Why Are Firms with More Managerial Ownership Worth Less?

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Abstract

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Keywords: Firm valuation, Director and officer ownership, Liquidity, Performance history

JEL Classifications: G30, G32

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Using more than 50,000 firm-years from 1988 to 2015, we show that the empirical relation between a firm's Tobin's q and managerial ownership is systematically negative. When we restrict our sample to larger firms as in the prior literature, our findings are consistent with the literature, showing that there is an increasing and concave relation between q and managerial ownership. We show that these seemingly contradictory results are explained by cumulative past performance and liquidity. Better performing firms have more liquid equity, which enables insiders to more easily sell shares after the IPO, and they also have a higher Tobin's q.

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1. Introduction

A well-known result in empirical corporate finance is that firm value is positively correlated with managerial ownership over some range of ownership and then, beyond that range, becomes negatively correlated. Morck, Shleifer, and Vishny (1988, MSV from hereon) is the first paper to document this relation for a sample of Fortune 500 firms and is one of the most highly cited papers in corporate finance. Subsequently, McConnell and Servaes (1990) show evidence supporting a concave relation for a broader sample. Several theory papers model the tension between managerial ownership and incentives and predict such a concave relation (e.g., Stulz (1988) or Harris and Raviv (1988)). Though the subsequent literature generally finds that the relation between firm value and managerial ownership is upward-sloping over some range (additional evidence is provided by, e.g., Holderness, Kroszner and Sheehan (1999), McConnell, Servaes, and Lins (2008), or Li, Sun, and Yannelis (2017)), it has been debated extensively whether the relation can be interpreted causally (see, for instance, Demsetz (1983), Demsetz and Lehn (1985), Himmelberg, Hubbard, and Palia (1999), Demsetz and Villalonga (2001), Zhou (2001), and Coles, Lemmon, and Meschke (2012)).

In this paper, we build the largest database of managerial ownership information ever used in the literature. While the samples in existing studies are tilted towards large firms and have data for few years, we have much broader coverage from 1988 to 2015 as we have data for more than 1,800 firms (after excluding utilities, financial firms, and dual class firms) per year on average. With our sample, we find strong and robust evidence that the relation between firm value and managerial ownership is negative rather than positive and thus opposite to theoretical predictions and prior empirical findings. Yet, when we restrict our sample to the subset of larger firms similar to the samples used by McConnell and Servaes (1990) or MSV, we recover their findings of a positive relationship between value and managerial ownership over some range of ownership.

Our investigation of the consistently negative relation between firm value and managerial ownership leads to a straightforward explanation. Managers own more shares at the IPO than they typically want to own over time. As a result, they want to decrease their ownership, but face frictions in doing so. If a

firm's stock is illiquid, it takes time to sell large stakes and doing so may be expensive. Managers may not even be able to sell under conditions that are acceptable to them. As a consequence, the level of managerial ownership of a firm depends on its past history. If the firm's stock is highly liquid quickly after the IPO, managers decrease their ownership so that the firm eventually has low managerial ownership. The firms whose stock is liquid are typically successful firms, which mean firms with a high Tobin's q. Hence high q firms tend to have low managerial ownership. Conversely, firms with high managerial ownership are firms whose stock has lacked liquidity. Such firms are firms that have not been consistently successful, and therefore end up with high managerial ownership and low q. With this theory, the relation between managerial ownership and Tobin's q is the outcome of the past history of the firm. This mechanism also explains why the results in the literature hold for highly liquid large firms, but not for other firms: it is because frictions in the adjustment of managerial ownership are not relevant for large liquid firms.

