The Effect of Institutional Ownership Types on Innovation and Competition *

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Abstract

We document two countervailing effects of ownership structure of firms by financial institutional owner type: higher within-firm ownership by focused, long-term financial institutions promotes innovation as measured by patent applications and R&D spending. However, more between-firm same-industry connections through ownership by the same institutions leads the connected firms to innovate less and more closely follow industry peers in setting corporate policies. These results contribute to an ongoing debate about the effects of common ownership on competition.

Keywords: Institutional investors, investor type, networks, innovation, patents, product market, competition

JEL classification: G30, G32

*The ideas in this paper are solely those of the authors and do not necessarily reflect the view of the Federal Reserve System. All errors are our own.

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"What stands out about the increase in horizontal shareholding resulting from institutional investors is that its potential anticompetitive effects have, until now, gone unnoticed and unaddressed."

- Einer Elhauge, 2016, "Horizontal Shareholding"

Harvard Law Review 129

1 Introduction

Institutional ownership of firms in the economy has seen a marked rise in the past few decades, with average institutional ownership of a firm rising from 20% to 30% of the total to over 65% of the total by the 2010s, with the residual retail ownership correspondingly falling from 80% to less than 35% of the firm.[1] Due to this trend, the effects of institutional ownership have attracted increased interest in the literature, including the effects of institutional ownership on innovation have attracted significant attention.[2] Of the many effects of institutional ownership, its role in shaping innovation is particularly important since it can determine the competitiveness of firms and even nations (Porter, 1985; 1990).

We contribute to the understanding of the role of institutional ownership on innovation and competition in two novel ways. First, we find that different types of institutional investors have different effects in the area of competitive behavior, consistent with prior findings on R&D by Bushee (1998) and misvaluation and governance by Borochin and Yang (2017). More importantly, however, we find that between-firm connections through institutional ownership types have distinct and even more robust effects. Specifically, same-industry common ownership by institutional investor types results in less competitive behavior, including innovation and other firm financial policies.

[1] Based on data from Thomson Reuters s34 Holdings Database and corroborated by Blume and Kein (2014) and Borochin and Yang (2017).

[2] See, e.g., Bushee (1998; 2001), Atanassov (2013), Aghion, Van Reenen, and Zingales (2013), Brav, Jiang, Ma, and Tian, (2016).

There is a debate about the optimal ownership structure for the firm in terms of its ability to compete with its peers. Innovation is a good way to study this because it is a costly and easily observable way firms can compete with each other, and our study contributes to this debate. On one side, Azar, Schmalz and Tecu (2017) find that common ownership by mutual funds results in anti-competitive behavior in airlines. A common owner reduces the incentive for any individual airline to compete on price since the owner holds a claim on the aggregate cash flow from the entire industry, consistent with prior theoretical findings.[3] Conversely, He and Huang (2017) find that common ownership makes firms more competitive by enabling market share growth through expanding the boundaries of the firm, improved pricing power, and higher quality information production.[4] By separating the previously monolithic block of institutional ownership into types, we provide a potential resolution to this debate.

Indeed, we document two countervailing effects of ownership structure of firms by financial institutional owner type: higher within-firm ownership by long-horizon financial institutions promotes innovation as measured by patent applications. However, more between-firm same-industry connections through ownership by focused and long-horizon institutional owners leads the connected firms to innovate less. Furthermore, same-industry common ownership by both focused and diversified long-horizon instutional investors causes firms to more closely follow industry peers in setting corporate policies.

These dampening effects of same-industry common ownership by institutional type on innovation and other firm policies related to competition suggest a more nuanced view of the optimal ownership structure of the firm. Within-firm levels of focused, long-horizon institutional investor ownership is good for promoting innovation and therefore competition. However, between-firm common ownership linkages by the same institutional investor are bad for it.

[3] See, e.g., O'Brien and Salop (2000), Gilo, Moshe, and Spiegel (2006), Rubin (2006).
[4] See also Kacperczyk, Sialm, and Zheng (2005).

2 Data and Hypothesis Development

2.1 Institutional Ownership and Investor Types

We obtain data on institutional investor ownership from the Thomson Reuters Institutional Holdings database. This database lists the positions of institutional investors conducting business in the U.S. with investments over $100 million as reported in 13F forms filed with the Securities and Exchange Commission (SEC) every quarter.

We categorize institutional owners into types following Bushee (1998, 2001). Bushee (1998, 2001) categorizes institutional investors into "dedicated" (DED), "quasi-indexer" (QIX), and "transient" (TRA) types based on their portfolio characteristics of turnover and diversification.[5] DED institutions have low portfolio turnover and therefore long investment horizons, as well as focused portfolio holdings and therefore larger stakes in individual firms. This combination of portfolio focus and long horizon aligns their objectives most closely with firm innovation as a firm-specific project with long-horizon payoffs (Bushee, 1998; 2001; Borochin and Yang, 2017).

The second category, QIX, is defined by low turnover but diversified portfolio holdings. Like the DEDs, the QIX institutions' long horizons make innovation relevant but their diversified position makes firm-specific decisions less so. Their conventional perception as passive investors with little influence on corporate governance has recently been challenged (Boone and White, 2015; Appel, Gormley, and Keim, 2016).

The third category, TRA, have high portfolio turnover and high diversification consistent with opportunistic strategies. We focus our analysis of the effects of institutional ownership on DED and QIX institutional investors since they both make long-horizon investments: DED investors actively select a smaller number of assets to own for the long term, while the more passive QIX institutions hold a diversified portfolio of assets. We omit the TRA institutional type from the analysis because neither their short investment horizon nor their

[5]We are grateful to Brian Bushee for providing this data on his website.

diversified portfolio holdings make long-term firm-specific innovation relevant to their firm selection decision.

Figure 1 Panel A shows the proportions of DED and QIX institutional ownership within the average firm through time, computed using cross-sectional averages of firm-level institutional ownership from Thomson Reuters' Institutional Holdings data.We see that the proportional amount of DED ownership decreases over time, while QIX remains largely constant.[6]

DED investors focus on a smaller number of firms that they hold for long-run growth (Bushee, 1998; 2001), and thus have incentives to encourage the firm to optimize for long-run value (Borochin and Yang, 2017). QIX investors have a similar long-term view, but may care less about the long-run value of each individual firm due to a diversified portfolio. We expect dedicated and quasi-indexer institutional ownership levels and changes to have differential effects on innovation within the firm:

Hypothesis 1. *Firms with a higher percentage of dedicated (quasi-indexer) institutional investors engage in more innovation.*

Hypothesis 2. *Firms that experience an increase in dedicated (quasi-indexer) institutional investors engage in more innovation.*

2.2 Network Measures

In addition to investigating the effects of levels and changes in institutional ownership type on competitive behavior as measured by innovation within the firm, we consider the degree of common ownership by institutional type within the same SIC3 industry relative to the total number of owners of that type. This allows us to test whether ownership networks that result in higher common ownership promote competitive policies within the firm (He

[6]The two long-horizon ownership types do not add up to 100% ownership because transient (TRA) and uncategorized institutions are omitted.

and Huang, 2017; Kacperczyk, Sialm, and Zheng, 2005) or impede them (Azar, Schmalz, and Tecu, 2017; Elhauge, 2016). We focus on same-industry common ownership following He an Huang (2017) since competition primarily occurs in the same industry. We construct a network for each firm with other firms in the same and other industries as nodes and institutional ownership linkages between them as edges. We define a linkage between two firms through an institutional owner when that owner reports holding both firms in their 13F SEC filing for the quarter.[7]

We illustrate a simple network of institutional investment that defines our measures of common ownership $pDEDnet$ and $pQIXnet$ in Figure 2. To measure the proportion of common DED ownership for Firm 1 in Figure 2, we compute the average number of connections Firm 1 has to other firms in the same SIC3 industry through dedicated institutional owners. We then normalize this average by the number of DED investors in Firm 1. Of its same-SIC3 peers Firm 1 has two connections to Firm 2 (through DED2 and DED3), one connection to Firm 3 (through DED2), and one with Firm 4 (through DED1). The average number of DED connections to same-SIC3 firms is $\frac{4}{3}$, and the total number of DED owners is 5. The normalized $pDEDnet$ measure for Firm 1 is thus $\frac{4}{3*5} = 26.66\%$. Note that the upper bound of average connections to same-SIC3 firms is equal to the number institutional investors of that type, giving the network measure a range from 0 to 1. We follow the same process to calculate a QIX same-industry common ownership fraction $pQIXnet$.

Figure 1 Panel B captures the average amount of same-industry connectedness between firms through institutional ownership type by year. We plot the ratio of same-SIC3 industry connections to other firms by institutional ownership type normalized by the number of total institutional owners of that type. The plot shows the ratio within the average firm by year using Thomson Reuters' Institutional Holdings data.We see that the number of same-industry connections through each long-term institutional ownership type for the average

[7]In this analysis we use an equal-weighted measure that treats all linkages the same regardless of institutional owner portfolio weight. An alternative specification with strengths of linkages based on portfolio weights produces similar results.

firm rises through time, even after being normalized by the total number of institutional owners, for both DED and QIX types. Common ownership is becoming a greater factor for all firms, so its effects merit investigation.

Studying the effects of these network measures by institutional owner type on innovation allows us to contribute to the ongoing debate in the literature about the effects of common ownership on competitive behavior. WeGiven the mixed evidence on common ownership and competitive behavior from prior studies, we state our hypotheses about the effects of institutional networks on innovation in their null form:

Hypothesis 3. *The number of same-industry connections to other firms through institutional investors does not affect innovation regardless of institutional ownership type.*

Hypothesis 4. *The increase in same-industry connections to other firms through institutional investors does not affect innovation regardless of institutional ownership type.*

2.3 Innovation Data

Our primary measure of firm competitive behavior is innovation. We measure innovation using log-transformed patent and citation counts from the USPTO data obtained through the Harvard Dataverse from 1980 to 2010. Only those patents that are eventually granted are included in this database. We follow the innovation literature in using the application date of the patent, rather than the date it is granted, as the effective date of the patent (Griliches, Pakes, and Hall, 1998; Cohen, Diether, and Malloy, 2013; Fang, Tian, and Tice, 2014). The effective date for citations is when they are recorded in another patent application. The typical lead time for a patent from application to grant date is two years (Hall, Jaffe, and Trajtenberg, 2001). We match the patent application year and quarter date with Thomson 13 F quarterly filing dates to establish the actual time of innovation activity (Griliches, Pakes, and Hall, 1988). Because a simple count of patents does not differentiate between more and less impactful patents, we create a second measure of innovation output by counting the total number of non-self-citations for each firm's patent portfolio by quarter.

To more precisely define the types of innovation we follow prior innovation literature (Almeida, Hsu, and Li, 2013; Phelps, 2010; Benner and Tushman, 2002; Katila and Ahuja, 2002; Sorensen and Stuart, 2000) in identifying patent subtypes to measure the degree of risk-taking in the innovation that takes place. We classify a patent as a safer exploitative type if at least 60% of the patents it cites constitute the firm's existing knowledge base, coming from its own previously filed patents over the past five years and other companies patents cited by the firms patents filed over the past five years. Conversely, we classify a patent to be a riskier exploratory type if at least 60% of the patents it cites are outside of the firm's existing knowlege base.

Figure 3 Panel A presents the average number of total patents applied for, as well as exploratory and exploitative patent types, by firm throughout our sample.[8] The post-2003 peak and subsequent dropoff in patent applications is due to the requirement that the application be subsequently granted, with the latest grant date occurring in 2009 in our sample and a typical two year period between grant date and application date (Hall, Jaffe, and Trajtenberg, 2001).

Figure 3 Panel B shows the average number of patents applied for by firms with above-median DED and QIX ownership through time. While firms with above-median dedicated ownership have more patent applications in the early part of the sample, they are subsequently overtaken by firms with above-median quasi-indexer ownership.

Figure 3 Panel C demonstrates that firms in the upper tercile of same-SIC3 industry connectedness through dedicated institutional ownership hold more patents than those in the upper tercile of connectedness by transient ownership. This contemporaneous difference suggests that common ownership has an effect on firm patenting, but could be the result of self-selection by dedicated owners into more innovative firms, or could be explained by other

[8] This average is computed conditional on patenting, and does not include firms that have never received a patent.

firm characteristics related to more common ownership such as size or age. This difference in patenting motivates our more detailed investigation into the effects of common ownership on patenting in the rest of the paper.

