effects of interaction terms between High_Tech and common ownership measures, as well as between varying common ownership measures, and profitability metrics.

Tables 11 and 12 present the effects of various common ownership measures on industry-level profitability, specifically through industry markups and Price-Cost Margins (PCM), respectively. In both analyses, the model's R^2 exhibits minimal variation across different common ownership metrics. For the markups model, R^2 ranges from 0.147 in the fifth model, which incorporates the density metric of common ownership, to 0.153 in the first model, which utilizes MHHI Delta. Consequently, for these models, 14.7% and 15.3% of the variance in industry-level markups can be accounted for by the variables included in each model.

Similarly, for PCMs, R^2 ranges from 0.0705 in the fifth model, also incorporating the density metric, to 0.0733 in the third model, which uses PCF as a metric of common ownership. Thus, 7.1% and 7.3% of the variance in industry-level PCMs are explained by the models' respective variables. This comparison highlights that markups are more consistently and accurately explained by the independent variables than Price-Cost Margins, as reflected by the higher R^2 values in the markups models.

The results from Table 11 and Table 12 illustrate the effects of common ownership across different sector classifications. For high-tech sectors, an increase from the 25th to the 75th percentile in the Modified Herfindahl-Hirschman Index (MHHI) Delta corresponds to a markup increase of 1.421% and a PCM increase of 2.130%, both significant at the 1% level. Across all sectors, similar percentile increases result in markup and PCM increases of 2.363% and 1.049% respectively, with the markup effect significant at the 1% level.

The interaction terms in the models vary in significance and effect size. In high-tech sectors,

a percentile increase in the Percentage of Common Funds (PCF) results in a markup decrease of 1.174%, significant at the 5% level, while a similar increase in the Percentage of Common Stocks (PCS) leads to a markup increase of 1.674% and a PCM increase of 1.378%, both significant at the 1% level. The density measure also shows a positive impact in high-tech sectors, with an increase from the 25th to the 75th percentile leading to a markup increase of 1.687%, significant at the 1% level.

Overall, these results provide partial support for the hypothesis that common ownership significantly increases industry-level profitability in High-Tech sectors. While most models confirm a positive effect, the interaction term for C shows no significant relation, and the PCF measure in high-tech sectors indicates a significant negative relationship for markups. Conversely, the PCM models are more aligned with the hypothesis, with 4 out of 5 interaction terms positive and significant, three at the 1% level and one at the 5% level. The exception is the PCF measure, which shows an insignificant relationship in PCM models.

The narrative changes when considering industry concentration through the Herfindahl-Hirschman Index (HHI). It is highly significant and positive for markup models, indicating higher industry markups with increasing concentration. However, this does not translate similarly for PCMs, with only three models showing negative coefficients, significant at the 10% level. The natural log of industry assets and the reciprocal of the number of firms in an industry show positive and significant relationships, supporting the literature, though the magnitude of estimates is lower than previous research by Koch et al. (2021). R&D intensity presents a contrasting effect, being negative in markup models and positive in PCM models, reflecting the varying impacts of R&D investments on different profitability measures.

5.2 The impact of Common ownership in High-Tech sectors on innovation

In this subsequent part, I will test whether common ownership in High-Tech sectors enables more efficient R&D expenditures by firms through the reduction of duplicate R&D activities. Based on the previously stated hypothesis, the expected results would show a negative relationship between the number of patents in each industry and the R&D intensity, as indicated by the interaction term of High-Tech classification and common ownership metrics. Furthermore, a positive relationship is expected between patent citations and the real value of patents and this interaction term.

The models are estimated using a fixed effects regression. Since the dependent variables for innovation output (patents, citations, and the real value of patents) are measured using their natural logarithm, and all independent variables except for the natural log of total assets are measured without transformation, the results should be interpreted as follows: a 1-point increase in the common ownership metrics corresponds to a proportional change in the dependent variables. Specifically, the coefficient estimates indicate the percentage change in patents, citations, and real value of patents for a one-unit change in the common ownership metrics. For the last model, which has R&D Intensity as the dependent variable, and all independent variables except for the natural log of total assets are measured without transformation, the results should be interpreted as follows: a 1-point increase in the common ownership metrics corresponds to a unit change in the R&D Intensity. Specifically, the coefficient estimates indicate the absolute

change in R&D Intensity for a one-unit change in the common ownership metrics.

In Table 15, the models explain between 18.1% and 18.3% of the variance in the natural logarithm of the number of patents. The interaction terms for $C \times HighTech$, $PCF \times HighTech$, and $PCS \times HighTech$ show significant negative coefficients, suggesting a negative association between common ownership and the number of patents in high-tech sectors, albeit with mixed results from other common ownership measures like $MHHI \Delta$, C , and $Density$ showing positive effects. In the citation models (Table 16), 75.8% of the variance in citations is explained. The interaction term for $C \times HighTech$ is significantly negative, while $PCS \times HighTech$ is positive and significant, indicating conflicting influences of common ownership on the level of citations in high-tech sectors. For the value of patents (Table 17), explained variance ranges from 21.0% to 21.6%. Positive significant coefficients for $MHHI \Delta \times HighTech$ and $C \times HighTech$ contrast with negative significant coefficients for $PCF \times HighTech$, $PCS \times HighTech$, and $Density \times HighTech$, providing partial evidence for a positive relationship between common ownership and patent value. Regarding R&D Intensity (Table 18), with R^2 between 15.1% and 15.5%, the interaction terms $PCS \times HighTech$ and $Density \times HighTech$ are negatively significant, supporting the hypothesis of reduced R&D intensity in high-tech sectors under common ownership. However, PCS shows a minimal positive coefficient, indicating nuanced effects of common ownership metrics on R&D intensity.

Overall, these results offer only partial support for the hypothesis that common ownership significantly impacts innovation metrics in high-tech sectors, with findings indicating both negative and positive relationships depending on the specific measure and aspect of innovation examined.

5.3 Robustness Check of the Relation between Common Ownership and Industry-Level Profitability & Innovation metrics

The first robustness check involved rerunning the regression with robust standard errors clustered at the industry (NAICS) level. The results for the Markup and PCM models, observed in Table 13 and Table 14 respectively, indicate a significant reduction in the statistical significance of nearly all common ownership interaction terms, rendering them insignificant. Specifically, the robustness adjustment highlights that the previously significant results do not hold under the control for heteroskedasticity using industry-level robust standard errors.

In the markup model (Table 13), $MHHI \Delta$ and C are the only common ownership metrics retaining statistical significance at the 5% level. The interaction terms, particularly $MHHI \Delta \times HighTech$ and $C \times HighTech$, lose their significance, showcasing increased standard errors compared to earlier models. Despite the interaction terms losing significance, the main effects of $MHHI \Delta$ and C continue to exhibit a positive relationship with markups, albeit now significant only at the 5% level. Interaction terms involving $PCF \times HighTech$ and $PCS \times HighTech$ show no statistical significance, echoing a similar trend for the individual PCF and PCS metrics. The PCM model (Table 14) reveals a common trends where robust standard errors lead to a general loss of statistical significance for interaction terms, including $MHHI \Delta \times HighTech$ and $C \times HighTech$. The individual metrics of $MHHI \Delta$ and C also fail to achieve statistical significance under this robustness check. Interaction terms for $PCF \times HighTech$ and

PCS x HighTech likewise show no significant effects.

For the regression models measuring the relationship with the natural logarithm of patents (Table 19), citations (Table 20), and the value of patents (Table 21), the robustness adjustments further reduce the statistical significance of most interaction terms. The interaction of *PCF x HighTech* remains significant in the patent model, suggesting a robust negative impact on patent numbers in High-Tech sectors. Similarly, in the citation model, the interaction term of *PCS x HighTech* continues to show significance, indicating a positive relationship with citation counts. For R&D intensity (22), only the interaction term *Density x HighTech* remains significant and positive, suggesting a limited positive effect of common ownership on R&D intensity in High-Tech sectors under robust estimation.

Overall, the employment of robust standard errors clustered at the industry level has highlighted a general decrease in the significance of the interaction terms across models, emphasizing the potential influence of heteroskedasticity on previous findings. Caution is advised in interpreting these effects as the robustness checks suggest a need for more conservative conclusions regarding the impact of common ownership on profitability and innovation in High-Tech sectors.

5.4 Exogenous variation in common ownership metrics

This research examines the exogenous changes in common ownership resulting from asset manager mergers, using a Difference in Difference (DiD) approach to mitigate concerns about endogeneity between common ownership metrics and firm profitability. The DiD framework, grounded in a quasi-natural experiment via financial institutional mergers, provides a robust method to assess changes in common ownership that are likely independent of the underlying firm profitability. Drawing on insights from He & Huang (2016) and Azar et al. (2018), this study exploits the randomness in ownership metrics changes induced by mergers. These mergers are presumed not to be influenced by the firms' current assets, allowing for a causal analysis of the effects of common ownership on profitability and innovation.

The results from this DiD estimation indicate that no statistically significant relation is present between changes in the level of common ownership as a result of mergers and markups (Table 23). However, some statistically significant results indicate a negative relation between PCMs and an increase in common ownership as a result of mergers (Table 23). Although the magnitude of the change is small, it is strongly statistically significant at the 1% level, controlling for robust standard errors at the industry level. A finding in sharp contrast to the hypothesis set forth, that common ownership would increase industry profitability in High-Tech sectors as duplicate common R&D expenditures could be reduced.

While analyzing the innovation aspect of the hypothesis (Table 24), it was suggested that common ownership would lead to fewer patent issuances and more citations in High-Tech sectors. Initial evidence supporting this claim was observed using the simplest identification models. However, when controlling for industry characteristics, this result also becomes statistically insignificant.

The latter part of the hypothesis (Table 25), suggesting that common ownership in High-Tech sectors would correlate with a higher value of patents, is not supported by the DiD estimates. No evidence was found indicating that increasing common ownership in High-Tech sectors decreases

the R&D intensity. On the contrary, a positive relationship is identified, though this intercept is close to zero and only statistically significant at the 10% level.

5.5 Discussion

The findings of this study reveal no definitive evidence to suggest a statistically significant positive correlation between common ownership and industry-level profitability in the High-Tech sectors. This outcome aligns with recent research in the domain, which similarly identifies no substantial link between common ownership and profitability metrics at the industry level, such as those discussed in Koch et al. (2021) and Kennedy et al. (2017). The latter also observed no connection between common ownership and product market prices. Furthermore, Dennis et al. (2021) clarifies that the effects noted by Azar et al. (2018), who reported a positive relationship between common ownership and airline-level prices, are attributable to the market share component of the common ownership measure, MHHI Delta, rather than to the direct influence of ownership shares or voting rights.

The impact of common ownership on innovation is further examined in relation to the second hypothesis. There is partial evidence suggesting that common ownership in High-Tech sectors leads to a reduction in patent issuance's and an increase in citations per issued patent. This pattern supports the findings of Li et al. (2022), which indicated that common owners in venture capital (VC) settings contribute to a decrease duplicate R&D investment, confirming this effect in our sector-wide dataset.

Regarding the influence of common ownership on the value of patents and R&D intensity, no definitive relationship is established. Consequently, we find no additional evidence to support the hypothesis that common ownership in High-Tech sectors enhances the efficiency of R&D expenditures, thereby increasing the value per patent and reducing overall investment in research and development.

6 Conclusion

This paper observes that the increasing common ownership in sectors identified as High-Tech does not consistently correlate with enhanced profitability metrics, which would serve as proxies for reduced competitive incentives within an industry. While instances exist where the anticipated positive correlation is observed and the estimates are statistically significant, these results typically become insignificant when controlling for robust standard errors at the industry level. A similar trend is observed in innovation metrics, where the number of patents would act as a proxy for the quantity of innovations per firm, citations would represent the quality, and the inflation-adjusted value of patents another quality metric. Additionally, R&D intensity serves as a proxy for relative investment in research and development within a sector.