Our theory predicts that the relation between managerial ownership and Tobin's q depends on the evolution of stock liquidity. Firms with a history of greater stock liquidity should not have a negative relation between Tobin's q and managerial ownership. We split the sample between firms that have high past stock liquidity and firms that have low past stock liquidity. We find strong evidence that the firms with high past liquidity have a relation between Tobin's q and managerial ownership that is consistent with McConnell and Servaes (1990), while firms with low past liquidity exhibit a strong negative relation between firm value and managerial ownership. We use two different measures of liquidity throughout. The first one is the measure of Amihud (2002) and the second one is the measure developed by Fong, Holden and Trzcinka (2017) (FHT thereafter). The results for firms with a history of low liquidity are very strong irrespective of the estimation method and irrespective of the liquidity measure.

A direct test of our theory that the relation between Tobin's q and managerial ownership reflects past history is to regress Tobin's q on the change in managerial ownership since the IPO or first available ownership observation. Our prediction is that firms whose managerial ownership fell more have a higher Tobin's q. These are successful firms whose managers were able to sell shares easily because their stock

had been liquid for a number of years. We find strong evidence that Tobin's q is positively related to the drop in managerial ownership since the IPO.

With our theory, managerial ownership should be decreasing in past stock liquidity. We find strong evidence that a firm's current managerial ownership is a decreasing function of the number of years the firm has had with high stock liquidity, which are years in which managers could have decreased their ownership at lower cost. The evidence holds for both the Amihud and FHT liquidity measure.

We go further towards a causal interpretation of the relation between managerial ownership and liquidity by using two exogenous shocks that improved liquidity. Such shocks should lead to a decrease in managerial ownership if our explanation for the negative relation is correct. We first use the major Nasdaq reforms in the late 1990s as a shock to liquidity (see, for instance, Barclay et al. (1999)). Although the NYSE and Amex were also impacted by some of these reforms, Nasdaq experienced a greater improvement in execution costs (e.g., Bessembinder (1999)). We estimate a difference-in-differences regression around the Nasdaq reforms to study the impact of liquidity on managerial ownership and find clear evidence that managerial ownership decreases as a result of the shock to liquidity. The introduction of decimalization, which affected large firms with small spreads but not smaller listed companies, provides a second shock to liquidity (e.g., Bessembinder (2003), Furfine (2003)).[1] We again find that firms whose liquidity increased relatively more experienced greater drops in their managerial ownership.

Our explanation for the negative relation between managerial ownership and Tobin's q is that higher liquidity decreases managerial ownership and that some of the forces that lead to higher liquidity increase Tobin's q as well.[2] In particular, better operating performance generally improves both liquidity and Tobin's q. We find strong support for the hypothesis that a stock is more liquid if its cumulative past performance is better. The results hold when performance is measured by sales growth or ROA. We then show that Tobin's q is also higher for firms with greater past performance. Overall, our evidence suggests

[1] The introduction of decimalization as a shock to liquidity has been used in a variety of corporate finance settings (see, Fang, Noe and Tice (2009), Bharath, Jayaraman, and Nagar (2013), Edmans, Fang, and Zur (2013), Fang, Tian, and Tice (2014) and Norli, Ostergaard, and Schindele (2015)).

[2] Fang, Noe, and Tice (2009) show that Tobin's q is related to concurrent liquidity. We argue that it is not only concurrent liquidity but also the entire history of liquidity that is important.

that theories of firm value and managerial ownership should take into account frictions that impede adjustments in managerial ownership.

The paper proceeds as follows. In Section 2, we present our dataset. We show in Section 3 that the relation between Tobin's q and managerial ownership is opposite for our whole sample from what MSV or McConnell and Servaes (1990) found, but is similar to theirs for the subset of the largest stocks. We also demonstrate that our main results are robust to a variety of different estimation methods. In Section 4, we develop hypotheses, based on the impact of liquidity on managerial ownership, which could explain the results uncovered in Section 3. We then show in Section 5 that the relation between Tobin's q and managerial ownership indeed depends on a firm's liquidity history. In Section 6, we find that Tobin's q is strongly positively related to the drop in managerial ownership since the IPO. In Section 7, we provide evidence that managerial ownership is negatively related to a stock's liquidity history. We then confirm in Section 8 that both liquidity and Tobin's q increase with past performance. We conclude in Section 9.