2.4 Financial Statement Data

We collect information on firm characteristics as control variables for the relationship between institutional investor ownership levels and networks with innovation. We define firm characteristics based on financial statement data obtained from Standard and Poor's Compustat North American quarterly database from 1980 to 2010. All value amounts are measured in 2000 dollars using CPI to adjust for inflation. We remove any firms with negative book asset value, market equity, book equity, capital stock, sales, dividends, debt, and inventory. These firms are prone to data errors, are likely to be distressed or severely unprofitable, or are otherwise likely to be outliersl. We also delete observations in which book assets or sales growth over the quarter is greater than 1 or less than -1 and remove firms worth less than $5 million in 2000 dollars in book value or market value to remove observations that have abnormally large changes due to acquisitions or small asset bases. Next, we remove outliers defined as firm-quarter observations that are in the first and 99th percentile tails for all relevant variables used in our analysis. Following standard practice in the literature, we remove all firms in the financial and insurance, utilities, and public administration industries as they tend to be heavily regulated.

Merging institutional investor data to corporate financial data based on a firm's CUSIP and year-quarter gives us a sample of 203,988 firm-quarter observations spanning 8,359 firms. Table I provides the summary statistics. The average (median) firm in our sample has 40.4% (37.2%) institutional ownership, with 5.6% (3.6%) of the firm owned by dedicated institutional investors and 68.1% (68.8%) owned by quasi-indexer institutional investors. The average (median) amount of same-SIC3 common ownership relative to total number of investors by type is 25.1% (22.2%) for dedicated, and 35.7% (33.3%) for quasi-indexer ownership networks. Patenting activity is significantly skewed with the average (median) firm applying 4.6 (0.0) patents per quarter, with a standard deviation of 30.8 patents and a right tail of 91 patents at the 99th percentile.

Table II presents the correlation matrix for the key variables in our study. The within-firm level of DED ownership is negatively correlated with all innovation outcomes, while that of QIX ownership is positively correlated. We find low but consistently negative correlations between networks of institutional ownership types on innovative behavior. Notably, the common ownership network measures have greater correlations with innovation than the firm-specific levels of ownership, motivating the importance of considering between-firm ownership linkages resulting from common ownership of firms by financial institutions.

We further motivate our study by comparing firm characteristics in two-sample t-tests by levels and networks of institutional ownership in Table III. Specifically, we compare firms with above-median quasi-indexer institutional ownership ($isQIX$) with those with above-median dedicated institutional ownership ($isDED$) in the left set of columns of the table. Similarly, we compare firms above the median of same-industry connectedness through quasi-indexer ownership ($isQIXnet$) with those with above-median connectedness through dedicated ownership ($isDEDnet$) in the right set of columns.

In the ownership level comparisons on the left side of Table III, we find that the two types of long-horizon institutional investor, dedicated and quasi-indexer, hold firms with significantly different characteristics. Specifically, we find that $isQIX$ firms have more patents than $isDED$ firms do, with average counts of 7.2 to 2.8 patents granted per quarter respectively, significant at the 1% level. This greater level of innovation by $isQIX$ firms extends to the number of exploratory and exploitative patents and citation counts with the same level of significance.

Notably, the univariate relationship between the level of institutional investor ownership by type and innovation documented above reverses itself when we consider the degree of between-firm same-industry connectedness in the right columns of Table III. Here, firms with above-median connectedness to other same-SIC3 firms through dedicated institutional owners have a higher average quarterly patent count than those with connectedness through quasi-indexer owners, 5.5 to 0.6 respectively. A similar pattern is also observed for the exploitative and exploratory patent types as well as citation counts. The between-firm connections measured by the $isQIXnet$ and $isDEDnet$ variables provide information that is significantly different from that of firm-specific ownership given by $isDED$ and $isQIX$.

Furthermore, we note that levels and networks by long-term ownership type affect other decisions within the firm besides innovation in Table III. In a comparison of within-firm ownership, $isDED$ firms are less levered, hold more cash, have more working capital, pay fewer dividends, have higher R&D expense and lower PP&E and ROA, have lower CAPEX, and are in less concentrated industries than $isQIX$ firms. Comparing between-firm common ownership by type, $isDEDnet$ firms are more levered, hold less cash, have less working capital, pay more dividends, have lower R&D expense, higher ROA, higher PP&E, higher CAPEX, and are also in less concentrated industries than $isQIXnet$ firms. This set of results motivates a study of how other corporate decisions related to competition are affected by levels and networks of institutional ownership type.

The univariate findings in Table III provide preliminary evidence that both the level of types of institutional ownership within the firm as well as the same-industry connectedness to other firms through a type of institutional ownership both affect patenting activity as a form of competitive behavior. We next examine these relationships in a panel context with control variables to account for potential confounding effects.

3 The Effects of Institutional Investor Type on Innovation

In this section we consider the effects of overlapping ownership by institutional types on competitive behavior within the firm as measured by R&D, patenting, and citation activity.

We make a tradeoff between minimizing endogeneity in the innovation decision and sample selection bias by including firms that have been granted at least one patent. This subsample contains 141,413 firm-quarter observations across 4,817 firms.

3.1 R&D Expense

We begin by estimating the effect of contemporaneous levels of within-firm ownership $pTYPE$, as well as between-firm same-industry connectedness $pTYPEnet$ as described in Section 2.2, by institutional type on variables of interest $Y_{i,t}$: the one-year forward of R&D expense normalized by firm size, RQ, the contemporaneous output elasticity of R&D, the log of the contemporaneous optimal R&D expense from the RQ model, and the difference of logs of actual and optimal contemporaneous R&D. Research and development is a costly strategy that can help the firm more effectively compete by raising barriers to entry and providing superior product. RQ is the measure of effectiveness of the R&D strategy for the firm, and the level of optimal R&D and the gap between actual and optimal R&D tells us how much the firm should invest in R&D and by how much it over- or under-invests. Eq. (1) describes this baseline model for each quarter. We include the level and network measure of ownership by type for DED and QIX, as well as year, quarter, and industry fixed effects. We follow Peterson (2009) in clustering standard errors by firm and quarter.

$$Y_{i,t|t+1} = \alpha + \beta_1 pTYPE_{i,t} + \beta_2 pTYPEnet_{i,t} + fe_t + fe_j + \varepsilon_{i,t} \quad (1)$$

Table IV Panel A presents the results for DED in Columns (1) through (4). Consistent with Bushee (1998) we find that the level of within-firm dedicated ownership results in higher R&D expense a year from now, significant at the 1% level. DED ownership is related to a lower contemporaneous RQ, a lower optimal R&D expense, and a smaller difference between the logs of optimal and actual R&D expense. Meanwhile between-firm same-industry connections through DED ownership result in lower R&D expense, lower optimal

R&D expense, and a smaller distance between optimal and actual R&D expense all significant at the 1% level, as well as a higher RQ marginally significant at the 10% level.

The results for QIX in Columns (5) through (8) of Table IV Panel A show that the within-firm level of quasi-indexer ownerhsip predicts lower future R&D expense and lower RQ significant at the 1% level, while the between-firms same-industry connectedness is related ot higher future R&D expense, lower RQ, lower optimal R&D expense and a smaller distance between actual and optimal R&D expense. These preliminary results provide evidence that institutional investor ownership has a significant relationship with firm competitiveness, and that the relationship is distinct for within-firm and between-firm ownership by institutional type. We next combine both types in one specification:

$$Y_{i,t|t+1} = \alpha + \beta_1 pDED_{i,t} + \beta_2 pQIX_{i,t} + \beta_3 pDEDnet_{i,t} + \beta_4 pQIXnet_{i,t} + fe_t + fe_j + \varepsilon_{i,t} \quad (2)$$

We tabulate the results from the model in Eq. (2) in Columns (1) through (4) of Table IV Panel B. When we include within-firm DED and QIX ownership together, both predict lower future R&D expense and lower RQ significant at the 1% level. The level of dedicated ownership is weakly negatively related to optimal R&D expenditure at the 10% level, but strongly positively related to the gap between actual and optimal R&D. The level of quasi-indexer ownership is also positively related to optimal R&D and negatively to the R&D gap all at the 1% significance level.

Between-firm same-industry connectedness through DED ownership reduces future R&D expenditure, increases RQ, and decreases the gap between actual and optimal R&D at the 1% significance level, and increases optimal R&D expenditure significant at the 5% level. Meanwhile same-industry connectedness through QIX ownership predicts higher future R&D spending, is related to lower contemporaneous RQ, lower optimal R&D spending, and a higher gap between actual and optimal R&D.

Despite controlling for year, quarter, and industry effects on firm-specific innovation, the constant term is significant at the 1% level in all specifications of Table IV thus far suggesting the model of within- and between-firm ownership type alone does not fully explain firm investment in R&D. Furthermore, the observed relationships between ownership levels and networks could be caused by self-selection of institutional owners into firms with certain characteristics that correlate with innovation. Therefore, we introduce control variables related to innovation into our baseline model to obtain our full model at quarterly frequency:

$$\begin{aligned} Y_{i,t} = \alpha &+ \beta_1 pDED_{i,t-1} + \beta_2 pQIX_{i,t-1} + \beta_3 \Delta pDEDnet_{i,t-1,t} + \beta_4 pQIXnet_{i,t-1} + \beta_5 pINST_t \\ &+ \beta_6 lnTA_t + \beta_7 MtB_t + \beta_8 RD_t + \beta_9 ROA_t + \beta_{10} PPE_t + \beta_{11} Lev_t + \beta_{12} CAPEX_t \\ &+ \beta_{13} HHI_t + \beta_{14} HHI_t^2 + \beta_{15} LTCR_t + \beta_{16} lnAge_t + fe_t + fe_j + \varepsilon_{i,t} \end{aligned} \tag{3}$$

where $pINST$ is the overall fraction of the firm's market capitalization reported owned by institutional investors in 13F filings, $lnTA$ is log-transformed total assets of the firm to control for firm size, MtB is the market to book value of equity ratio to control for growth options, RD is the R&D expenditure, ROA is the return on assets, PPE is the plant, property, and equipment net of depreciation, Lev is the ratio of total debt to total assets, $CAPEX$ is capital expenditure, HHI is the Hirshleifer-Herfindahl index for the firm's SIC3 industry, HHI^2 is the square of HHI to account for nonlinearities in industry concentration, $LTCR$ is an indicator variable for whether the firm has a credit rating to control for access to financing of innovation, and $lnAge$ is the log of firm age. The control variables are defined in Appendix A. As before, we include year, quarter, and industry fixed effects and double-cluster standard errors by firm and year-quarter.

The relationship between institutional ownership type and R&D in the presence of control variables is described in Columns (5) through (8) of Table IV Panel B. While the QIX firm ownership and network variables lose significance, only the relationship between common

DED ownership and the gap between actual and optimal R&D becomes insignificant in Column (8) suggesting that the DED relationship with firm R&D is robust.

We next decompose the level of ownership by type, as well as the level of between-firms same-industry common ownership by institutional type, into the lag of the level and the contemporaneous change:

$$X_{i,t} \equiv X_{i,t-1} + \Delta X_{i,t-1,t}$$

This decomposition gives us two distinct advantages. First, it allows us to study the impact of levels as well as changes of institutional ownership type on innovation and competition. Second, while the lagged level controls for likely persistence in institutional ownership, the contemporaneous change in ownership to act as a shock. It thus allows us a first attempt to address the potential selection bias between institutional ownership and competition by controlling for the existing relationship between the two. We address potential endogeneity issues more rigorously in Section 4. Our updated version of the baseline model without controls becomes

$$\begin{aligned} Y_{i,t|t+1} = \alpha &+ \beta_1 pDED_{i,t-1} + \beta_2 \Delta pDED_{i,t-1,t} + \beta_3 pQIX_{i,t-1} + \beta_4 \Delta pQIX_{i,t-1,t} + \beta_5 pDEDnet_{i,t-1} \\ &+ \beta_6 \Delta pDEDnet_{i,t-1,t} + \beta_7 pQIXnet_{i,t-1} + \beta_8 \Delta pQIXnet_{i,t-1,t} + fe_t + fe_j + \varepsilon_{i,t} \end{aligned} \tag{4}$$

and its equivalent version with controls

$$
\begin{aligned}
Y_{i,t|t+1} = {} & \alpha + \beta_1 pDED_{i,t-1} + \beta_2 \Delta pDED_{i,t-1,t} + \beta_3 pQIX_{i,t-1} + \beta_4 \Delta pQIX_{i,t-1,t} + \beta_5 pDEDnet_{i,t-1} \\
& + \beta_6 \Delta pDEDnet_{i,t-1,t} + \beta_7 pQIXnet_{i,t-1} + \beta_8 \Delta pQIXnet_{i,t-1,t} + \beta_9 pINST_t + \beta_{10} lnTA_t \\
& + \beta_{11} MtB_t + \beta_{12} RD_t + \beta_{13} ROA_t + \beta_{14} PPE_t + \beta_{15} Lev_t + \beta_{16} CAPEX_t + \beta_{17} HHI_t \\
& + \beta_{18} HHI_t^2 + \beta_{19} LTCR_t + \beta_{20} lnAge_t + fe_t + fe_j + \varepsilon_{i,t}
\end{aligned} \tag{5}
$$

We present the results from estimating the model in Eq. (4) in Columns (1) through (4), and that in Eq. (5) in Columns (5) through (8) of Panel C of Table IV. The results are consistent with prior ones in Panel B, with both the level and change of $pDED$ predicting lower future R&D and lower RQ with statistical significance. We again document a negative relationship between $pDED$ and optimal R&D expense and a positive one with the gap between actual and optimal R&D expense when controls are included. The results for $pQIX$ are similar though with less significance.