Furthermore, these estimates do not consistently correlate with reduced patenting activity, increased citations, higher value of patents, and reduced R&D intensity. This finding is not entirely in line with previous literature such as Li et al. (2022), which anticipates anticompetitive effects resulting from common ownership on innovation metrics. However, it is important to note that these studies are primarily conducted in the Venture Capital (VC) sector, which

allows researchers to analyze project-level data. This study took a more broad industry level approach, making comparisons between results more challenging.

The results from this paper are inconsistent with the hypothesis put forward by Azar et al. (2018) that increased common ownership reduces product market competition. Contrary to the findings of Azar et al. (2022), which reported worse banking terms, and Azar et al. (2018), which observed increased ticket prices, this study does not find a direct negative impact of common ownership on competition within High-Tech sectors. These results thus do not call for antitrust regulation on within industry common ownership.

However, as noted, other sectors characterized by higher ownership concentration, less diversification, and closer monitoring of investments, such as venture capitals (VCs), could present increased incentives for anti competitive behavior. Investigating the effects of common ownership in such contexts would be insightful, particularly to see how outcomes might differ if investment managers internalize significant portions of the financial outcomes of their portfolio firms.

7 Limitations

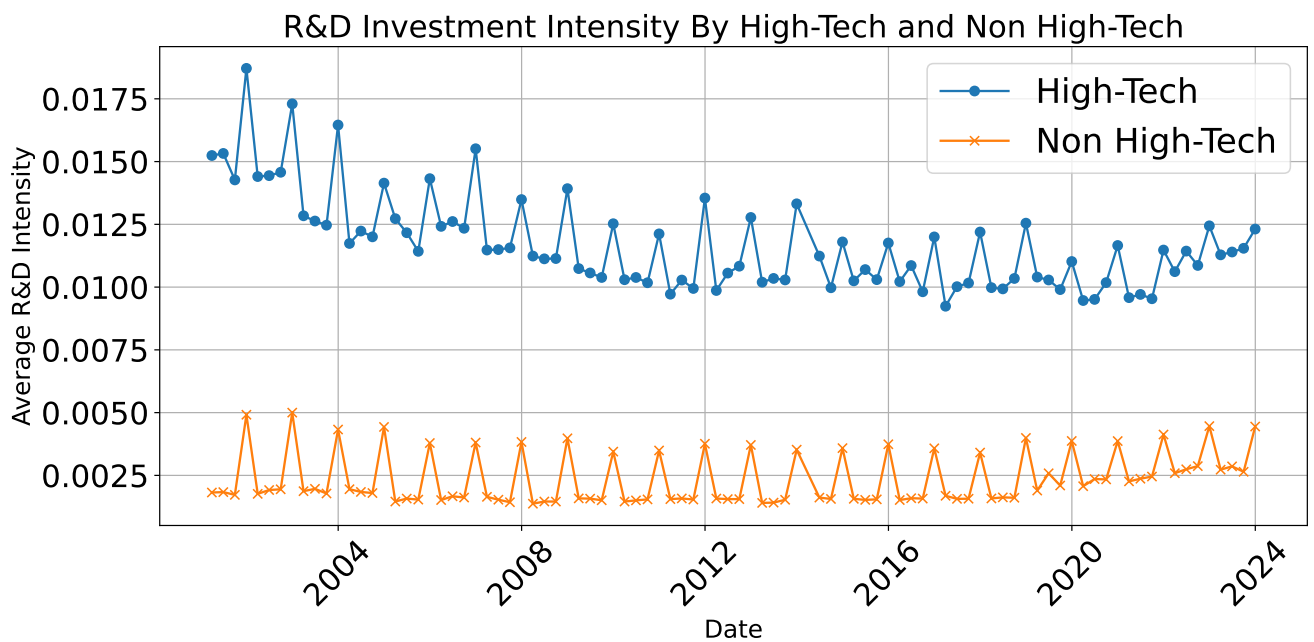
As this is the first study examining industry-level innovation outcomes from increased common ownership, there are no existing models for reference to interpret these results. The inclusion of these models aimed to illustrate the expected influence of common ownership on innovation and, subsequently, profitability. However, the metrics used to aggregate innovation at this level are debatable. By summing the total patents issued per firm each quarter, taking the average citations per patent, and averaging the value per patent, interpretations may become skewed. Additionally, these variables were further aggregated from the firm to the industry level by averaging the number of patents, citations, and the real value per patent. This identification strategy could be susceptible to distortion by outliers, as firms issuing a single patent within the period are weighted equally to firms that issued 50 patents during the same quarter.

Appendix

A General figures regarding High-Tech and Common Ownership metrics

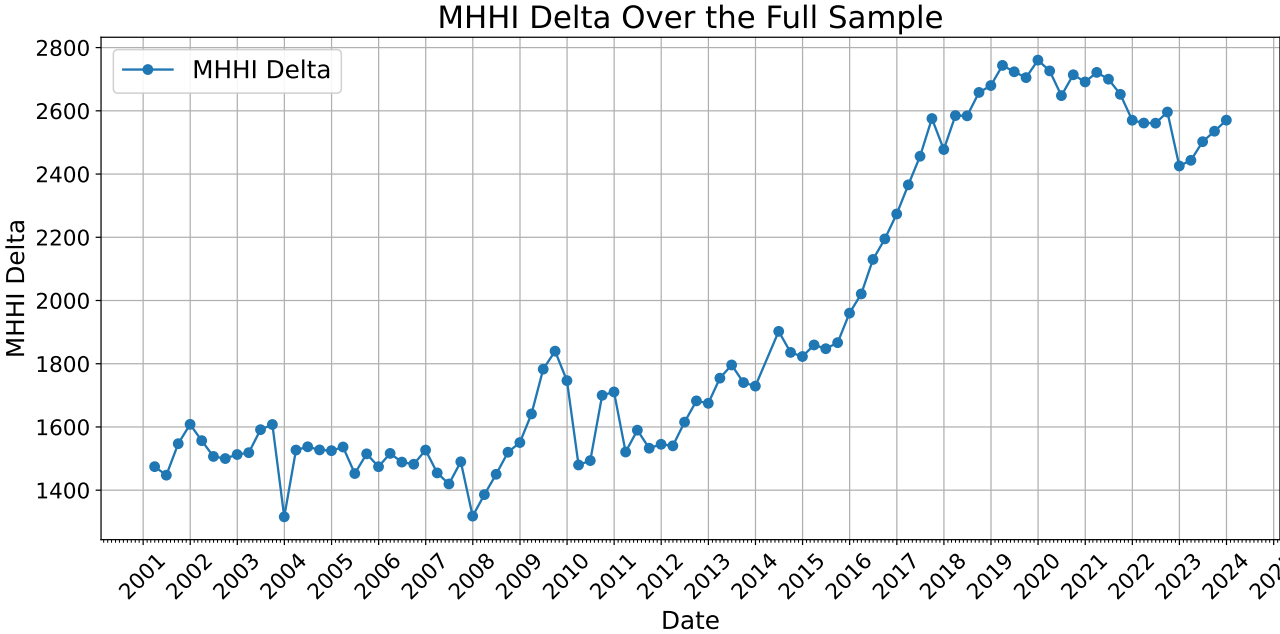
Companies which report under the United States Generally Accepted Accounting Principles (GAAP), are required to recognize expenses of Research and Development (R&D) in the same fiscal year they are spent, which in term can create volatility in earnings. Additionally, if R&D expenses are expensed this effectively reduces the taxable income for that year, which could be done to manage earnings expectation corporatefinanceinstitute.com (2015). This can be observed in figure 1 where significant seasonality in R&D expenses can be observed, this does not originate from varying levels of total assets (as these are stable quarter to quarter).

Figure 1: R&D investment intensity is calculated as investment in R&D over Total Assets by each industry



¹ **Note:** For the following figures 2, 3, 4, 5 of common ownership metrics, data from 2014Q1 is excluded due to inconsistencies of Thomson data regarding double reporting of mutual funds. Further details are available in footnote linked before the note.

Figure 2: Note 2014Q1 is excluded, refer to note 1 for further explanation



¹Note that in 2014Q1, a significant outlier was observed for all common ownership measures; this outlier skewed the average measures for MHHI Delta, C, PCF, PCS, and Density. This likely results from the issues noted by Koch et al. (2021) and described in further detail by WRDS (2020). The significant data inconsistency originates from a substantial variation in mutual fund ownership in the first quarter of 2014, which likely stems from double reporting (mutual funds listed twice). Following this observation, I decided to exclude the respective quarter from my data analysis and charting.

