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Lysle Boller
Fiona Scott Morton

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ABSTRACT

We test if an increase in common ownership changes future expected profits with an event study method. We collect instances of a stock entering the S&P 500 index and identify its product market competitors. We measure the change in institutional and common ownership (with product market rivals) and find that entering stocks experience a significant increase in both. We measure the stock returns of the entrant's product market rivals upon the entry news. We find that increases in common ownership (driven by the whole vector of ownership similarity) cause increases in stock returns, consistent with a hypothesis that common ownership raises profits.

Lysle Boller
Economics Dept
Duke University
Durham, NC
lysle.boller@duke.edu

Fiona Scott Morton
Yale School of Management
Box 208200
New Haven, CT 06520-8200
and NBER
fiona.scottmorton@yale.edu

1 Introduction

Large diversified institutional investors, sovereign wealth funds, and individuals often hold, own, or manage significant stakes in companies that compete with one another in the product market. For example, Vanguard holds stakes of over 5% in at least six U.S. domestic airlines (Schmalz, 2018). This type of common owner is relatively new — driven by the rise in popularity of mutual funds and sovereign wealth funds — and, as we will discuss below, prevalent in the United States. The problem that arises when an owner holds stakes in two or more firms that compete with each other in the product market is that incentives for competition may be reduced. Consider a diversified owner who holds a portfolio of investments in airlines – Delta, American, Southwest and United. This owner is impacted by aggressive competition differently than an undiversified owner, e.g. an owner who only invests in Delta stock. The undiversified Delta owner may benefit when Delta steals market share away from United or Southwest. By contrast, the diversified investor may find that the profits lost by United and Southwest offset some or all of the gains to Delta. Thus, the incentives to promote vigorous competition are weaker for a diversified owner when compared to an undiversified owner.

The theoretical threat to competition from widespread common ownership has motivated new research in Industrial Organization to determine if an empirical effect can be measured (see Backus et al. (2018), Azar et al. (2018a), Azar et al. (2016) for a few examples). The existing literature examines particular outcomes such as specific prices or entry decisions in individual industries using different identification strategies. There are also economy-wide studies that examine price cost margins, accounting profits and so forth. We take a different approach, testing for an impact of increased common ownership on future expected profits using the associated changes in a stock prices. We collect instances where Standard & Poor's selects a firm to be listed on the S&P 500 index between 2000 and 2017 and show that this announcement increases both institutional ownership and common ownership between the entrant and its product market rivals. It is well known that an entering stock experiences a demand shock with index inclusion, which increases its stock price. We contribute to this literature by showing that this effect is strongly related to the magnitude of the underlying shift in ownership. The main focus of this paper, however, is on the reaction of stocks of the *product market rivals* of the entering firms. The rivals do not experience increased demand for their stock because they are already in the index.[1] We can therefore isolate the effect of

[1] In fact, demand may actually decrease as the weight of index incumbents tends to decrease after changes to index membership.

ownership on competition in the product market by studying how the stock price of rivals responds to the entry of a firm into the index.

The key theoretical IO insight that drives the concern about the impact of common ownership is the well-established result that competition drives down profits. A single owner of all the firms in an industry will achieve higher profits than the standalone firms because it can replicate the monopoly outcome; and this outcome, by definition, delivers maximum profit. This insight is the reason that mergers of competitors are subject to regulatory review. Common ownership is analogous to a merger, only weaker due to the (typically) lower ownership shares involved. Common owners, therefore, have incentives to soften competition in a way that brings industry outcomes such as prices, quantities, capacity, or new product introductions closer to the levels a monopolist would choose. A *perfectly* diversified common owner is, additionally, indifferent to the allocation of those profits across particular firms. When there are a variety of common owners that are not perfectly symmetric, as well as undiversified owners, the intuition carries through if the common owners cause softened competition that benefits all firms in the industry. With softer competition and higher profits for every firm, the undiversified owner will benefit from common owners who alter the competitive environment.

The legal role and arrangements of the parties typically vary across the institutional investor category. A fund may hold the stock, while the investor is the legal owner of the shares. Meanwhile, an investment management company hired by the fund (and often sharing a name) chooses the stocks in which the fund invests. Individual funds are typically separate legal entities, but belong to a "fund family" that often governs and votes its shares in a bloc. We will treat all such fund families - along with their management companies - as unitary actors and refer to them in the text as "a fund." Also of concern to competition are sovereign wealth funds and individual owners such as Warren Buffet who may have yet different legal arrangements to hold stocks. Because this paper is about the economic effects of common institutional investors, the particular legal arrangements of institutional investors will not be necessary for our analysis, so we will abstract from them. Throughout the paper "funds" or "owners" are the agents taking action, and we will describe them as "owning" or "holding" stock and "voting" those shares.

Fund investment managers as well as ultimate owners generally benefit when current or future profits rise. Higher current profits will be paid out as dividends or retained to invest in projects that make the company more valuable. The expectation of higher profits in the future leads to higher current stock prices. When stock prices rise, an individual investor, sovereign wealth fund, or diversified mutual fund experiences positive returns and their portfolios grow in value. For mutual funds, high returns may attract investors from competing savings products or competing mutual funds. Managers of mutual funds are often compensated for returns, assets under management, and on the flow of investment into the fund. Index funds are slightly different. They generate value to investors by tracking a diversified index of assets, such as the S&P 500. Index funds care about their tracking error, or how much they deviate from the performance of the index itself. While this may be goal in theory, in practice, the range of tracking errors among S&P mutual funds is quite significant. Regardless of tracking error, if the stocks forming an index fund grow in value, this will tend to attract more capital into the segment and increase assets under management for the index fund. Thus, managers of all investment vehicles weakly prefer that the value of their assets grow, and most actively gain from higher profits and stock prices.

Secondly, a large mutual fund, sovereign wealth fund, or individual has the ability to affect competition in an industry if it engages in effective corporate governance. It has long been recognized in the corporate finance literature that the separation of ownership and control generates an agency problem for a firm's top management, who may not want to exert costly effort. This combination of incentive (higher returns) and ability (corporate governance) to soften competition by large diversified institutional investors, sovereign wealth funds, or individual owners raises the concern that product market competition may be harmed.

Whether common ownership is a problem deserves serious empirical study and policy attention because any harm could potentially be extremely large. Yet it is difficult to come up with a clean empirical test that can be applied to multiple industries due to the many kinds of market structures, cost structures, and dimensions of competition that characterize US industries. As remarked by Backus et al. (2019a) among others, what is needed for empirical research on this question is a setting where there is an exogenous change in common ownership. We exploit the fact that a stock entering the S&P 500 from outside the S&P index family experiences a sharp increase in institutional ownership as well as common ownership. We use the exogenous change in ownership of the security to examine the stock price responses of the entering security itself and its competitors. We exploit the same setting as He and Huang (2017) do except they focus on the context of unexpected acquisitions by blockholders. In our setting of index entry, the entering security experiences more demand from institutional investors, many of whom track indices with varying levels of precision, which drives up its price. Secondly, their increased holdings generate more overlap between that security and its product market competitors that are already in the S&P 500. Critically, S&P 500 securities that compete with the entrant in the product market do not experience increased demand because they are already in the index, but do share the increase in common ownership. We find that these rival stocks experience an economically and statistically significant increase in abnormal returns when their rival enters the S&P 500, which reflect an expectation of higher future profits.

A number of assumptions are required for our empirical tests to be determinative of the effect of increased common ownership on profits. When the stock enters the index the sudden jump in common ownership will cause a change in expected future profits if, first, common ownership softens competition, second, if the particular increase in common ownership caused by the index entry is sufficient to change the product market equilibrium, and third, all of this is known to investors. We will explain below why the first assumption is well supported by economic theory. The second assumption may not hold in all markets, and for this reason our empirical work is conservative. For example, it could be that the change in common ownership caused by index entry is too small to warrant a change in product market behavior in a particular industry. Or, it could be too small to change corporate governance incentives due to the distribution of ownership in that industry, and would therefore have no impact on competitive behavior. We assume, as does much of the finance literature, that stock prices incorporate all available public information about future profits. If increases in common ownership do indeed allow an industry to soften competition and earn higher profits, this will cause the stock price to increase at the moment that informed traders learn that common ownership will increase. In our setting, this corresponds to the date that S&P announces the impending change to the index. Investors understand that an increase in institutional ownership will cause an increase in expected profits going forward, and therefore bid up the stock of competitors in that industry.

Our findings are several fold. First, we demonstrate that on average the institutional ownership of a security rises sharply by several percentage points when it enters the S&P 500 index from outside the S&P index family. Consistent with previous literature, we find that the stock prices of index entrants increase at the time of entry likely due to both demand and common ownership effects, and we provide evidence that the size of this increase is linked to the size of the change in institutional ownership that results from index entry. Most strikingly, we find that competitors who are themselves index incumbents incur higher abnormal returns upon the entry of their rivals when compared with non-incumbent competitors. This finding is supported by a null result for two control groups. Entrants that do not experience an increase in institutional ownership do not generate similar spillover effects to their rivals, and competitors that are not index incumbents do not incur higher abnormal returns.

The second part of the paper correlates abnormal returns with measures of common ownership. There are a number of such measures that have been proposed by different researchers. We show that only vector similarity measures (Cosine similarity and Bray-Curtis similarity) are correlated with returns. These two measures predict higher stock price returns at a diminishing rate. We also examine whether an increase in "kappa," a primitive that summarizes the competitive incentives of common ownership, explains returns and find that it does. Following (Backus et al., 2019b), we exploit the fact that kappa may be decomposed into a cosine similarity measure and a ratio of the relative ownership concentration of investors of the entrant and the incumbent. An increase in cosine similarity predicts an increase in returns, whereas more concentration on the part of owners of the entering security predicts a slight decrease in returns. These results are consistent with the underlying theory, as we explain in detail below.

Our experiment cannot directly shed direct light on the mechanism through which common ownership generates higher profits. This is a major question for future research in corporate governance. However, the paper takes two steps forward. First, it demonstrates that increases in common ownership lead to higher stock prices, and second, the results provide support for some mechanisms and not others. For example, the increase in the total holdings of the three largest funds does not predict higher future profits.

Our paper contributes to the common ownership literature by examining an alternative route to an economy-wide analysis: the stock market event study. Our data allow us to measure the impact of common ownership across many firms and industries. These analyses allow us to draw a causal inference from our experiment. We conclude that the evidence is consistent with an increase in common ownership that translates into higher future expected profits and an increase in returns.

2 Literature Review

2.1 Theory of Common Ownership

The theoretical implications of growing common ownership on the unilateral incentives of firms in the marketplace are straightforward. The intuition was first formalized in Rotemberg (1984) and Bresnahan and Salop (1986). Suppose that a set of owners hold stakes in competing firms in an industry and the goal of the owners of those firms is to maximize profit. The common shareholders prefer the monopoly outcome and have the ability to engage in corporate governance to affect the strategy of the company through voting, compensation, communication, and other tools. Managers of these companies will therefore strive to attain, or get closer to, the outcome that maximizes joint profits. If owners are not symmetric across competitors then they will not agree on strategies that move profits between competitors. However, each will benefit from a strategy that increases the profits of every competitor in the market. These forces will tend to move industry outcomes towards monopoly prices, quantities, or innovation levels. The mechanism through which owners transmit their incentives to managers could range widely. Managers could be financially incentivized by common owners who benefit from softer competition between rivals, owners could provide strategic guidance, owners could vote in particular ways, and so forth. In general, focused ownership, where owners have stakes in only one firm in an industry, will create more incentive to compete relative to common ownership because in that setting every owner internalizes only benefits to its own firm and places zero weight on the profits of rival firms. Common ownership, by contrast, incentivizes owners to encourage firms to move from a competitive equilibrium closer to the monopoly equilibrium.

O'Brien and Salop (2000) embed the ownership patterns generated by common ownership into a Cournot model and show that average markups are equal to the inverse demand elasticity multiplied by a modified Herfindahl-Hirshman Index (MHHI) that is equal to the standard HHI plus a term that captures the additional incentives created by the additional layer of owners, MHHI delta (MHHID). MHHI and MHHID were the first theoretical constructs taken to the data in the empirical literature described below. One interesting property of MHHI is its sensitivity to ownership symmetry. If common owners are exactly symmetric in holding the same percentage of the same set of companies, ownership is proportional to control, and other owners (retail investors) are atomistic, then in this model the monopoly outcome is achieved. This is true whether the common owners each hold 2% or 20% of the competing companies. As discussed in Backus et al. (2019a), there are few models of corporate governance that can speak to this assumption. It is reasonable, however, that in the absence of other large stakeholders, common ownership could be effective even with relatively low ownership stakes. While it is a useful construct, MHHI may be difficult to interpret due to the fact that it is a function not only of ownership shares, but also of endogenously determined market shares. Therefore MHHI can both affect the competitive process, but is also likely an outcome of the competitive process. Ownership shares may react to product market shares, e.g. if a large fund decides that it wants to hold only the top competitors in the industry. The fact that MHHI is endogenous has led to work deriving simple unilateral effects metrics as in Backus et al. (2019b), who analyze a more general model in which common ownership incentivizes firms to maximize their own profits as well as a weighted average of rivals' profits. We provide an overview of that model in Section 5.1.

Static Nash competition in prices or quantities is a central element both in recent literature as well as in earlier work by Bresnahan and Salop (1986) and O'Brien and Salop (2000). These models do not incorporate tacit collusion. However, the possibility of common owners enabling tacit collusion was made long ago in the literature (Malueg, 1992). Gilo et al. (2006) explicitly consider the ability of common ownership to facilitate tacit collusion in a supergame. The paper shows that the cross-holdings of common ownership expand the range of discount factors for which tacit collusion can be sustained. In their framework, common owners introduce incentives to increase the patience of managers who might otherwise deviate from a collusive equilibrium. We adopt this perspective also. There are a number of ways in which common owners could cause managers to be more patient. For example, Antón et al. (2018a) empirically examines compensation contracts of top executives. The paper shows that the sensitivity of executive wealth to performance falls when common ownership rises, meaning that incentives to steal share or undercut rivals are less sharp. If common owners support such contracts they may be able to make executives more patient. Another mechanism that could make managers more patient is described by Schmalz (2018). He notes that when activist investors want to take over a company in order to shake up an industry and explicitly increase competitive pressure on competitors, institutional investors often side with management against the activists. Maintaining long run profits for all firms require turning down those opportunities to make profit in the short run that destroy the profitable equilibrium. Ciliberto et al. (2019) demonstrates that when all airlines mention "capacity discipline" in their earnings calls each supplies less seat capacity in the subsequent quarter. A common owner could support the executives of each of its competing portfolio firms that wish to engage in capacity discipline, and encourage that strategy rather than urging them to break ranks and steal share.

We feel that softening competition through mechanisms such as those described, and no doubt others, is an overlooked aspect of the common ownership debate. Many critics of common ownership point out that different owners own different shares of the different rivals. They will not in general be indifferent about where in the industry profits are earned, therefore a strategy that favors one firm over another is unlikely to be adopted. However, a general softening of competition so that every firm competes less hard and earns more profit is beneficial to every owner, including those that are entirely focused on holding one competitor. Such an undiversified owner will accommodate the tacitly-collusive equilibrium if her firm earns a higher present discounted value flow of profit than in a more vigorously-competitive equilibrium. This will generally be true if profits rise due to the change in competition and the owner values the future more than the gain from defection in the short run.[2] These conditions are more likely to hold in a more concentrated market structure. Generally, common owners that have asymmetric stakes across competitors will prefer common ownership if it leads to higher prices in the industry and higher PDV profits for every firm. Recent empirical work has not considered this case, likely because economists have poor tools for either predicting or measuring tacit collusion. It is interesting to observe that the higher airline prices found by Azar et al. (2018a) are significant only in markets where the HHI is above about 2300.

2.2 Theory of Corporate Governance

As noted above, the corporate governance role of large owners is a natural, and indeed expected, channel through which common owners might affect firm strategy. Corporate governance is widely regarded as a force that can prevent managers from acting in their own interests, rather than on behalf of shareholders. In our setting, the shareholders prefer less vigorous competition. However, engaging in effective corporate governance is costly because a shareholder must become informed about the products, costs, demand, and capabilities of the company, determine best practices, and take time to monitor and communicate with managers. Only large shareholders will find it in their financial interests to take these costly steps. Indeed, strong corporate governance is one way in which large mutual funds claim to add value as institutional investors. The excerpt below from Vanguard provides a typical example.