Turning to the between-firm connections, both levels and changes of $pDEDnet$ also predicts significantly lower future R&D expense, and the level is significantly related to contemporaneous RQ and optimal R&D expense. The changes in $pQIXnet$ predict higher R&D expense, and are related to higher contemporaneous RQ and optimal R&D, and a lower gap between actual and optimal R&D, while the level of $pQIXnet$ is negatively related to RQ. Overall the results in Panels A-C of Table IV show that institutional ownership types have a significant and distinct relationship with R&D expenditure, the RQ measure of productivity of R&D, and the optimal level of R&D expenditure as well as the gap between it and the actual amount. Furthermore, there are distinct relationships between R&D variables and the within-firm level and between-firm connections through institutional ownership types. These relationships are robust to alternative specifications that take into account dynamics and control variables related to innovation. We next test the relationship between institutional ownership types and innovation outcomes measured by patents and citations to address Hypotheses (1) through (4) more directly.

3.2 Patents and Citations

We next apply the model developed in Eq. (5) to innovation outcomes relevant to competition: patents counts, patent types, and citations. While R&D decisions discussed in Section 3.1 are the input into innovation as part of a competitive strategy, patents and citations represent the direct output and result of that strategy. We tabulate the estimation of Eq. (5) for one- and two-year leads[9] of quarterly patent applications and citations in Table V.

Consistent with Hypotheses (1) and (2), the within-firm level and change in DED ownership increases the log-transformed number of patents a year from now by 1.00 and .354 at the 1% and 5% significance levels respectively in Column (1). Within-firm QIX ownership levels and changes also predict higher patent counts with smaller coefficients of .336 and .330 respectively at the 1% significance level. These effects persist at the two-year horizon in Column (3), though with some loss of significance. Notably, both DED and QIX within-firm ownership predicts lower citations at the one-year and two-year horizons in Columns (2) and (4) respectively.

Furthermore, Columns (1) through (4) show a distinct relationship of between-firm connections through DED ownership and future innovation. The level and change of overlapping DED ownership between the firm and same-industry peers predicts fewer patents one year in the future with coefficients of -.307 and -.126 in Column (1), and two years in the future with coefficients of -.354 and -.137 in Column (3), all significant at the 1% level. There is no significant relationship between common QIX ownership and future patent counts. DED same-industry common ownership also negatively predicts future citation counts at both

[9]We emphasize future patent applications a year or more from the current date to capture the future effects of current innovation policy decisions and minimize endogeneity concerns.

the one-year and two-year horizons at the 1% significance level, while QIX only predicts citations one year ahead. This evidence supports the rejection of Hypotheses (3) and (4), particularly for dedicated institutional investors. The negative relationship of between-firm same-industry connections through DED ownership and future patenting is consistent with the anticompetitive interpretation of common institutional ownership by Azar, Schmalz and Tecu (2017). Notably, this effect is not observed for QIX institutions.

3.3 Innovation Types and Outcomes

We consider the effects of ownership levels and networks by type on competitive behavior in more detail by separating patent types into exploratory and exploitative following Almeida, Hsu, and Li (2013). Exploratory patent types are shown to be related to more risky, groundbreaking innovation while exploitative patent types are safer and more iterative.[10] Based on the observations of Porter (1985) and Porter (1990), we expect exploratory (exploitative) innovation to obtain more (less) competitive advantage for the patenting firm. We also consider the number of citations for self-owned patents, as well as outside patents in applications submitted in the future period, as related measures of the types of innovation sought by the firm. Taking one-year forwards of log-transformed quarterly counts of these dependent variables as $Y_{i,t+1}$, we apply the model in Eq. (5).

Table VI Panel A presents the results for the innovation types, which futher confirm the differential effects of institutional types documented above. We suppress controls in Eq. (5) for brevity, and again include firm, year, and quarter dummies and cluster standard errors by firm and year-quarter. The lagged level and change of within-firm dedicated ownership $pDED$ have no relationship to exploitative patents, but do predict a reduction in logs of exploratory patents by -.250 and -.156 respectively at the 1% significance level. Consistent with this, the change in $pDED$ also forecast lower log citations of outside patents by -.217 significant at the 1% level. The level and change in $pQIX$ predicts more log-transformed

[10]See, e.g., Phelps, 2010; Benner and Tushman, 2002; Katila and Ahuja, 2002; Sorensen and Stuart, 2000.

exploitative patent applications by .047 and .030 respectively, both significant at the 5% level, and fewer exploratory patents by -.107 and -.043 with 1% and 5% significance levels respectively. Consistent with this, level and change in $pQIX$ also predicts more future self-citations by .037 and .024 respectively at the 1% and 5% significance levels. These results persist at the two-year horizon.

The network effects on innovation type are more muted, but the level of between-firm connectedness $pDEDnet$ predicts fewer exploitative patent applications by -.025 as well as fewer outside patent citations by -.052, both significant at the 5% level. The change in $pQIXnet$ is negatively related to future exploitative patents with a coefficient of -.106 and positively with exploratory patents by .141, significant at the 10% and 1% levels respectively. These results are qualitatively similar at the two-year horizon, with $pQIXnet$ also predicting more outside citations by .228 at the 1% significance level.

We next consider the outcomes of firm innovation, specifically the impact as measured by the percentage of cites a patent attracts from the patenting firm itself as well as from outside firms. As with journal articles and self-citations, we view patents that attract within-firm citations as being less impactful than those that attract citations from outside. We create quarterly percentages of citations of the firm's patents by the firm itself and by outside firms relative to the total number of citations and use these impact outcomes as additional dependent variables $Y_{i,t+1}$ in Eq. (5).

We present the results in Table VI Panel B. The controls in Eq. (5) are suppressed for brevity. We include firm, year, and quarter dummies and cluster standard errors by firm and year-quarter. We observe that levels and changes in both $pDED$ and $pQIX$ predict lower proportions of outside citations both at the one-year and two-year horizons, all at the 1% significance level. Furthermore, the common ownership measure $pDEDnet$ predicts lower self-citations and outside citations at both horizons, while $pQIXnet$ predicts lower self-citations. These results further support the anticompetitive view of common ownership.

Combined with the evidence from Table IV and Table V, the results in Table VI find support Hypotheses (1) and (2): within-firm DED and QIX institutional ownership is negatively related to R&D expense but positively related to future patenting. The within-firm levels of both institutional ownership types predict fewer exploratory patents, but QIX ownership predicts more exploitative ones.

Furthermore, we find evidence to reject Hypothesis 3 and 4. The network effects of dedicated ownership matter for innovation and competitive behavior. Most significantly, higher same-industry overlapping dedicated ownership *pDEDnet* predicts lower future R&D expenditure, patents, and citations. Furthermore, higher same-industry DED common ownership predicts less patent impact as measured by both external and internal citations.

4 Robustness and Identification Tests

4.1 Heckman Correction

The control variables related to innovation which we included in the prior section may not fully account for a self-selection issue in our sample: institutions of different types may select firms based on some other characteristics related to future innovation, leading to an omitted variable bias. We address this concern using the Heckman (1979) method. We define the first-stage probit selection model to account for dedicated versus transient institutional owner selection into specific firms. Here DvQ is a dummy variable that takes a value of '1' for firms in the upper tercile of dedicated ownership but not of quasi-indexer ownership, and '0' for the converse.

$$\begin{aligned} DvQ_{i,t} = \Phi(&\alpha + \gamma_1 NUMEST_{i,t-1} + \gamma_2 RV_{i,t-1,t} + \gamma_3 nMgrSSIC3_{i,t-1} + \gamma_4 pINST_t + \gamma_5 lnTA_t \\ &+ \gamma_6 MtB_t + \gamma_7 RD_t + \gamma_8 ROA_t + \gamma_9 PPE_t + \gamma_{10} Lev_t + \gamma_{11} CAPEX_t + \gamma_{12} HHI_t \\ &+ \gamma_{13} HHI_t^2 + \gamma_{14} LTCR_t + \gamma_{15} lnAge_t) \end{aligned} \tag{6}$$

where $NUMEST$ is the number of analysts following the firm from IBES as a measure of information quality, RV is the realized volatility of returns over the past year as a measure of overall firm risk, $nMgrSSIC3$ is the number of connections to other same-SIC3 industry firms through institutional ownership regardless of type. These instrumental variables should determine institutional owner self-selection. We exclude them from the second-stage of the Heckman model. The remaining control variables are the same as defined in Eq. (3). We compute the Mills lambda $\lambda(Z, \gamma)$ from the variables Z and coefficients γ of the first-stage regression, and add it to the second stage regression of the Heckman model for our prior variables of interest. The $\lambda(Z, \gamma)$ measure controls for the self-selection in the institutional ownership decision, allowing us to more clearly draw causal connections between levels and networks of institutional ownership types and our variables of interest describint future innovation $Y_{i,t+1}$: patent applications, citations, exploratory and exploitative patent types, and fractions of citations for own versus outside patents. The second-stage regression in Eq. (7) repeats the estimation in Eq. (3) with the addition of $\lambda(Z, \gamma)$ from Eq. (6) to control for selection bias:

$$\begin{aligned} Y_{i,t+1} = \alpha &+ \beta_1 pDED_{i,t-1} + \beta_2 \Delta pDED_{i,t-1,t} + \beta_3 pQIX_{i,t-1} + \beta_4 \Delta pQIX_{i,t-1,t} + \beta_5 pDEDnet_{i,t-1} \\ &+ \beta_6 \Delta pDEDnet_{i,t-1,t} + \beta_7 pQIXnet_{i,t-1} + \beta_8 \Delta pQIXnet_{i,t-1,t} + \beta_9 pINST_t + \beta_{10} lnTA_t \\ &+ \beta_{11} MtB_t + \beta_{12} RD_t + \beta_{13} ROA_t + \beta_{14} PPE_t + \beta_{15} Lev_t + \beta_{16} CAPEX_t + \beta_{17} HHI_t \\ &+ \beta_{18} HHI_t^2 + \beta_{19} LTCR_t + \beta_{20} lnAge_t + \beta_{21} \lambda(Z, \gamma) + fe_t + fe_j + \varepsilon_{i,t} \end{aligned} \tag{7}$$

The results are described in Table VII. After controlling for self-selection by DED versus QIX institutions into specific firms, the level of dedicated ownership $pDED$ and both the level and change in $pQIX$ still predict higher future patent counts and lower future citation counts at the one-year horizon at the 1% and 5% significance levels respectively. Critically, $pDEDnet$ still has a negative relationship with both future patent applications and citations with coefficients of -.185 and -.544 both significant at the 1% level. $pDEDnet$

also predicts fewer exploitative patents with a coefficient of -.091 and citations of outside patents by -.112 at the 1% significance levels, while weakly predicting more self-citations with a coefficient of .011 significant at the 10% level. Since these effects obtain in the presence of the Mills lambda controlling for selection of firms by DED and QIX institutional owners, we can ascribe a causal relationship between higher between-firms same-industry connections through dedicated institutional owners, lower innovation, and therefore less competition.