2. Data and summary statistics

We start by describing how we construct our dataset of managerial ownership. Section 16(a) of the Securities Exchange Act of 1934 requires directors, executive officers, and persons who own more than 10% of a company's common stock to file reports of their ownership and changes in ownership with the SEC. Companies derive from these data a table with an annual snapshot of stock ownership information of all directors and officers that they report in their proxy statements. The table includes all vested stock as well as shares of common stock that can be acquired within 60 days of the reporting date through options or vesting stock awards. Our data source is this director and officer ownership table from corporate proxy statements. For simplicity, and to be consistent with the prior literature, we use the term 'managerial ownership' for the vested (or soon vesting) equity ownership of officers and directors. Our managerial ownership data definition is the same as the one used in, e.g., Himmelberg, Hubbard, and Palia (1999), Holderness, Kroszner, and Sheehan (1999), Helwege, Pirinsky, and Stulz (2007), or

Fahlenbrach and Stulz (2009). We then define in Section 2.2 our measures of firm value, past liquidity and past performance. Lastly, we provide summary statistics for our panel in Section 2.3.

2.1. Ownership data

We use data on managerial ownership from the 1988 to the 2016 proxy season. We start with the data set used earlier in Fahlenbrach and Stulz (2009), collected from Compact Disclosure for the period 1988-2003. For the period 2004-2016, we download and parse all proxy materials and information statements from the U.S. Securities and Exchange Commission's (SEC) EDGAR (Electronic Data Gathering, Analysis, and Retrieval system) website.[3] We identify patterns in the beneficial ownership section disclosure that allow us to use regular expressions to capture the director and officer ownership percentage.[4] We keep one filing per firm in each calendar year, which leaves us with 64,093 firm-year observations over 2004-2016. Our primary source of data is the SEC's form DEF 14A (definitive proxy statement). Out of 74,249 DEF 14A forms parsed over 2004-2016, we are able to obtain the D&O ownership percentage for 52,953 of them which corresponds to a 71% success rate. We obtain the remaining 11,140 D&O ownership firm-year observations from proxy materials and information statements other than form DEF 14A. Of these, 5,060 firm-year observations are from form PRE 14A (preliminary proxy statement).

Our algorithm is able to extract the D&O ownership percentages for approximately 3,900-5,200 unique firms each year. When we verify the accuracy of our data for a subsample for which commercially available data (Corporate Library) exists, we find a correlation of 0.98 between our ownership measure and the hand-collected measure of the Corporate Library, on a sample of approximately 24,000 common observations. There are approximately 3,300 firm-year observations for which we have data on D&O ownership from the Corporate Library database, but for which we were not able to extract information

[3] We use the aggregate term "proxy statements" for a set of proxy materials and information statements that we list and describe in the Appendix.
[4] We design a total of 66 non-redundant regular expressions. One example of a very common formulation is: "All Executive Officers and Directors as a Group".

from SEC filings. Manual inspection suggests that non-standard ownership reporting in proxy statements explains our inability to find these observations. We use the Corporate Library observations to complete the time-series of D&O ownership data obtained from our algorithm. We also apply our algorithm to SEC filings S-1 and S-1/A that allow us to extract pre-IPO D&O ownership.

As is common in the literature, we exclude dual class firms. We develop an algorithm for the identification of dual class firms that we apply to companies' proxy statements. We identify 1,278 dual class firms all of which we check by hand. We also crosscheck our list with the list of dual class firms of Gompers, Ishii, and Metrick (2010) for firms that our data sets have in common. A detailed description of the parsing process and the dual class algorithm is provided in Appendix B.