Figure 3: Note 2014Q1 is excluded, refer to note 1 for further explanation

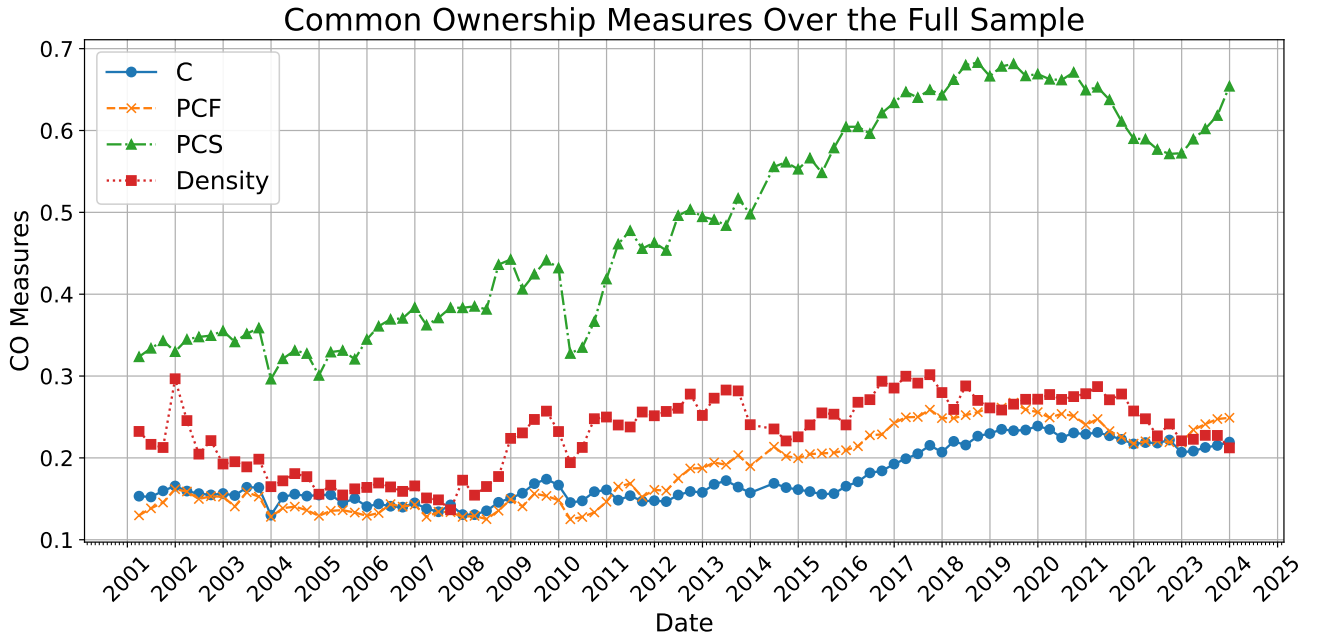


Figure 4: Note 2014Q1 is excluded, refer to note 1 for further explanation

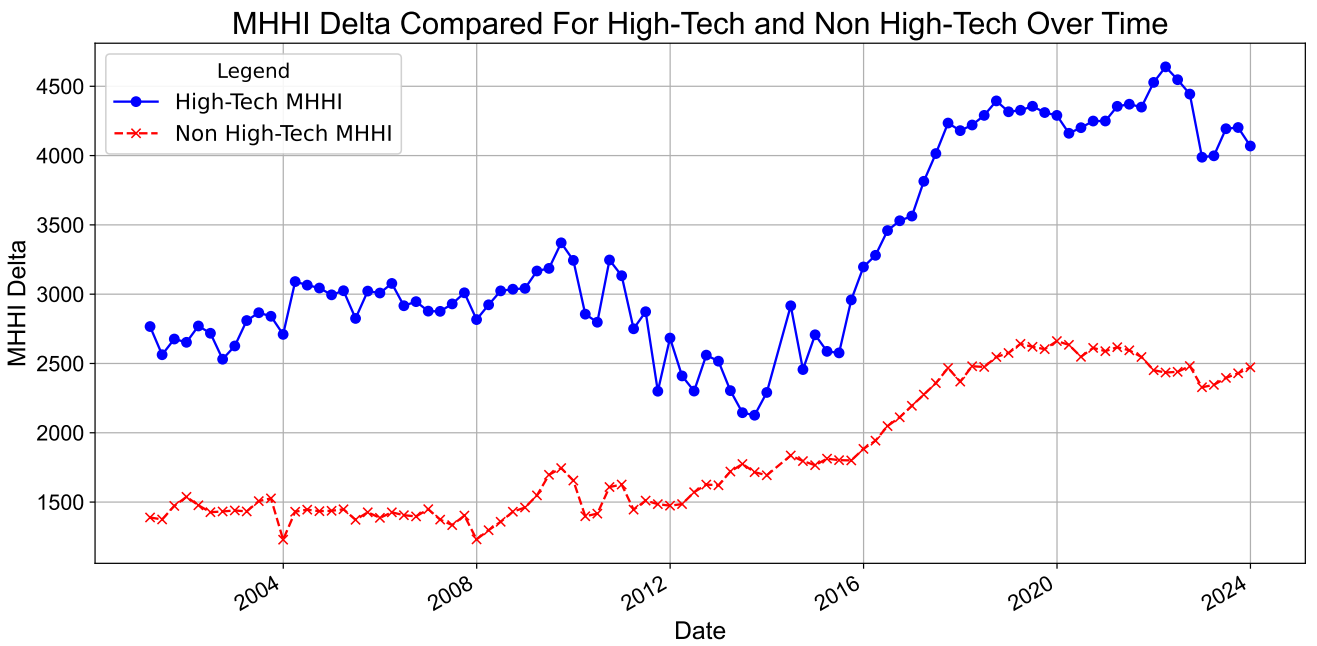
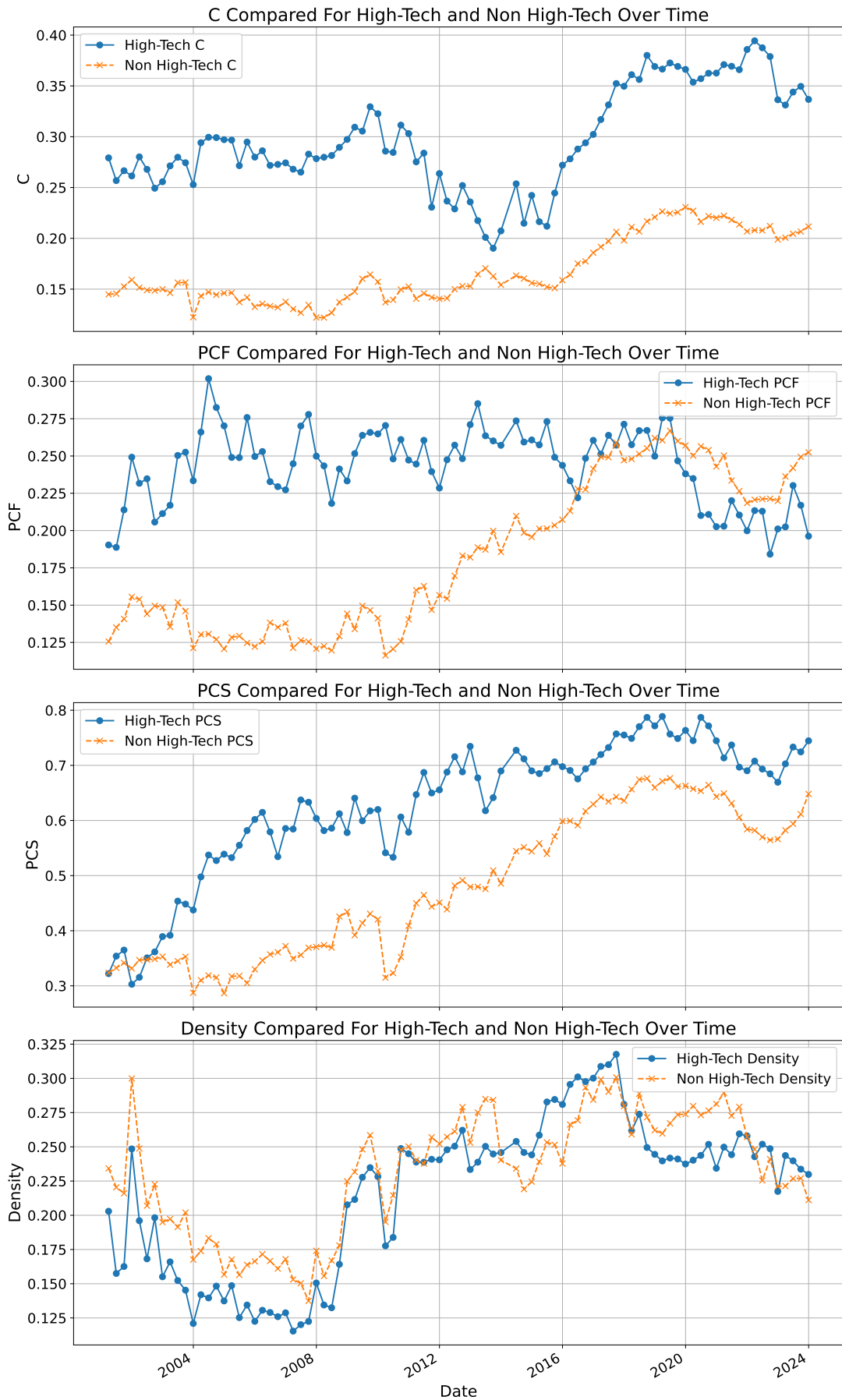


Figure 5: Note 2014Q1 is excluded, refer to note 1 for further explanation



B Tables on Filtering and Summary Statistics

Table 1: Criteria for Retaining or Excluding Records

Action	Criterion
Keep	Manager's ownership is at least 0.5% of shares outstanding.
Drop	Firm lacks quarterly net sales data; net sales are preferred over revenue for better coverage.
Drop	NAICS code is less than 1000. Convert all NAICS codes to 4 digits for compatibility.
Keep	Total Assets exceed \$1 million.
Keep	Sales greater than \$250,000.
Keep	Sales exceed Earnings Before Interest and Taxes (EBIT).
Keep	At least 10 consecutive observations are present for at least two firms.
Keep	At least two firms present per unique sector data combination.

Table 2: Summary Statistics

Variable	Mean	Std. Dev.	P25	Median	P75	N
Common ownership measures						
MHHL_Delta	1945.714	1533.145	704.724	1635.779	2933.898	15715
C	0.177	0.141	0.063	0.147	0.265	15715
PCF	0.186	0.157	0.000	0.182	0.282	15715
PCS	0.491	0.347	0.000	0.571	0.750	15715
Density	0.229	0.176	0.128	0.208	0.286	15715
Profitability measures						
Markup	1.132	0.150	1.047	1.103	1.174	15715
PCM	0.347	0.175	0.220	0.328	0.451	15715
Other industry variables						
High_Tech	0.059	0.235	0.000	0.000	0.000	15715
HHI	4407.520	2368.795	2505.936	4048.509	5861.203	15715
Ln(Assets)	9.676	1.940	8.309	9.570	10.962	15715
1 / No. Firms	0.223	0.159	0.091	0.200	0.333	15715
Capital Intensity	6.954	8.233	2.886	4.667	7.663	15715
Sales Growth	-0.011	0.229	-0.051	0.016	0.078	15656
R&D Intensity	0.003	0.006	0.000	0.000	0.002	15715
R&D Missing	0.502	0.500	0.000	1.000	1.000	15715
Leverage	0.301	0.194	0.153	0.261	0.418	15715

Table 3: Summary Statistics for High-Tech Sectors

Variable	Mean	Std. Dev.	P25	Median	P75	N
Common ownership measures						
MHHI_Delta	3307.353	1461.601	2145.331	3220.958	4513.201	920
C	0.299	0.135	0.189	0.287	0.409	920
PCF	0.244	0.090	0.185	0.250	0.306	920
PCS	0.630	0.179	0.538	0.667	0.750	920
Density	0.215	0.071	0.161	0.224	0.262	920
Profitability measures						
Markup	1.123	0.085	1.074	1.119	1.171	920
PCM	0.432	0.178	0.300	0.422	0.567	920
Other industry variables						
HHI	2180.360	1412.162	1064.738	2008.432	2615.115	920
Ln(Assets)	11.219	1.324	10.540	11.375	12.286	920
1 / No. Firms	0.049	0.044	0.017	0.030	0.077	920
Capital Intensity	5.914	1.970	4.495	5.529	7.327	920
Sales Growth	-0.004	0.175	-0.036	0.021	0.061	920
R&D Intensity	0.012	0.008	0.004	0.012	0.017	920
R&D Missing	0.002	0.047	0.000	0.000	0.000	920
Leverage	0.149	0.084	0.085	0.132	0.201	920

Table 4: Summary Statistics innovation

Variable	Mean	SD	P25	Median	P75	N
Common ownership measures						
MHHI_Delta	2406.058	1602.957	1117.645	2165.515	3483.054	6945
C	0.220	0.149	0.102	0.196	0.313	6945
PCF	0.213	0.147	0.118	0.211	0.294	6931
PCS	0.533	0.293	0.375	0.600	0.750	6945
Density	0.233	0.132	0.149	0.220	0.278	6945
Innovation proxies						
ln(patents)	1.797	1.479	0.638	1.609	2.866	6945
ln(citations)	1.916	1.695	0.911	2.121	3.045	6380
ln(real_value)	2.362	1.516	1.437	2.361	3.475	6945
R&D_Intensity	0.005	0.008	0.000	0.001	0.008	6945
Other Industry Variables						
HHI	3803.868	2309.913	1959.826	3284.383	5221.781	6945
Ln(Assets)	10.562	1.873	9.246	10.608	11.852	6945
1 / No. Firms	0.147	0.129	0.059	0.100	0.200	6945
Capital Intensity	7.950	9.587	3.715	5.290	8.131	6945
R&D Missing	0.246	0.431	0.000	0.000	0.000	6945
Leverage	0.269	0.180	0.137	0.230	0.360	6945