4.2 Other Firm Policies

If the reduced innovation that we observe in firms that are part of same-industry networks of ownership by dedicated institutions is due to anticompetitive effects of common ownership, we should expect these effects to extend to other corporate policies besides innovation. To investigate this implication, we consider firm-specific deviations from industry medians for several key financial ratios. The intuition behind this test is that firms will follow trends if they do not actively seek a competitive advantage, and thus less competitive firms will have financial ratios that more closely follow industry medians. Meanwhle firms that are actively trying to compete will be more likely to deviate from industry policy trends.

To do this, we create a sample of firms with matching Compustat and Thomson Reuters 13F data, summarized in Table VIII. Specifically, we look at the absolute difference of five quarterly financial ratios affecting competitive behavior relative to their contemporaneous industry medians. The first, cash to total assets, which is driven by profitability and determines financial constraints and ability to take advantage of growth opportunities through expansion and acquisition. Working capital to total assets determines firm liquidity and amount of investment in current assets used in production. Accumulated stock of quarterly R&D to total assets over the next year drives innovation which determines competitive advantage following Porter (1985) and Porter (1990). The accumulated stock of advertising expense over the next year drives competitive advantage through brand awareness and market share. Total payouts as the sum of dividends and repurchases to total assets affect the attractiveness of the firm in the equity market. These variables are defined in Appendix A.

Panel A of Table VIII shows that firms make significant deviations in cash, working capital, R&D, advertising, and payout policies from their contemporaneous industry medians: the standard deviations of differences from the median are roughly equal in magnitude to the mean levels of the deviations across all five policies. Furthermore, Panel B shows that while the correlation between cash and working capital policy is relatively high at .55 due to the mechanical relationship between the two, the distances from industry medians for other policies are not highly correlated.

Panel C of Table VIII presents two-sample t-tests as evidence that both the within-firm levels of DED and QIX ownership, as well as between-firm same-industry connections through DED and QIX institutional owners, are significantly related to firm deviations from industry medians. Firms with above-median dedicated ownership (isDED) in a given quarter have greater distances from industry median cash holdings and R&D expenditure over the next year along with lower payouts than firms with above-median quasi-indexer ownership (isQIX). Firms with above-median same-industry connections through dedicated ownership (isDEDnet) have smaller distances from industry median cash holdings, working capital levels, and future annualized R&D and advertising expenditures, but higher payout ratios than firms with above-median same-industry connections through quasi-indexer ownership (isQIXnet). Since $isDEDnet$ firms stay closer to median industry levels for financial policies, they appear more likely to follow industry trends than make major policy changes relative to $isQIXnet$ firms.

The above results provide additional evidence that firms that are part of same-industry networks of dedicated ownership pursue less competitive policies. However, these univariate findings do not control for other firm characteristics potentially related to competitive behavior, which we next include in a multivariate regression setting. Eq. (8) presents our model:

$$
\begin{aligned}
DIST_{i,t+1} = \alpha &+ \beta_1 pDED_{i,t-1} + \beta_2 \Delta pDED_{i,t-1,t} + \beta_3 pTRA_{i,t-1} + \beta_4 \Delta pTRA_{i,t-1,t} + \beta_5 pDEDnet_{i,t-1} \\
&+ \beta_6 \Delta pDEDnet_{i,t-1,t} + \beta_7 pTRAnet_{i,t-1} + \beta_8 \Delta pTRAnet_{i,t-1,t} + \beta_9 pINST_t + \beta_{10} lnTA_t \\
&+ \beta_{11} MtB_t + \beta_{12} RD_t + \beta_{13} ROA_t + \beta_{14} PPE_t + \beta_{15} Lev_t + \beta_{16} CAPEX_t + \beta_{17} HHI_t \\
&+ \beta_{18} HHI_t^2 + \beta_{19} LTCR_t + \beta_{20} lnAge_t + fe_t + \varepsilon_{i,t}
\end{aligned} \tag{8}
$$

We regress the next quarter's distances from industry median for cash, working capital, R&D and advertising expenditure over the subsequent year, and payouts, all normalized by next quarter's total assets, on levels and changes in the within-firm ownership level and between-firm ownership connections by institutional type as in Eq. (5) before.[11] Since we use distances from quarterly industry medians, we omit industry fixed effects but include year and quarter ones, and cluster standard errors by firm and quarter.

We begin by considering the effects of dedicated ownership separately. Table IX Panel A shows that between-firm connections within the same SIC3 industry through dedicated ownership has a similar effect on firm policies, pushing them closer to industry medians. The level of *pDEDnet* reduces the distance of firm cash holdings relative to the industry median by -.036, and the change in *pDEDnet* by a further -.019, both significant at the 1% level. We observe a similar effect for distance of working capital relative to the median, with coefficients of -.032 and -.019 respectively, both significant at the 1% level also. Consistent with our prior findings on innovation, the distance of future R&D stock from the industry median is also reduced by -.007 and -.006 with significance at the 1% level in both cases.[12] The change in *pDEDnet* brings future advertising expenditure stock is closer to the median

[11] We use next quarter's values for these financial ratios since they can be changed more quickly than innovation decisions, with the exception of R&D and advertising expense which we instead sum over the following year. We do this because R&D expense is not reported reliably on a quarterly basis, and advertising expense is not reported on a quarterly basis at all.

[12] Since our innovation results in Table V include industry fixed effects, they are in spirit similar to looking at deviations from industry levels.

by -.001 weakly significant at the 10% level. Finally, both levels and changes in $pDEDnet$ push payout policy closer to industry medians by -.001 each, with significance at the 10% and 5% levels respectively. The within-firm level of dedicated ownership $pDED$ has much less effect on firm policy deviations from industry medians, pushing cash holdings closer and working capital and payout policy farther away from them. The consistent effects of $pDEDnet$ in driving policy ratios closer to the medians, however, support the rejection of 3 and 4.

We interpret negative coefficients in Table IX as anti-competitive since it means the firm adopts policies more similar to its peers rather than pursuing more novel policies that would push it away from the industry median. By the same reasoning, positive coefficients mean that the firm is able to make bigger deviations from the median policies of its peers, making it more able to pick an optimal level that would maximize its value. Thus, $pDEDnet$ has statistically significant anti-competitive effects on all five policy ratios. These results support our prior findings that $pDEDnet$ reduces innovation as measured by R&D expenditure and patent counts, and further supports the rejection of Hypotheses 3 and 4.

Panel B of Table IX reports analogous results for quasi-indexer ownership by itself. In comparison to $pDED$, levels and changes of within-firm quasi-indexer ownership $pQIX$ have much more significant effects on all corporate policies, pushing cash and R&D expense closer and working capital, advertising expenditure, and payout ratios farther away from the median level. The level and change in $pQIXnet$ have negative coefficients on the distances from industry medians for all policies with the exception of advertising expenditure, largely consistent with those for $pDEDnet$.

Finally, we consider both DED and QIX ownership jointly in Panel C of Table IX. While the results for $pDED$ and $pQIX$ are similar to those in Panels A and B respectively, the coefficients on $pDEDnet$ and $pQIXnet$ are both less significant when jointly estimated in Panel C while the R^2 is not significantly improved relative to Panels A and B. This suggests that the two same-industry common ownership measures $pDEDnet$ and $pQIXnet$ have similar effects on financial policies related to competition, while *pDEDnet* has the stronger effect of the two on innovation measures related to competition as shown in Table V.

5 Conclusion

Innovation is a costly effort that firms undertake to achieve a competitive advantage (Porter, 1985; 1990). We find that institutional ownership types affect competitive behavior as measured by innovativeness of the firm, both through the level of within-firm ownership by institutions of a specific type as well as through common ownership measured by the number of between-firm connections through institutional ownership types. Consistent with prior findings on R&D expense by Bushee (1998), we find that higher within-firm dedicated ownership is related to more patent applications. Within-firm ownership by the other long-term investor type, the quasi-indexers, produces similar results.

Moreover, we find that between-firm connections through dedicated institutional owners have strong anti-competitive effects on innovation, which is robust to controlling for self-selection of institutional types into owned firms. Between-firm connections through quasi-indexer institutional investors do not have a similarly strong effect on innovation, demonstrating a differential effect between the two types of long-horizon institutional investors.

Firms with more connections to same-industry peers through both dedicated and quasi-indexer institutional ownership adopt policies closer to industry medians on cash holdings, working capital levels, R&D expenditures and advertising expenditures, and payout ratios. This shows that while common ownership through dedicated institutions has stronger anti-competitive effects, both dedicated and quasi-indexer common ownership results in higher conformity with industry standards in the firm. These results support the anti-competitive findings of common ownership by Azar, Schmalz, and Tecu (2017).

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Appendix A

We detail the construction of our control variables below. Summary statistics of these variables are reported in Table I.

Has Dedicated (DED) Investors
: Indicator dummy taking a value of '1' if the firm is held by any institutional investors classified as "Dedicated" based on Bushee (2001) this quarter, '0' otherwise

Has Quasi-Indexer (QIX) Investors
: Indicator dummy taking a value of '1' if the firm is held by any institutional investors classified as "Quasi-Indexer" based on Bushee (2001) this quarter, '0' otherwise

% of Dedicated Inst. Investors
: Number of shares held by institutional investors classified as "Dedicated" based on Bushee (2001) / Total number of shares held by institutional investors

% of Quasi-Indexer Inst. Investors
: Number of shares held by institutional investors classified as "Quasi-Indexer" based on Bushee (2001) / Total number of shares held by institutional investors

% of Overlapping Dedicated Inv. in Same SIC3 to Total DED Inv.
: Average number of connections through DED investors to each same-SIC3 firm, normalized by total DED investors

% of Overlapping Quasi-Indexer Inv. in Same SIC3 to Total QIX Inv.
: Average number of connections through QIX investors to each same-SIC3 firm, normalized by total QIX investors

Total Patents
: Number of subsequently granted patents applied for in a given quarter from the USPTO Harvard Dataverse database

Total Exploitative Patents
: At least 60% of the patents it cites are from the firm's existing knowledge base defined as its own previously filed patents over the past five years and other companies patents cited by the firms patents filed over the past five years

Total Exploratory Patents
: At least 60% of the patents it cites are from outside the firm's existing knowledge base

Total Patent Citations
: The number of new citations for the firm's portfolio of patents recorded in the current quarter

% Institutional Ownership

Total number of shares held by institutional investors from Thomson 13F / Shares outstanding

Total Asset Value

Assets - Total (ATQ) * Adjustment to 2000 Dollars in $ Millions

Market-to-Book Ratio

$\frac{\text{Price-Close-Quarter (PRCCQ) * Common Shares Outstanding (CSHOQ)}}{\text{Total Common Equity (CEQQ)}}$

Firm Age

Number of years the firm reports data to COMPUSTAT

Debt / Assets

$\frac{\text{Short-Term Debt (DSTTQ)} + \text{Long-Term Debt-Total (DLTTQ)}}{\text{Total Assets (ATQ)}}$

Long-term Debt / Assets

$\frac{\text{Long-Term Debt-Total (DLTTQ)}}{\text{Total Assets (ATQ)}}$

Has LT Credit Rating

Indicator dummy taking a value of ‘1’ if the firm has a Moody’s credit rating in the current quarter

Has LT Credit Rating

Indicator dummy taking a value of ‘1’ if the firm has a Moody’s credit rating in the current quarter

Cash / Assets

$\frac{\text{Cash (CHEQ)}}{\text{Total Assets (ATQ)}}$

Working Capital / Assets

$\frac{\text{Current Assets-Total (ACTQ) - Current Liabilities-Total (LCTQ)}}{\text{Total Assets (ATQ)}}$

SIC3 HHI

$\sum_i (\% \text{ Market share of firm}_i)^2$

Table I: Sample statistics of innovation, institutional investor, and firm characteristics. Innovation characteristics are defined in Section 2.3. Institutional investor types are defined in Section 2.1. Firm characteristics are defined in Appendix A.