We then match our ownership data with stock return data from the Center for Research in Security Prices (CRSP), and accounting data from Standard and Poor's Compustat database. The managerial ownership data are matched with Compustat data as of the closest fiscal-year-end date prior to the proxy date. For determining the total number of shares outstanding from CRSP, we follow past studies (e.g., Helwege, Pirinsky, and Stulz (2007) and Fahlenbrach and Stulz (2009)) and use shares outstanding in the month prior to the proxy date. We verify that the rule captures the most common lag between record date and proxy date by developing an algorithm that extracts the record date from proxy statements. The results of the (unreported) analysis warrant the use of our approach. We require firms to have total assets greater than zero and to have a non-missing *Central Index Key* (CIK) identifier. We remove utilities and financial firms, and eliminate observations with missing Compustat and CRSP data. We also match the data to Jay Ritter's IPO database using CRSP's PERMNO identifier. Finally, we merge the data with the Fama-French 49 industry classification obtained from Kenneth French's website. Our final sample contains 56,903 firm-year observations for 8,049 unique firms over fiscal years 1988-2015. Of the final 56,903 firm-year observations, 31,249 observations are from the data set used earlier in Fahlenbrach and Stulz (2009); 11,445 are from our algorithm; 13,131 are common to our algorithm and the Corporate Library data; and 1,078 are uniquely from Corporate Library.

2.2. Firm value, past liquidity, and past performance variables

We use Tobin's q as a proxy for firm value. We follow Kaplan and Zingales (1997) and define Tobin's q as the ratio of the market value of assets to the book value of assets, where the market value of assets is calculated as the sum of the book value of assets and the market value of common stock less the book value of common stock and deferred taxes. In the q regressions, we include the control variables used by Himmelberg, Hubbard and Palia (1999). Their controls are designed to capture cross-sectional differences in the most important firm characteristics and also differences in growth options. We include the ratio of R&D to sales, the ratio of capital expenditures to assets, and the ratio of advertising to sales to control for growth opportunities.

We consider two proxies for liquidity: (1) Amihud's (2002) measure, and (2) Fong, Holden, and Trzcinka's (2017) FHT measure. Amihud's (2002) illiquidity measure is calculated for each stock i in year y from daily data. It is defined as

$$\text{Amihud}_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{D_{iy}} \frac{|R_{it}|}{VOLD_{it}}, \tag{1}$$

where D_{iy} is the number of days for which data are available for stock i in year y, R_{it} is the return on stock i on day t, and $VOLD_{it}$ is the respective daily dollar volume. Fong, Holden, and Trzcinka's (2017) illiquidity measure is calculated for each stock i in year y from daily data. It is defined as

$$\text{FHT}_{iy} = 2\sigma N^{-1}\left(\frac{1+z}{2}\right), \tag{2}$$

where σ is the return volatility, $N^{-1}()$ is the inverse function of the cumulative normal distribution, and z is the empirically observed frequency of a zero return day. The empirically observed frequency of a zero return is computed as $z = \frac{ZRD}{TD}$, where ZRD is the number of zero returns days, and TD is the total number of trading days (zero and non-zero returns days) in a given stock-year.

To identify firms that exhibit high (respectively low) liquidity, we classify stocks each year based on our two proxies for liquidity. Because both measures reflect illiquidity, high values for the Amihud and FHT measures correspond to low liquidity levels. Hence, for any given year, the liquidity of a given stock is categorized as "high" if the value is in the bottom quartile of the respective illiquidity measure relative

to the entire CRSP universe of firms. We then compute how many years each firm has experienced in a high liquidity state. Our ownership sample starts in 1988 but to compute these measures of past liquidity, we go as far back as 1963, the start year of the daily CRSP file.[5] We normalize the number of years in a high liquidity state by the number of years in CRSP. We create liquidity subsamples by splitting the entire sample into quartiles based on the distribution of the normalized measure of past liquidity across all years and firms. Firm-year observations are in the "high liquidity" sample if they are in the top quartile of the normalized liquidity distribution, and firm-year observations are in the "low liquidity" sample if the firm-year observation is in the bottom quartile of the normalized liquidity distribution.