Table 5: Summary Statistics for Innovation in High Tech sectors

Variable	Mean	SD	P25	Median	P75	N
Common ownership measures						
MHHI_Delta	3294.886	1428.032	2152.768	3178.638	4491.393	837
C	0.300	0.132	0.193	0.287	0.408	837
PCF	0.247	0.088	0.188	0.250	0.309	837
PCS	0.623	0.176	0.533	0.667	0.743	837
Density	0.216	0.072	0.161	0.224	0.263	837
Innovation proxies						
ln(patents)	2.544	1.456	1.253	2.628	3.643	837
ln(citations)	2.223	1.817	1.269	2.698	3.519	810
ln(real_value)	2.223	1.077	1.694	2.216	2.920	837
R&D_Intensity	0.012	0.007	0.005	0.012	0.018	837
Other Industry Variables						
HHI_Scaled	2106.992	1391.114	1046.692	1979.510	2548.333	837
Ln(Assets)	11.260	1.286	10.613	11.418	12.277	837
1 / No. Firms	0.045	0.038	0.017	0.029	0.067	837
Capital Intensity	5.920	1.966	4.546	5.515	7.321	837
R&D Missing	0.000	0.000	0.000	0.000	0.000	837
Leverage	0.147	0.084	0.083	0.127	0.199	837

Table 6: Pairwise Correlations among Common Ownership Measures

	MHHI_Delta	C	PCF	PCS	Density
MHHI_Delta	1.0000	0.9726	0.5682	0.5407	0.0716
C	0.9726	1.0000	0.5578	0.5017	0.0743
PCF	0.5682	0.5578	1.0000	0.7535	0.0671
PCS	0.5407	0.5017	0.7535	1.0000	0.0121
Density	0.0716	0.0743	0.0671	0.0121	1.0000

Table 7: Correlations between PCM and Markup

PCM	Markup as in Koch et al. (2021)	Markup at the Industry Level
PCM	0.2418	0.5548

Table 8: High-Tech Classification Business Dynamic Statistics

NAICS	Description
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
3364	Aerospace Product and Parts Manufacturing
5112	Software Publishers
5182	Data Processing, Hosting, and Related Services
5191	Other Information Services
5413	Architectural, Engineering, and Related Services
5415	Computer Systems Design and Related Services
5417	Scientific Research and Development Services

Table 9: Overview of asset management M&A from He & Huang (2016)

Acquirer Company	Target Company	Announced	Complete	Flag
Wells Fargo & Co.	Benson Associates, LLC	8/26/2003	8/26/2003	0
Bank of America Corporation	Fleet Boston Corporation	10/27/2003	4/1/2004	1
Wells Fargo & Co.	Strong Financial Corp.	5/26/2004	1/3/2005	0
Transamerica Invt Mgmt	WestCap Investors, LLC	5/19/2005	8/4/2005	0
Bank of NY Trust Co	Mellon Bank	12/3/2006	7/2/2007	1
RiverSource Investments	J. & W. Seligman & Co., Inc.	7/7/2008	11/7/2008	0
Bank of America Corporation	Merrill Lynch & Co.	9/14/2008	1/1/2009	1
Barclays Bank PLC	Lehman Brothers Inc.	9/16/2008	9/22/2008	1
BlackRock Inc.	Barclays Bank Plc	9/16/2009	12/1/2009	0

Table 10: List of Managers and Their Corresponding Manager Numbers

Manager Name	Manager Number (mgrno)
Wells Fargo & Co.	65850
Benson Associates, LLC	8287
Bank of America Corporation	62890
Fleet Boston Corporation	38260
Strong Financial Corp	82100
Transamerica Invt Mgmt, LLC	84750
WestCap Investors, LLC	92160
Bank of NY Trust Co	6890
Mellon Bank NA	55390
RiverSource Investments, LLC	45639
J. & W. Seligman & Co., Inc.	78400
Merrill Lynch & Co Inc	56780
Barclays Bank PLC	7900
Lehman Brothers Inc.	50200
BlackRock Inc	11386

C Main regressions employed

These specifications detailed below are used to assess the first hypothesis, which examines the influence of common ownership on industry-level profitability within the High-Tech sector.

$$\begin{aligned}
 Markup_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} + \beta_3\text{High Tech}_{it} \quad (1) \\
 & + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} + \beta_7\text{Capital intensity}_{it} \\
 & + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} + \beta_{10}\text{R\&D missing}_{it} \\
 & + \beta_{11}\text{Leverage}_{it} + \Gamma \text{ Quarter effects} + \Theta \text{ Industry effects} + u_{it}
 \end{aligned}$$

$$\begin{aligned}
 PCM_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} + \beta_3\text{High Tech}_{it} \quad (2) \\
 & + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
 & + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
 & + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \Gamma \text{ Quarter effects} \\
 & + \Theta \text{ Industry effects} + u_{it}
 \end{aligned}$$

$$\begin{aligned}
 Markup_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{Density}_{it}) + \beta_2\text{Density}_{it} + \beta_3\text{High Tech}_{it} \quad (3) \\
 & + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
 & + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
 & + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \Gamma \text{ Quarter effects} \\
 & + \Theta \text{ Industry effects} + u_{it}
 \end{aligned}$$

$$\begin{aligned}
 PCM_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{Density}_{it}) + \beta_2\text{Density}_{it} + \beta_3\text{High Tech}_{it} \quad (4) \\
 & + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
 & + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
 & + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \Gamma \text{ Quarter effects} \\
 & + \Theta \text{ Industry effects} + u_{it}
 \end{aligned}$$

$$\begin{aligned}
 Markup_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times C_{it}) + \beta_2C_{it} + \beta_3\text{High Tech}_{it} \quad (5) \\
 & + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
 & + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
 & + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \Gamma \text{ Quarter effects} \\
 & + \Theta \text{ Industry effects} + u_{it}
 \end{aligned}$$

$$\begin{aligned}
PCM_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times C_{it}) + \beta_2C_{it} + \beta_3\text{High Tech}_{it} \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
& + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned} \tag{6}$$

$$\begin{aligned}
Markup_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCF}_{it}) + \beta_2\text{PCF}_{it} + \beta_3\text{High Tech}_{it} \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
& + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned} \tag{7}$$

$$\begin{aligned}
PCM_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCF}_{it}) + \beta_2\text{PCF}_{it} + \beta_3\text{High Tech}_{it} \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
& + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned} \tag{8}$$

$$\begin{aligned}
Markup_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCS}_{it}) + \beta_2\text{PCS}_{it} + \beta_3\text{High Tech}_{it} \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
& + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned} \tag{9}$$

$$\begin{aligned}
PCM_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCS}_{it}) + \beta_2\text{PCS}_{it} + \beta_3\text{High Tech}_{it} \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{Sales growth}_{it} + \beta_9\text{R\&D intensity}_{it} \\
& + \beta_{10}\text{R\&D missing}_{it} + \beta_{11}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned} \tag{10}$$

The specifications detailed below are used to assess the second hypothesis, which examines the

influence of common ownership on industry-level innovation within the High-Tech sector.

$$\begin{aligned}
\ln(patents)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} & (11) \\
& + \beta_3\text{High Tech}_{it} + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} + \beta_9\text{R\&D missing}_{it} \\
& + \beta_{10}\text{Leverage}_{it} + \Gamma\text{Quarter effects} + \Theta\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(patents)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times C_{it}) + \beta_2C_{it} + \beta_3\text{High Tech}_{it} & (12) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} \\
& + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} + \Gamma\text{Quarter effects} \\
& + \Theta\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(patents)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCF}_{it}) + \beta_2\text{PCF}_{it} + \beta_3\text{High Tech}_{it} & (13) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} \\
& + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} + \Gamma\text{Quarter effects} \\
& + \Theta\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(patents)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCS}_{it}) + \beta_2\text{PCS}_{it} + \beta_3\text{High Tech}_{it} & (14) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} \\
& + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} + \Gamma\text{Quarter effects} \\
& + \Theta\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(patents)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{Density}_{it}) + \beta_2\text{Density}_{it} + \beta_3\text{High Tech}_{it} & (15) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} + \beta_7\text{Capital intensity}_{it} \\
& + \beta_8\text{R\&D intensity}_{it} + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} \\
& + \Gamma\text{Quarter effects} + \Theta\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(citations)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} & (16) \\
& + \beta_3\text{High Tech}_{it} + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} + \beta_9\text{R\&D missing}_{it} \\
& + \beta_{10}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(citations)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times C_{it}) + \beta_2C_{it} + \beta_3\text{High Tech}_{it} & (17) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} \\
& + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(citations)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCF}_{it}) + \beta_2\text{PCF}_{it} + \beta_3\text{High Tech}_{it} & (18) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} \\
& + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(citations)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCS}_{it}) + \beta_2\text{PCS}_{it} + \beta_3\text{High Tech}_{it} & (19) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D intensity}_{it} \\
& + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} \\
& + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(citations)_{it} = & \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{Density}_{it}) + \beta_2\text{Density}_{it} + \beta_3\text{High Tech}_{it} & (20) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} + \beta_7\text{Capital intensity}_{it} \\
& + \beta_8\text{R\&D intensity}_{it} + \beta_9\text{R\&D missing}_{it} + \beta_{10}\text{Leverage}_{it} \\
& + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(\mathit{real_value})_{it} = & \beta_0 + \beta_1(\mathit{High_Tech}_{it} \times \mathit{MHHI_Delta}_{it}) + \beta_2\mathit{MHHI_Delta}_{it} & (21) \\
& + \beta_3\mathit{High_Tech}_{it} + \beta_4\mathit{HHI}_{it} + \beta_5 \ln(\mathit{Assets}_{it}) + \beta_6(1/\mathit{no. firms})_{it} \\
& + \beta_7\mathit{Capital_intensity}_{it} + \beta_8\mathit{R\&D_intensity}_{it} + \beta_9\mathit{R\&D_missing}_{it} \\
& + \beta_{10}\mathit{Leverage}_{it} + \Gamma\mathit{Quarter effects} + \Theta\mathit{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(\mathit{real_value})_{it} = & \beta_0 + \beta_1(\mathit{High_Tech}_{it} \times \mathit{C}_{it}) + \beta_2\mathit{C}_{it} + \beta_3\mathit{High_Tech}_{it} & (22) \\
& + \beta_4\mathit{HHI}_{it} + \beta_5 \ln(\mathit{Assets}_{it}) + \beta_6(1/\mathit{no. firms})_{it} \\
& + \beta_7\mathit{Capital_intensity}_{it} + \beta_8\mathit{R\&D_intensity}_{it} \\
& + \beta_9\mathit{R\&D_missing}_{it} + \beta_{10}\mathit{Leverage}_{it} + \Gamma\mathit{Quarter effects} \\
& + \Theta\mathit{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(\mathit{real_value})_{it} = & \beta_0 + \beta_1(\mathit{High_Tech}_{it} \times \mathit{PCF}_{it}) + \beta_2\mathit{PCF}_{it} + \beta_3\mathit{High_Tech}_{it} & (23) \\
& + \beta_4\mathit{HHI}_{it} + \beta_5 \ln(\mathit{Assets}_{it}) + \beta_6(1/\mathit{no. firms})_{it} \\
& + \beta_7\mathit{Capital_intensity}_{it} + \beta_8\mathit{R\&D_intensity}_{it} \\
& + \beta_9\mathit{R\&D_missing}_{it} + \beta_{10}\mathit{Leverage}_{it} + \Gamma\mathit{Quarter effects} \\
& + \Theta\mathit{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(\mathit{real_value})_{it} = & \beta_0 + \beta_1(\mathit{High_Tech}_{it} \times \mathit{PCS}_{it}) + \beta_2\mathit{PCS}_{it} + \beta_3\mathit{High_Tech}_{it} & (24) \\
& + \beta_4\mathit{HHI}_{it} + \beta_5 \ln(\mathit{Assets}_{it}) + \beta_6(1/\mathit{no. firms})_{it} \\
& + \beta_7\mathit{Capital_intensity}_{it} + \beta_8\mathit{R\&D_intensity}_{it} \\
& + \beta_9\mathit{R\&D_missing}_{it} + \beta_{10}\mathit{Leverage}_{it} + \Gamma\mathit{Quarter effects} \\
& + \Theta\mathit{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
\ln(\mathit{real_value})_{it} = & \beta_0 + \beta_1(\mathit{High_Tech}_{it} \times \mathit{Density}_{it}) + \beta_2\mathit{Density}_{it} + \beta_3\mathit{High_Tech}_{it} & (25) \\
& + \beta_4\mathit{HHI}_{it} + \beta_5 \ln(\mathit{Assets}_{it}) + \beta_6(1/\mathit{no. firms})_{it} + \beta_7\mathit{Capital_intensity}_{it} \\
& + \beta_8\mathit{R\&D_intensity}_{it} + \beta_9\mathit{R\&D_missing}_{it} + \beta_{10}\mathit{Leverage}_{it} \\
& + \Gamma\mathit{Quarter effects} + \Theta\mathit{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
R\&D_Intensity_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{MHHI Delta}_{it}) + \beta_2\text{MHHI Delta}_{it} & (26) \\
& + \beta_3\text{High Tech}_{it} + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D missing}_{it} + \beta_9\text{Leverage}_{it} \\
& + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
R\&D_Intensity_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times C_{it}) + \beta_2C_{it} + \beta_3\text{High Tech}_{it} & (27) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D missing}_{it} + \beta_9\text{Leverage}_{it} \\
& + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
R\&D_Intensity_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCF}_{it}) + \beta_2\text{PCF}_{it} + \beta_3\text{High Tech}_{it} & (28) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D missing}_{it} + \beta_9\text{Leverage}_{it} \\
& + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
R\&D_Intensity_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{PCS}_{it}) + \beta_2\text{PCS}_{it} + \beta_3\text{High Tech}_{it} & (29) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} \\
& + \beta_7\text{Capital intensity}_{it} + \beta_8\text{R\&D missing}_{it} + \beta_9\text{Leverage}_{it} \\
& + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