	No. Obs	Mean	Std Dev	1%	50%	99%
Has Dedicated (DED) Investors	203988	0.770	0.421	0.000	1.000	1.000
Has Quasi-Indexing (QIX) Investors	203988	0.988	0.107	0.000	1.000	1.000
% of Dedicated (DED) Investors	203988	0.056	0.086	0.000	0.036	0.333
% of Quasi-Indexing (QIX) Investors	203988	0.681	0.155	0.000	0.688	1.000
% of Overlapping DED Investors in Same SIC3 / Total DED Investors	154639	0.251	0.174	0.000	0.222	0.758
% of Overlapping QIX Investors in Same SIC3 / Total QIX Investors	196725	0.357	0.190	0.065	0.333	1.000
Total Patents	203988	4.6	30.8	0.0	0.0	91.0
Total Exploratory Patents	203988	1.9	12.1	0.0	0.0	38.0
Total Exploitative Patents	203988	1.3	11.8	0.0	0.0	26.0
Total Patent Citations	203988	17.9	161.9	0.0	0.0	339.0
% Institutional Ownership	203988	0.404	0.284	0.002	0.372	1.000
Total Asset Value ($M)	203988	5409.3	39667.8	5.0	233.7	92135.2
Market-to-Book Ratio	169780	1.783	1.593	0.346	1.234	8.617
Firm Age (Years)	203988	2.5	0.8	0.7	2.6	3.8
Debt / Assets	193374	0.189	0.172	0.000	0.163	0.663
Long-term Debt / Assets	200940	0.144	0.152	0.000	0.102	0.609
Has LT Credit Rating	203988	0.234	0.423	0.000	0.000	1.000
Cash / Assets	203004	0.199	0.231	0.000	0.100	0.913
Working Capital / Assets	193933	0.340	0.227	-0.105	0.327	0.845
Payout Ratio	162928	0.006	0.014	0.000	0.000	0.073
R&D Expense / Assets	200355	0.013	0.022	0.000	0.000	0.101
Return on Assets	201337	-0.002	0.051	-0.223	0.010	0.073
PP&E / Assets	202601	0.254	0.191	0.007	0.212	0.819
Capital Expenditure / Assets	200664	0.013	0.015	0.000	0.008	0.073
SIC3 HHI	203988	0.144	0.136	0.021	0.102	0.791

Table II: Pairwise correlation matrix of innovation and institutional investor characteristics. Innovation characteristics are defined in Section 2.3. Institutional investor types are defined in Section 2.1. Firm characteristics are defined in Appendix A.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) % of Dedicated (DED) Investors							
(2) % of Quasi-Indexing (QIX) Investors	-0.330						
(3) % of Overlapping DED Inv in Same SIC3 to Total DED Inv	-0.102	-0.153					
(4) % of Overlapping QIX Inv in Same SIC3 to Total QIX Inv	-0.019	0.128	0.332				
(5) Total Patents	-0.027	0.010	-0.034	-0.126			
(6) Total Exploratory Patents	-0.023	0.003	-0.031	-0.121	0.882		
(7) Total Exploitative Patents	-0.027	0.012	-0.037	-0.107	0.876	0.727	
(8) Total Patent Citations	-0.007	0.020	-0.068	-0.113	0.638	0.587	0.557

Table III: Comparison of means for firms with dedicated institutional investors versus firms with transient institutional investors and firms with dedicated institutional investor networks versus firms with transient insitutional investor networks. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, transient institutional investors are institutional investors characterized as having high portfolio turnover and highly diversified portfolio holdings. In column (1), sorting by firm based on its percentage of dedicated institutional investors, isDED is equal to 1 if the percentage of dedicated institutional investors within a firm falls into the upper tercile and 0 otherwise. Similarly in column (2), sorting by firm based on its percentage of transient institutional investors, isQIX is equal to 1 if the percentage of transient institutional investors within a firm falls into the upper tercile and 0 otherwise. Likewise, in columns (3) and (4), we sort firms based on its dedicated and transient investor networks, respectively. isQIXnet is equal to 1 if ... Standard errors are reported in the parentheses and clustered by both firm and year-quarter as in Petersen (2009). Significance at the 10% level is indicated by *, 5% level by **, and 1% level by ***.

	isQIX	isDED	Sig	isQIXnet	isDEDnet	Sig
Has Dedicated (DED) Investors	0.473	1.000	***	1.000	1.000	***
Has Quasi-Indexing (QIX) Investors	1.000	0.985	***	1.000	1.000	***
% of Dedicated (DED) Investors	0.014	0.107	***	0.108	0.055	***
% of Quasi-Indexing (QIX) Investors	0.811	0.584	***	0.639	0.666	***
% of Overlapping DED Inv. in Same SIC3 to Total DED Inv.	0.259	0.236	***	0.117	0.337	***
% of Overlapping QIX Inv. in Same SIC3 to Total QIX Inv.	0.391	0.345	***	0.482	0.263	***
Total Patents	7.2	2.8	***	0.6	5.5	***
Total Exploratory Patents	2.5	1.4	***	0.2	2.2	***
Total Exploitative Patents	2.3	0.7	***	0.2	1.4	***
Total Patent Citations	24.5	13.7	***	2.1	16.9	***
% Institutional Ownership	0.340	0.430	***	0.328	0.517	***
Total Asset Value ($M)	10905.8	2445.9	***	371.1	6643.1	***
Market-to-Book Ratio	1.626	1.913	***	1.743	1.817	***
Firm Age (Years)	2.7	2.3	***	2.3	2.6	***
Debt / Assets	0.204	0.178	***	0.155	0.195	***
Long-term Debt / Assets	0.146	0.140	***	0.113	0.159	***
Has LT Credit Rating	0.276	0.195	***	0.063	0.332	***
Cash / Assets	0.157	0.242	***	0.279	0.180	***
Working Capital / Assets	0.308	0.374	***	0.410	0.306	***
Payout Ratio	0.007	0.005	***	0.005	0.007	***
R&D Expense / Assets	0.011	0.016	***	0.021	0.011	***
Return on Assets	-0.002	-0.003	***	-0.021	0.009	***
PP&E / Assets	0.264	0.240	***	0.204	0.290	***
Capital Expenditure / Assets	0.012	0.013	***	0.011	0.014	***
SIC3 HHI	0.152	0.138	***	0.138	0.133	***

Table IV: Estimation of innovation on types of institutional investor levels and networks. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, transient institutional investors are institutional investors characterized as having high portfolio turnover and highly diversified portfolio holdings. Percentage of dedicated or transient institutional investors is relative to the total number of institutional investors within a firm. Standard errors are reported in the parentheses and clustered by both firm and year-quarter as in Petersen (2009). Significance at the 10% level is indicated by *, 5% level by **, and 1% level by ***.

Panel A: No Controls								
	R&D Exp. / TA 1-Yr Fwd (1)	RQ (2)	Ln(Opt. R&D Exp.) (3)	Ln(R&D) -Ln(Opt. R&D) (4)	R&D Exp. / TA 1-Yr Fwd (5)	RQ (6)	Ln(Opt. R&D Exp.) (7)	Ln(R&D) -Ln(Opt. R&D) (8)
% of Dedicated (DED) Investors$_t$	0.037 ***	-0.094 ***	-11.321***	6.429 ***				
	(0.011)	(0.016)	(0.842)	(0.430)				
% of Quasi-Indexing (QIX) Inv.$_t$					-0.031 ***	-0.035 ***	0.266	-0.093
					(0.004)	(0.006)	(0.166)	(0.125)
% of Overlapping DED Inv. in Same SIC3 / Total DED Inv.$_t$	-0.023 ***	0.007 *	-1.760 ***	0.506 ***				
	(0.004)	(0.004)	(0.218)	(0.140)				
% of Overlapping QIX Inv. In Same SIC3 / Total QIX Inv.$_t$					0.020 ***	-0.042 ***	-6.305 ***	2.824 ***
					(0.004)	(0.005)	(0.195)	(0.154)
Constant	0.005	0.171 ***	5.981 ***	-4.863 ***	0.031 **	0.180 ***	4.837 ***	-3.821 ***
	(0.011)	(0.010)	(0.508)	(0.388)	(0.015)	(0.015)	(0.331)	(0.312)
No. Obs.	141413	76516	74486	74129	177384	95318	91644	91125
Adjusted R^2	0.433	0.136	0.406	0.526	0.411	0.116	0.596	0.538
Industry Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y

Panel B: With Controls

	R&D Exp. / TA 1-Yr Fwd (1)	RQ (2)	Ln(Opt. R&D Exp.) (3)	Ln(R&D) -Ln(Opt. R&D) (4)	R&D Exp. / TA 1-Yr Fwd (5)	RQ (6)	Ln(Opt. R&D Exp.) (7)	Ln(R&D) -Ln(Opt. R&D) (8)
% of Dedicated (DED) Investors$_t$	-0.045 ***	-0.072 ***	-1.095 *	2.496 ***	-0.027 ***	-0.032 *	0.701 ***	2.130 ***
	(0.011)	(0.019)	(0.574)	(0.461)	(0.005)	(0.019)	(0.204)	(0.352)
% of Quasi-Indexing (QIX) Inv.$_t$	-0.041 ***	-0.042 ***	0.740 ***	-0.745 ***	-0.007 ***	-0.012	0.288 ***	-0.059
	(0.006)	(0.008)	(0.216)	(0.186)	(0.003)	(0.008)	(0.085)	(0.166)
% of Overlapping DED Inv. in Same SIC3 / Total DED Inv.$_t$	-0.038 ***	0.013 ***	0.346 **	-0.346 ***	-0.014 ***	0.012 **	0.117 **	-0.007
	(0.004)	(0.005)	(0.161)	(0.125)	(0.002)	(0.005)	(0.055)	(0.095)
% of Overlapping QIX Inv. In Same SIC3 / Total QIX Inv.$_t$	0.050 ***	-0.034 ***	-7.582 ***	2.713 ***	0.003	-0.007	-0.077	-0.427 **
	(0.006)	(0.007)	(0.246)	(0.221)	(0.002)	(0.008)	(0.091)	(0.194)
% Institutional Ownership					0.000	0.017 ***	-0.020	-0.304 ***
					(0.001)	(0.004)	(0.050)	(0.096)
Ln(Total Assets)					-0.001 ***	0.005 ***	0.914 ***	-0.294 ***
					(0.000)	(0.001)	(0.012)	(0.036)
Market-to-Book Ratio					-0.001 ***	0.000	0.025 ***	-0.004
					(0.000)	(0.001)	(0.008)	(0.013)
R&D Expense / Assets					2.563 ***	0.276 ***	0.794	36.829 ***
					(0.074)	(0.058)	(0.622)	(1.374)
Return on Assets					-0.104 ***	0.100 ***	2.191 ***	0.018
					(0.012)	(0.024)	(0.233)	(0.339)
PP&E / Assets					-0.018 ***	-0.081 ***	-0.432 ***	0.243
					(0.002)	(0.008)	(0.108)	(0.187)
Total Debt / Assets					-0.021 ***	-0.008	-0.366 ***	0.293 **
					(0.002)	(0.006)	(0.078)	(0.140)
Capital Expenditure / Assets					0.003	0.025	2.378 ***	0.392
					(0.017)	(0.046)	(0.595)	(1.031)
SIC3 HHI					0.004	-0.031	0.030	-0.946 *
					(0.008)	(0.020)	(0.249)	(0.486)
SIC3 HHI^2					-0.007	0.034	-0.183	1.116 *
					(0.009)	(0.028)	(0.310)	(0.608)
Has LT Credit Rating					-0.001	-0.005 **	0.104 ***	-0.100
					(0.001)	(0.002)	(0.034)	(0.082)
Ln(Firm Age)					-0.004 ***	-0.010 ***	0.042 *	-0.164 ***
					(0.001)	(0.002)	(0.023)	(0.043)
Constant					0.039 ***	0.190 ***	-2.163 ***	-1.788 ***
					(0.006)	(0.017)	(0.208)	(0.447)
No. Obs.					110216	59995	58309	58309
Adjusted R^2					0.762	0.174	0.893	0.681
Industry Fixed Effects?					Y	Y	Y	Y
Time Fixed Effects?					Y	Y	Y	Y