> During the past 12 months, we conducted over 800 engagements with the management or directors at companies of different types and sizes, encompassing nearly $1 trillion in Vanguard fund assets. Our engagement volume represents an increase of 19% over the previous 12-month period and 67% over the past three years. Though we engage with companies for a variety of reasons, we are most likely to engage because we are preparing to vote at the shareholder meet-

[2]See Tirole (1988) for an extensive discussion of supergames.

> ing, an event has occurred at the company that could affect stock value, or our research has uncovered a specific governance concern that is not on the ballot.[3]

The fact that index funds, ETFs, and diversified mutual funds engage in corporate governance is well established in the literature (Fink, 2018; Brav et al., 2018; Appel et al., 2016). However, there is a striking lack of literature in the field of corporate governance that discusses exactly how corporate governance works and which owners have what types of influence. There is an old literature in this area (see, for example, Hart (1979)), however it is quite abstract. Most models only go as far as to separate ownership (typically denoted β) from control (typically denoted γ) and posit that they may not be equal.[4] Measurement of β is fairly straightforward because it represents the rights to profit share. γ, however, measures how much influence a shareholder has on the management of the company and may, in general, depend on both ordinal and cardinal size of the shareholder as well as reputation, investment in information, and other factors. Papers such as Brito et al. (2018) present theory models of managerial decision-making under these conditions. However, there is no consensus we know of that establishes the relationship of β and γ for larger shareholders or gives guidance on how to take existing theories to the data.

Furthermore, there is a school of thought that argues managers are under-monitored due to free-riding and other factors and thus there is not nearly enough corporate governance to begin with (Bebchuk and Hirst, 2019). In this framework, existing corporate governance is largely a passive, box-ticking kind of activity where the corporation is rated for having outside directors, a split chair, or incentive-based compensation, for example, but nothing substantive is reviewed. In such a world, managers are essentially unmonitored by their owners. Should managers of most of American capital be unmonitored by the owners of that capital, we would have a more serious problem for the fucntioning of capitalism than any issue generated by common ownership. Our view is that this interpretation of corporate governance is too pessimistic; we believe that large owners have substantive engagement with management on costs, growth, and strategic direction of the company through effective oversight. However, we know of no research in the corporate governance literature that helps us to be more empirically precise on this question.

[3] Vanguard, Our Engagement Efforts and Proxy Voting: An Update, https://about.vanguard.com/vanguard-proxy-voting/update-on-voting/index.html (accessed November 28, 2016)

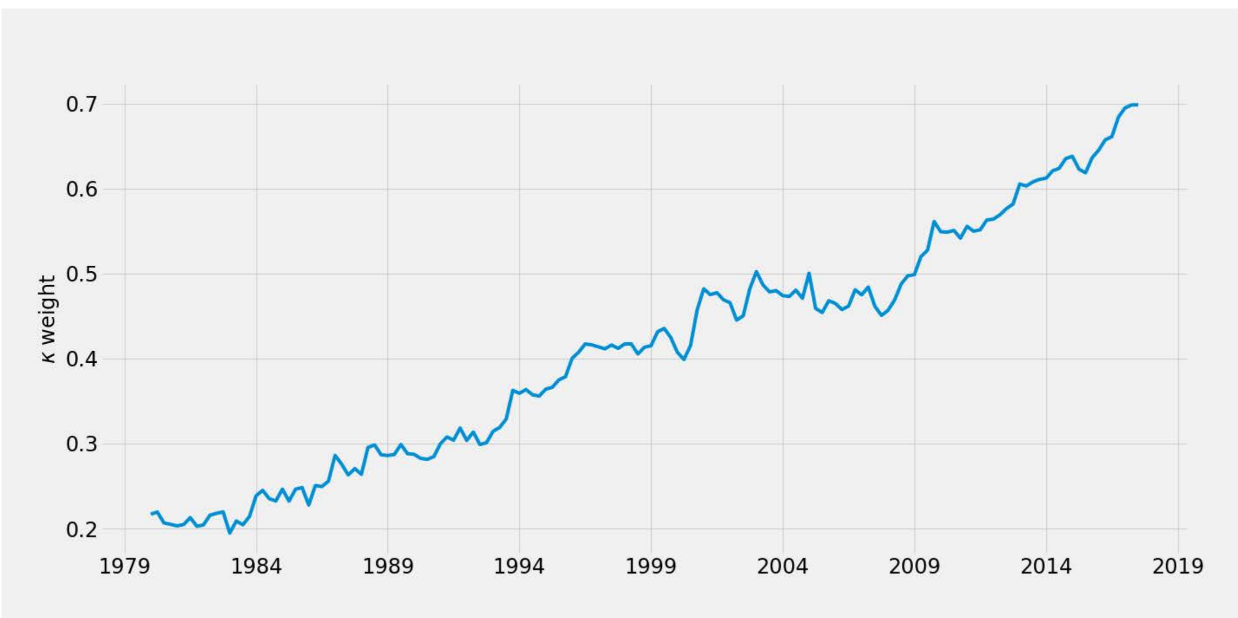
[4] Violations of proportional control is particularly relevant when considering retail investors whose shares are extremely small and who are likely to have effectively zero control of the corporation.

2.3 Empirics: Existence and Impact of Common Owners

2.3.1 Trends in Common Ownership

There is ample evidence that common owners are large and have been growing in the United States for many decades. See, for example, work from 1996 by Hansen and Lott (1996) that documents the growing share of owners that are diversified. More recent work by Backus et al. (2019a) states that "[at] the beginning of 2018, the four largest asset managers (Blackrock, Vanguard, State Street, and Fidelity) managed over $16 trillion in assets, and for 88% of firms on the S&P 500 Index, the largest shareholder was one of those four asset managers." Posner et al. (2017) point to the fact that over 70% of the US stock market was held by institutional investors by 2017 whereas in 1950 that share was only 7%. Azar et al. (2018b) provides multiple examples of industries in which top institutional shareholders hold large blocks of stock in each of the relevant firms, including airlines, banks, and supermarkets.

Figure 1: Historical Trend in Profit Weights



To develop a sense of how important these trends are, we display in Figure 1 a graph from Backus et al. (2019b). The authors calculate profit weights using historical data on common ownership. They find that the average weight firms would assign to profits of other S&P 500 firms has grown from around 20% to around 70%.[5] We note that this graph is not a

[5]They provide several different parametric assumptions that permit control to differ from ownership. We

theoretical construct; it is a way to display the ownership data for US stocks over time. The increase in the average weight placed on other companies' profits is large and indicates that managers' incentives may have changed significantly over the past several decades.

2.3.2 Competitive Effects of Common Ownership

A series of early empirical papers (Azar et al., 2016, 2018a) kicked off a new area of empirical literature assessing the competitive effects of common ownership. The first of these papers focuses on banking and the second on airlines. Both evaluate the relationship between MHHID and prices in the industry — interest rates in the case of banks or airfares in the case of airlines. Because MHHID is endogenous, the authors use an instrumental variables strategy in an attempt to isolate exogenous movement in MHHID to determine if it caused a change in prices. These initial papers resulted in a follow-on wave of activity asking similar questions. For example, Backus et al. (2018) look at ready-to-eat cereal and find no impact of profit weights on scanner data price measures. Because it is likely that the impact of common ownership varies across industries, it would be useful to have many more such industry studies.

It may also be the case that price is not always the outcome affected by common ownership. For example, innovation and entry are dimensions of competition that have strong effects on both profits and consumer welfare. Antón et al. (2018b) examines the impact of common ownership on innovation that has spillovers to other firms in the portfolio, some of which are product market competitors. The idea is that positive spillovers benefit product market rivals, and common owners hold stakes in those rivals, so they benefit. If this externality is internalized by common owners, then those owners may incentivize firms in their portfolio to engage in more R&D when the firms operate in an industry with beneficial spillovers. In such a setting, investments in innovation will generate a higher return for the common owner than the focused owner. To the extent the innovating firms compete in the product market, however, the common owners may desire softer competition, which could reduce innovation. The authors look for cross-sectional differences in R&D spending and patent filings according to common ownership and product market competition and obtain results that support both hypotheses.

A second recent paper on common ownership Gerakos and Xie (2019) demonstrates that when owners hold stakes in both a branded pharmaceutical manufacturer and a generic

display the basic case where ownership is equal to control rights.

competitor, a settlement between them that prevents or delays generic entry into the brand's market is more likely. The authors focus on Paragraph IV challenges, which are cases where the generic has the ability to enter the market against the brand provided the brand's patent does not protect it (which will be the case if the patent has expired or is not infringed, e.g. the color of the pill). During the time period of the data (2003-16) settling these cases so that the generic stayed off the market was common, and settlements were generally considered legal until 2013 when the Supreme Court ruled that such settlements could be a violation of the antitrust laws.[6] The authors show that when generic owners also own the brand, settlements are more likely. This setting is a clever place to look for an impact of common ownership because the impact of generic entry (small profit gain) on brand profits (large loss) is asymmetric and therefore a small share in the brand will generate significant financial incentive to alter the behavior of the generic. A second paper in this same industry also demonstrates an impact of common ownership. Newham et al. (2018) takes the problem back one step and examines generic drug entry, or lack thereof, by generics who share common owners with the brand experiencing patent expiration. The authors ask whether generic firms are less likely to launch a product that competes with a brand when there is a common owner between the two firms. Using entry and ownership data from the US they find a large effect, noting that "a one-standard-deviation increase in common ownership decreases the probability of generic entry by 9-13%."

A second body of work uses cross-industry macro or finance datasets to look for the impact of common ownership. Gutierrez and Philippon (2017) study the relationship between investment over time and competition. They calculate a number of concentration metrics but also MHHI, the Herfindahl measure adjusted for common ownership. They find that industries with higher levels of MHHI have lower levels of investment for any given Tobin's Q. Koch et al. (2019) examines the correlation between common ownership and accounting profits, markups, capital expenditure, advertising, and other outcome measures. Overall, they find no relationship between outcomes and common ownership changes or levels, rejecting "even modestly sized economic effects." The downside to the method in both papers is the inherent imprecision of accounting data of markups, investment, monthly industry producer price indices, etc., but, more importantly, the simultaneous determination of both institutional holdings and these industry and firm characteristics. Using mergers between investment funds is a popular method of isolating exogenous variation in common ownership. However, the mergers Koch et al. (2019) exploit do not affect the measures of common ownership used in the paper, making them a poor instrument. This stands in contrast to He

[6] *FTC v. Actavis, Inc.*, 570 U.S. 136 (2013).

and Huang (2017) who similarly use a dataset from 1980 to 2014 but employ a set of mergers that cause measures of cross ownership to increase. They find that exogenous changes in common ownership due to the mergers increase the prevalence of joint ventures, productivity, and operating margins.

More importantly for our purposes, He and Huang (2017) carry out an analogous test to our own using changes in block holding. They compare abnormal returns of existing block held competitors in the same industry as the new block purchase, relative to the returns of block-held stocks in another SIC code. The authors find that returns of competitors rise by 2.1% compared with unrelated stocks which have an abnormal return of close to zero. In an earlier paper, Antón and Polk (2014) examine the relationship between common ownership and share price movements. Their metric of co-ownership, FCAP, is the sum of the holdings of each fund in the two stocks of interest normalized by the sum of the market capitalization of the two stocks. Exploiting plausibly exogenous variation in common ownership caused by a 2003 mutual fund scandal, they provide evidence for a causal relationship between common ownership and co-movement in stock prices, controlling for attributes of the securities. The authors suggest that the co-movement is generated by correlated asset flows, i.e. institutional investors will tend to buy or sell an entire portfolio at once. Thus, the fact that common owners may impact the relationship between the stocks they hold is already established in the literature.

The mechanism by which common ownership might lessen competition remains uncertain and under study. The first and only paper that we are aware of with results in this area to date is Antón et al. (2018a), described above. Antón et al. (2018a) study a large number of US firms and evaluate executive compensation as a channel of causality. They first show that a common owner with a goal of softening competition will want to compensate top management for more profits, but not for "beating" a rival - because trying to beat a rival will generate profit-decreasing competition. The intuition of the model is that pay-for-performance incentives generate vigorous competition which leads to price cutting that harms both firms. Moving top management payments closer to a flat salary is more conducive to softening competition between firms in the product market. The authors study how "wealth-performance sensitivity," the measure of the impact of an additional dollar of earnings on the wealth of top management, varies with common ownership. Their empirical results demonstrate that increases in common ownership lead to changes in executive compensation that favor absolute performance as compared to relative performance. This result is consistent with common ownership leading to softer product market competition.

It is well documented that large investors and funds communicate directly with the top management of the firms they hold, a fact that the funds promote as improving corporate governance (Posner et al., 2017). These communications, however, are not public. Although these communications could theoretically include illegal attempts to establish collusion between competing firms, we do not promote that hypothesis here, nor do we have any analysis in this paper designed to shed light on it.

2.4 Research on Index Entry

There is a long literature in finance that examines the impact of a stock entering a particular index. A clear and comprehensive literature review can be found in Afego (2017). The basic fact the literature establishes and then attempts to explain is why a stock price rises upon inclusion in an index. There are two basic theories in the literature: demand and information.

The first theory notes that investors tracking the index now demand the security, and if demand slopes down, prices will rise. The idea that demand slopes down for an individual security is contrary to some asset pricing theories. One would think arbitrageurs would move their money to other securities that are substitutes. However, an early influential paper by Shleifer (1986) as well as others provide evidence of downward-sloping demand for securities.[7] Our research design allows us to be agnostic on the existence and size of a demand effect. We examine the stock price increase of the entrant's product market *rival*, which is already in the index and therefore should not experience this demand effect.

A second theory for why the entrant's stock price might increase is that entry conveys new information (Jain, 1987). If the index seeks firms with capable management or those in growing industries, for example, then investors might reasonably interpret inclusion as positive news about future profits. There is an extensive finance literature in this area. Particular theories in the literature include the idea that inclusion might raise the liquidity of the stock (Mazouz and Freeman, 2012), increase investor awareness (Elliott et al., 2008), or reduce information asymmetry (Baran and King, 1986).

There is a small set of papers that consider the impact on competitors of index entrants. Gygax and Otchere (2010) examine price effects of index inclusion on incumbents of the S&P 500, comparing incumbents in the same GICS industry classification as the entrant

[7] Liu (2000) uses evidence from the Nikkei 500 and Biktimirov et al. (2004) uses data from the Russell 2000, reaching similar conclusions.

with non-industry incumbents. They find a small negative impact on stock prices of S&P incumbent firms, which they attribute to selling pressure caused by index reweighting. This finding is intuitive – firms entering the S&P 500 tend to have a larger capitalization than the firms they are replacing, reducing the weights of the other indexed firms and generating selling pressure by funds tracking the index. Interestingly, the authors find that negative rebalancing effects are mitigated for firms in the same industry as the entrant, which they attribute to non-specific "industry effects." Chen and Lin (2018) examine effects of entry on 264 S&P 500 firms added to the S&P 500 from 1976 to 2011 as well as the returns of the most similar-sized competitor in the same 4-digit SIC industry. They also find that stock prices fall slightly with index entry. While the authors interpret the result as evidence of a "competitive disadvantage" caused by the entering firm, it is also consistent with the portfolio rebalancing found in the previous paper. Likewise, Cai (2007) compares entering stocks from 1976-2001 with industry- and size-matched counterparts that are already in the index. The definition he uses for industry is a 4 digit SIC code. Like previous papers, he finds that the larger the entrant, the more there is a negative stock price response by index incumbents, consistent with rebalancing. He also finds that the matched competitors' stock prices rise slightly with entry of the focal firm.

Although this finance literature provides some interesting observations about how firms react to the inclusion of a competitor in the S&P 500, they tend not to spend time carefully defining a product market. Moreover, these papers show evidence of a negative rebalancing effect which would offset any positive effect of common ownership, leading to further difficulties with interpretation. Most importantly, this literature ignores a key source of heterogeneity among entering firms: all the papers described above pool together companies that were promoted from a smaller S&P index with companies that were not previously members of any S&P index. In Section 4, we show that stock price reactions to entry diverge sharply between these two groups. And we show that institutional investors purchase a much larger number of shares for the latter group as compared to the former. Pooling outcomes from the two groups masks important empirical outcomes that are uncovered in our analysis.