$$\begin{aligned}
R\&D_Intensity_{it} = \beta_0 + \beta_1(\text{High Tech}_{it} \times \text{Density}_{it}) + \beta_2\text{Density}_{it} + \beta_3\text{High Tech}_{it} & (30) \\
& + \beta_4\text{HHI}_{it} + \beta_5 \ln(\text{Assets}_{it}) + \beta_6(1/\text{no. firms})_{it} + \beta_7\text{Capital intensity}_{it} \\
& + \beta_8\text{R\&D intensity}_{it} + \beta_9\text{Leverage}_{it} + \mathbf{\Gamma}\text{Quarter effects} + \mathbf{\Theta}\text{Industry effects} + u_{it}
\end{aligned}$$

Where:

- $\mathbf{\Gamma}$ and $\mathbf{\Theta}$ are vectors.
- u_{it} is the error term,
- The subscript it indexes industries and quarterly observations.

D Regression Results

Table 11: High Tech Interaction Terms of Common Ownership Metrics on Markups

MHHI Delta x HighTech	0.060** (0.028)				
MHHI Delta	0.106*** (0.010)				
C x HighTech		0.038 (0.033)			
C		0.106*** (0.010)			
PCF x HighTech			-0.097** (0.039)		
PCF			0.021*** (0.006)		
PCS x HighTech				0.079*** (0.018)	
PCS				0.004 (0.003)	
Density x HighTech					0.167*** (0.042)
Density					-0.012** (0.005)
HighTech	0.025 (0.020)	0.031 (0.020)	0.052** (0.021)	-0.011 (0.022)	0.004 (0.021)
HHI	0.063*** (0.007)	0.059*** (0.007)	0.030*** (0.007)	0.029*** (0.007)	0.028*** (0.007)
ln(assets)	0.027*** (0.001)	0.028*** (0.001)	0.031*** (0.001)	0.029*** (0.001)	0.030*** (0.001)
1 / no firms	0.072*** (0.013)	0.073*** (0.013)	0.082*** (0.013)	0.078*** (0.013)	0.079*** (0.013)
Capital intensity	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Sales Growth	0.056*** (0.003)	0.056*** (0.003)	0.054*** (0.003)	0.055*** (0.003)	0.055*** (0.003)
R&D intensity	-2.233*** (0.198)	-2.261*** (0.198)	-2.247*** (0.199)	-2.223*** (0.199)	-2.198*** (0.199)
R&D missing	-0.003 (0.002)	-0.003 (0.002)	-0.003 (0.002)	-0.003 (0.002)	-0.003 (0.002)
Leverage	-0.144*** (0.006)	-0.147*** (0.006)	-0.154*** (0.006)	-0.153*** (0.006)	-0.152*** (0.006)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.153	0.152	0.150	0.147	0.147
Observations	15493	15493	15386	15493	15493

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: High Tech Interaction Terms of Common Ownership Metrics on PCM

MHHI Delta x HighTech	0.090*** (0.029)				
MHHI Delta	0.047*** (0.010)				
C x HighTech		0.087** (0.034)			
C		0.048*** (0.011)			
PCF x HighTech			-0.060 (0.040)		
PCF			-0.018*** (0.006)		
PCS x HighTech				0.065*** (0.018)	
PCS				-0.005* (0.003)	
Density x HighTech					0.112*** (0.043)
Density					-0.001 (0.005)
HighTech	0.135*** (0.021)	0.138*** (0.021)	0.165*** (0.022)	0.117*** (0.023)	0.133*** (0.022)
HHI	0.005 (0.008)	0.004 (0.007)	-0.012* (0.007)	-0.012* (0.007)	-0.012* (0.007)
ln(assets)	0.014*** (0.001)	0.014*** (0.001)	0.017*** (0.001)	0.016*** (0.001)	0.016*** (0.001)
1 / no firms	0.062*** (0.013)	0.063*** (0.013)	0.063*** (0.013)	0.064*** (0.013)	0.067*** (0.013)
Capital intensity	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Sales Growth	0.006* (0.003)	0.006* (0.003)	0.004 (0.003)	0.005 (0.003)	0.005 (0.003)
R&D intensity	1.050*** (0.204)	1.030*** (0.204)	1.037*** (0.204)	1.065*** (0.204)	1.075*** (0.204)
R&D missing	-0.009*** (0.003)	-0.009*** (0.003)	-0.009*** (0.003)	-0.008*** (0.003)	-0.008*** (0.003)
Leverage	-0.098*** (0.007)	-0.099*** (0.007)	-0.105*** (0.007)	-0.103*** (0.006)	-0.103*** (0.007)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.072	0.072	0.073	0.071	0.071
Observations	15493	15493	15386	15493	15493

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: High Tech Interaction Terms of Common Ownership Metrics on Markups using Standard Errors at the Industry Level

MHHI Delta x HighTech	0.060 (0.075)				
MHHI Delta	0.106** (0.048)				
C x HighTech		0.038 (0.088)			
C		0.106** (0.054)			
PCF x HighTech			-0.097 (0.079)		
PCF			0.021 (0.018)		
PCS x HighTech				0.079 (0.049)	
PCS				0.004 (0.007)	
Density x HighTech					0.167 (0.108)
Density					-0.012 (0.010)
HighTech	0.025 (0.021)	0.031 (0.021)	0.052** (0.022)	-0.011 (0.031)	0.004 (0.024)
HHI	0.063** (0.027)	0.059** (0.028)	0.030 (0.023)	0.029 (0.022)	0.028 (0.023)
ln(assets)	0.027*** (0.005)	0.028*** (0.005)	0.031*** (0.006)	0.029*** (0.006)	0.030*** (0.006)
1 / no firms	0.072* (0.042)	0.073* (0.042)	0.082* (0.044)	0.078* (0.043)	0.079* (0.043)
Capital intensity	-0.004*** (0.002)	-0.004*** (0.002)	-0.004*** (0.002)	-0.004*** (0.002)	-0.004*** (0.002)
Sales Growth	0.056*** (0.009)	0.056*** (0.009)	0.054*** (0.008)	0.055*** (0.009)	0.055*** (0.009)
R&D intensity	-2.233*** (0.447)	-2.261*** (0.454)	-2.247*** (0.465)	-2.223*** (0.461)	-2.198*** (0.454)
R&D missing	-0.003 (0.006)	-0.003 (0.006)	-0.003 (0.006)	-0.003 (0.006)	-0.003 (0.006)
Leverage	-0.144*** (0.026)	-0.147*** (0.026)	-0.154*** (0.027)	-0.153*** (0.027)	-0.152*** (0.027)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.153	0.152	0.150	0.147	0.147
Observations	15493	15493	15386	15493	15493

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: High Tech Interaction Terms of Common Ownership Metrics on PCM using Standard Errors at the Industry Level

MHHI Delta x HighTech	0.090 (0.059)				
MHHI Delta	0.047 (0.040)				
C x HighTech		0.087 (0.075)			
C		0.048 (0.044)			
PCF x HighTech			-0.060 (0.080)		
PCF			-0.018 (0.015)		
PCS x HighTech				0.065 (0.057)	
PCS				-0.005 (0.007)	
Density x HighTech					0.112 (0.121)
Density					-0.001 (0.011)
HighTech	0.135*** (0.019)	0.138*** (0.019)	0.165*** (0.021)	0.117*** (0.035)	0.133*** (0.026)
HHI	0.005 (0.035)	0.004 (0.035)	-0.012 (0.030)	-0.012 (0.030)	-0.012 (0.030)
ln(assets)	0.014* (0.008)	0.014* (0.008)	0.017** (0.008)	0.016** (0.008)	0.016* (0.008)
1 / no firms	0.062 (0.051)	0.063 (0.052)	0.063 (0.052)	0.064 (0.052)	0.067 (0.052)
Capital intensity	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)
Sales Growth	0.006 (0.007)	0.006 (0.007)	0.004 (0.007)	0.005 (0.007)	0.005 (0.007)
R&D intensity	1.050* (0.576)	1.030* (0.577)	1.037* (0.581)	1.065* (0.587)	1.075* (0.590)
R&D missing	-0.009 (0.006)	-0.009 (0.006)	-0.009 (0.006)	-0.008 (0.006)	-0.008 (0.006)
Leverage	-0.098*** (0.026)	-0.099*** (0.026)	-0.105*** (0.026)	-0.103*** (0.025)	-0.103*** (0.026)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.072	0.072	0.073	0.071	0.070
Observations	15493	15493	15386	15493	15493

Standard errors in parentheses

Table 15: High Tech Interaction Terms of Common Ownership Metrics on the Natural Logarithm of Patents

MHHI Delta x HighTech	-0.362 (0.246)				
MHHI Delta	0.257* (0.134)				
C x HighTech		-0.576** (0.290)			
C		0.452*** (0.138)			
PCF x HighTech			-1.616*** (0.341)		
PCF			0.005 (0.079)		
PCS x HighTech				-0.409** (0.159)	
PCS				-0.071* (0.043)	
Density x HighTech					-0.364 (0.361)
Density					0.201** (0.086)
HighTech	0.465 (0.500)	0.526 (0.500)	0.660 (0.500)	0.603 (0.503)	0.431 (0.501)
HHI	0.537*** (0.101)	0.593*** (0.099)	0.447*** (0.089)	0.434*** (0.088)	0.447*** (0.088)
ln(assets)	0.203*** (0.021)	0.197*** (0.021)	0.220*** (0.021)	0.218*** (0.021)	0.212*** (0.021)
1 / no firms	-0.700*** (0.200)	-0.711*** (0.200)	-0.681*** (0.201)	-0.715*** (0.201)	-0.716*** (0.200)
Capital intensity	-0.021*** (0.003)	-0.020*** (0.003)	-0.021*** (0.003)	-0.021*** (0.003)	-0.020*** (0.003)
R&D intensity	20.992*** (1.909)	20.932*** (1.908)	21.271*** (1.911)	20.991*** (1.909)	20.965*** (1.913)
R&D missing	-0.046 (0.034)	-0.048 (0.034)	-0.047 (0.034)	-0.048 (0.034)	-0.043 (0.034)
Leverage	-0.086 (0.105)	-0.067 (0.105)	-0.126 (0.104)	-0.101 (0.104)	-0.115 (0.104)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6945	6945	6931	6945	6945
R^2	0.181	0.182	0.183	0.182	0.182