We follow the same procedure for our measures of past performance. To identify firms that exhibit good performance relative to the market as a whole, we classify stocks each year based on two operating performance measures. Our main performance measure is sales growth, but we also report results using return on assets (ROA). A given firm-year observation is categorized as "high performance" if the value is in the top quartile relative to the entire CRSP-Compustat universe of firms in a given year. We then count how many years each firm has experienced in a high performance state. We again start the accumulation in 1963. We create a normalized measure of performance history by dividing the number of years in a performance state by the number of years in the CRSP-Compustat universe.

2.3. Summary statistics

Table 1 provides summary statistics for the key variables used in the study. From 1988 to 2015, the sample has at least 1,500 non-financial, non-utility, non-dual class firms each year. Overall, we have managerial ownership data for more than 56,000 firm-years. The number of firms with complete managerial ownership increases until the end of the 1990s/early 2000s and then declines until the end of

[5] The measure will be truncated for firms that have been listed earlier than 1963 and have been ranked in the respective liquidity category. General Electric (GE) is an example of such a firm.

the sample. The pattern for the number of firms with complete managerial ownership data corresponds to the trends in the overall number of listed firms in the United States documented by Doidge, Karolyi, and Stulz (2017). The average of managerial ownership across the early years (until 2002) is fairly stable over time at around 23% although the median ownership declines. After 2002, average and median managerial ownership start to significantly decline. Figure 1, which displays the mean and median managerial ownership, shows the decline separately for Nasdaq and for NYSE and Amex firms. The decline is larger for Nasdaq firms, but both lines decrease substantially during the sample. It is not clear though whether the decline in ownership is driven by trends in managerial ownership or a change in the composition of listed firms. For example, Kahle and Stulz (2017) show that during the last two decades, listed firms have become larger and older, and large and old firms have on average lower managerial ownership.

The average age of firms in the comprehensive sample of US firms of Kahle and Stulz (2017) is 12.2 years in 1995 and 18.4 years in 2015. The corresponding numbers in our sample are 13.8 years in 1995 and 19.2 years in 2015, suggesting that we collected data for a representative sample of U.S. publicly listed firms. The average age of more than ten years since initial listing in our sample guarantees that we have a large cross-sectional and time-series variation in the liquidity history which we can exploit later. There are no obvious time trends in Tobin's q, with a full sample average of 1.9 and median of 1.45.

Table 1 also shows time-series statistics for the illiquidity measures. Both measures significantly decline (i.e., liquidity increases) during our sample period. The correlation of the liquidity measures is 0.72, indicating that they capture some of the same components of liquidity. Since the fraction of days with no trading plays a prominent role in the FHT measure, it is not surprising that this measure falls sharply with decimalization of quotes across US exchanges in 2001. The impact of the financial crisis of 2007/2009 on the liquidity measures is evident from Table 1 as well: illiquidity spiked during the financial crisis.

3. Tobin's q and managerial ownership: evidence from 1988 to 2015

In this section, we document the correlation between Tobin's q and managerial ownership for our sample and for a subset of large firms that maps closely the data examined by prior studies. We will be agnostic about the 'correct' specification of this relation and show results for a simple linear specification, a piecewise linear specification using the breakpoints of MSV, and the quadratic specification of McConnell and Servaes (1990).[6]

3.1. Empirical methodology

It is problematic to estimate OLS pooled time-series and cross-sectional q regressions without properly adjusting standard errors, because with q as the dependent variable, observations and error terms are likely to be correlated both across years and across firms. Gompers, Ishii, and Metrick (2010) point out that in a cross-sectional regression of firm-level returns on exogenous characteristics, the error terms are correlated, and since the numerator of q contains the market value of equity, q regressions will also have some unknown cross-sectional dependence. Fama and MacBeth (1973) (FM) suggest to handle such an unknown cross-sectional correlation structure by estimating a separate regression for each cross-section, and then performing inference on the time-series mean and standard deviation of the cross-sectional coefficients. The FM procedure was however developed to account for the correlation between observations on different firms in the same year, not to account for the correlation between observations on the same firm in different years (Petersen (2009)). To apply the FM procedure correctly, we must therefore adjust for time-series dependence in the estimated cross-sectional coefficients. To do so, we estimate a first-order autoregressive model for each coefficient and then use the estimated autoregression coefficients to adjust the FM standard errors (e.g., Fama and French (2002) or Graham, Lemmon and Schallheim (1998)).[7]