3 Data

3.1 Financial Data

Trading data, including stock prices, returns, and market capitalization, are provided by the Center for Research in Security Prices (CRSP) via Wharton Research Data Services (WRDS). Other financial data, such as shares outstanding and accounting profits are from Compustat. WRDS provides linking information between CRSP and Compustat databases.

3.2 Ownership Data

We use data from 13-F filings to measure institutional holdings of individual securities in our sample. A description of this data, which we use more extensively to assess the relationship between the results of this event study and metrics from the common ownership literature is provided in Section 5. The SEC requires that institutional investors with over $100 million in assets report holdings at quarterly intervals under Section 13-F of the Securities Exchange Act of 1934. These forms are made available to the public via the SEC's EDGAR database. Thomson-Reuters compiles these reports into a single database that incorporates records as far back as 1980, which we access through WRDS.

The Thomson-Reuters database has historically suffered from quality issues. In particular, WRDS notes that records from 2010 through 2016 were corrupted, with a significant number of records from this period excluded as a result. WRDS and Thomson-Reuters posted an update in June 2018 with a regenerated database that has reintroduced the missing data.[8]

Our analysis uses institutional ownership data to illustrate the magnitude of changes to institutional ownership after index entry, and to identify the particular funds that purchase shares of entrants after entry. Figure 8 plots the distribution of within-firm institutional shareholdings by quarter for the relevant time period of our analysis. Although institutional shareholdings typically fall within a reasonable range, and display a consistent time trend, they can sometimes exceed 100% of a firm's outstanding shares. There appear to be multiple potential causes for this discrepancy. One explanation stems from short-selling: institutional

[8]For more detail, see the corresponding research note posted by WRDS. We recommend that scholars interested in this area take advantage of the data organized and cleaned by Chris Conlon, Matt Backus, and Mike Sinkinson which they have kindly posted.

investors may lend assets to other investors, who then sell the borrowed assets to other institutions in order to create a short position. If both institutions report these holdings, double-counting may occur. This form of measurement error is difficult to remove from the data, but we do not think it should create bias in our results. Another possible source of measurement error relates to stock splits. We have found several examples of mismatches between shareholdings listed by institutions and the shares outstanding for firms reported by Thomson-Reuters. If reported shares outstanding are out-of-date, and if a stock split occurs, then the corresponding percentage shareholdings of institutions may be overstated. As a result, we replace the shares outstanding and share price data from Thomson-Reuters with financial data obtained from CRSP, which appears to reduce measurement error in the dataset. Finally, some firms may issue multiple classes of securities. Naive aggregation of securities by firm may overstate the number of institutional shareholdings for the primary security.[9] Although the updated data appear to be reliable for the purposes of our analysis (examining simple quarterly changes in shareholdings for firms after entry), care should be taken when performing inference with the Thomson-Reuters data.

3.3 Sample of Entrants

CRSP provides a data set containing dates of entry and exit for firms in the S&P 500 from 1925 to the present. We construct our sample by limiting the CRSP data set to 463 entrants from 2000 to 2017.[10] Although CRSP provides the *effective* date of entry for each entrant, Standard & Poors began preannouncing index changes in October of 1989. Given that our goal is to assess the market reaction to entry, we are more interested in measuring abnormal returns as of the *announcement* date, as this is when the news regarding entry into the index would be incorporated into firms' stock prices.

To collect announcement dates, we conduct a news search using Factiva to retrieve press releases from Standard & Poor's and corresponding dates for each of the 463 entrants in the sample. These press releases provide two additional pieces of information that are central to our analysis. First, they disclose whether a particular firm is added or removed because of a

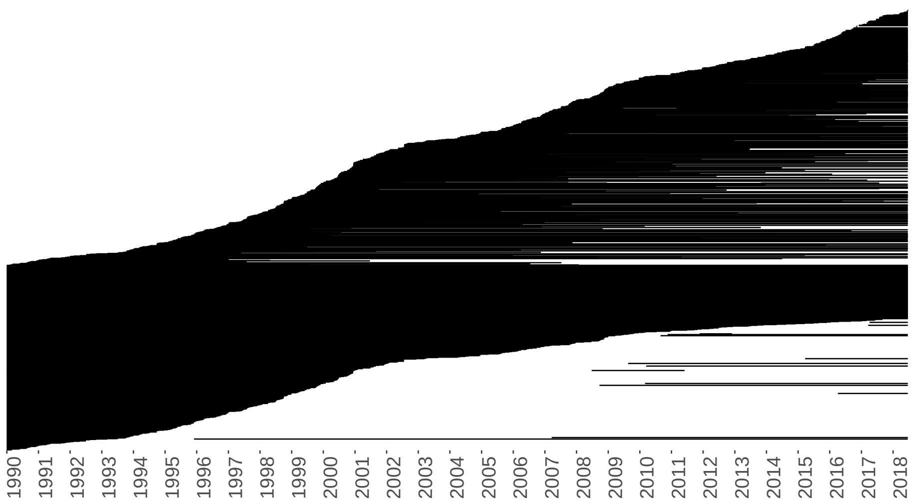
[9] A related anomaly in the Thomson-Reuters database relates the existence of distinct fund managers that are members of a single institution. For example, Blackrock includes several distinct funds that appear to be incorporated in different countries. To the extent that these funds can be considered to operate under the incentives of the umbrella firm, they should be aggregated accordingly. See Ben-David et al. (2018) for more detail.

[10] This sample excludes 12 entrants from the CRSP data set that are listed as having entered and exited the the S&P 500 on the same day.

confounding event such as a merger or spinoff. We remove 63 entrants from the sample that entered the index as the result of an event that could potentially confound our analysis.[11] Second, the announcements disclose whether a firm was moved from one of S&P's smaller cap indices, the S&P Midcap 400 or the S&P Smallcap 600. As discussed above, this provides an important source of variation in the shock to institutional ownership.

The remaining 400 entrants in the sample were merged with header files from Compustat that provide a link to financial data. 20 entrants do not have a corresponding header in the Compustat database or do not have sufficient returns data prior to the entry event, bringing the number of entrants in our final sample to 380.

Figure 2: Entry and Exit in the S&P 500 (1989 - 2017)



Note: Each horizontal line represents the incumbency period of a firm in the S&P 500.

A natural strategy to expand our sample would be to examine index exit. Although we have data regarding firm exits, they are not symmetric observations with respect to our analysis. Exiting firms tend to be removed because they are acquired, go private, or declare bankruptcy. Measuring the change in common ownership between the exiting firm and its product market competitor in the index is then often not possible. Some companies are removed because they are no longer "large" or representative of the market. These are typically moved to either the S&P Midcap 400 or S&P Smallcap 600. As demonstrated in

[11]In particular, we removed firms that entered as a result of a spinoff, acquisition, rebranding, or IPO. Additionally, we removed several entrants in the CRSP database that represented additional share classes issued by incumbent firms.

Figure 5, index switching does not sharply change institutional ownership. For all of these reasons we do not extend our analysis to the exiting sample. [12]

3.4 Industry Classifications

To construct a sample of competing firms to our sample of entrants, we examine several different industry classifications commonly used in the finance and trade literature. The three most common are the Standard Industrial Classication (**SIC**), originally developed by the United States government in 1937, the North American Industry Classication System (**NAICS**), developed as a replacement for SIC by US, Canadian, and Mexican governments to harmonize reporting of government statistics, and the Global Industry Classication System (**GICS**), which is jointly maintained by S&P and Morgan Stanley Capital International (**MSCI**) in conjunction with their indices.

Existing literature points to several potential advantages of GICS over SIC and NAICS when performing financial analysis. Bhojraj et al. (2003) compare these systems by examining firms in the S&P 1500, and find that GICS industries have higher intra-industry comovement in stock returns and higher cross-sectional comovement in various multiples, growth rates, and financial ratios.[13] Hrazdil et al. (2013) present similar findings with an expanded sample that includes all firms in the NYSE and the NASDAQ between 1990 and 2009. Most importantly, Bhojraj et al. (2003) identify a major problem with SIC and NAICS, namely that data vendors are the ones left to classify firms into different industries. This leads to significant discrepancies between databases regarding the particular industry of a given firm. GICS classifications, on the other hand, are assigned by specialists at S&P and MSCI, which provides a measure of consistency across different data sources. Additionally, the fact that the GICS classification is maintained by Standard & Poor's makes it a more suitable choice for performing financial analysis related to S&P indices. For these reasons, we select GICS as our primary traditional industry classification for analysis. CRSP provides two data sets that contain the GICS industry code for firms in its database.[14] We select competitors for a

[12]Previous literature does not find a significant "deletion" effect, and suggests that while added firms experience a positive information shock, deleted firms do not incur a negative information shock upon exit Chen et al. (2004). Our analysis suggests a different interpretation. Asymmetry between additions and deletions may be caused by the fact that the corresponding shocks to institutional ownership are asymmetric.

[13]The S&P 1500 refers to the combined indices of the S&P 500, the S&P Midcap 400, and the S&P Smallcap 600.

[14]The `COMPHIST` table provides this information for firms starting in 2007 and the `CSTHIST` table contains information for firms prior to 2007.

given entrant by filtering these data sets for firms within the same GICS subindustry.[15]

In addition to GICS classifications, we examine the network classifications created by Hoberg and Phillips (2016) as an alternative method, selecting firms in the CRSP database that are also identified as a competitor in the Hoberg-Phillips data set. In contrast to traditional industry classification systems, which contain a fixed number of industry groups, Hoberg and Phillips scrape business descriptions from 10-K filings and use text analysis to construct a network classification data set that has parameters (between zero and one) that measure the strength or likelihood the two firms are in the same industry.

As an alternative to the industry classifications described above, we conduct a review of competitor quality using undergraduate research assistants who had no prior knowledge of stock movements or the sample. We gave these RAs the union of GICS and Hoberg-Phillips competitors for a given entrant. They were tasked with removing any competitors that did not clearly operate in the same business sector using information from a fixed set of analyst reports. This latter classification is our most preferred as it has fewer obviously incorrect competitors included. We will use this classification ("Manual") in our results as well as GICS.

We should state the obvious here, which is that product market competition cannot be neatly mapped to ticker symbols and therefore any classification system will have error. However, we do not want the perfect to be the enemy of the good (or better) and therefore we proceed with the best method we can devise. We believe that the manual and GICS classifications capture important product market competitors for our entrants.

The number of competitors in each type of classification are shown in Table 1 below.

[15] The GICS subindustry is the most granular level of the GICS industry classification.

Table 1: Number of Competitors in Sample

Classification	Entrant Type	N
GICS	S&P Incumbent	2217
GICS	Non-Incumbent	27515
HP	S&P Incumbent	3402
HP	Non-Incumbent	27056
Manual	S&P Incumbent	721
Manual	Non-Incumbent	2487

Note: The third column contains the number of entrant-competitor pairs in the sample, therefore firms may be counted multiple times if they compete with multiple entrants to the S&P 500 over the relevant time period.

4 The Event Study

We use an event study methodology to estimate abnormal returns both for entrants to the S&P 500 and for industry competitors. Consistent with prior literature, we show that entrants to the S&P 500 generate significantly positive abormal returns. We use our definition of product market competitor to identify stocks both in the S&P and outside that compete with the entering firm. We extend the event study to examine abnormal returns of these product market competitors.

We follow the classic event study methodology summarized in Campbell et al. (1997). Notation in the following sections closely follows this standard reference. Inference in the context of correlated abnormal returns that arise from analyzing securities exposed to the same event follows Kolari and Pynnönen (2010).

In this section, we begin with our motivation, describing the natural experiment presented by the addition of firms to the S&P 500. We proceed with a formal definition of the event study by describing the relevant sources of data, event definition, and firm selection criteria. Next, we describe the model used to measure normal and abnormal returns, the choice of the estimation window, and the choice of the event window. We define a testing procedure to determine if the securities under study generate non-zero abnormal returns over the event window. Finally, we present our results and interpretation.

4.1 S&P Index Additions as a Natural Experiment

We argue that the addition of a firm to the S&P 500 serves as a shock to institutional ownership that investors cannot predict prior to announcement of the firm's addition. Moreover, we assume — and justify below — that the addition of the focal firm contains no information about the profitability of its product market rivals that are already in the index. The literature on index entry hypothesizes various reasons why the index entrant's stock price should rise: increased demand from institutions, greater liquidity, etc. None of these reasons apply to the entrant's product market rivals. Our identification strategy is similar in spirit to the one in He and Huang (2017). Next we discuss the index selection process and provide evidence for our assumption.

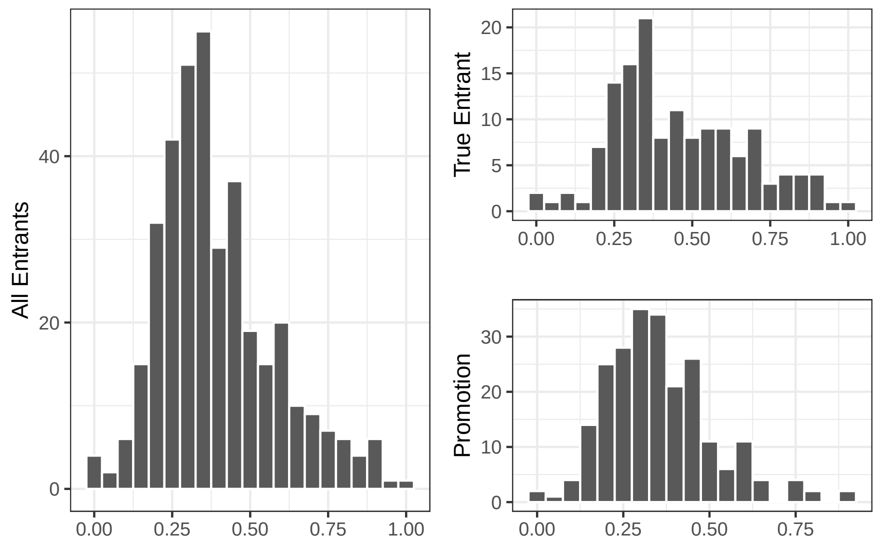
Changes to the S&P 500 are usually caused by the need to remove a firm from the index because of a transaction or merger. Removal may also occur if the market capitalization of a firm has fallen significantly or if S&P decides that a firm "[ceases] to represent the economy" (Chen et al., 2004). Index additions are typically announced in tandem with deletions. In order to be eligible for inclusion in the S&P 500, firms must be U.S. companies with unadjusted market capitalization of $8.2 billion, be sufficiently liquid, and have positive total earnings for the trailing year.[16] Subject to passing these eligibility requirements, an internal committee at S&P chooses firms with the goal of creating a proxy for the broader economy. Although the S&P 500 contains many of the largest U.S. firms, the list of firms tends to only partially overlap with the largest 500 firms in the U.S., and there are many large firms that are not included in the index. For example, as of the last trading day in 2017 there were 201 firms domiciled in the U.S. with market capitalization of at least $8.2 billion that were not members of index, according to data provided by CRSP. This suggests that the pool of potential entrants is relatively large and that stock prices would be relatively unaffected prior to any announcement of an index modification, to the extent that the selection process is not predictable and information is not leaked to the market.

We provide empirical support for our assumption of exogenous entry with four pieces of evidence. First, we note that there is no clear "threshold" of firm size that guarantees entry into the S&P 500. The typical entrant ranks in the 30th percentile of the distribution of market capitalization for index incumbents. There is wide dispersion, however, in the size

[16]Note that there are various exceptions to these rules, and some discretion is left to S&P's internal committee. S&P defines a U.S. company as one that files 10-K reports and which has a primary exchange listing on a U.S. exchange. See https://us.spindices.com/documents/methodologies/methodology-sp-us-indices.pdf for an overview of S&P's indexing methodology.

of added entrants, as shown in Figure 3 below.

Figure 3: Distribution of Entrant Size Relative to S&P Incumbents



Note: Right panel shows distribution of entrant size for the two comparison groups used in the event study — true entrants and promoted entrants. These two groups are discussed in more detail beginning in Section 4.2.

Second, qualitative evidence from market participants is provided with two quotations below. Market participants appear to think that the choice of new S&P entrants is random. A 2015 article quotes the CEO of United Continental, which at the time was not a member of the S&P index. He notes that despite the fact that UAL met the requirements to be listed in the index, there was little it could do to influence the decision of S&P regarding its choice to add the firm.