Panel C: Differences and Lags

	R&D Exp. / TA 1-Yr Fwd (1)	RQ (2)	Ln(Opt. R&D Exp.) (3)	Ln(R&D) -Ln(Opt. R&D) (4)	R&D Exp. / TA 1-Yr Fwd (5)	RQ (6)	Ln(Opt. R&D Exp.) (7)	Ln(R&D) -Ln(Opt. R&D) (8)
% of DED Investors$_{t-1}$	-0.054 ***	-0.086 ***	-1.913 ***	3.163 ***	-0.029 ***	-0.044 **	0.654 ***	2.614 ***
	(0.013)	(0.021)	(0.607)	(0.477)	(0.005)	(0.022)	(0.228)	(0.392)
Δ % of DED Investors$_{t-1,t}$	-0.024 **	-0.034 **	-1.371 ***	1.438 ***	-0.015 ***	-0.012	0.324 *	1.082 ***
	(0.010)	(0.015)	(0.479)	(0.355)	(0.005)	(0.016)	(0.174)	(0.296)
% of QIX Investors$_{t-1}$	-0.049 ***	-0.050 ***	0.884 ***	-0.850 ***	-0.009 ***	-0.015	0.309 ***	-0.056
	(0.007)	(0.009)	(0.236)	(0.209)	(0.003)	(0.009)	(0.099)	(0.186)
Δ % of QIX Investors$_{t-1,t}$	-0.014 ***	-0.024 ***	0.233	-0.366 **	0.001	-0.003	0.193 ***	-0.121
	(0.004)	(0.006)	(0.168)	(0.164)	(0.003)	(0.007)	(0.071)	(0.154)
% of Overlapping DED Inv. in Same SIC3 / Total DED Inv.$_{t-1}$	-0.043 ***	0.015 ***	0.354 **	-0.341 **	-0.015 ***	0.014 **	0.133 **	0.046
	(0.005)	(0.006)	(0.166)	(0.134)	(0.002)	(0.006)	(0.062)	(0.107)
Δ % of Overlapping DED Inv. in Same SIC3 / Total DED Inv.$_{t-1,t}$	-0.024 ***	0.006	0.194	-0.218 **	-0.008 ***	0.004	0.012	0.072
	(0.004)	(0.004)	(0.122)	(0.099)	(0.001)	(0.005)	(0.044)	(0.064)
% of Overlapping QIX Inv. in Same SIC3 / Total QIX Inv.$_{t-1}$	0.054 ***	-0.033 ***	-7.806 ***	2.650 ***	0.004	-0.010 ***	-0.098	-0.512
	(0.007)	(0.007)	(0.246)	(0.231)	(0.003)	(0.009)	(0.100)	(0.216)
Δ % of Overlapping QIX Inv. in Same SIC3 / Total QIX Inv.$_{t-1,t}$	0.050 ***	-0.010 *	-4.417 ***	1.658 ***	0.012 ***	0.007 ***	0.009 ***	-0.222 **
	(0.005)	(0.006)	(0.183)	(0.187)	(0.003)	(0.008)	(0.077)	(0.149)
% Institutional Ownership					-0.002 *	0.016	-0.005 ***	-0.333 ***
					(0.001)	(0.004)	(0.051)	(0.099)
Ln(Total Assets)					-0.001 **	0.004 ***	0.912	-0.281 ***
					(0.000)	(0.001)	(0.012)	(0.035)
Market-to-Book Ratio					-0.001 ***	0.001 ***	0.025 ***	-0.001
					(0.000)	(0.001)	(0.008)	(0.013)
R&D Expense / Assets					2.599 ***	0.273 ***	0.682 ***	37.694 ***
					(0.074)	(0.059)	(0.649)	(1.436)
Return on Assets					-0.093 ***	0.103	2.189 ***	-0.031
					(0.013)	(0.025)	(0.237)	(0.348)
PP&E / Assets					-0.016 ***	-0.081	-0.471 ***	0.280
					(0.002)	(0.009)	(0.110)	(0.195)
Total Debt / Assets					-0.019 ***	-0.007 *	-0.367	0.301 **
					(0.002)	(0.006)	(0.080)	(0.144)
Capital Expenditure / Assets					-0.013	0.019	2.501	0.287
					(0.017)	(0.047)	(0.609)	(1.086)
SIC3 HHI					0.007	-0.036 **	-0.060 ***	-0.754
					(0.008)	(0.021)	(0.256)	(0.498)
SIC3 HHI^2					-0.010	0.037 ***	-0.126	0.991
					(0.009)	(0.028)	(0.317)	(0.625)
Has LT Credit Rating					-0.001	-0.005 ***	0.104 ***	-0.119
					(0.001)	(0.002)	(0.034)	(0.081)
Ln(Firm Age)					-0.004	-0.010	0.037	-0.153 ***
					(0.001)	(0.002)	(0.024)	(0.044)
Constant	0.040 ***	0.205 ***	4.759 ***	-4.008 ***	0.040	0.200	-2.090	-2.146 ***
	(0.014)	(0.012)	(0.324)	(0.415)	(0.007)	(0.017)	(0.222)	(0.477)
No. Obs.	128551	70784	68992	68666	102196	56613	55109	55109
Adjusted R^2	0.447	0.150	0.626	0.559	0.769	0.182	0.892	0.687
Industry Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y

Table V: Estimation of innovation strategy on types of institutional investor levels and networks. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, transient institutional investors are institutional investors characterized as having high portfolio turnover and highly diversified portfolio holdings. Percentage of dedicated or transient institutional investors is relative to the total number of institutional investors within a firm. All controls are defined in Appendix A. Standard errors are reported in the parentheses and clustered by both firm and year-quarter as in Petersen (2009). Significance at the 10% level is indicated by *, 5% level by **, and 1% level by ***.

	Ln(Patents) 1-Yr Fwd (1)	Ln(Citations) 1-Yr Fwd (2)	Ln(Patents) 2-Yr Fwd (3)	Ln(Citations) 2-Yr Fwd (4)
% of Dedicated (DED) Investors$_{t-1}$	1.006 ***	-0.369	0.821 ***	-0.719 *
	(0.231)	(0.350)	(0.267)	(0.393)
Δ % of Dedicated (DED) Investors$_{t-1,t}$	0.354 **	-0.385 *	0.241	-0.585 **
	(0.144)	(0.220)	(0.170)	(0.247)
% of Quasi-Indexing (QIX) Investors$_{t-1}$	0.336 ***	-0.291 *	0.281 **	-0.470 ***
	(0.116)	(0.159)	(0.133)	(0.176)
Δ % of Quasi-Indexing (QIX) Investors$_{t-1,t}$	0.330 ***	-0.008	0.301 ***	-0.102
	(0.076)	(0.099)	(0.088)	(0.114)
% of Overlapping DED Inv. in	-0.307 ***	-0.493 ***	-0.354 ***	-0.570 ***
Same SIC3 / Total DED Inv.$_{t-1}$	(0.069)	(0.092)	(0.080)	(0.105)
Δ % of Overlapping DED Inv. in	-0.126 ***	-0.233 ***	-0.137 ***	-0.271 ***
Same SIC3 / Total DED Inv.$_{t-1,t}$	(0.046)	(0.063)	(0.052)	(0.069)
% of Overlapping QIX Inv. in	0.108	0.367 **	0.026	0.297
Same SIC3 / Total QIX Inv.$_{t-1}$	(0.120)	(0.161)	(0.140)	(0.181)
Δ % of Overlapping QIX Inv. in	0.118	0.250 **	0.039	0.183
Same SIC3 / Total QIX Inv.$_{t-1,t}$	(0.080)	(0.122)	(0.094)	(0.135)
% Institutional Ownership	-0.062	0.240 **	-0.004	0.303 ***
	(0.080)	(0.097)	(0.090)	(0.106)
Ln(Total Assets)	0.540 ***	0.555 ***	0.596 ***	0.592 ***
	(0.023)	(0.038)	(0.026)	(0.041)
Market-to-Book Ratio	0.082 ***	0.092 ***	0.099 ***	0.111 ***
	(0.009)	(0.013)	(0.011)	(0.014)
R&D Expense / Assets	12.328 ***	14.017 ***	14.403 ***	15.533 ***
	(0.780)	(1.285)	(0.908)	(1.455)
Return on Assets	-0.250	-0.911 ***	-0.019	-0.704 *
	(0.226)	(0.332)	(0.266)	(0.374)
PP&E / Assets	0.003	0.224	0.037	0.293
	(0.146)	(0.178)	(0.167)	(0.197)
Total Debt / Assets	-0.759 ***	-1.031 ***	-0.883 ***	-1.182 ***
	(0.090)	(0.115)	(0.104)	(0.128)
Capital Expenditure / Assets	2.851 ***	6.056 ***	3.315 ***	6.763 ***
	(0.615)	(0.859)	(0.702)	(0.955)
SIC3 HHI	0.344	0.782 **	0.446	1.097 **
	(0.261)	(0.376)	(0.304)	(0.449)
SIC3 HHI^2	-0.414	-0.838 *	-0.524	-1.141 **
	(0.341)	(0.457)	(0.398)	(0.538)
Has LT Credit Rating	0.082 *	0.112 *	0.085	0.128 **
	(0.047)	(0.058)	(0.053)	(0.062)
Ln(Firm Age)	0.057 **	0.087 ***	0.043	0.064 *
	(0.026)	(0.033)	(0.030)	(0.038)
Constant	-2.439 ***	-1.434 ***	-2.344 ***	-0.963 *
	(0.350)	(0.433)	(0.410)	(0.506)
No. Obs.	110528	110528	110528	110528
Adjusted R^2	0.4991	0.4631	0.5138	0.5054
Industry Fixed Effects?	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y

Table VI: Estimation of innovation strategy on types of institutional investor levels and networks. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, transient institutional investors are institutional investors characterized as having high portfolio turnover and highly diversified portfolio holdings. Percentage of dedicated or transient institutional investors is relative to the total number of institutional investors within a firm. All controls are defined in Appendix A. Standard errors are reported in the parentheses and clustered by both firm and year-quarter as in Petersen (2009). Significance at the 10% level is indicated by *, 5% level by **, and 1% level by ***.

Panel A: Firm Behavior

	% Exploit 1-Yr Fwd (1)	% Explore 1-Yr Fwd (2)	% Citing Self 1-Yr Fwd (3)	% Citing Others 1-Yr Fwd (4)	% Exploit 2-Yr Fwd (5)	% Explore 2-Yr Fwd (6)	% Citing Self 2-Yr Fwd (7)	% Citing Others 2-Yr Fwd (8)
% of Dedicated (DED) Investors$_{t-1}$	0.022	-0.250 ***	-0.018	-0.217 ***	0.025	-0.256 ***	-0.011	-0.233 ***
	(0.040)	(0.056)	(0.021)	(0.065)	(0.044)	(0.067)	(0.025)	(0.075)
Δ % of Dedicated (DED) Investors$_{t-1,t}$	-0.002	-0.156 ***	-0.019	-0.147 **	0.001	-0.140 ***	-0.022	-0.114 **
	(0.028)	(0.052)	(0.016)	(0.059)	(0.027)	(0.050)	(0.017)	(0.053)
% of Quasi-Indexing (QIX) Investors$_{t-1}$	0.047 **	-0.107 ***	0.037 ***	-0.118 ***	0.042 *	-0.114 ***	0.038 ***	-0.139 ***
	(0.022)	(0.027)	(0.013)	(0.034)	(0.023)	(0.031)	(0.014)	(0.035)
Δ % of Quasi-Indexing (QIX) Investors$_{t-1,t}$	0.030 **	-0.043 **	0.024 **	-0.046 *	0.039 **	-0.055 ***	0.025 ***	-0.052 **
	(0.014)	(0.020)	(0.009)	(0.024)	(0.015)	(0.021)	(0.009)	(0.023)
% of Overlapping DED Inv. in	-0.025 **	-0.028	0.001	-0.052 **	-0.027 **	-0.005	0.004	-0.036
Same SIC3 / Total DED Inv.$_{t-1}$	(0.012)	(0.018)	(0.006)	(0.021)	(0.013)	(0.021)	(0.007)	(0.024)
Δ % of Overlapping DED Inv. in	-0.010	0.019	0.001	0.015	-0.006	0.009	0.000	0.005
Same SIC3 / Total DED Inv.$_{t-1,t}$	(0.008)	(0.013)	(0.004)	(0.015)	(0.008)	(0.014)	(0.005)	(0.015)
% of Overlapping QIX Inv. in	-0.026	-0.016	-0.002	-0.031	-0.030	-0.028	-0.008	-0.046
Same SIC3 / Total QIX Inv.$_{t-1}$	(0.019)	(0.029)	(0.011)	(0.034)	(0.020)	(0.032)	(0.012)	(0.038)
Δ % of Overlapping QIX Inv. in	-0.010	-0.023	-0.006	-0.025	-0.003	-0.051 *	-0.005	-0.050
Same SIC3 / Total QIX Inv.$_{t-1,t}$	(0.017)	(0.026)	(0.010)	(0.029)	(0.017)	(0.027)	(0.010)	(0.031)
Constant	-0.106 *	0.141 ***	-0.024	0.068	-0.077	0.270 ***	-0.012	0.228 ***
	(0.060)	(0.047)	(0.046)	(0.069)	(0.071)	(0.049)	(0.050)	(0.073)
No. Obs.	110528	110528	110528	110528	110528	110528	110528	110528
Adjusted R^2	0.139	0.178	0.081	0.223	0.160	0.196	0.091	0.237
Controls?	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y