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 16: High Tech Interaction Terms of Common Ownership Metrics on the Natural Logarithm of Citations

MHHI Delta x HighTech	-0.324 (0.291)				
MHHI Delta	0.204 (0.165)				
C x HighTech		-0.613* (0.342)			
C		0.285* (0.170)			
PCF x HighTech			-0.310 (0.403)		
PCF			-0.003 (0.098)		
PCS x HighTech				0.515*** (0.189)	
PCS				-0.080 (0.053)	
Density x HighTech					0.105 (0.425)
Density					-0.036 (0.106)
HighTech	1.943** (0.802)	2.005** (0.803)	1.929** (0.801)	1.641** (0.804)	1.845** (0.803)
HHI	0.293** (0.122)	0.309** (0.120)	0.197* (0.107)	0.224** (0.107)	0.229** (0.107)
ln(assets)	-0.056** (0.027)	-0.058** (0.027)	-0.048* (0.026)	-0.051* (0.026)	-0.052** (0.026)
1 / no firms	0.002 (0.252)	0.001 (0.252)	0.007 (0.252)	-0.049 (0.252)	-0.007 (0.252)
Capital intensity	0.009*** (0.003)	0.009*** (0.003)	0.009*** (0.003)	0.009*** (0.003)	0.009*** (0.003)
R&D intensity	-0.404 (2.291)	-0.446 (2.291)	-0.407 (2.292)	-0.065 (2.291)	-0.290 (2.297)
R&D missing	-0.153*** (0.041)	-0.153*** (0.041)	-0.145*** (0.041)	-0.152*** (0.041)	-0.153*** (0.042)
Leverage	-0.737*** (0.129)	-0.735*** (0.129)	-0.745*** (0.127)	-0.778*** (0.127)	-0.767*** (0.127)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6380	6380	6366	6380	6380
R^2	0.758	0.758	0.758	0.758	0.758

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: High Tech Interaction Terms of Common Ownership Metrics on the Real Value of Patents

MHHI Delta x HighTech	0.798*** (0.269)				
MHHI Delta	0.410*** (0.147)				
C x HighTech		1.072*** (0.318)			
C		0.179 (0.151)			
PCF x HighTech			-2.026*** (0.373)		
PCF			-0.023 (0.087)		
PCS x HighTech				-0.636*** (0.175)	
PCS				-0.032 (0.047)	
Density x HighTech					-0.816** (0.397)
Density					-0.066 (0.094)
HighTech	-0.148 (0.548)	-0.196 (0.548)	0.360 (0.545)	0.340 (0.552)	0.132 (0.549)
HHI	0.733*** (0.110)	0.644*** (0.109)	0.582*** (0.097)	0.535*** (0.097)	0.568*** (0.097)
ln(assets)	0.581*** (0.023)	0.587*** (0.023)	0.619*** (0.023)	0.611*** (0.023)	0.600*** (0.023)
1 / no firms	1.506*** (0.220)	1.499*** (0.220)	1.613*** (0.219)	1.568*** (0.220)	1.527*** (0.220)
Capital intensity	0.008*** (0.003)	0.008*** (0.003)	0.009*** (0.003)	0.008*** (0.003)	0.008*** (0.003)
R&D intensity	-13.641*** (2.092)	-13.748*** (2.093)	-13.873*** (2.087)	-13.903*** (2.094)	-14.060*** (2.100)
R&D missing	0.216*** (0.037)	0.217*** (0.037)	0.208*** (0.037)	0.217*** (0.037)	0.217*** (0.037)
Leverage	-2.564*** (0.115)	-2.588*** (0.115)	-2.686*** (0.114)	-2.612*** (0.114)	-2.612*** (0.114)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6945	6945	6931	6945	6380
R^2	0.212	0.211	0.216	0.211	0.210

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: High Tech Interaction Terms of Common Ownership Metrics on R&D Intensity

MHHI Delta x HighTech	-0.002 (0.002)				
MHHI Delta	0.001 (0.001)				
C x HighTech		-0.001 (0.002)			
C		0.001 (0.001)			
PCF x HighTech			0.002 (0.002)		
PCF			0.001 (0.001)		
PCS x HighTech				-0.003** (0.001)	
PCS				0.001** (0.000)	
Density x HighTech					-0.014*** (0.002)
Density					-0.000 (0.001)
HighTech	0.001 (0.003)	0.001 (0.003)	0.000 (0.003)	0.002 (0.003)	0.003 (0.003)
HHI	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
ln(assets)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000** (0.000)
1 / no firms	-0.002 (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.002* (0.001)
Capital intensity	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
R&D missing	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Leverage	-0.005*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6945	6945	6931	6945	6945
R^2	0.151	0.151	0.152	0.152	0.155

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: High Tech Interaction Terms of Common Ownership Metrics on the Natural Logarithm of Patents with Robust Standard Errors at the Industry Level

MHHI Delta x HighTech	-0.362 (1.247)				
MHHI Delta	0.257 (0.504)				
C x HighTech		-0.576 (1.359)			
C		0.452 (0.543)			
PCF x HighTech			-1.616** (0.730)		
PCF			0.005 (0.224)		
PCS x HighTech				-0.409 (0.610)	
PCS				-0.071 (0.118)	
Density x HighTech					-0.364 (1.155)
Density					0.201 (0.178)
HighTech	0.465 (0.367)	0.526 (0.354)	0.660** (0.279)	0.603 (0.395)	0.431 (0.309)
HHI	0.537 (0.418)	0.593 (0.408)	0.447 (0.408)	0.434 (0.400)	0.447 (0.412)
ln(assets)	0.203* (0.106)	0.197* (0.105)	0.220** (0.109)	0.218** (0.108)	0.212* (0.109)
1 / no firms	-0.700 (0.736)	-0.711 (0.734)	-0.681 (0.734)	-0.715 (0.722)	-0.716 (0.740)
Capital intensity	-0.021* (0.012)	-0.020* (0.012)	-0.021* (0.012)	-0.021* (0.012)	-0.020* (0.012)
R&D intensity	20.992** (10.276)	20.932** (10.138)	21.271** (10.374)	20.991** (10.379)	20.965** (10.394)
R&D missing	-0.046 (0.069)	-0.048 (0.069)	-0.047 (0.069)	-0.048 (0.069)	-0.043 (0.069)
Leverage	-0.086 (0.322)	-0.067 (0.325)	-0.126 (0.326)	-0.101 (0.321)	-0.115 (0.320)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6945	6945	6931	6945	6945
R^2	0.181	0.182	0.183	0.182	0.182

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: High Tech Interaction Terms of Common Ownership Metrics on the Natural Logarithm of Citations with Robust Standard Errors at the Industry Level

MHHI Delta x HighTech	-0.324 (0.664)				
MHHI Delta	0.204 (0.353)				
C x HighTech		-0.613 (0.701)			
C		0.285 (0.338)			
PCF x HighTech			-0.310 (0.551)		
PCF			-0.003 (0.159)		
PCS x HighTech				0.515** (0.220)	
PCS				-0.080 (0.109)	
Density x HighTech					0.105 (0.648)
Density					-0.036 (0.140)
HighTech	1.943*** (0.221)	2.005*** (0.219)	1.929*** (0.191)	1.641*** (0.200)	1.845*** (0.207)
HHI	0.293 (0.250)	0.309 (0.246)	0.197 (0.214)	0.224 (0.216)	0.229 (0.220)
ln(assets)	-0.056 (0.060)	-0.058 (0.061)	-0.048 (0.065)	-0.051 (0.062)	-0.052 (0.064)
1 / no firms	0.002 (0.481)	0.001 (0.476)	0.007 (0.495)	-0.049 (0.497)	-0.007 (0.491)
Capital intensity	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)
R&D intensity	-0.404 (2.855)	-0.446 (2.904)	-0.407 (2.760)	-0.065 (2.778)	-0.290 (2.726)
R&D missing	-0.153** (0.062)	-0.153** (0.062)	-0.145** (0.062)	-0.152** (0.062)	-0.153** (0.062)
Leverage	-0.737*** (0.258)	-0.735*** (0.261)	-0.745*** (0.265)	-0.778*** (0.264)	-0.767*** (0.266)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6380	6380	6366	6380	6380
r2_within	0.758	0.758	0.758	0.758	0.758

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 21: High Tech Interaction Terms of Common Ownership Metrics on the Real Value of Patents with Robust Standard Errors at the Industry Level

MHHI Delta x HighTech	0.798 (0.891)				
MHHI Delta	0.410 (0.409)				
C x HighTech		1.072 (0.970)			
C		0.179 (0.429)			
PCF x HighTech			-2.026 (1.298)		
PCF			-0.023 (0.156)		
PCS x HighTech				-0.636 (0.719)	
PCS				-0.032 (0.088)	
Density x HighTech					-0.816 (1.169)
Density					-0.066 (0.190)
HighTech	-0.148 (0.276)	-0.196 (0.270)	0.360 (0.298)	0.340 (0.402)	0.132 (0.283)
HHI	0.733** (0.328)	0.644* (0.330)	0.582** (0.293)	0.535* (0.300)	0.568* (0.299)
ln(assets)	0.581*** (0.096)	0.587*** (0.097)	0.619*** (0.092)	0.611*** (0.094)	0.600*** (0.094)
1 / no firms	1.506** (0.634)	1.499** (0.643)	1.613** (0.645)	1.568** (0.653)	1.527** (0.647)
Capital intensity	0.008 (0.010)	0.008 (0.010)	0.009 (0.010)	0.008 (0.010)	0.008 (0.010)
R&D intensity	-13.641* (7.068)	-13.748** (6.975)	-13.873* (7.106)	-13.903* (7.098)	-14.060** (7.061)
R&D missing	0.216*** (0.076)	0.217*** (0.076)	0.208*** (0.075)	0.217*** (0.076)	0.217*** (0.076)
Leverage	-2.564*** (0.308)	-2.588*** (0.311)	-2.686*** (0.310)	-2.612*** (0.312)	-2.612*** (0.313)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6945	6945	6931	6945	6945
R^2	0.212	0.211	0.216	0.211	0.210

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 22: High Tech Interaction Terms of Common Ownership Metrics on R&D Intensity with Robust Standard Errors at the Industry Level

MHHI Delta x HighTech	-0.002 (0.008)				
MHHI Delta	0.001 (0.003)				
C x HighTech		-0.001 (0.009)			
C		0.001 (0.003)			
PCF x HighTech			0.002 (0.006)		
PCF			0.001 (0.001)		
PCS x HighTech				-0.003 (0.005)	
PCS				0.001 (0.001)	
Density x HighTech					-0.014* (0.008)
Density					-0.000 (0.001)
HighTech	0.001 (0.002)	0.001 (0.002)	0.000 (0.001)	0.002 (0.003)	0.003* (0.002)
HHI	0.000 (0.002)	0.001 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)
ln(assets)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)
1 / no firms	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)
Capital intensity	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
R&D missing	-0.001** (0.001)	-0.001** (0.001)	-0.001** (0.001)	-0.001** (0.001)	-0.001** (0.001)
Leverage	-0.005*** (0.002)	-0.005*** (0.002)	-0.006*** (0.002)	-0.005*** (0.002)	-0.005*** (0.002)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	6945	6945	6931	6945	6945
R^2	0.151	0.151	0.152	0.152	0.155

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The Tables 23, 24, and 25 are all estimated using robust standard errors clustered at the industry level.