> United Continental (UAL), which today reported a 1Q profit, wants to join rivals Delta Air Lines (DAL) and American Airlines Group (AAL) in the S&P benchmark club of US equities. DAL and AAL were recently admitted, joining Southwest Airlines (LUV), once the solo flier. Asked about the possibility, UAL CEO Jeff Smisek jokes: "I think about that every night just before I go to bed...I'm a really boring guy." CFO John Rainey adds that UAL already meets the qualifications and inclusion would help its stock price long-term. But "there's nothing we can do to make them more interested in us," Rainey says. "It's largely

> outside of our control."[17]

An article from 2000 provides an overview of how investors place bets on which firms might be added to the index. In this case, although investors appeared to consider the addition of a tech firm most likely, the S&P ended up adding Robert Half International, an HR consulting firm.

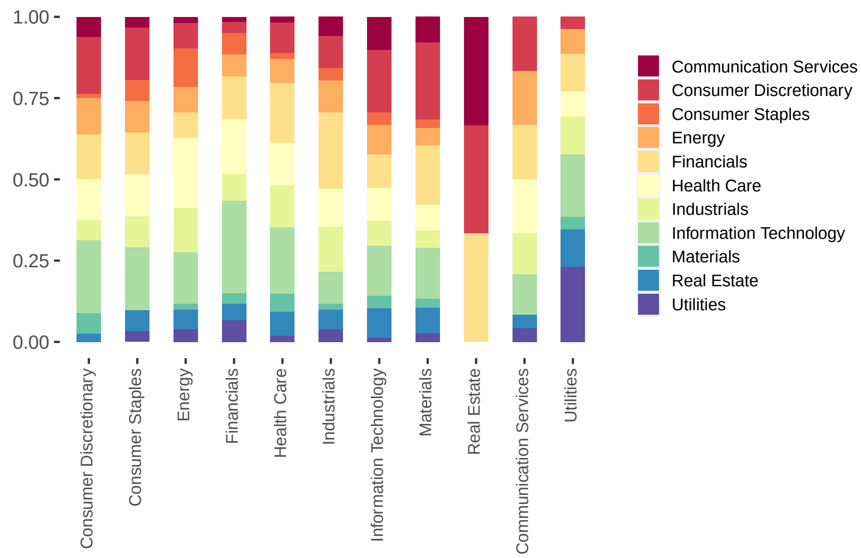
> The Standard & Poor's 500 Index is missing one stock Friday, and some investors are clamoring to figure out which new stock will be added to the closely followed index... S&P usually announces deletions and replacements to its indices at least several days in advance. But "sometimes a deal just happens too fast," and S&P isn't able to announce changes ahead of time, Levine said... As a result, certain fund managers are scrambling to figure out who might replace Associates First. Whichever stock is added will be in heavy demand because index funds that try to mirror the performance of the S&P 500 will be required to buy it... Some investors are betting that Standard & Poor's will add a technology stock to the index. If so, candidates include Brocade Communications Systems Inc. (BRCD), Juniper Networks Inc. (JNPR), VeriSign Inc. (VRSN) and Ciena Corp. (CIEN)...[18]

Third, we examine whether firms are typically replaced by another firm from the same industry. If this were the case, market participants might guess the likely candidate for index inclusion given knowledge of an upcoming deletion event (e.g. an announcement of an acquisition of an S&P incumbent that would remove it from the index). Figure 4 demonstrates that the industry of entrants are similarly dispersed for deletions from particular industries.

[17] United Continental Pining to Join S&P 500, *Dow Jones Newswires* (April 23, 2015).

[18] Investors Guess Which Stock Will Be Added To S&P 500, *Dow Jones Newswires* (December 1, 2000).

Figure 4: Industry of Deletion vs. Industry of Entrant



Note: Horizontal axis indicates industry of exiting firm, and colored bars indicate the percentage of entering firms corresponding to a particular GICS industry.

Lastly, it could simply be that the S&P committee is picking entrants from "growing" industries, and that entry is predictive of industry performance. Whereas monopoly incentives typically imply a reduction in output, industry growth would generate growth in output. Figures 9 and 10 in the Appendix examine the excess growth rate in sales, compared to the S&P average, using data from 10-K filings in the industries of entrant firms one and two years after the entry event. Table 12 in the Appendix provides a regression formulation showing that industries with an S&P 500 entrant do not experience sales growth significantly different than the overall average.

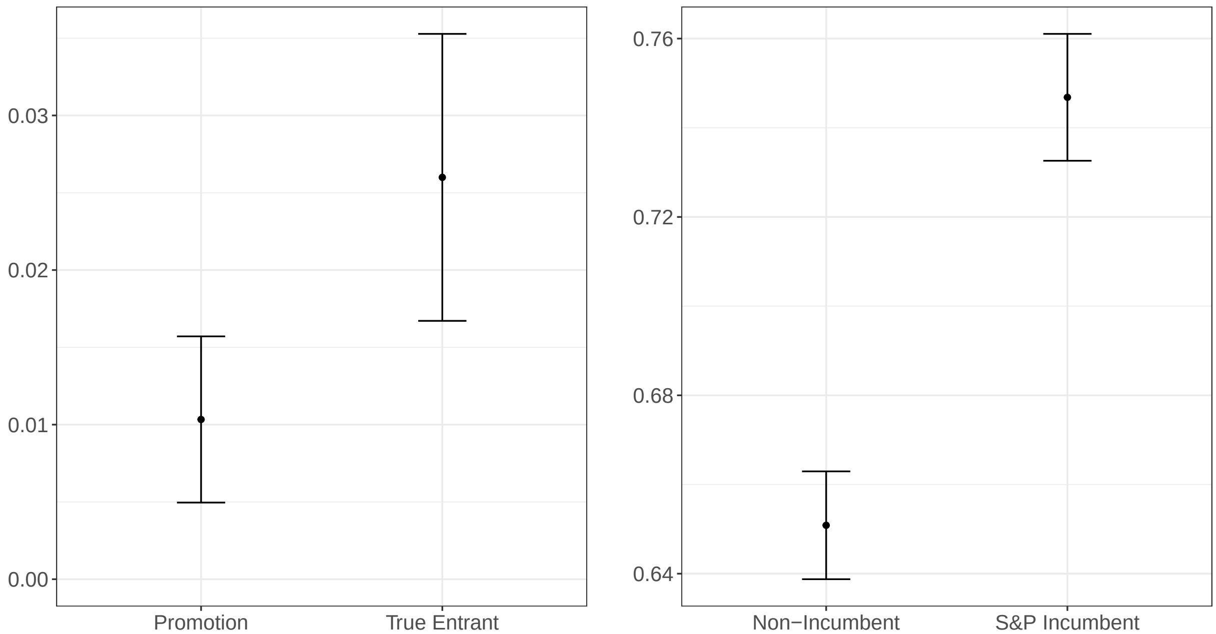
4.2 Identifying Variation in Common Ownership

We exploit variation in the shock to common and institutional ownership generated by the fact that some entrants transfer to the S&P 500 from a smaller Standard & Poor's Index, whereas other entrants are admitted to the S&P 500 directly, even though they were not previously members of the index. We call these two groups **promotions** and **true entrants**, respectively, and show that true entrants experience a more pronounced shock to ownership by institutional funds and in common ownership upon entry.

We further separate product-market competitors along a second dimension. Some are S&P 500 incumbents and some are not. We demonstrate that S&P 500 index rivals of true entrants experience a larger increase in institutional and common ownership upon entry than rivals of promoted firms or rivals that are not members of the index.

Figure 5 below, displays these two dimensions of variation. The plot on the left shows the distribution of changes in institutional ownership for the two kinds of entrants, as measured by the quarterly difference in total 13-F holdings before and after index addition. The first group, promotions, generates only a small reaction from institutional shareholders when compared with the second group, true entrants. The mean change in institutional ownership for promotions is roughly one percent of total shareholdings. For true entrants, on the other hand, the mean change in institutional holdings comes to about 250 basis points, i.e. a transfer from retail investors to institutions of about 2.5% of the equity of the typical added firm. The plot on the right shows total institutional holdings of S&P 500 incumbent product market competitors compare to non-incumbent product market competitors. Institutions hold about 10 percentage points more of the equity of S&P 500 incumbent PMCs when compared to non-incumbent PMCs.

Figure 5: Shock to Institutional Ownership



Note: Left panel indicates the percentage of total equity transferred from retail investors to institutional investors after entry to the S&P 500. Right panel indicates the (pre-entry) institutional ownership levels of non-incumbent and S&P 500 incumbent firms in the full sample of competitors.

The figures above concern aggregate institutional shareholdings only, and therefore ignore changes in the underlying structure of institutional shareholdings. In fact, it is ownership similarity, not total institutional ownership that is most directly connected to the common ownership hypothesis. Distributions of ownership similarity for true entrants and promotions are shown in Figures 6 and 7 below. We present distributions for two measures of ownership similarity — Bray-Curtis is an L1 metric that gives equal weight to small and large institutional owners, and Cosine is an L2 metric that assigns a larger weight to larger owners. Figure 6 shows that competitors of true entrants that are incumbents in the S&P 500 see a clear positive shift in the distribution of ownership similarity with true entrants. Competitors that are not S&P 500 incumbents appear to have a much smaller shift in ownership similarity. Figure 7 demonstrates that there do not appear to meaningful shifts in the distribution of ownership similarity for competitors of promoted entrants, even among S&P 500 incumbents. A more detailed overview of these ownership similarity measures, and their relationship to the common ownership hypothesis, is discussed in Section 5 below.

Figure 6: Distribution of Change in Ownership Similarity (True Entrants)

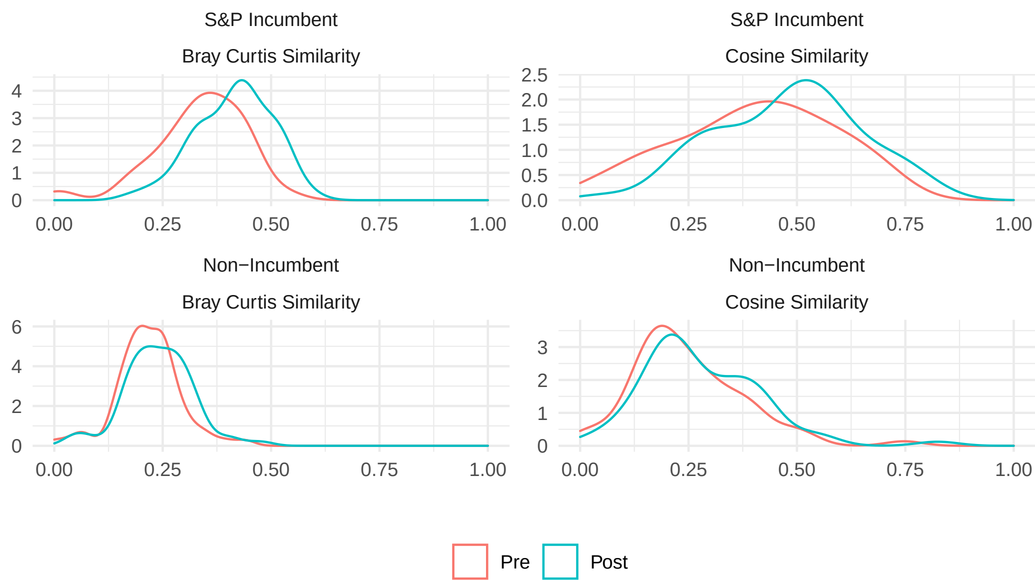
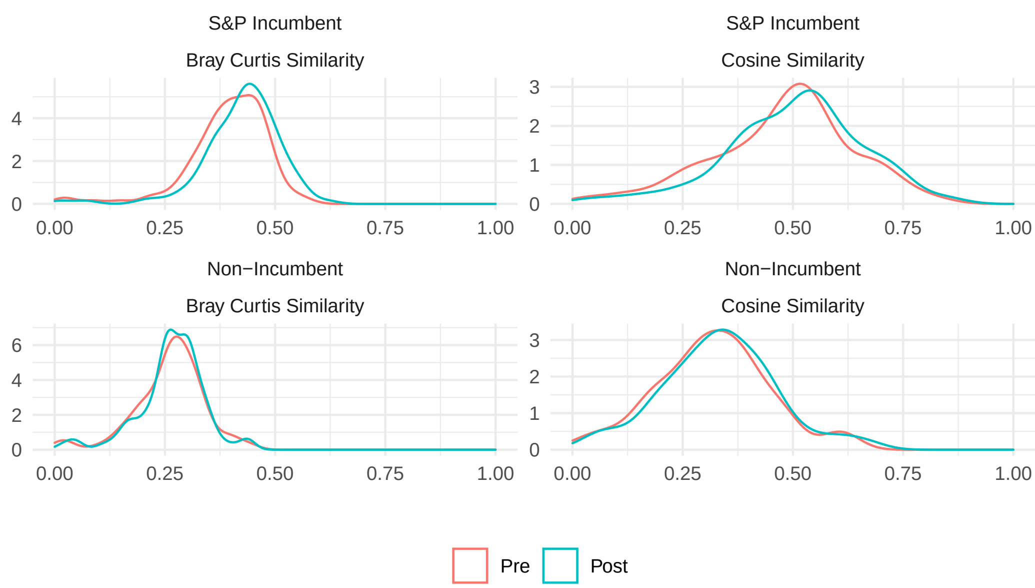


Figure 7: Distribution of Change in Ownership Similarity (Promotions)



4.3 Identifying Assumptions

We need three assumptions to hold for our tests to be informative. The first is an exclusion restriction in a difference-in-differences setting, i.e. that the difference in abnormal returns between competitors of true entrants and competitors of promoted entrants arises solely due to the differing shocks to their ownership structure.[19] This is reasonable because index entry itself does not change the nature of the product, costs, demand, or competition on the ground; the stock is simply part of an index when it was not before. Even if index membership were to change one or more of these variables, there is no reason to think that it would affect true entrants and promoted entrants differently. The channel through which competition is implicated is the new ownership structure, and this is also the only obvious difference between our comparison groups. Note that this assumption is relatively weak in that it allows for inclusion to affect profitability of the entrant's industry, as long as this effect is the same for industries of true entrants and promoted entrants.

Our second assumption is that investors have rational expectations and incorporate new information into stock prices immediately. Therefore the change in the stock price at the announcement of entry reflects expected changes in ownership structure and competitive behavior that are caused by index entry and the design of mutual funds. Though these ownership changes occur later in time, they do not respond to the stock price increase as they are expected.

Finally, investors must not have access to information about index changes before they are publicly announced, otherwise prices would already reflect expected changes to competition. We have provided substantial evidence that investors cannot predict index changes at the beginning of this section. Furthermore, to the extent that prices already incorporate any non-public information, we would be unable to detect any significant effect in our subsequent analysis.

4.4 Event Definition and Selection Criteria

In this study, the events of interest are the entry of firms to the S&P 500. The securities in the study are the publicly-traded stocks of entering firm as well as their publicly-traded industry competitors. We calculate results using three different industry definitions, described above. We choose a three-day event window beginning on the day of the **announcement** by Standard and Poor's of the entry of a firm to the S&P 500, as this is the relevant date on which the news of a firm's entry becomes public. Announcements typically occur anywhere from several days to several weeks prior to the actual transition of a firm to the S&P 500.

[19]A similar exclusion restriction must hold for the comparison between S&P 500 incumbents and non-incumbents.

4.5 Measurement of Normal and Abnormal Returns

We use daily returns data provided by CRSP to estimate the normal and abnormal equity returns for the selected firms. The relationship between normal, abnormal, and actual returns is given by

$$\epsilon_{ijt} = R_{ijt} - E[R_{ijt}|X_t]$$

where ϵ_{ijt} is the abnormal return for firm i over the event j on day t, and the two terms on the right-hand side represent the actual return and the normal (expected) return conditional on market information at date t. We measure abnormal returns for event j for both the entrant and its industry competitors, therefore j can be equivalently thought of as an industry index.

To estimate abnormal and normal returns, we implement a standard market model

$$R_{ijt} = \alpha_{ij} + \beta_{ij} R_{mt} + \epsilon_{ijt}$$

where R_{mt} represents the market portfolio, for which we use S&P 500 index returns. Other variants include a CAPM model, which is essentially the same as the market model with a restriction on the form of the intercept to match the empirical risk-free rate, or a factor model that includes additional controls. The direct use of CAPM has fallen out of favor, and there is typically little gain from using a factor model MacKinlay (1997). The majority of recent empirical work uses an unrestricted market model (Sorokina et al., 2013).