Panel B: Patent Impact

	% Cited by Self 1-Yr Fwd (1)	% Cited by Others 1-Yr Fwd (2)	% Cited by Self 2-Yr Fwd (3)	% Cited by Others 2-Yr Fwd (4)
% of Dedicated (DED) Investors$_{t-1}$	-0.002	-0.325 ***	-0.014	-0.311 ***
	(0.027)	(0.060)	(0.028)	(0.067)
Δ % of Dedicated (DED) Investors$_{t-1,t}$	-0.013	-0.184 ***	-0.004	-0.182 ***
	(0.021)	(0.054)	(0.019)	(0.054)
% of Quasi-Indexing (QIX) Investors$_{t-1}$	0.014	-0.122 ***	0.013	-0.149 ***
	(0.015)	(0.026)	(0.016)	(0.028)
Δ % of Quasi-Indexing (QIX) Investors$_{t-1,t}$	0.016	-0.065 ***	0.014	-0.061 ***
	(0.011)	(0.017)	(0.011)	(0.017)
% of Overlapping DED Inv. in	-0.019 **	-0.071 ***	-0.023 ***	-0.062 ***
Same SIC3 / Total DED Inv.$_{t-1}$	(0.008)	(0.017)	(0.009)	(0.020)
Δ % of Overlapping DED Inv. in	-0.013 **	-0.031 **	-0.016 **	-0.031 **
Same SIC3 / Total DED Inv.$_{t-1,t}$	(0.006)	(0.013)	(0.006)	(0.013)
% of Overlapping QIX Inv. in	-0.029 **	0.042	-0.030 **	0.036
Same SIC3 / Total QIX Inv.$_{t-1}$	(0.014)	(0.027)	(0.014)	(0.030)
Δ % of Overlapping QIX Inv. in	-0.016	0.010	-0.019 *	0.018
Same SIC3 / Total QIX Inv.$_{t-1,t}$	(0.010)	(0.025)	(0.010)	(0.027)
Constant	-0.018	0.204 ***	-0.006	0.318 ***
	(0.028)	(0.063)	(0.027)	(0.064)
No. Obs.	110528	110528	110528	110528
Adjusted R^2	0.101	0.287	0.121	0.343
Controls?	Y	Y	Y	Y
Industry Fixed Effects?	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y

Table VII: Heckman estimation to address selection bias. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, transient institutional investors are institutional investors characterized as having high portfolio turnover and highly diversified portfolio holdings. Percentage of dedicated or transient institutional investors is relative to the total number of institutional investors within a firm. All controls are defined in Appendix A. Standard errors are reported in the parentheses and clustered by both firm and year-quarter as in Petersen (2009). Significance at the 10% level is indicated by *, 5% level by **, and 1% level by ***.

	Ln(Patents) 1-Yr Fwd (1)	Ln(Citations) 1-Yr Fwd (2)	% Exploit 1-Yr Fwd (3)	% Explore 1-Yr Fwd (4)	% Citing Self 1-Yr Fwd (5)	% Citing Others 1-Yr Fwd (6)
% of Dedicated (DED) Investors$_{t-1}$	0.488 ***	-0.473 **	-0.023	0.012	-0.034 *	0.064
	(0.132)	(0.198)	(0.049)	(0.035)	(0.020)	(0.054)
Δ % of Dedicated (DED) Investors$_{t-1,t}$	0.041	-0.552 *	-0.040	-0.039	-0.012	-0.030
	(0.203)	(0.305)	(0.076)	(0.054)	(0.030)	(0.084)
% of Quasi-Indexing (QIX) Investors$_{t-1}$	0.204 **	-0.028	-0.031	0.062 ***	0.026 **	0.004
	(0.081)	(0.122)	(0.030)	(0.022)	(0.012)	(0.033)
Δ % of Quasi-Indexing (QIX) Investors$_{t-1,t}$	0.223 **	0.217	0.025	0.044	0.021	0.064
	(0.102)	(0.153)	(0.038)	(0.027)	(0.015)	(0.042)
% of Overlapping DED Inv. in	-0.185 ***	-0.544 ***	-0.091 ***	-0.015	0.011 *	-0.122 ***
Same SIC3 / Total DED Inv.$_{t-1}$	(0.045)	(0.067)	(0.017)	(0.012)	(0.007)	(0.018)
Δ % of Overlapping DED Inv. in	-0.090	-0.256 **	0.012	0.005	0.014	0.008
Same SIC3 / Total DED Inv.$_{t-1,t}$	(0.074)	(0.111)	(0.028)	(0.020)	(0.011)	(0.030)
% of Overlapping QIX Inv. in	-0.083	-0.350 ***	-0.061 ***	-0.022	0.001	-0.070 ***
Same SIC3 / Total QIX Inv.$_{t-1}$	(0.061)	(0.091)	(0.023)	(0.016)	(0.009)	(0.025)
Δ % of Overlapping QIX Inv. in	0.126	-0.128	-0.050	0.022	0.004	-0.035
Same SIC3 / Total QIX Inv.$_{t-1,t}$	(0.110)	(0.165)	(0.041)	(0.030)	(0.016)	(0.045)
Constant	-3.387 ***	-4.160 ***	-0.445 ***	-0.252 ***	-0.106 ***	-0.598 ***
	(0.150)	(0.226)	(0.056)	(0.040)	(0.022)	(0.061)
No. Obs.	58538	58538	58538	58538	58538	58538
Controls?	Y	Y	Y	Y	Y	Y
Industry Fixed Effects?	Y	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y	Y
Mills Ratio	0.262 ***	0.430 ***	0.019	-0.039 ***	-0.022 ***	0.003
	(0.039)	(0.059)	(0.015)	(0.010)	(0.006)	(0.016)

Table VIII: Sample statistics for Compustat firms with institutional ownership data. Institutional investor types are defined in Section 2.1. Firm characteristics are defined in Appendix A.

Panel A: Summary Statistics

	No. Obs	Mean	Std Dev	1%	50%	99%
Cash / TA - Distance From Median	203004	0.122	0.140	0.000	0.066	0.594
Working Cap / TA - Distance From Median	193933	0.137	0.121	0.000	0.104	0.497
R&D Stock / TA - Distance From Median	200398	0.092	0.148	0.000	0.033	0.758
Ads Accounts / TA - Distance From Median	199712	0.010	0.026	0.000	0.000	0.143
Payout / TA - Distance From Median	162928	0.005	0.013	0.000	0.000	0.070

Panel B: Correlation Matrix

	(1)	(2)	(3)	(4)
(1) Cash / TA - Distance From Median				
(2) Working Cap / TA - Distance From Median	0.5551			
(3) R&D Stock / TA - Distance From Median	0.3500	0.2383		
(4) Ads Accounts / TA - Distance From Median	0.0171	0.0272	0.0537	
(5) Payout / TA - Distance From Median	-0.0227	-0.0123	-0.0528	0.0353

Panel C: t-Test of Means

	isQIX	isDED	Sig	isQIXnet	isDEDnet	Sig
Cash / TA - Distance From Median	0.114	0.134	***	0.151	0.106	***
Working Cap / TA - Distance From Median	0.139	0.138		0.155	0.119	***
R&D Stock / TA - Distance From Median	0.086	0.101	***	0.142	0.071	***
Ads Accounts / TA - Distance From Median	0.010	0.010	***	0.010	0.009	***
Payout / TA - Distance From Median	0.006	0.005	***	0.004	0.006	***

Table IX: Estimation of firm characteristics on types of institutional investor levels and networks to test the impact of institutional investors on firm operational conformity. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, transient institutional investors are institutional investors characterized as having high portfolio turnover and highly diversified portfolio holdings. Percentage of dedicated or transient institutional investors is relative to the total number of institutional investors within a firm. All controls are defined in Appendix A. Standard errors are reported in the parentheses and clustered by both firm and year-quarter as in Petersen (2009). Significance at the 10% level is indicated by *, 5% level by **, and 1% level by ***.

Panel A: DED

	Cash / TA (1)	Working Cap / TA (2)	R&D Exp. / TA (3)	Ads Exp. / TA (4)	Payout / TA (5)
% of Dedicated (DED) Investors$_{t-1}$	-0.057 ***	0.005	-0.002	-0.004	0.001
	(0.020)	(0.019)	(0.007)	(0.004)	(0.002)
Δ % of Dedicated (DED) Investors$_{t-1,t}$	-0.029 *	0.036 ***	0.002	-0.001	0.004 **
	(0.016)	(0.013)	(0.005)	(0.003)	(0.002)
% of Overlapping DED Inv. in Same SIC3 / Total DED Inv.$_{t-1}$	-0.036 ***	-0.032 ***	-0.007 ***	-0.002	-0.001 *
	(0.007)	(0.008)	(0.002)	(0.001)	(0.001)
Δ % of Overlapping DED Inv. in Same SIC3 / Total DED Inv.$_{t-1,t}$	-0.019 ***	-0.019 ***	-0.006 ***	-0.001 *	-0.001 **
	(0.005)	(0.005)	(0.002)	(0.001)	(0.001)
Constant	0.241 ***	0.186 ***	0.061 ***	0.007 ***	0.001
	(0.011)	(0.012)	(0.004)	(0.002)	(0.001)
No. Obs.	108478	105681	101995	101539	92495
Adjusted R^2	0.263	0.124	0.402	0.046	0.073
Controls?	Y	Y	Y	Y	Y
Industry Fixed Effects?	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y

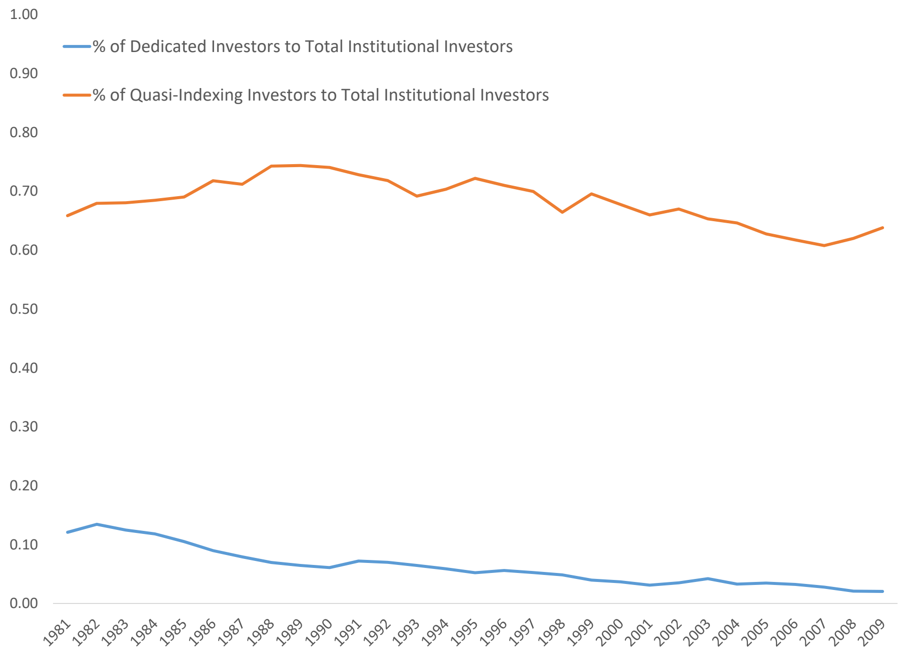
Panel B: QIX

	Cash / TA (1)	Working Cap / TA (2)	R&D Exp. / TA (3)	Ads Exp. / TA (4)	Payout / TA (5)
% of Quasi-Indexing (QIX) Investors$_{t-1}$	-0.016 *	0.028 ***	-0.005 *	0.005 ***	0.008 ***
	(0.009)	(0.008)	(0.003)	(0.001)	(0.001)
Δ % of Quasi-Indexing (QIX) Investors$_{t-1,t}$	-0.007	0.019 ***	-0.002	0.003 ***	0.005 ***
	(0.006)	(0.005)	(0.002)	(0.001)	(0.001)
% of Overlapping QIX Inv. in Same SIC3 / Total QIX Inv.$_{t-1}$	-0.040 ***	-0.027 ***	-0.013 ***	-0.001	-0.003 ***
	(0.009)	(0.008)	(0.002)	(0.001)	(0.001)
Δ % of Overlapping QIX Inv. in Same SIC3 / Total QIX Inv.$_{t-1,t}$	-0.019 ***	-0.011 *	-0.006 ***	-0.001	0.000
	(0.006)	(0.006)	(0.002)	(0.001)	(0.000)
Constant	0.262 ***	0.192 ***	0.071 ***	0.003	-0.002 **
	(0.012)	(0.012)	(0.004)	(0.002)	(0.001)
No. Obs.	141889	138641	132096	131789	121102
Adjusted R^2	0.253	0.121	0.413	0.041	0.078
Controls?	Y	Y	Y	Y	Y
Industry Fixed Effects?	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y