Table 23: The Effect of Exogenous Variation in MHHI Delta on Industry Level Profitability

Dependent variable	Markup	Markup	PCM	PCM
Treat_MHHI x Post	0.006 (0.024)	0.013 (0.016)	-0.066*** (0.022)	-0.012 (0.010)
Treat_MHHI	0.009 (0.015)		0.063** (0.028)	
HHI		-0.007 (0.100)		-0.224*** (0.064)
ln(assets)		-0.010 (0.016)		-0.017 (0.021)
1 / no firms		-0.438 (0.296)		-0.241 (0.291)
Capital intensity		-0.014** (0.006)		0.007 (0.006)
Sales Growth		0.022 (0.022)		-0.029* (0.016)
R&D intensity		-4.151** (2.104)		1.064 (1.763)
R&D missing		0.057 (0.056)		0.028 (0.051)
Leverage		-0.141 (0.108)		-0.073 (0.104)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects		Yes		Yes
Observations	910	910	910	910
R^2	0.369	0.451	0.269	0.407

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The Tables 23, 24, and 25 are all estimated using robust standard errors clustered at the industry level.

Table 24: The Effect of Exogenous Variation in MHHI Delta on Industry Level Natural log of Patents and Citations

Dependent variable	Ln(Patents)	Ln(Patents)	Ln(Citations)	Ln(Citations)
Treat_MHHI x Post	-0.307** (0.139)	-0.212 (0.186)	0.288 (0.257)	0.310** (0.130)
Treat_MHHI	0.273 (0.244)		0.011 (0.232)	
HHI		1.078 (1.561)		0.498 (0.638)
ln(assets)		-0.364** (0.181)		0.042 (0.199)
1 / no firms		-3.962 (4.724)		3.087** (1.455)
Capital intensity		0.014 (0.063)		0.034 (0.051)
R&D intensity		27.825 (18.495)		-1.495 (10.687)
Leverage		1.770** (0.763)		-1.066 (1.001)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects		Yes		Yes
Observations	837	837	810	810
R^2	0.237	0.325	0.897	0.899

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The Tables 23, 24, and 25 are all estimated using robust standard errors clustered at the industry level.

Table 25: The Effect of Exogenous Variation in MHHI Delta on Industry Level Natural log of Patent Value and R&D intensity

Dependent variable	ln(Value)	ln(Value)	R&D Intensity	R&D Intensity
Treat_MHHI x Post	-0.010 (0.390)	-0.217 (0.199)	0.001 (0.001)	0.002* (0.001)
Treat_MHHI	-0.401 (0.385)		0.003* (0.002)	
HHI		-0.616 (1.439)		-0.008 (0.007)
ln(assets)		0.872** (0.347)		-0.001 (0.001)
1 / no firms		17.409*** (3.335)		-0.052 (0.035)
Capital intensity		-0.000 (0.073)		-0.001*** (0.000)
R&D intensity		-19.477 (18.676)		
Leverage		-1.914 (1.777)		-0.009 (0.009)
Time (Quarter) Fixed Effects	Yes	Yes	Yes	Yes
Industry (NAICS) Fixed Effects		Yes		Yes
Observations	837	837	837	837
R^2	0.317	0.464	0.220	0.357

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Thesis Planning Timeline

Below is the detailed planning timeline for the stages of my thesis from proposal submission to defense.

Date	Activity
10th of May	Final review and proofreading of the proposal. Submission of the proposal.
13th May	Schedule a meeting to discuss the submitted proposal and plan the next steps based on feedback.
15th May	Incorporate feedback from the proposal discussion and continue with data analysis.
22nd May	Check progress on detailed analysis using the finalized variables.
24th May	CFA Level 2 exam date; limited availability for thesis work until this date.
29th May	Mid-analysis review meeting to discuss preliminary results and methodological approaches.
7th June	Incorporate feedback and continue with data analysis towards final results and conclusions. Submission of the thesis draft.
16th-20th June	Begin revising the thesis based on initial feedback.
26th June	Continue revising thesis based on ongoing feedback.
5th July	Second draft review meeting.
12th July	Final revisions based on last feedback.
20th July	Prepare the final manuscript for submission and plan a date to defend my thesis.
26th July	Defend my thesis

E Programming code

Please review the additional do-file, python script and SAS file for further reference.

References

- Alegre-Vidal, J., Lapiedra-Alcam, R. & Chiva-Gmez, R. (2004, July). Linking operations strategy and product innovation: an empirical study of Spanish ceramic tile producers. *Research Policy*, 33(5), 829–839. Retrieved 2024-06-30, from <https://www.sciencedirect.com/science/article/pii/S0048733304000095> doi: 10.1016/j.respol.2004.01.003
- Anton, M., Ederer, F., Gin, M. & Schmalz, M. C. (2024, March). *Innovation: The Bright Side of Common Ownership?* [Working Paper]. National Bureau of Economic Research. Retrieved 2024-06-30, from <https://www.nber.org/papers/w32192> doi: 10.3386/w32192
- Anton, M. & Polk, C. (2014). Connected Stocks. *The Journal of Finance*, 69(3), 1099–1127. Retrieved 2024-06-18, from <https://onlinelibrary.wiley.com/doi/abs/10.1111/jofi.12149> (_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.12149>) doi: 10.1111/jofi.12149
- Azar, J. (2011, November). *A New Look at Oligopoly: Implicit Collusion Through Portfolio Diversification* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-03-10, from <https://papers.ssrn.com/abstract=1993364> doi: 10.2139/ssrn.1993364
- Azar, J., Raina, S. & Schmalz, M. (2022). Ultimate ownership and bank competition. *Financial Management*, 51(1), 227–269. Retrieved 2024-04-25, from <https://onlinelibrary.wiley.com/doi/abs/10.1111/fima.12368> (_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/fima.12368>) doi: 10.1111/fima.12368
- Azar, J., Schmalz, M. C. & Tecu, I. (2018). Anticompetitive Effects of Common Ownership. *The Journal of Finance*, 73(4), 1513–1565. Retrieved 2024-03-10, from <https://onlinelibrary.wiley.com/doi/abs/10.1111/jofi.12698> (_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.12698>) doi: 10.1111/jofi.12698
- Azar, J. & Vives, X. (2021, March). *Revisiting the Anticompetitive Effects of Common Ownership* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-03-10, from <https://papers.ssrn.com/abstract=3805047> doi: 10.2139/ssrn.3805047
- Backus, M., Conlon, C. & Sinkinson, M. (2021, January). *Common Ownership and Competition in the Ready-to-Eat Cereal Industry* [Working Paper]. National Bureau of Economic Research. Retrieved 2024-04-25, from <https://www.nber.org/papers/w28350> doi: 10.3386/w28350
- Balkin, D. B., Markman, G. D. & Gomez-Mejia, L. R. (2000, December). Is ceo pay in high-technology firms related to innovation? *Academy of Management Journal*, 43(6), 1118–1129. Retrieved 2024-06-30, from <https://journals.aom.org/doi/abs/10.5465/1556340> (Publisher: Academy of Management) doi: 10.5465/1556340
- Bresnahan, T. F. & Salop, S. C. (1986, June). Quantifying the competitive effects of production joint ventures. *International Journal of Industrial Organization*, 4(2), 155–175. Retrieved 2024-05-29, from <https://www.sciencedirect.com/science/article/pii/0167718786900287> doi: 10.1016/0167-7187(86)90028-7

- Bustos, J. P. G. & Hernandez-Lara, A. B. (2016). CORPORATE GOVERNANCE AND INNOVATION: A SYSTEMATIC LITERATURE REVIEW. *Corporate Ownership and Control*. Retrieved 2024-06-30, from <https://virtusinterpress.org/CORPORATE-GOVERNANCE-AND,3983.html>
- Census.gov. (2023, January). *BDS-High Tech Methodology*. Retrieved 2024-06-09, from <https://www.census.gov/programs-surveys/ces/data/public-use-data/experimental-bds/bds-high-tech/methodology.html> (Section: Government)
- Cohen, L. & Frazzini, A. (2008). Economic Links and Predictable Returns. *The Journal of Finance*, 63(4), 1977–2011. Retrieved 2024-06-18, from <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6261.2008.01379.x> (_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1540-6261.2008.01379.x>) doi: 10.1111/j.1540-6261.2008.01379.x
- corporatefinanceinstitute.com. (2015). *Capitalizing R&D Expenses*. Retrieved 2024-06-25, from <https://corporatefinanceinstitute.com/resources/accounting/capitalizing-rd-expenses/>
- Dalziel, T., Gentry, R. J. & Bowerman, M. (2011). An Integrated Agency Resource Dependence View of the Influence of Directors' Human and Relational Capital on Firms' R&D Spending. *Journal of Management Studies*, 48(6), 1217–1242. Retrieved 2024-06-30, from <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-6486.2010.01003.x> (_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1467-6486.2010.01003.x>) doi: 10.1111/j.1467-6486.2010.01003.x
- Damanpour, F. (1992, July). Organizational Size and Innovation. *Organization Studies*, 13(3), 375–402. Retrieved 2024-06-30, from <https://doi.org/10.1177/017084069201300304> (Publisher: SAGE Publications Ltd) doi: 10.1177/017084069201300304
- De Loecker, J. & Warzynski, F. (2012, May). Markups and Firm-Level Export Status. *American Economic Review*, 102(6), 2437–2471. Retrieved 2024-06-07, from <https://www.aeaweb.org/articles?id=10.1257/aer.102.6.2437> doi: 10.1257/aer.102.6.2437
- Dennis, P. J., Gerardi, K. & Schenone, C. (2021, September). *Common Ownership Does Not Have Anti-Competitive Effects in the Airline Industry* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-06, from <https://papers.ssrn.com/abstract=3063465> doi: 10.2139/ssrn.3063465
- Dictionary, C. B. E. (2024, May). *common ownership*. Cambridge University Press. Retrieved 2024-05-28, from <https://dictionary.cambridge.org/dictionary/english/common-ownership>
- Domowitz, I., Hubbard, R. G. & Petersen, B. C. (1987). Oligopoly Supergames: Some Empirical Evidence on Prices and Margins. *The Journal of Industrial Economics*, 35(4), 379–398. Retrieved 2024-06-18, from <https://www.jstor.org/stable/2098579> (Publisher: Wiley) doi: 10.2307/2098579