[6] Researchers have pointed out that the breakpoints in MSV are to a certain extent arbitrary (Demsetz and Villalonga (2001). The quadratic specification of McConnell and Servaes (1990) has been criticized because ownership and ownership squared are highly correlated and collinearity may become an issue. Hence, we also estimate a simple linear specification.

[7] Petersen (2009) explains that these adjusted Fama-MacBeth standard errors do best when the firm effect dies off fast enough and the researcher has a sufficient number of time periods per firm. In our sample, we have a long time-series of annual coefficents (28 years); we do not have good empirical or theoretical predictions about how quickly the firm effect decays.

Thompson (2011) and Petersen (2009) show, as an alternative, how one can compute standard errors that allow for arbitrary correlations of error terms both between firms (within each cross-section) and over time (for each firm). Thompson (2011) argues that double clustering is likely to be most helpful in data sets with the following characteristics: the regression errors include significant firm and time components, the regressors themselves include significant firm and time components, and the number of firms and time periods is not too different. In our setting, regression errors likely include significant time and firm components, regressors vary probably more by firm than by time, but we have also far more firms than time periods. Petersen (2009) suggests that for datasets like ours, with a large cross-section but a small number of observations per firm (only seven on average), having time dummies and clustering by firm will yield almost identical results to double clustering. In robustness tests, we confirm that double clustering makes little difference in our sample. We therefore include time dummies and cluster standard errors by firm but not by time throughout our main specifications.

3.2. Results

Table 2 shows the association between Tobin's q and managerial ownership for our sample. Panel A shows adjusted Fama-Macbeth regression results while Panel B features results from time-series / cross-sectional OLS regressions.

The first three columns of Panel A show the results for our entire sample of firms. In the linear specification of Column 1, the effect of managerial ownership is persistently negative: The lower the managerial ownership, the higher is firm value. The coefficient of -0.30 can be interpreted as follows: an interquartile decrease in managerial ownership (from 0.30 to 0.04) is associated with an increase in Tobin's q of 0.078, or 4% relative to average q. The sign of the coefficient is thus opposite of what the literature has persistently found and what agency theory would suggest (e.g., Jensen and Meckling (1976)).

Column 2 shows the coefficients of the piecewise linear specification of Morck, Shleifer, and Vishny (1988). Here, we find that none of the managerial ownership coefficients is statistically significantly

positive, and that the coefficients on the managerial ownership interval between 0 and 5% and from 5% to 25% are statistically significantly negative. The coefficient estimate of -1.74 (-0.73) implies that moving from 5% managerial ownership to 0% (25% to 5%) ownership would increase firm value by about 0.09 (0.15) units of Tobin's q. We again find the somewhat surprising result of a robust negative relation between firm value and managerial ownership. Finally, Column 3 shows the results of the quadratic specification of McConnell and Servaes (1990). The coefficients on managerial ownership and ownership squared are opposite to what the literature has documented (e.g. McConnell and Servaes (1990); Holderness, Krozner, and Sheehan (1999)). The coefficient on managerial ownership is negative and strongly significant, and the coefficient on managerial ownership squared is positive and significant. The breakpoint implied by these coefficients is approximately 45.6%, and given that the 90th percentile of managerial ownership is at 50%, the relation between firm value and managerial ownership is downward sloping over most of the range of managerial ownership observed in our data. Figure 2 draws the relation between q and managerial ownership implied by the estimates of Columns 1 to 3. Figure 2 shows that for our sample that is much closer to a representative sample of US public firms, the relation between firm value and managerial ownership is different from the findings of the existing literature, no matter how we specify the relation between value and managerial ownership.