We choose an estimation window beginning 200 days prior to the relevant announcement date and ending 10 days prior to the announcement date so that the estimates are not affected by any leakage of information for a short window prior to the actual announcement date. Abnormal returns over the event window are calculated as the difference between actual returns and normal returns (fitted values).

$$\hat{\epsilon}_{ijt} = R_{ijt} - \hat{\alpha}_{ijt} - \hat{\beta}_{ijt} R_{mt}$$

Cumulative abnormal returns for individual firms are calculated by summing daily abnormal returns over the event window:

$$\widehat{CAR}_{ij}(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} \hat{\epsilon}_{ijt}$$

where τ_1 and τ_2 indicate the beginning and end of the event window.

4.6 Standard Errors

4.6.1 Individual Securities

To conduct hypothesis tests, we require an estimator of the variance for the cumulative abnormal returns of the sample over the event window. Assuming that individual security returns are i.i.d. normal, the OLS estimator of the error variance is consistent, giving an estimator for the individual security CAR variance

$$\hat{V}_{ij} \equiv \widehat{Var}[\widehat{CAR}_{ij}(\tau_1, \tau_2)] = \frac{(\tau_2 - \tau_1 + 1)}{T - 2} \sum_t \hat{\epsilon}_{ijt}^2$$

where T is the length of the estimation window. The squared residuals are summed over the estimation window. Under the assumptions stated above, the standardized CAR estimate, $\widehat{SCAR}_{ij} \equiv \widehat{CAR}_{ij}/\hat{V}_{ij}^{1/2}$ follows a t distribution.

4.6.2 Testing for No Event Effect

One commonly used statistic to test against a null hypothesis of no event effect is given below. N_j indicates the number of firms in our sample for an event j. The form of the variance results from the fact that the individual SCARs follow a t distribution. The resulting test statistic t_P is commonly referred to in the literature as Patell's statistic after Patell (1976).

$$\begin{aligned} \overline{SCAR}_j(\tau_1, \tau_2) &= \frac{1}{N_j} \sum_i \widehat{SCAR}_i(\tau_1, \tau_2) \\ \hat{V}_j^P[\overline{SCAR}_j(\tau_1, \tau_2)] &= \frac{T - 2}{N_j(T - 4)} \\ t_P &\equiv \overline{SCAR}_j/(\hat{V}_j^P)^{1/2} \end{aligned} \tag{1}$$

Patell's statistic may be rejected even if there is no mean effect if the event increases the **variance** of returns (event-induced variance). To account for this, Boehmer et al. (1991) propose the use of the sample variance in the cross-section of event-window abnormal returns.

$$\hat{V}_j^B[\overline{SCAR}_j(\tau_1,\tau_2)] = \frac{1}{N_j^2}\sum_i (SCAR_i - \overline{SCAR})^2$$

$$t_B \equiv \overline{SCAR}_j/(\hat{V}_j^B)^{1/2}$$

The standardized industry-mean CARs may then be aggregated across events in the same manner to conduct inference over the entire sample.

4.6.3 Adjustments for Event Correlation

The distribution of the CAR variance estimators discussed above are valid assuming that abnormal returns of individual securities are uncorrelated over the event window. This assumption is problematic in our setting, as we analyze securities in the same industry responding to the same event (the addition of a competitor to the S&P 500). There are several approaches to inference in this setting (Kothari and Warner, 2007). One involves aggregating the individual equities of the competitor firms into a portfolio, which can then be analyzed as if it were a single security.[20] Although the portfolio approach is appealing for its simplicity, it is less powerful than alternative approaches (Kolari and Pynnönen, 2010).[21] Furthermore, it would make further analysis of heterogeneity in the response of individual securities more difficult.

Kolari and Pynnönen (2010) provide correlation-corrected Patell and BMP statistics that essentially cluster standard errors for securities that are exposed to the same event. They show that the traditional Patell and BMP t-statistics may be adjusted using the average sample cross-correlation of estimation residuals, $\bar{r}$. The adjusted statistics are:

$$t_P^{\text{Robust}} = t_P\left(\frac{1}{1+(N_j-1)\bar{r}}\right)^{0.5}$$

$$t_{AB}^{\text{Robust}} = t_B\left(\frac{1-\bar{r}}{1+(N_j-1)\bar{r}}\right)^{0.5}$$

[20] This is often referred to as the Jensen-alpha approach.

[21] Intuitively, the loss of power from the portfolio method arises from the fact that only a single β is estimated from a market model of a portfolio rather than an individual security β_i from a market model for each security.

4.7 Results

Recall our hypothesis: provided that the increase in institutional ownership is large enough to affect industry equilibrium and investors realize the impact of the change, expected profits of firms in the industry will rise with index entry. When the expected future profits of the entrant and its product market competitors rise, stock prices should immediately incorporate that information and generate positive abnormal returns.

4.7.1 Entrant Abnormal Returns

Table 2 below presents the average CAR for true and promoted entrants, as well as Patell and BMP test statistics. The difference in the inclusion effect is stark. Promoted firms gain a return of only 1.3% compared to 4.0% for true entrants, demonstrating that the index inclusion effect is strongly linked to changes in shareholdings from institutional investors (shown previously in Figure 5).

Table 2: Mean Entrant CARs and Significance Tests

Entrant Type	Mean CAR	t_P	t_B	N
True Entrant	4.03%	14.32***	10.54***	147
Promotion	1.28%	4.73***	3.79***	233

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

As previously discussed, much of the previous literature examining the inclusion effect has attempted to test two alternative theories. The information hypothesis suggests that index inclusion reveals positive information to the market, which responds by driving the price of entrants up. The demand hypothesis suggests that positive shocks are due to downward-sloping short-term demand curves. Table 2 provides striking evidence that the entrant effect is caused by the magnitude of the change in ownership structure for entering firms, a fact that, to our knowledge, has not been recognized in the literature. This table will be the only time in the paper that we examine the CAR of the entrant itself. In order to disentangle effects of a change in ownership structure from demand effects, we continue on with analysis of competitor abnormal returns.

4.7.2 Competitor Abnormal Returns

As we have shown in Figure 5, there are two sources of variation in ownership similarity among product market competitors (PMCs) of entrants to the S&P 500. The first source of variation corresponds to whether PMCs compete with true entrants or promoted entrants. True entrants incur a much larger shock to ownership similarity when compared with promoted entrants, therefore we would expect larger abnormal returns among this group to the extent that the common ownership hypothesis is valid. The second source of variation corresponds to whether PMCs are S&P incumbents or not. The observable change in ownership similarity for PMCs that are not members of the S&P 500 is close to zero. Therefore we expect the CAR for PMCs outside the S&P to be relatively smaller in comparison to S&P incumbents.

The existence of two comparison groups (competitors of promoted entrants, and competitors outside the S&P 500) naturally suggests a differencing estimator to measure the effect of the shock to institutional ownership on abnormal returns. The first difference (true vs. promoted) addresses a potential concern that, despite the evidence above, there is something special about an entrant into the S&P 500 that raises expectations about future profits. If such an unobserved "S&P 500 halo effect" exists, it is reasonable that it would both affect entrants that switch indices and entrants that come directly into the S&P 500, whereas the increase in common ownership is much larger for true entrants. By comparing the response of these two groups, we may be able to difference out any such halo effect. The second difference (S&P 500-incumbent vs. non-incumbent) would similarly remove any common industry effect that does not result from a change in ownership structure.

Table 3 below shows the mean industry cumulative abnormal return of the product market competitor for different subgroups. Patell and BMP t-statistics are reported for a test corresponding to a null hypothesis of whether the mean CAR is equal to zero. These test statistics are robust to correlation between CARs by event following the methodology outlined in Kolari and Pynnönen (2010) and discussed above. The results in Table 3 show a pattern of negative mean return which we discuss below. But the group that we hypothesize should have a larger CAR is the "True-Yes" subgroup. The CARs for this subgroup are both positive in an absolute sense and much more positive than the other subgroups, as well as statistically significant. This finding is consistent with a positive effect of common ownership on future profits.

Table 3: Mean Competitor CARs and Significance Tests

Entrant Type	S&P	$\overline{CAR}$	t_P^{Robust}	t_{B1}^{Robust}	J	N
GICS						
True	No	-0.22%	-1.45	-0.42	137	8560
True	Yes	0.23%	4^{***}	2.13^{*}	131	714
Promotion	No	-0.26%	-9.82^{***}	-1.06	222	15465
Promotion	Yes	-0.49%	-4.06^{***}	-3.67^{***}	215	1355
HP						
True	No	-0.35%	-6.41^{***}	-1.77	115	8928
True	Yes	0.46%	0.14	1.24	108	1103
Promotion	No	-0.33%	-7.08^{***}	-1.65	193	14839
Promotion	Yes	-0.50%	-3.33^{***}	-2.55^{*}	182	2048
Manual						
True	No	0.04%	-2.64^{**}	-0.21	76	683
True	Yes	0.41%	1.41	2.18^{*}	68	219
Promotion	No	-0.54%	-6.16^{***}	-2.58^{**}	134	1549
Promotion	Yes	-0.91%	-4.64^{***}	-5.98^{***}	120	451

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

Note: J refers to the number of entry events. N refers to the number of entrant-competitor pairs in the sample.

We find that there is a significant negative return for the group of promoted competitors that are members of the S&P 500. This result looks like the previous literature that finds an overall negative effect of index entry on incumbent S&P firms (Gygax and Otchere, 2010), which they ascribe to a portfolio rebalancing effect that causes selling pressure among incumbent firms. However, in our sample the negative point estimates seem to be generated by the inclusion in our sample of technology companies during the dot-com bust.[22]

[22]The point estimates for PMCs of promoted firms that are not S&P 500 incumbents are also negative, but, with the exception of the manual competitor classification, we cannot reject a null hypothesis that these estimates are different than zero at typical significance levels with the BMP t-statistic. A more detailed examination of the manual classification, provided in Figure 11, shows that the negative sign of this point estimate is primarily caused by a number of technology firms in our sample that experienced highly negative returns in the year 2000 during the dot-com bust. If we exclude observations from this year from our sample, this point estimate is no longer significant, as shown in Table 13.

To the extent that either of these issues affects our primary group of interest (S&P 500-incumbent PMCs that compete with “True” entrants), the positive point estimates in Table 3 will underestimate the effect of increased common ownership on stock returns. This is another reason to focus on our differenced estimate, shown in Table 4. The significant, positive point estimates in the second rows of each subgroup is again consistent with a hypothesis that the shock to institutional ownership results in increased industry profitability.

Table 4: Difference in Competitor CARs (True - Promoted)

S&P	$\Delta\overline{CAR}$	$t_P^{\Delta\text{Robust}}$	$t_{B1}^{\Delta\text{Robust}}$
GICS			
No	0.04%	5.06***	0.35
Yes	0.72%	5.64***	3.89***
HP			
No	-0.02%	-0.68	-0.46
Yes	0.96%	2.03*	2.39*
Manual			
No	0.59%	1.68	1.15
Yes	1.31%	3.89***	5.27***

* Significant at the 0.05 level.
** Significant at the 0.01 level.
*** Significant at the 0.001 level.

To exploit our last source of variation in the shock to common ownership, S&P 500 incumbency, we calculate a double-difference estimator. Table 5 differences the estimates from Table 4 for each competitor classification and pools variances accordingly. The point estimates are again positive and significant, consistent with a positive effect of common ownership on industry profitability.

Table 5: Difference-in-Differences of Competitor CARs Δ(S&P 500 Incumbent) - Δ(Non-Incumbent)

Industry Definitions	$\Delta\Delta\overline{CAR}$	$t_P^{\Delta\Delta\text{Robust}}$	$t_{B1}^{\Delta\Delta\text{Robust}}$
GICS	0.69%	2.1*	2.53*
HP	0.98%	2.05*	2.09*
Manual	0.72%	2.1*	2.28*

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

To summarize, the data demonstrate that competitors incur significantly higher positive returns if they are members of the S&P 500 and if the index entrant is a true entrant. Competitors of promoted entrants, on the other hand, incur negative abnormal returns if they are S&P 500 incumbents, consistent with a index rebalancing hypothesis. Competitors that are not members of the S&P 500 do not experience significant changes to their stock prices. These findings are consistent with a hypothesis that firms that experience an increase in common ownership incur higher profits in expectation. In order to examine this relationship more closely, we explore how abnormal returns vary with more specific measures of investor overlap and common ownership in Section 5.

4.7.3 Event Window Placebo Test

We implement a placebo test by shifting the event window in our event study forward by five days. This placebo event window measures cumulative abnormal returns over a period prior to any announcement of index addition, therefore we would not expect to see significant results. Results are shown in Tables 14, 15, and 16. Most of these point estimates are not significantly different than zero, and those that do appear to hold at modest levels of significance have the opposite sign of what we would expect. The results of this placebo give us confidence that our primary results discussed above are not solely due to chance.

4.7.4 Interpreting Magnitudes

How plausible are the estimated magnitudes for abnormal returns given above? We stress that even small competitive effects could have an outsize impact on share prices. Consider, for example, the average increase in profit margins that would be needed to support a one percent increase in stock price. Assuming, consistent with S&P 500 averages, net margins of 11%, a debt-to-equity ratio around 0.9, and a cost of capital of 8%, then it would only take a 0.06% increase in margins to raise the present discounted value of future profits by 1%. Alternatively, consider that US stock PE ratios have historically ranged around 20x, i.e., a share price is about 20 times its earnings. Therefore, a 0.05% increase in earnings (margins) should translate to a 1% increase in share price. Market prices would therefore have to increase by even less than margins to achieve this change.

5 Metrics of Common Ownership

We have demonstrated that there is a clear link between changes in institutional ownership and the abnormal returns to firms that enter the S&P 500 and their product market competitors. In previous sections, we have not used direct measures of institutional ownership except to demonstrate that there is a reaction in the shareholding structure of promoted index entrants when compared to true entrants.

In this section, we examine how abnormal returns for competitors vary with alternative measures of common ownership. We choose and then formally define these measures. As motivation for our choices, we first review a simple model of firm behavior under the common ownership hypothesis and derive profit weights following Backus et al. (2019b). We then discuss how the incentives reflected by profit weights relate to tacit collusion and describe and calculate metrics that reflect the similarity of owners of firm pairs. We also review several other metrics used to measure common ownership in the broader literature.

5.1 Profit Weights

We follow Backus et al. (2019b) in their definition and calculation of profit weights who, as discussed, build on earlier work by Rotemberg (1984), Bresnahan and Salop (1986), and O'Brien and Salop (2000). They extend the basic framework of own-firm profit maximization to one in which firms maximize cash flows to their investors, which results in managers who place positive weights on rivals' profits.

Assuming shareholder i owns a percentage β_{if} of firm f, they are entitled to a proportion of total profits π_f generated by the firm. This gives an expression for the value of a shareholder's portfolio across all firms in the portfolio:

$$\sum_f \beta_{if}\pi_f$$

Letting γ_{if} represent the control weight of owner i in firm f, we can write the firm's objective function as a control-weighted sum of its shareholders' portfolios:

$$\sum_i \gamma_{if} \sum_g \beta_{ig} \pi_g$$

An assumption of proportional control rights would imply $\gamma_{if} = \beta_{if}$. The above formulation is more general, however, and allows for alternative specifications of shareholder control. Backus et al. (2019b) show that rearranging terms yields an equivalent maximization problem in which the firm maximizes not only its own profits, but an additional term that represents a weighted portfolio of rivals' profits:

$$\begin{aligned} &\pi_f + \sum_g \kappa_{fg} \pi_g \\ &\kappa_{fg} \equiv \frac{\sum_i \gamma_{if} \beta_{ig}}{\sum_i \gamma_{if} \beta_{if}} \end{aligned} \tag{2}$$

Here, κ_{fg} are the *profit weights*, which measure the value to firm f of a dollar generated for a competing firm g. Profit weights are the channel through which common ownership affects firm behavior.[23] Measuring profit weights requires knowledge not only of owners' shareholdings, but also of control weights (managerial influence) each shareholder has in each firm of their portfolio. The former can be estimated from the data, to the extent that it is available. The latter is a stand-in for a model of corporate governance and cannot be easily calibrated from the data.