- Dosi, G. & Nelson, R. R. (2010, January). Chapter 3 - Technical Change and Industrial Dynamics as Evolutionary Processes. In B. H. Hall & N. Rosenberg (Eds.), *Handbook of the Economics of Innovation* (Vol. 1, pp. 51–127). North-Holland. Retrieved 2024-06-11, from <https://www.sciencedirect.com/science/article/pii/S0169721810010038> doi: 10.1016/S0169-7218(10)01003-8
- Dou, W. W., Ji, Y. & Wu, W. (2021, May). Competition, profitability, and discount rates. *Journal of Financial Economics*, 140(2), 582–620. Retrieved 2024-05-29, from <https://www.sciencedirect.com/science/article/pii/S0304405X20303536> doi: 10.1016/j.jfineco.2020.12.013
- Drechsler, F. S. (2020, January). *Institutional Ownership breadth*. Retrieved 2024-06-13, from <https://www.fredasongdrechsler.com/data-crunching/io.breadth>
- Elhauge, E. (2020, April). *How Horizontal Shareholding Harms Our Economy - And Why Antitrust Law Can Fix It* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-09, from <https://papers.ssrn.com/abstract=3293822> doi: 10.2139/ssrn.3293822
- Elzinga, K. G. & Mills, D. E. (2011, May). The Lerner Index of Monopoly Power: Origins and Uses. *American Economic Review*, 101(3), 558–564. Retrieved 2024-06-04, from <https://www.aeaweb.org/articles?id=10.1257/aer.101.3.558> doi: 10.1257/aer.101.3.558
- EuroNews.com. (2024, March). *OPEC+ oil giants extend oil output cuts amid economic uncertainty*. Retrieved 2024-04-25, from <https://www.euronews.com/business/2024/03/04/opec-oil-giants-extend-oil-output-cuts-amid-economic-uncertainty>
- Farkas, G. (2005, January). Fixed-Effects Models. In K. Kempf-Leonard (Ed.), *Encyclopedia of Social Measurement* (pp. 45–50). New York: Elsevier. Retrieved 2024-06-21, from <https://www.sciencedirect.com/science/article/pii/B0123693985001614> doi: 10.1016/B012-369398-5/00161-4
- Fisher, I. (1930). *The Theory of Interest: As Determined by Impatience to Spend Income and Opportunity to Invest It*. MacMillan Company. (Accession Number: 6255 Source: oclc)
- Fresard, L. & Phillips, G. M. (2022, October). *Product Markets, Competition and Corporate Finance: A Review and Directions for Future Research* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-02, from <https://papers.ssrn.com/abstract=4247331> doi: 10.2139/ssrn.4247331
- Gatignon, H., Tushman, M. L., Smith, W. & Anderson, P. (2002). A Structural Approach to Assessing Innovation: Construct Development of Innovation Locus, Type, and Characteristics. *Management Science*, 48(9), 1103–1122. Retrieved 2024-06-30, from <https://www.jstor.org/stable/822604> (Publisher: INFORMS)
- Gerardi, K., Lowry, M. & Schenone, C. (2023, November). *A Critical Review of the Common Ownership Literature* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-04-25, from <https://papers.ssrn.com/abstract=4630765> doi: 10.29338/wp2023-17

- Gibbon, A. J. & Schain, J. P. (2023, July). Rising markups, common ownership, and technological capacities. *International Journal of Industrial Organization*, 89, 102900. Retrieved 2024-06-07, from <https://www.sciencedirect.com/science/article/pii/S0167718722000753> doi: 10.1016/j.ijindorg.2022.102900
- Gilje, E. P., Gormley, T. A. & Levit, D. (2018, April). The Rise of Common Ownership. *University of Pennsylvania and Washington University in St. Louis, Working Paper*.
- Gonzalez-Uribe, J. (2020, January). Exchanges of innovation resources inside venture capital portfolios. *Journal of Financial Economics*, 135(1), 144–168. Retrieved 2024-07-01, from <https://www.sciencedirect.com/science/article/pii/S0304405X19301424> doi: 10.1016/j.jfineco.2019.05.017
- Hart, O. D. (1979). On Shareholder Unanimity in Large Stock Market Economies. *Econometrica*, 47(5), 1057–1083. Retrieved 2024-06-05, from <https://ideas.repec.org//a/ecm/emetrp/v47y1979i5p1057-83.html> (Publisher: Econometric Society)
- He, J. & Huang, J. (2016, January). *Product Market Competition in a World of Cross-Ownership: Evidence from Institutional Blockholdings* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-29, from <https://papers.ssrn.com/abstract=2380426> doi: 10.2139/ssrn.2380426
- Hennig, J. C., Oehmichen, J., Steinberg, P. J. & Heigermoser, J. (2022, May). Determinants of common ownership: Exploring an information-based and a competition-based perspective in a global context. *Journal of Business Research*, 144, 690–702. Retrieved 2024-05-29, from <https://www.sciencedirect.com/science/article/pii/S0148296322001357> doi: 10.1016/j.jbusres.2022.02.019
- Hirschman, A. O. (1945). *National Power and the Structure of Foreign Trade*. University of California Press. (Google-Books-ID: BezqxPq50dwC)
- Hitt, M. A., Hoskisson, R. E., Ireland, R. D. & Harrison, J. S. (1991). Effects of Acquisitions on R&D Inputs and Outputs. *The Academy of Management Journal*, 34(3), 693–706. Retrieved 2024-06-30, from <https://www.jstor.org/stable/256412> (Publisher: Academy of Management) doi: 10.2307/256412
- Johannessen, J., Olsen, B. & Lumpkin, G. (2001, January). Innovation as newness: what is new, how new, and new to whom? *European Journal of Innovation Management*, 4(1), 20–31. Retrieved 2024-06-30, from <https://doi.org/10.1108/14601060110365547> (Publisher: MCB UP Ltd) doi: 10.1108/14601060110365547
- Kennedy, P., O'Brien, D. P., Song, M. & Waehrer, K. (2017, July). *The Competitive Effects of Common Ownership: Economic Foundations and Empirical Evidence* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-04-25, from <https://papers.ssrn.com/abstract=3008331> doi: 10.2139/ssrn.3008331
- Koch, A., Panayides, M. & Thomas, S. (2021, January). Common ownership and competition in product markets. *Journal of Financial Economics*, 139(1), 109–137. Retrieved 2024-04-25,

- from <https://www.sciencedirect.com/science/article/pii/S0304405X20301938> doi: 10.1016/j.jfineco.2020.07.007
- Kogan, L., Papanikolaou, D., Seru, A. & Stoffman, N. (2017, May). Technological Innovation, Resource Allocation, and Growth*. *The Quarterly Journal of Economics*, 132(2), 665–712. Retrieved 2024-06-30, from <https://doi.org/10.1093/qje/qjw040> doi: 10.1093/qje/qjw040
- Kor, Y. Y. (2006). Direct and interaction effects of top management team and board compositions on R&D investment strategy. *Strategic Management Journal*, 27(11), 1081–1099. Retrieved 2024-06-30, from <https://onlinelibrary.wiley.com/doi/abs/10.1002/smj.554> (_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/smj.554>) doi: 10.1002/smj.554
- Kostovetsky, L. & Manconi, A. (2020, April). *Common Institutional Ownership and Diffusion of Innovation* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-30, from <https://papers.ssrn.com/abstract=2896372> doi: 10.2139/ssrn.2896372
- Lambert, T. A. & Sykuta, M. E. (2018, May). *The Case for Doing Nothing About Institutional Investors Common Ownership of Small Stakes in Competing Firms* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-04-28, from <https://papers.ssrn.com/abstract=3173787>
- Lerner, A. P. (1934). The Concept of Monopoly and the Measurement of Monopoly Power Market Power: Concept and Measurement 1 Review of Economic Studies 157 (1934). *Journal of Reprints for Antitrust Law and Economics*, 27(2), 471–492. Retrieved 2024-06-04, from <https://heionline.org/HOL/Page?handle=hein.journals/jrepale27>
- Li, X., Liu, T. & Taylor, L. A. (2022, December). *Common Ownership and Innovation Efficiency* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-11, from <https://papers.ssrn.com/abstract=3479439> doi: 10.2139/ssrn.3479439
- MorganStanley.com. (2020, October). *Morgan Stanley to Acquire Eaton Vance*. Retrieved 2024-04-26, from <https://www.morganstanley.com/press-releases/morgan-stanley-to-acquire-eaton-vance>
- O'Brien, D. P. & Salop, S. C. (2000). Competitive Effects of Partial Ownership: Financial Interest and Corporate Control. *Antitrust Law Journal*, 67(3), 559–614. Retrieved 2024-03-10, from <https://www.jstor.org/stable/40843443> (Publisher: American Bar Association)
- Palacios, L., Moussawi, R. & Glushkov, D. (2009, May). *Calculate Institutional Ownership, Concentration, and Breadth Ratios*. Retrieved 2024-06-13, from <https://gist.github.com/mgao6767/41877b83763846008680acb3d355e9ff>
- Phillips, G. M. (1995, February). Increased debt and industry product markets an empirical analysis. *Journal of Financial Economics*, 37(2), 189–238. Retrieved 2024-06-18, from <https://www.sciencedirect.com/science/article/pii/0304405X9400785Y> doi: 10.1016/0304-405X(94)00785-Y

- Posner, E., Morton, S. & Weyl, E. (2016, January). A Proposal to Limit the Anti-Competitive Power of Institutional Investors. *SSRN Electronic Journal*. doi: 10.2139/ssrn.2872754
- Rock, E. B. & Rubinfeld, D. L. (2017, March). *Defusing the Antitrust Threat to Institutional Investor Involvement in Corporate Governance* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-06-09, from <https://papers.ssrn.com/abstract=2925855> doi: 10.2139/ssrn.2925855
- Rotemberg, J. (1984). *Financial transaction costs and industrial performance* (Working Paper). Cambridge, Mass. : Massachusetts Institute of Technology. Retrieved 2024-03-10, from <https://dspace.mit.edu/handle/1721.1/47993> (Accepted: 2009-10-01T21:11:05Z)
- Rubinstein, A. & Yaari, M. (1983, February). The Competitive Stock Market as Cartel Maker: Some Examples.
- Schumpeter, J. A. (1934). *The theory of economic development; an inquiry into profits, capital, credit, interest, and the business cycle*. Cambridge, Mass., Harvard University Press. Retrieved 2024-06-30, from <http://archive.org/details/theoryofeconomic0000schu>
- Schumpeter, J. A. (1939). Business cycles: A theoretical, historical and statistical analysis of the capitalist process. *McGraw Hill Book Company*.
- Scitovsky, T. (1955). Economic Theory and the Measurement of Concentration. *NBER Chapters*, 101–118. Retrieved 2024-06-04, from <https://ideas.repec.org/h/nbr/nberch/0955.html> (Publisher: National Bureau of Economic Research, Inc)
- Smith, K., Evangelista, R., Sandven, T. & Sirilli, G. (1998, February). Measuring Innovation in European Industry. *International Journal of the Economics of Business*, 5, 311–333. doi: 10.1080/13571519884413
- Thompson, V. A. (1965). Bureaucracy and Innovation. *Administrative Science Quarterly*, 10(1), 1–20. Retrieved 2024-06-30, from <https://www.jstor.org/stable/2391646> (Publisher: [Sage Publications, Inc., Johnson Graduate School of Management, Cornell University]) doi: 10.2307/2391646
- Torshizi, M. & Clapp, J. (2020, November). *Price Effects of Common Ownership in the Seed Sector* [SSRN Scholarly Paper]. Rochester, NY. Retrieved 2024-04-25, from <https://papers.ssrn.com/abstract=3338485> doi: 10.2139/ssrn.3338485
- TradeNews.com. (2020, August). *Franklin Templeton completes \$4.5 billion Legg Mason takeover*. Retrieved 2024-04-26, from <https://www.thetradenews.com/franklin-templeton-completes-4-5-billion-legg-mason-takeover/>
- Ven, A. H. V. d. (1986, May). Central Problems in the Management of Innovation. *Management Science*. Retrieved 2024-06-30, from <https://pubsonline.informs.org/doi/abs/10.1287/mnsc.32.5.590> (Publisher: INFORMS) doi: 10.1287/mnsc.32.5.590

- Vives, X. (2020, May). Common ownership, market power, and innovation. *International Journal of Industrial Organization*, 70, 102528. Retrieved 2024-06-30, from <https://www.sciencedirect.com/science/article/pii/S0167718719300505> doi: 10.1016/j.ijindorg.2019.102528
- WRDS. (2020). *Notes on Regenerated Data (as of June 2018)*. Retrieved 2024-06-25, from https://wrds-www.wharton.upenn.edu/documents/952/S12_and_S34_Regenerated_Data_2010-2016.pdf
- Zheng, X., Xu, W. & Xue, S. (2024, June). *KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data*. Retrieved 2024-06-30, from <https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data> (original-date: 2020-04-25T19:45:07Z)