Columns 4 to 6 re-estimate the three specifications for the largest 500 firms by sales. MSV used the Fortune 500 firms in their study. At the time, financial firms were markedly less important in the Fortune 500 than they are now. Since we drop financial firms as well as dual-class firms from our sample, a sample focused on the Fortune 500 firms has half the observations than a sample using the 500 largest firms by sales. Not surprisingly, therefore, when we use the Fortune 500 firms (not reported), most of our estimates are insignificant. In contrast, when we use the largest 500 firms, we find results that are strongly consistent with the results in the earlier literature, namely that q increases with managerial ownership for low values of managerial ownership and falls with high values of managerial ownership. Column 4 shows that the coefficient on managerial ownership in the linear specification is negative but statistically indistinguishable from zero. The piecewise linear specification in Column 5 has positive and

statistically significant coefficients for the managerial ownership ranges from 0 to 5% and from 5% to 25%, and a negative and statistically significant coefficient for managerial ownership over 25%. Finally, with the quadratic specification, q increases significantly with managerial ownership and falls significantly with the square of managerial ownership. The breakpoint implied by the quadratic specification is approximately 25% so that for managerial ownership levels larger than 25%, further increases in managerial ownership are associated with decreases in firm value. Figure 3 displays the implied relation between Tobin's q and managerial ownership based on the coefficient estimates for 500 largest firms from Table 2. The figure conforms to the finding in the literature of a curvilinear relation between Tobin's q and managerial ownership.

Panel B shows results from OLS regressions. The coefficients are of similar magnitude and the economic interpretation is very similar to the results of Panel A for all firms and for the largest 500 firms, but statistical significance is weaker for the largest 500 firms.

3.3. Robustness

Table 3 contains additional regressions to support the main conclusion from our analysis in Table 2 that Tobin's q correlates negatively with managerial ownership for a large sample of firms. In Column 1, we reproduce the results from Table 2, Panel B, Column 3 for ease of comparison. In Column 2, we cluster standard errors by firm and year and show that double-clustering makes almost no difference in our sample, in line with the prediction of Petersen (2009). In Column 3, we add industry x time fixed effects to the regression in Column 1 and show that allowing industry effects to vary by year has virtually no impact on our conclusions.

Researchers have argued that empirical estimates of q are noisy measures of the true q (e.g., Erickson and Whited (2006), Gompers, Ishii, and Metrick (2009), Peters and Taylor (2017)). Of particular concern is the denominator of q as calculated by Kaplan and Zingales (1997). Research and development, brand management, and human capital are reflected in the market value of a firm's capital, but generally not in

its book value.[8] The noise will increase standard errors, but will, under the assumption of the measurement error of q being uncorrelated with the independent variables, not bias coefficients. The problem can be alleviated by using robust estimation methods or transformations of q. Gompers, Ishii, and Metrick (2010) suggest estimating Tobin's q regressions as median regressions, or using a log transformation or -1/q transformation. Column 4 shows the results when we estimate a median regression in which the sum of absolute and not squared residuals is minimized, and Column 5 shows results from a regression in which the dependent variable is the natural logarithm of Tobin's q. Both specifications confirm our prior result of a counter-intuitive U-shaped relation between q and managerial ownership for the entire sample, with breakpoints that are well above 50%. The result is quantitatively and qualitatively similar when we use the -1/q transformation (not reported).

Bartlett and Partnoy (2018) question Gompers, Ishii, and Metrick's (2010) independence assumption between measurement error of q and independent variables. In that case, coefficient estimates would be biased due to the measurement error in the dependent variable. They advocate using the 'total q' measure of Peters and Taylor (2017) instead of a simple measure that scales market value of assets by total assets. Peters and Taylor (2017) develop a proxy for Tobin's q that accounts for intangible capital in the denominator. In Column 6, we estimate a specification with their proxy for Tobin's q. Our results are qualitatively similar but have weaker statistical significance: Tobin's q is significantly negatively related to managerial ownership, and the coefficient of managerial ownership squared is positive but statistically insignificant. We also estimate a linear specification with Peters and Taylor's (2017) Tobin's q proxy (Column 7), because the breakpoint implied in the quadratic specification is large and almost outside the range of observed ownership (77.5%). The coefficient on managerial ownership in the linear specification in Column (7) is strongly statistically significant and negative.