5.2 Ownership Similarity and Coordinated Effects

The theory above converts the typical firm objective of profit maximization into a more complex objective function that incorporates weights on profits of other firms held by its owners. In principle, this is what the manager of the focal firm solves each period without any assistance or communication from any common owner. While this type of expression is a convenient method of writing down tacit collusion for an economist, it requires the strong assumption that the manager maximizes the profits of the firm's owners. It might be difficult for a principal to incentivize a manager to make this calculation. The informational burden

[23] Interestingly κ_{fg} can be larger than one. This occurs when common owners hold larger shares in a rival than in the focal firm. In this setting a dollar of profit earned by the rival accrues more to the owner than a dollar earned by the focal firm. Thus, if the owner can influence which firm should take a profitable opportunity, it prefers the rival to do so.

would be high, and would likely be difficult to contract upon.

5.2.1 An Alternative Symmetric Model

We propose a supergame model of tacit collusion as a simple addition to the above, or alternative for those who are concerned about the incentive scheme and informational burden it requires. Tacit collusion in this setting occurs when managers compete less vigorously today in the expectation that others in their industry will respond by continuing the favorable strategy tomorrow. Participants in successful tacit collusion are relatively patient – they must value the expected future profits obtained through cooperation more than they value the short-term profits that may be gained by deviating. Competitors will find tacit collusion more difficult to achieve than explicit collusion (abstracting from legal concerns) because, by definition, no direct communication occurs. Firms that attempt to create tacit collusion must be alert for the conditions under which tacit collusion could arise and be encouraged and sustained by managerial actions.[24]

One way to conceptualize the effect of increased common ownership would be through an increase in the discount factor. Common owners might cause managers of firms in their portfolios to experience a higher discount factor, or to be more patient, by visiting them to discuss strategy or by creating more confidence that their rivals are not about to abandon the current equilibrium. The literature demonstrates that when the discount factor is higher, a larger set of equilibria can be supported which increases the likelihood tacit collusion can be sustained. Even if ownership shares of different owners were asymmetric, an increase in common ownership could generate an increase in the value of the future for all competing firms in the portfolio. Notice that in such a supergame, a rival that had no common owners would also likely experience higher profits.[25]

5.2.2 Contrast with Asymmetric Incentives

When ownership of one firm becomes very concentrated in a particular owner, that owner benefits more when profits flow to that firm relative to a competitor where it holds a lower share. Thus, absent other considerations, the common owner would prefer that the two

[24]See Tirole (1988), Chapter 6, which outlines the basic model and provides many citations for variations on the folk theorem.

[25]It is likely possible to construct counterexamples. For example, suppose the non-common rival has enough capacity to find it profitable to price below its rivals and take all demand.

managers direct profits to the firm that is owned in a more concentrated fashion by the common owner. The profit weight formulation above reflects this incentive by incorporating competitive arrangements that might be highly asymmetric. For example, consider how a duopoly in which one firm assigns a relatively low weight to the second and the second firm assigns a relatively high weight to the first incentivizes profit-shifting from the second firm to the first. We will borrow a term from the corporate governance literature and (loosely) refer to this incentive as 'tunneling.' A firm that experiences a rise in the concentration of common ownership thus might experience higher profits because its less concentrated rival alters its competitive behavior purposefully to benefit the concentrated firm. This incentive is naturally asymmetric. We note that such asymmetric arrangements might run counter to the legal obligations of managers, although this would depend on the preferences of owners that have voting rights.

The tension between symmetric and asymmetric common ownership incentives is captured within the profit weight framework. Backus et al. (2019b) show that κ_{fg} as defined in equation 2 may be further decomposed into an ownership similarity term and a measure of investor concentration based on the Herfindahl-Hirschman Index (HHI) as follows:

$$\kappa_{fg} = cos(\beta_f, \beta_g)\sqrt{\frac{IHHI_g}{IHHI_f}} \tag{3}$$

where $cos(\beta_f, \beta_g)$ is the cosine similarity between the vectors of shareholder ownership, and $IHHI_f = \|\beta_f\|^2$ is the shareholder concentration of firm f. Ownership similarity is the "symmetric" component of the profit weight, i.e. it appears in both κ_{fg} and κ_{gf}, and if it increases it will increase the objective functions of both firms in the industry. On the other hand, the relative shareholder concentration term is inherently asymmetric, i.e. an increase in shareholder concentration of f will move the second term in opposite directions depending on which kappa is being calculated. We have no *ex ante* hypothesis about the relative magnitudes of the investor similarity effect relative to the asymmetric concentration effect.

5.2.3 Ownership Similarity Measures

In our exploration of vector similarity we define two similarity metrics below. In these descriptions we define $\mathbf{M}$ as the ownership vector for an entrant firm j, and $\mathbf{N}$ as the ownership vector of its competitor k who is already in the index. Components of $\mathbf{M}$ and $\mathbf{N}$

correspond to ownership stakes. These metrics offer two different ways to capture ownership similarity. An L_2 metric gives a larger weight to larger owners when compared with an L_1 metric.

Cosine Similarity

As shown in equation 3, cosine similarity is one theoretical component of κ, and is therefore the first similarity metric that we examine. Cosine similarity can be thought of as a normalized dot-product. Recall the inner-product formulation $\mathbf{A}\cdot\mathbf{B} = \|\mathbf{A}\|\,\|\mathbf{B}\|\,cos(\theta)$. Abstracting from the possibility of large short positions, ownership shares are non-negative, therefore this similarity metric is restricted to the $[0,1]$ interval. Cosine similarity of zero corresponds with no common owners and cosine similarity of 1 corresponds to identical shareholding structure. Since this is an L_2 similarity measure, the metric will put more weight on large owners than small owners.

$$L_C(\mathbf{M},\mathbf{N}) = \frac{\mathbf{M}\cdot\mathbf{N}}{\|\mathbf{M}\|\,\|\mathbf{N}\|} = \frac{\sum\limits_i M_i N_i}{\sqrt{\sum\limits_i M_i^2}\sqrt{\sum\limits_i N_i^2}}$$

Bray-Curtis Similarity

An L_1 similarity measure, Bray-Curtis similarity, is derived in Deza and Deza (2009). This similarity metric stems from the Bray-Curtis distance:

$$d_B(\mathbf{M},\mathbf{N}) = \frac{\sum_i |M_i - N_i|}{\sum_i M_i + N_i}$$

The similarity measure transforms the Bray-Curtis distance so that it is bounded between 0 and 1:

$$L_B = 1 - d_B(\mathbf{M},\mathbf{N})$$

If we perfectly account for all owners, the denominator is equal to two, as each ownership vector sums to 1. Therefore, the Bray-Curtis similarity measure is also contained within $[0,1]$, with similarity of 1 indicating perfect shareholder overlap and similarity of 0 indicating orthogonal ownership vectors. This similarity metric is linear in the L_1 distance, and should therefore give an equal weight to shifts in ownership regardless of the size of the owners' stake.

5.3 Alternative Metrics

The Capitalist Conspiracy - CC

The “Big Three” funds, Blackrock, StateStreet, and Vanguard, tend to receive much of the attention when it comes to discussing the common ownership problem. To be fair, these funds have also joined the debate more prominently than others.[26] One of these three funds is the largest owner in a majority of firms in the S&P 500.

As the Big Three grow, one potential concern may be coordination among the owners that would allow for increased profits through tacit collusion. Suppose ownership control increases with absolute asset holdings across all companies, and therefore only the largest owners are able to influence the strategy of the firms they hold. We call this the “Capitalist Conspiracy” conjecture. Under this theory, if the top funds increase their ownership of the two competitors this will lead to a softening of competition between them. Note that the funds themselves need not be in the top three owners of the focal firm pair. We operationalize this hypothesis with a simple metric that measures the increase in the stake of the entrant firm by the three largest funds.

Fraction of Capitalization - FCAP

Introduced by Antón and Polk (2014), FCAP is defined as the total ownership value held by all common owners of the two competitors over the total market capitalization of the two stocks. An increase in FCAP would reflect the creation of new common owners of any size upon the entrant of a firm to the S&P 500 or an increase in shareholdings of existing common owners relative to undiversified owners.

Density of Firm-Pairs - DFP

Azar (2011) defines ownership network density as the number of firm-pairs that are connected in an industry divided by the maximum possible number of firm pairs. Azar considers firm pairs to be connected if the same institutional investor owns at least 5% of the two competitors. We calculate this statistic for a cutoff of 5% as well as a smaller cutoff of 2%. This statistic gives a weight of zero to small common owners and downweights common ownership that largely manifests itself as bilateral pairs rather than symmetric holdings. The

[26] See, for example, Remarks by Barbara Novick at FTC Hearing #8 on Competition and Consumer Protection in the 21st Century (available at https://www.blackrock.com/corporate/compliance/bii-terms-and-conditions?targetUrl=%2Fcorporate%2Fliterature%2Fwhitepaper%2Fpolicy-spotlight-common-ownership-data-is-incorrect-january-2019.pdf).

total possible number of firm pairs can become high in an industry with many firms which *reduces* the weight of any one pair. DFP puts relatively high weight on large owners.

The Percentage of Common Funds - PCF

Koch et al. (2019) suggest another metric for common ownership within an industry. They define a "common fund" as a fund that is a blockholder in at least two competitors within in an industry, where a blockholder is defined as a fund that owns at least 5% of the equity of a firm. The percentage of commond funds is calculated as the number of common blockholders within an industry divided by the total number of blockholders. We also calculate PCF using a smaller cutoff definition for blockholders of 2% of equity. This metric is quite similar to DFP except it does not feature combinatorics in the denominator and is therefore larger on average because many funds hold more than one competitor. It also puts relatively high weight on large owners.

6 Correlation of Common Ownership Metrics with Abnormal Returns

6.1 Methodology

We calculate each of the above metrics for firms in our sample of manually classified S&P incumbent competitors using quarterly ownership data from 13-F filings prior to and after the entry of firms to the S&P 500.[27] We then regress cumulative abnormal returns for firms from the event study on the quarterly change in each ownership measure. Next, we add a covariate to control for the pre-announcement level of each measure to parse out whether positive returns are predicted by levels of ownership structure or changes in ownership structure.

We assume, as we did above, that variation in the quarterly change and baseline common ownership metrics are exogenous with respect to the three-day abnormal return of stock prices following the announcement that a firm is added to the index.

Additionally, the metrics we use vary in the weights they put on different kinds of over-

[27]Firms without ownership information are removed from the sample, as well as several firms for which total institutional ownership was reported to be greater than 100%, potentially indicating underlying errors in the underlying data.

lap, thereby providing some insight as to whether and how ownership structure affects the competitive nature of industries.

To review, we construct the following metrics of common ownership:

(1) κ_{jk} is the weight that the entrant firm j places on the competitor k's profits. We use the proportional control assumption.

(2) κ_{kj} is the weight that the competitor firm k places on the entrant j's profits.

(3) The cosine measure of vector similarity of the owners of j and k described above. (L2, weights large owners more heavily)

(4) The Bray-Curtis measure of vector similarity of the owners of j and k described above. (L1, equal weight to owners of different sizes)

(5) CC, the "Capitalist Conspiracy" metric, which measures the change in the combined ownership stake of the three largest funds: Blackrock, StateStreet, and Vanguard.

(6) FCAP measures the joint percentage of the firms' market value held by funds that own at least a portion of each.

(7) DFP is the density of firm pairs measures the fraction of connected firm pairs within an industry.

(8) PCF measures the percentage of common blockholders within an industry.

6.2 Results

6.2.1 Changes in Common Ownership Metrics

Summary statistics for the metrics described above are contained in Table 6.[28] The first six metrics are calculated for each competitor, whereas the last four metrics are calculated per industry or per entrant. Table 7 provides the average change in each metric upon index entry, reported in units of standard deviation. Table 17 provides cross-correlation between metrics. Because the previous literature has not established a mechanism for the effects of common ownership, it is not clear *ex ante* which of these measures best captures the

[28]This table contains summary statistics for *baseline* metrics, i.e. calculated prior to index entry.

underlying competitive forces, to the extent that they are present. An important aspect of the Bray-Curtis and Cosine similarity measures is that they increase significantly upon entry of one of the stocks into the index. We test if these additional metrics also react to the inclusion event. Two metrics, each with two cutoffs, DFP and PCF, do not change with index entry, which may be reflective of the fact that indexing does not cause a major change in large blockholders as defined by arbitrary cutoffs. CC and FCAP both experience significant growth upon inclusion, demonstrating a clear reaction of the Big Three funds and an increase in total common market capitalization, respectively. Table 7 demonstrates that the kappa weights both increase, though by somewhat different amounts. Recall that κ_{kj} is the weight the incumbent firm places on the entrant. This increases significantly because both the cosine increases with the increased overlap in owners and the ratio of investor Herfindahls rises as the entrant's owners become more concentrated. The table also shows that κ_{jk} increases, but by about half as much. While this metric has the same cosine as the other, the ratio of Herfindahls is inverted, leading it to decrease with entry and somewhat offset the cosine increase.

Table 6: Baseline Summary Statistics

Metric	Mean	Median	Std. Dev.	N
Cosine	0.45	0.46	0.21	571
Bray-Curtis	0.37	0.39	0.12	571
κ_{kj}	0.52	0.50	0.30	571
κ_{jk}	0.47	0.42	0.31	571
FCAP	0.52	0.55	0.17	571
CC	0.07	0.05	0.06	571
Density (2%)	0.71	0.73	0.20	168
Density (5%)	0.29	0.21	0.23	168
PCF (2%)	0.33	0.32	0.08	168
PCF (5%)	0.27	0.27	0.12	168

Table 7: Quarterly Change in Metrics for Competitors Before and After Index Entry

Metric	Change	Standard Error
Cosine	0.177***	0.033
Bray-Curtis	0.348***	0.035
κ_{kj}	0.193***	0.035
κ_{jk}	0.071*	0.045
CC	0.366***	0.030
FCAP	0.172***	0.036
Density (2%)	0.034	0.038
Density (5%)	0.007	0.023
PCF (2%)	0.021	0.051
PCF (5%)	0.073*	0.053

* p<0.1; ** p<0.05; *** p<0.01 (one-sided)

Note: Cluster-robust errors are reported with clusters at the entrant level. Change is reported in units of standard deviation.

6.2.2 Relating Changes in Common Ownership to Changes Abnormal Returns

Index entry that exogenously increases common ownership may generate a new equilibrium in the product market that generates higher profits. If so, stock prices should increase, meaning CARs will be positive at the announcement. We expect an increase in common ownership metrics to predict higher stock price returns.

Table 8 provides the results from a regression of abnormal returns on the quarterly change in the corresponding common ownership metric. Measures of similarity are positive and significant. All metrics have been standardized such that coefficients may be interpreted as the change in abnormal returns due to a one standard deviation increase in the corresponding metric. Our results indicate that a one standard deviation increase in Cosine and Bray-Curtis similarity is associated with additional returns of 0.9% and 1.2%, respectively. Interestingly, an increase κ_{kj}, the profit weight that competitors place on the entering firm, reduces the returns of the competitor. This result is consistent with theory. Notice that entry causes an increase in ownership concentration for the entrant. Entry does not, however, cause a shift in ownership concentration for the competitor. This translates into an unambiguously positive effect of entry on the profit weight attached to the entrant, κ_{kj} and an ambiguous effect on the profit weight attached to the competitor κ_{jk}. When the competitor's owners increase the concentration of the entrant's owners by purchasing its stock, the competitor's owners are happier to earn profit through the entrant than they were before. Thus, to the extent higher total profits can be realized by shifting some earnings to the entrant and away from the competitor, the common owner is more willing to do that than it was previously, and this effect pushes down the competitor's returns. This effect is similar to the idea of 'tunneling' from corporate governance literature. The coefficient on κ_{jk} positive and significant for the same reason; the entrant's owners hold a larger share in the competitor and are more willing to earn profits through that channel. Those expected profits increase the competitor's returns.

Table 9 provides results from a similar regression, but calculated for the alternative metrics described above: the Capitalist Conspiracy metric, FCAP, Density of Firm Pairs, and Percentage of Common Funds. None of these metrics appear to have a significant relationship with the abnormal returns of product market competitors. Note that the CC and FCAP metrics demonstrate no clear relationship with abnormal returns despite having positive movement in the first stage. That is, the size of purchases by the Big Three funds and shifts in total common market capitalization do not appear predictive of returns. Similarity measures, which also have a foundation in the theoretical model discussed in Section 5, may provide the best link to common ownership incentives.