Panel C: DED and QIX

	Cash / TA (1)	Working Cap / TA (2)	R&D Exp. / TA (3)	Ads Exp. / TA (4)	Payout / TA (5)
% of Dedicated (DED) Investors$_{t-1}$	-0.050 **	0.041 *	0.001	-0.002	0.007 **
	(0.023)	(0.022)	(0.008)	(0.005)	(0.003)
Δ % of Dedicated (DED) Investors$_{t-1,t}$	-0.015	0.055 ***	0.004	0.000	0.006 ***
	(0.018)	(0.014)	(0.006)	(0.003)	(0.002)
% of Quasi-Indexing (QIX) Investors$_{t-1}$	-0.042 ***	0.026 **	-0.010 ***	0.007 ***	0.013 ***
	(0.013)	(0.012)	(0.004)	(0.002)	(0.001)
Δ % of Quasi-Indexing (QIX) Investors$_{t-1,t}$	-0.011	0.025 ***	-0.003	0.005 ***	0.009 ***
	(0.008)	(0.008)	(0.003)	(0.001)	(0.001)
% of Overlapping DED Inv. in	-0.026 ***	-0.022 ***	-0.003	-0.001	0.000
Same SIC3 / Total DED Inv.$_{t-1}$	(0.007)	(0.007)	(0.003)	(0.001)	(0.001)
Δ % of Overlapping DED Inv. in	-0.012 **	-0.014 ***	-0.003 *	-0.001	-0.001
Same SIC3 / Total DED Inv.$_{t-1,t}$	(0.006)	(0.005)	(0.002)	(0.001)	(0.001)
% of Overlapping QIX Inv. in	-0.051 ***	-0.036 ***	-0.018 ***	-0.003	-0.002 **
Same SIC3 / Total QIX Inv.$_{t-1}$	(0.012)	(0.011)	(0.003)	(0.002)	(0.001)
Δ % of Overlapping QIX Inv. in	-0.024 **	-0.012	-0.008 ***	-0.002	0.001
Same SIC3 / Total QIX Inv.$_{t-1,t}$	(0.010)	(0.008)	(0.003)	(0.001)	(0.001)
Constant	0.287 ***	0.184 ***	0.075 ***	0.004	-0.007 ***
	(0.015)	(0.015)	(0.005)	(0.003)	(0.001)
No. Obs.	106536	103886	100109	99683	90997
Adjusted R^2	0.265	0.126	0.404	0.048	0.080
Controls?	Y	Y	Y	Y	Y
Industry Fixed Effects?	Y	Y	Y	Y	Y
Time Fixed Effects?	Y	Y	Y	Y	Y

Panel A



Panel B

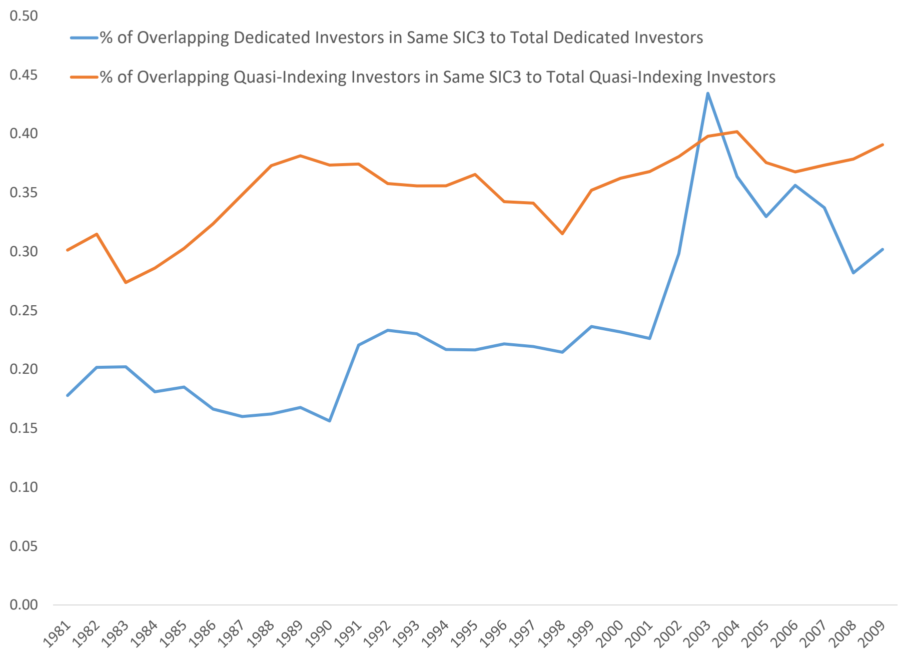


Figure 1: Percentage of transient or dedicated institutional ownership to total institutional ownership over time. Dedicated institutional investors, as defined in Bushee (1998, 2001), are characterized as having large average investment in firms in their portfolios and extremely low turnover. In contrast, quasi-indexer institutional investors are characterized as having low portfolio turnover but diversified portfolio holdings.

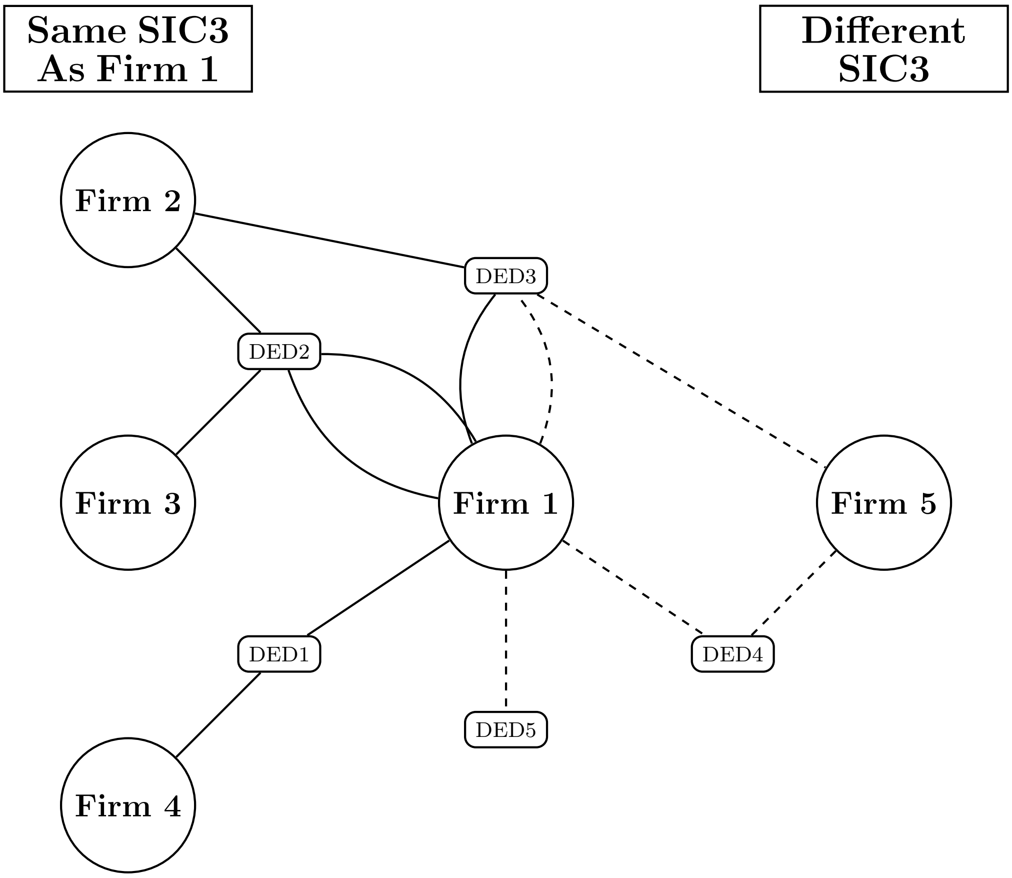


Figure 2: Example of institutional ownership network calculation. We define our common ownership measure as the average number of connections a firm has to same-industry peers through institutional owners of a given type, normalized by the number of institutional owners of that type for the firm. Of its same-SIC3 peers Firm 1 has two connections to Firm 2 (through DED2 and DED3), one connection to Firm 3 (through DED2), and one with Firm 4 (through DED1). The average number of DED connections to same-SIC3 firms is $\frac{4}{3}$, and the total number of DED owners is 5. The normalized $pDEDnet$ measure for Firm 1 is thus $\frac{4}{3*5} = 26.66\%$. Note that the upper bound of average connections to same-SIC3 firms is equal to the number of DED or QIX investors giving $pDEDnet$ and $pQIXnet$ a range from 0 to 1.

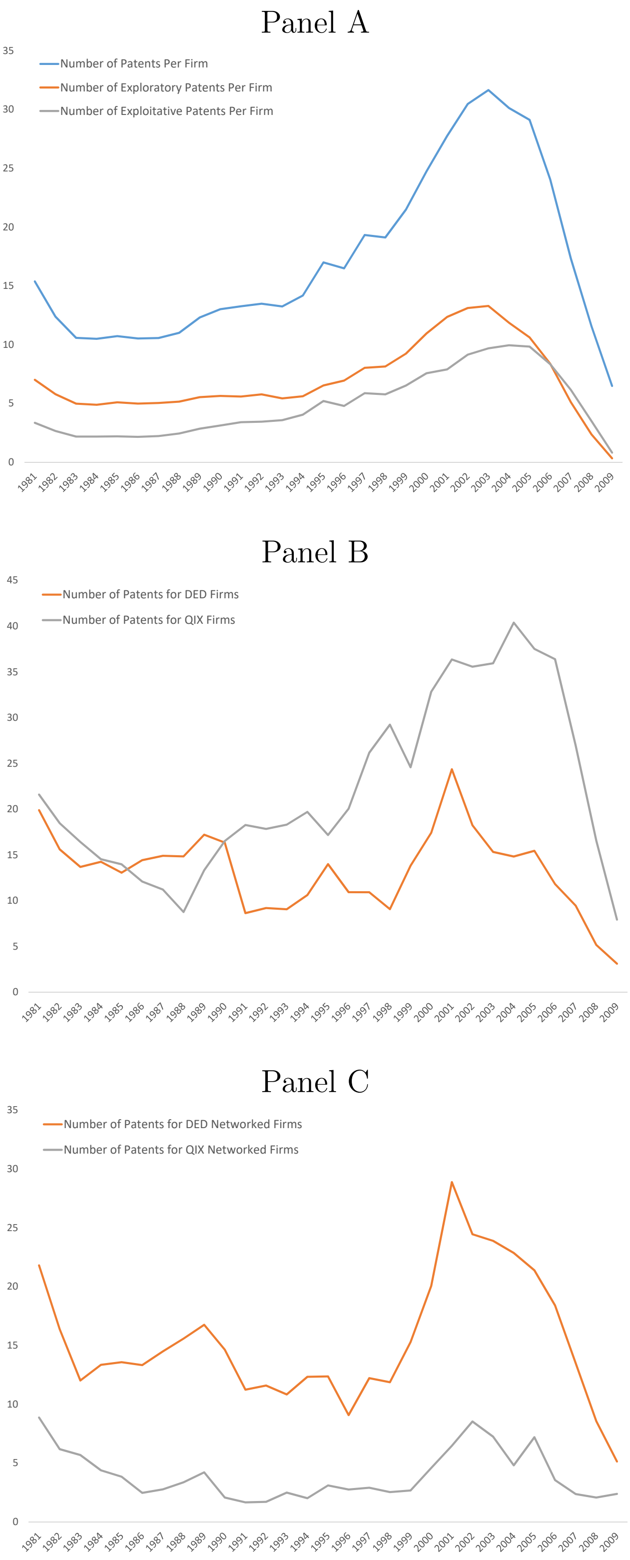


Figure 3: Time trends in innovation. We show the annual averages of patent counts, as well as patent types in Panel A. Panel B documents the average number of patents for firms with above-median within-firm DED and QIX ownership by year. Panel C does the same for firms with above-median same-SIC3 common ownership for DED and QIX institutional owners.