Table 8: Regression of CAR on Ownership Similarity and Profit Weights

	Cosine	Bray-Curtis	κ_{kj}	κ_{jk}
	(1)	(2)	(3)	(4)
Change	0.0093**	0.0126***	−0.0051	0.0078*
	(0.0037)	(0.0043)	(0.0087)	(0.0042)
Constant	−0.0062**	−0.0089***	−0.0035	−0.0051**
	(0.0026)	(0.0032)	(0.0021)	(0.0025)
Observations		571		

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

Table 9: Regression of CAR on Alternative Ownership Metrics

	CC	FCAP	DFP (2%)	DFP (5%)	PCF (2%)	PCF (5%)
	(1)	(2)	(3)	(4)	(5)	(6)
Change	−0.0005	−0.0059	0.00004	0.0005	0.0006	−0.0014
	(0.0080)	(0.0116)	(0.0053)	(0.0077)	(0.0047)	(0.0047)
Constant	−0.0043	−0.0035	−0.0045*	−0.0045*	−0.0045*	−0.0044*
	(0.0031)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
Observations			571			

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

Table 10 provides the same regression as before, but with an additional covariate added to control for the pre-entry baseline of each metric. We omit alternative metrics, which continue to show no clear relationship. Baseline common ownership metrics are negatively associated with abnormal returns, suggesting that firms that begin with lower levels of common ownership receive a relatively larger boost to the incumbent's stock price with a given amount of increase. This suggests there may be decreasing returns to ownership similarity for firms. As before, the quarterly change in each metric continues to be positive and significant with the exception of κ_{kj}.

Table 10: Regression of CAR with Levels

	Cosine (1)	Bray-Curtis (2)	κ_{kj} (3)	κ_{jk} (4)
Change	0.0114***	0.0143***	−0.0002	0.0080*
	(0.0039)	(0.0044)	(0.0075)	(0.0043)
Level	−0.0051**	−0.0051**	−0.0062***	−0.0005
	(0.0020)	(0.0020)	(0.0022)	(0.0017)
Constant	0.0053	0.0080	0.0074*	−0.0044
	(0.0043)	(0.0065)	(0.0043)	(0.0039)
Observations		571		

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

We note that these results are robust to the event window placebo test that was previously discussed in Section 4.7.3. A modified version of Table 8 is provided in Table 18 in the Appendix that uses placebo abnormal returns as the dependent variable. These results show that the placebo returns do demonstrate any significant relationship with common ownership metrics.

The results above point to investor similarity as an important predictor for explaining the magnitude of abnormal returns. The results concerning profit weights, however, are more difficult to interpret. The importance of the ownership similarity metrics in explaining returns may indicate that symmetric ownership is more important to explaining competition than the asymmetric κ metrics. We explore this issue next.

6.2.3 Kappa Decomposition

Equation 3 from Backus et al. (2019b) demonstrates how κ may be decomposed into two terms — an ownership similarity term and a term representing relative investor concentration. The entry of a firm into the S&P 500 tends to increase ownership similarity, a symmetric measure, as we have shown in Figures 6 and 7. The effect of entry on ownership concentration is not symmetric. Ownership concentration rises for the entrant but not for the competitor. This combination of effects generates a positive effect of entry on the profit weight attached to the entrant, κ_{kj} and an ambiguous effect on the profit weight attached to the competitor κ_{jk}.

Of course, the value of a firm is jointly determined by its own incentives as well as the incentives of other firms in its competitive environment, i.e. κ_{jk} and κ_{kj} should affect industry incentives, and therefore firm values, jointly. As a result, we consider the joint relationship of the components of κ presented in equation 3. Table 11 regresses abnormal returns of product market competitors on the change in cosine similarity and the change in investor concentration of the entrant firm and the product market competitor.[29] Under the common ownership hypothesis, we would expect competitor returns to increase with ownership similarity because this will soften downstream product market competition and raise expected profits. Likewise, the competitor should earn higher profits if its common owners are relatively more concentrated than the entrant, as they will optimally realize profits through that company rather than any of its rivals. The opposite holds true if the common owners are relatively more concentrated in the entrant. The intuition for this is the same — all else equal, investors would prefer to earn profits at the firm in which they hold a relatively larger stake.

The regression results in Table 11 are consistent with these theoretical predictions. We obtain a positive and significant coefficient, as before, on the cosine similarity regressor, while investor concentration in the entrant has a negative and significant effect on the returns of the competitor. Changes to investor concentration in the competitor itself are close to zero. This might be expected because our entry experiment does not cause major change to the shareholding structure of the incumbent firm.

[29] Covariates are log-transformed given that κ is log-linear in each component. In other words, taking logs of equation 3 yields $\log \kappa_{fg} = \log \cos(\beta_f, \beta_g) + \frac{1}{2} (\log IHHI_g - \log IHHI_f)$.

Table 11: Regression of CAR on Components of Kappa

ΔCosine	0.0153^{**}
	(0.0060)
ΔIHHI Competitor	0.0008
	(0.0034)
ΔIHHI Entrant	-0.0119^{*}
	(0.0071)
Constant	-0.0058^{**}
	(0.0025)
Observations	570

* p<0.1; ** p<0.05; *** p<0.01
Cluster-robust errors are reported with clusters at the entrant level.

6.3 Alternative Explanations

One potential criticism of the analysis above results relates to the notion that shares of competitor firms are substitutes for shares of the entrant because their returns are correlated. In this setting, active managers of diversified firms may realize that a rigid rule requiring purchase of the new entrant will be expensive due to increased demand for the security. A fund might carry out an alternative strategy that avoids purchasing costly shares of the entrant and instead purchasing cheaper substitutes that are product market competitors in that industry. Because PMCs have correlated returns, this will give the fund a similar level of diversification at a lower cost. Thus, PMCs may also receive a demand shock that we interpret as higher future profits, but in fact is unrelated to common ownership.

We construct a metric for the expected demand that an entrant will experience by taking the difference between baseline total institutional ownership of the entering firm and average institutional ownership within the S&P 500 for the same quarter. This gap serves as a proxy for the incremental demand for the entering security. We add this metric as an additional covariate to the previous results. Table 19 in the appendix provides the results of this exercise as a modification of Table 8, and Table 20 modifies 11. The results show that this metric provides significant explanatory power for the rival's abnormal returns. However, the relationship between CAR and ownership similarity remains relatively unchanged and significant. This exercise provides some evidence that the "substitute security" hypothesis cannot explain our results.

Of course, there could be some other reason we see increased stock prices upon index entry that we have not thought of yet. To help address this concern, we conduct an analysis to examine whether accounting measures of profitability grew in the years following index inclusion. This is a direct - albeit noisy - way to check if increased profits may be the reason for increased CARs. To measure profitability of competitors relative to their industry, we calculated the gross margin of each firm using financial statement data downloaded from Compustat, and subtracted the aggregate gross margin of the industry.[30] This "excess gross margin" was calculated for each competitor in the sample for the three years prior to and three years after the corresponding index entry event. We then calculated a difference-in-differences regression of the form:

$$\begin{aligned} ExcessMargin_{it} = \beta_0 + \beta_1 TrueEntrant_{it} + \beta_2 After_{it} + \beta_3 TrueEntrant_{it} After_{it} \\ + \beta_4 TrueEntrant_{it} After_{it} \Delta Cosine_{it} + \gamma_t + u_{it}, \end{aligned} \tag{4}$$

where γ_t represents year fixed effects. β_3, the typical difference-in-differences effect, can be interpreted as the increase in excess margin for a competitor of a true entrant conditional on no change in cosine similarity. β_4 can be interpreted as the increase in excess margin for a competitor of a true entrant conditional on changing cosine similarity from zero to one. Competitors of promoted entrants serve as a comparison group in the difference-in-differences specification. Results are provided in Table 21. We run two specifications with and without year fixed effects, and find a small positive effect on the third term (half a percentage point in the fixed effects specification), and a larger positive effect on the fourth term (two percentage points in the fixed effects specification). This indicates that excess margins of competitors of true entrants increased after index inclusion relative to competitors of promoted entrants, and that this increase was larger for firms that experienced a larger shock to ownership

[30] We focus on the manual industry classification for this exercise.

similarity. The point estimates are not significant at traditional levels, though the data are likely a noisy measure of the underlying true economic profit in which we are interested. Because accounting profits may not be an accurate measure of these economic profits, this exercise is inherently limited. It does, however, provide some suggestive evidence that stock returns may have translated to a real increase in profitability *ex post*.

6.4 Index Concentration

Some theories of competition depend on the *ex ante* market structure of the industry. For example, tacit collusion is easier to sustain in a more concentrated market structure. It may therefore be that common ownership is more effective in lessening competition in these settings.

Whereas typical measures of concentration examine functions of the number of firms in an industry or their market shares, a natural measure of concentration in our setting is index concentration, i.e. the share of an industry operating within the S&P 500. One might expect larger returns from the inclusion event for competitors that operate in industries whose firms are relatively concentrated in the S&P 500 due to the fact that common ownership is increasing for a larger share of the industry.

To calculate index concentration, we retrieve the market capitalization of each firm as of the date of the inclusion announcement, and calculate the percentage of industry market capitalization held by firms inside the S&P 500. We then regress the cumulative abnormal returns of competitors on this measure. Results are provided in Table 22 for the GICS and manual industry classifications. The coefficient on the index concentration measure is negative for the GICS classification but not the manual classification, although this positive coefficient is not significant. We also recompute the Cosine and Bray-Curtis columns of Table 8, which focuses on the manual classification, adding the index concentration measure as a covariate. Results are shown in Table 23. We find that there is a significant positive relationship between abnormal returns and the level of concentration of an industry in the index, holding constant measures of common ownership. In other words, more concentrated (in the index) industries appear to respond more strongly to an entry event regardless of the magnitude of the change in common ownership. The interaction term allows the impact of concentration to vary with the change in common ownership. If more concentrated industries react more strongly to increases in common ownership then this interaction will be positive. However, with the exception of the cosine similarity metric, this interaction is not significant.

Our dataset is not large enough to compare settings based on differences in market structure, though a large IO theory literature indicates that this would be a fertile place to look for competitive effects. Future research might provide a more formal analysis of how common ownership incentives vary with different market structures.

7 Conclusion

In this paper we have demonstrated that increases in institutional ownership and common ownership occur when stocks enter the S&P 500 index. We uncover a key source of variation among index entrants — "true entrants" that were not previously members of an S&P index incur much larger shocks to their ownership structure after entry when compared to entrants that are "promoted" from another S&P index. We replicate the classic index entry result; entrants experience abnormally positive returns upon entry, and we show that this effect is strongly linked to the size of the ownership shock (4.03% CAR for "true entrants" compared to only 1.28% CAR for "promoted" entrants). Furthermore, when common ownership increases with entry, the product market rivals of those entrants experience increased CAR. Combining an event study methodology with a difference-in-differences estimator, we show that positive abnormal returns accrue to an entrant's product market competitors when both companies are in the index.

We further explore heterogeneity in the magnitude of returns using detailed information on the level and changes of institutional ownership surrounding the index inclusion event. We calculate several metrics of the increase in common ownership and demonstrate that two of our measures of investor similarity (cosine and bray-curtis) show the expected relationship: increases in common ownership cause higher cumulative abnormal returns. Measures that focus on the largest funds or weigh larger funds more heavily, on the other hand, do not demonstrate a clear relationship with abnormal returns.

The policy implications of these findings are substantial. First, we generate these results using cases of index entry in many industries, thereby suggesting that common ownership incentives are not only confined to specific industries such as airlines, but could be widespread. Second, the owners that predict the increase in returns are not confined to the largest funds, suggesting that smaller shareholders may also play an important role in determining competitive outcomes. The impact of the change in ownership concentration on own and competitor's stock market returns is consistent with the theory that firms maximize their owners' profits and is, as far as we know, the first empirical evidence on this issue. Unfortunately, there are a limited number of theories to test in this area. We hope our results stimulate more research in corporate governance.

Lastly, these results lend support to those calling for more research of all kinds into the issue of common ownership. The mechanism that might cause common ownership to lead to higher profits is not yet certain, and more research in this area would be valuable. Even more valuable would be a study of large owners by the FTC because of its ability to obtain confidential information. Such a study would give the FTC more knowledge and expertise than other enforcement agencies and researchers, and would allow it to offer advice to both Congress and the courts concerning useful solutions to any problems it finds.

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Appendix

Table 12: Excess Sales Growth of Entrant Industries

	One Year	Two Year
Entrant Industry	0.001	0.005
	(0.007)	(0.006)
N	1411	1357

Note: Dependent variable is the future compound annual growth rate of sales for a GICS industry for one year (first column) and two years (second column) into the future. Entrant Industry is a dummy variable equal to one if a member of the GICS industry enters the S&P 500 in a particular year. Regression includes year fixed effects.

Table 13: Mean Competitor CARs and Significance Tests (2001-2017)

Entrant Type	S&P	$\overline{CAR}$	t_P^{Robust}	t_{B1}^{Robust}	J	N
GICS						
True	No	-0.18%	0.52	-0.44	124	7464
True	Yes	0.34%	4.23^{***}	2.38^{*}	118	616
Promotion	No	0.14%	1.43	0.36	191	11981
Promotion	Yes	-0.04%	-1.24	-1.56	185	1083
HP						
True	No	-0.30%	-5.4^{***}	-1.84	103	7444
True	Yes	0.30%	-1.72	0.21	96	943
Promotion	No	0.05%	6.46^{***}	-0.2	162	11446
Promotion	Yes	-0.02%	0.8	-0.42	152	1624
Manual						
True	No	-0.16%	-3.4^{***}	-0.77	70	606
True	Yes	0.39%	1.28	2.04^{*}	64	206
Promotion	No	0.09%	-1.17	-0.64	119	1336
Promotion	Yes	-0.55%	-3.54^{***}	-4.52^{***}	106	403

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

Table 14: Mean Competitor CARs and Significance Tests (Placebo)

Entrant Type	S&P	$\overline{CAR}$	t_P^{Robust}	t_{B1}^{Robust}	J	N
GICS						
True	No	-0.19%	-4.57^{***}	-0.86	137	8560
True	Yes	-0.22%	-1.53	-0.88	131	714
Promotion	No	0.09%	3.89^{***}	0.66	222	15465
Promotion	Yes	0.22%	2.02^{*}	1.5	215	1355
HP						
True	No	0.09%	-2.19^{*}	0.91	115	8928
True	Yes	0.16%	-2.14^{*}	-1.31	108	1103
Promotion	No	0.12%	11.53^{***}	1.39	193	14839
Promotion	Yes	0.01%	2^{*}	0.23	182	2048
Manual						
True	No	0.07%	-0.31	-0.72	76	683
True	Yes	-0.21%	-1.72	-1.09	68	219
Promotion	No	0.47%	4.64^{***}	2.4^{*}	134	1549
Promotion	Yes	0.24%	1.49	2.73^{**}	120	451

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

Table 15: Difference in Competitor CARs (True - Promoted, Placebo)

S&P	$\Delta\overline{CAR}$	$t_P^{\Delta\text{Robust}}$	$t_{B1}^{\Delta\text{Robust}}$
GICS			
No	-0.27%	-6^{***}	-1.09
Yes	-0.44%	-2.44^{*}	-1.67
HP			
No	-0.04%	-8.84^{***}	-0.08
Yes	0.14%	-2.9^{**}	-1.21
Manual			
No	-0.40%	-3.08^{**}	-1.85
Yes	-0.46%	-2.27^{*}	-2.25^{*}

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

Table 16: Difference-in-Differences of Competitor CARs Δ(S&P 500 Incumbent) - Δ(Non-Incumbent), Placebo

Industry Definitions	$\Delta\Delta\overline{CAR}$	$t_P^{\Delta\Delta\text{Robust}}$	$t_{B1}^{\Delta\Delta\text{Robust}}$
GICS	-0.17%	1.11	-0.35
HP	0.18%	2.77^{**}	-0.82
Manual	-0.05%	0.04	-0.34

* Significant at the 0.05 level.

** Significant at the 0.01 level.

*** Significant at the 0.001 level.

Table 17: Metric Cross-Correlations

	CC	Bray-Curtis	Cosine	FCAP	Density (2%)	Density (5%)	PCF (2%)	PCF (5%)	κ_{jk}	κ_{kj}
CC	1	0.35	0.38	0.34	0.22	0.70	-0.15	0.30	0.04	0.38
Bray-Curtis	0.35	1	0.89	0.75	0.22	0.23	0.20	0.18	0.28	0.66
Cosine	0.38	0.89	1	0.60	0.17	0.29	0.14	0.20	0.45	0.77
FCAP	0.34	0.75	0.60	1	0.35	0.23	0.25	0.24	0.03	0.41
Density (2%)	0.22	0.22	0.17	0.35	1	0.40	0.07	0.23	-0.02	0.11
Density (5%)	0.70	0.23	0.29	0.23	0.40	1	-0.07	0.46	0.11	0.29
PCF (2%)	-0.15	0.20	0.14	0.25	0.07	-0.07	1	0.36	-0.05	0.17
PCF (5%)	0.30	0.18	0.20	0.24	0.23	0.46	0.36	1	0.03	0.17
κ_{jk}	0.04	0.28	0.45	0.03	-0.02	0.11	-0.05	0.03	1	0.01
κ_{kj}	0.38	0.66	0.77	0.41	0.11	0.29	0.17	0.17	0.01	1

Table 18: Regression of CAR on Ownership Similarity and Profit Weights (Placebo)

	Cosine	Bray-Curtis	κ_{kj}	κ_{jk}
	(1)	(2)	(3)	(4)
Change	-0.0007	-0.0012	0.0014	-0.0015
	(0.0034)	(0.0029)	(0.0030)	(0.0027)
Constant	0.0003	0.0006	-0.0001	0.0003
	(0.0019)	(0.0020)	(0.0018)	(0.0017)
Observations	571			

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

Table 19: Regression of CAR with Expected Demand

	Cosine	Bray-Curtis	κ_{kj}	κ_{jk}
	(1)	(2)	(3)	(4)
Change	0.0080^{**}	0.0109^{**}	-0.0059	0.0090^{**}
	(0.0039)	(0.0044)	(0.0084)	(0.0043)
Expected Demand	0.0229^{**}	0.0199^{*}	0.0265^{**}	0.0282^{***}
	(0.0103)	(0.0105)	(0.0105)	(0.0100)
Constant	-0.0049^{*}	-0.0074^{**}	-0.0022	-0.0039^{*}
	(0.0025)	(0.0031)	(0.0022)	(0.0023)
Observations		571		

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

Table 20: Regression of CAR on Components of Kappa and Expected Demand

ΔCosine	0.0153***
	(0.0055)
ΔIHHI Competitor	0.0011
	(0.0033)
ΔIHHI Entrant	−0.0129*
	(0.0066)
Expected Demand	0.0276***
	(0.0101)
Constant	−0.0045*
	(0.0023)
Observations	570

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

Table 21: Excess Gross Margin Difference-in-Difference

	1	2
After	-0.001	-0.001
	(0.007)	(0.008)
True Entrant	-0.014	-0.013
	(0.009)	(0.013)
True Entrant * After	0.009	0.005
	(0.013)	(0.015)
True Entrant * After * Δ Cosine	0.021	0.020
	(0.068)	(0.046)
N	3339	3339
Year Fixed Effects	✗	✓

Table 22: Competitor CARs and SPX Market Share

	GICS	Manual
Intercept	0.008	-0.019*
	(0.006)	(0.010)
SPX Market Share	-0.013	0.021*
	(0.009)	(0.012)
N	2196	717

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

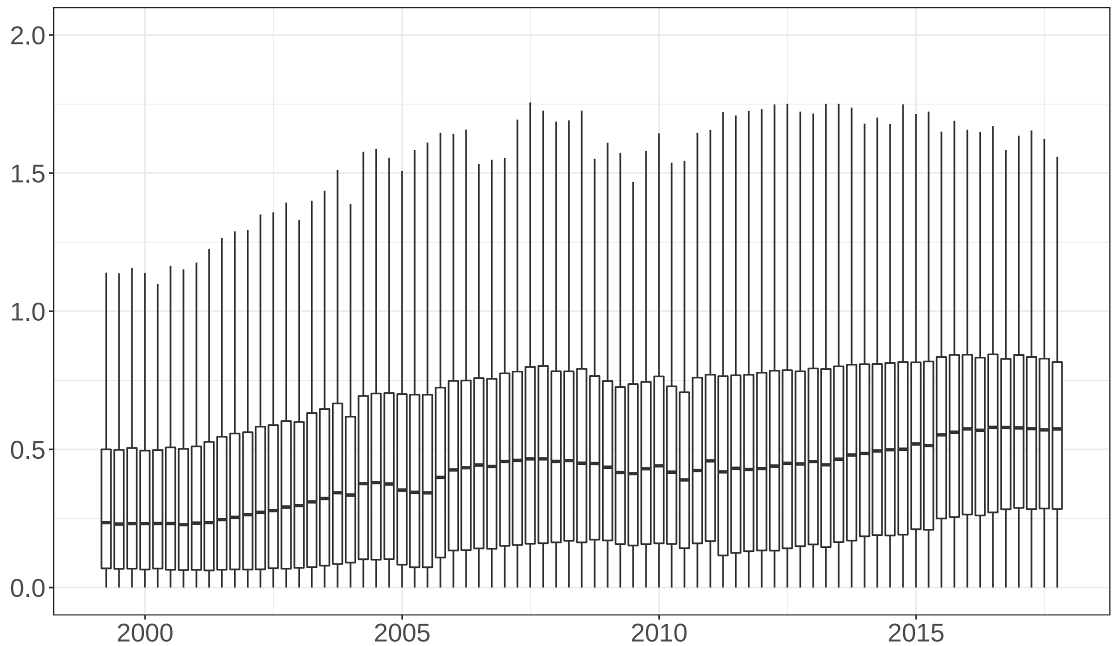
Table 23: Abnormal Returns with Concentration Measures

	Cosine	Bray-Curtis
	(1)	(2)
Change	0.0392**	0.0401**
	(0.0164)	(0.0197)
S&P Share	0.0371**	0.0427**
	(0.0157)	(0.0187)
Interaction	−0.0434**	−0.0399
	(0.0218)	(0.0243)
Constant	−0.0321***	−0.0387***
	(0.0121)	(0.0149)
Observations	564	

* p<0.1; ** p<0.05; *** p<0.01

Cluster-robust errors are reported with clusters at the entrant level.

Figure 8: Distribution of Institutional Ownership Shares (2000–2017)



Note: Each boxplot shows quarterly distribution of percentage of equity owned by institutions according to Thomson-Reuters 13-F data. The bold bar corresponds to the median of the distribution. The lower and upper hinges correspond to the 25th and 75th percentiles of the distribution. Whiskers extend to the remainder of the distribution.

Figure 9: Sales Growth of Entrant Industries (1 Year After Entry)

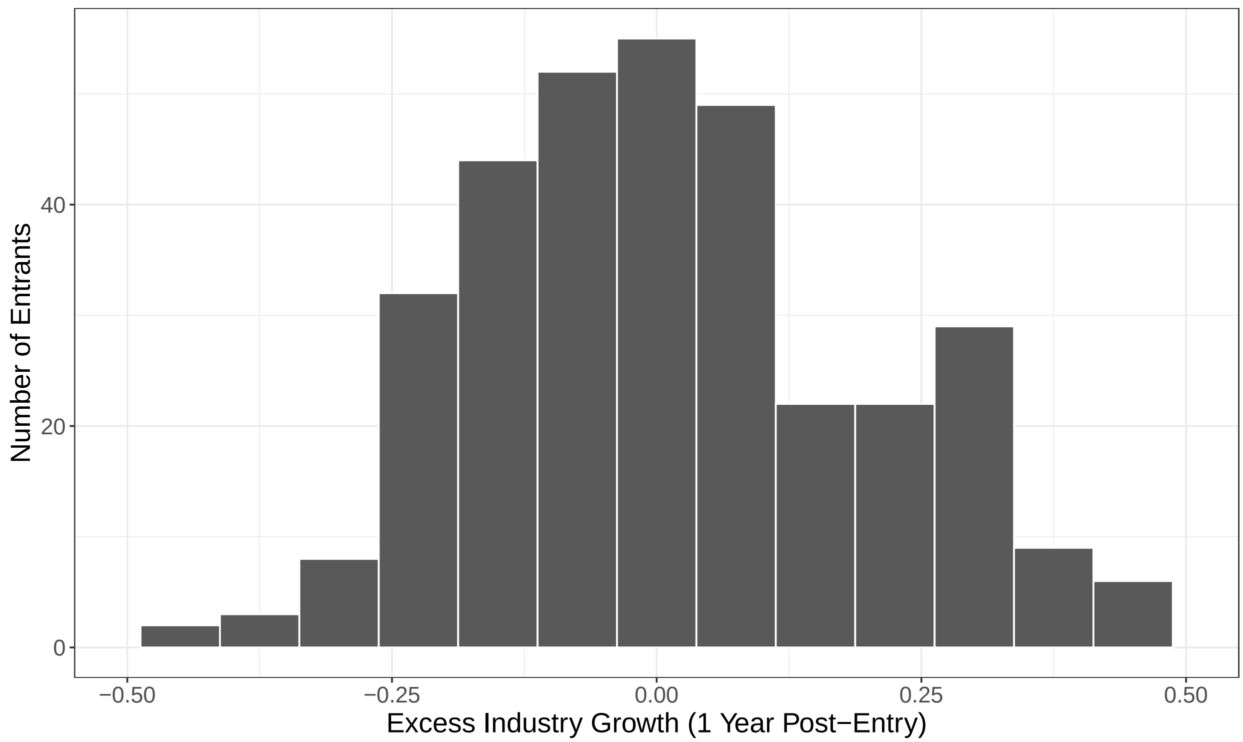


Figure 10: Sales Growth of Entrant Industries (2 Years After Entry)

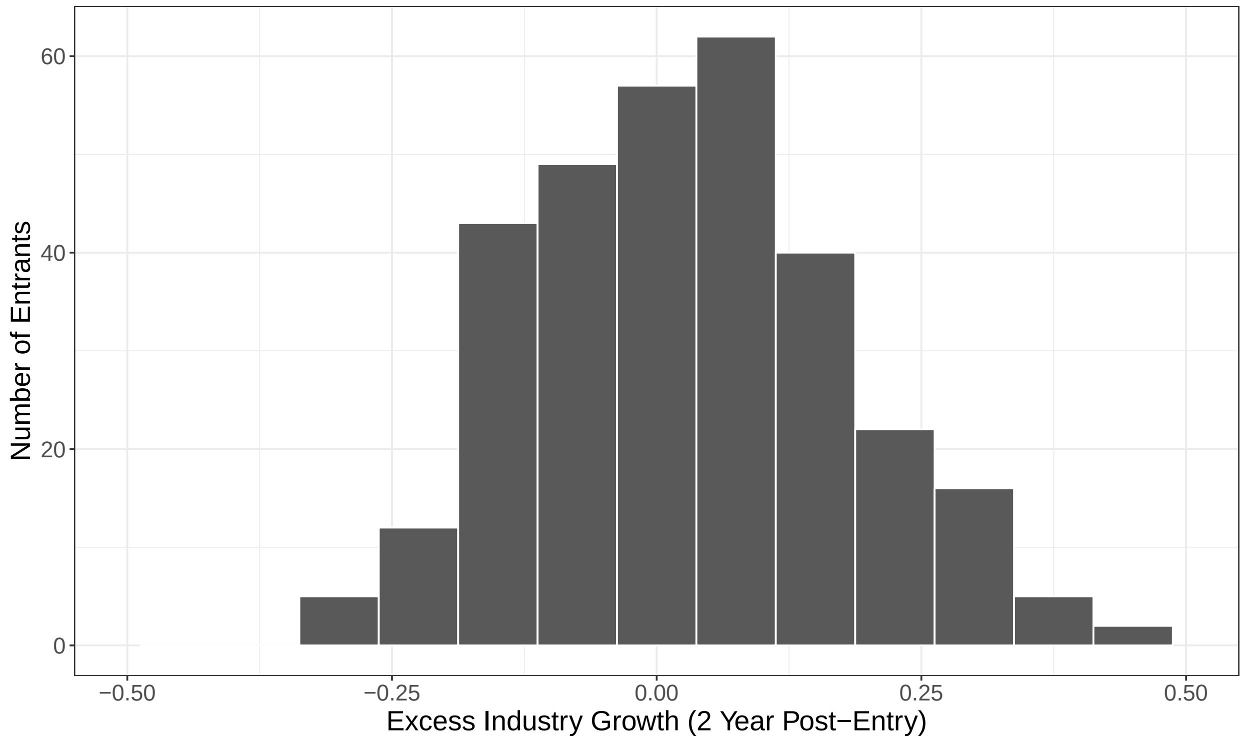
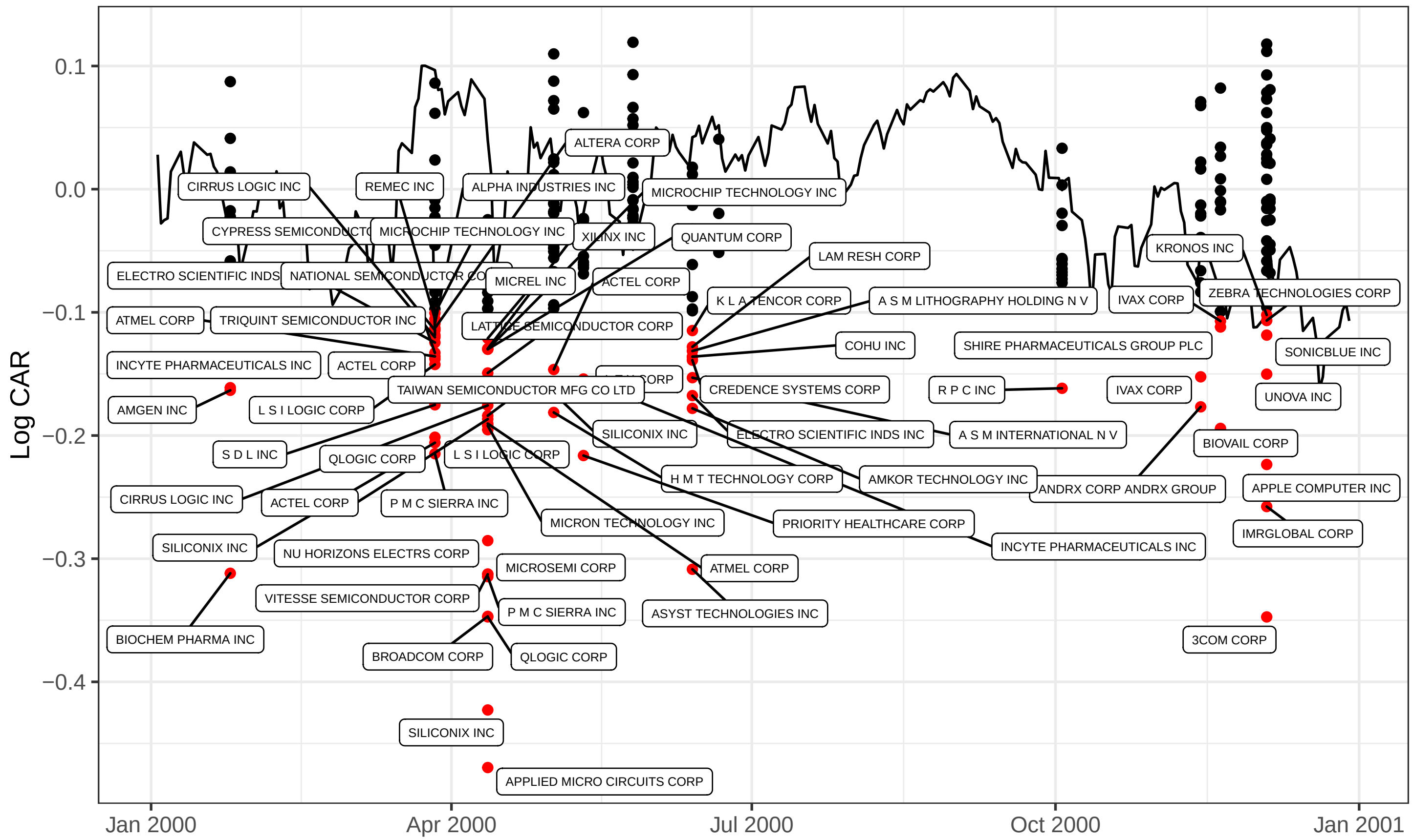


Figure 11: Negative Abnormal Returns in 2000



Note: Points show abnormal return of competitors in sample. Line shows normalized S&P 500 index movement over the period. Firms with CAR less than negative 5% are highlighted in red with corresponding labels showing firm names from the CRSP database. Negative outliers appear to consist primarily of tech firms that are included in our sample and experienced highly negative returns over the event window.