[8] As Bartlett and Partnoy (2018) and Gompers, Ishii, and Metrick (2010) point out, a firm's expenditures to develop knowledge, intellectual property, or software are generally expensed as research and development but are not capitalized on the balance sheet (except in the form of goodwill after acquisitions).

Finally, in unreported regressions, we estimate regressions with quadratic specifications for four different subperiods of seven years each. The evidence shows that the result of a U-shaped relationship between Tobin's q and managerial ownership is very robust in the data since 1995.

In summary, Tables 2 and 3 document a robust U-shaped relation between Tobin's q and managerial ownership for a large sample of US publicly listed firms. The breakpoints are such that the relation between Tobin's q and managerial ownership is negative for almost the entire observed spectrum of ownership. The remainder of the paper seeks to explain this surprising finding.

4. A potential explanation for the U-shaped relation between Tobin's q and managerial ownership

Helwege, Pirinsky, and Stulz (2007) develop and find support for a lifecycle theory of managerial ownership. When the firm is private, insiders have no choice but to own most of the equity since the equity cannot be widely held. Hence, a firm starts its public life with high managerial ownership. Eventually, many firms in the US have diffused ownership (La Porta, Lopez-de-Silanes, and Shleifer (1999)). As the firm goes public, managerial ownership falls as new shares are sold to outsiders and, in most cases, shares held by insiders are sold to outsiders as well. After the IPO, insiders generally want to decrease their stake further over time for diversification purposes. Further, if the firm is successful and has to raise funds, insiders are unlikely to be able to keep their proportional ownership as it would require them to invest more in the firm. However, insiders find it expensive to sell shares if the market for the shares is illiquid.[9] Managers may not even be able to sell under conditions that are acceptable to them. In contrast, if the firm's stock becomes highly liquid after the IPO, managers can decrease their ownership so that the firm eventually has low managerial ownership. It follows that the cumulative history of past liquidity should have first-order consequences for managerial ownership.

Liquidity tends to be higher for firms that are larger, more mature, better performing, have less volatility, fewer information asymmetries, and more analyst following (Holden, Jacobsen, and

[9] With this view, an increase in managerial ownership is also more informative about firm value than a decrease as shown in Fahlenbrach and Stulz (2009).

Subrahmanyam (2013); Roulstone (2003)). Another way to put this is that liquidity is better for firms that have made it – firms that analysts and institutional investors are interested in, and that have become large and successful. Firms that have struggled consistently are more likely to remain illiquid. Such firms have a low q and their illiquidity implies that insiders will typically have not succeeded in reducing their holdings on attractive terms.

Liquidity is correlated with firm characteristics that heighten concerns of outside shareholders regarding moral hazard and adverse selection on the part of insiders. Adverse selection concerns arise because insiders are better informed than potential investors, so that there is a risk that investors buy shares that are worth less than they think and insiders know that (see, e.g., Chemmanur and Fulghieri (1999)). Moral hazard concerns arise because insiders' incentives are to maximize their welfare even if it is at the expense of outside investors (e.g., Jensen and Meckling (1976)). As firms become more established and develop a history of good performance (Pagano, Panetta, and Zingales (1998)), these concerns become less important. A consequence of a decrease in these concerns is that the stock becomes more liquid and insiders can sell more shares.

We link the lifecycle theory of managerial ownership to measures of performance and liquidity and demonstrate that it is important to control for past liquidity and performance when trying to understand the relation between Tobin's q and managerial ownership. Firms whose stock is liquid are typically successful firms, which means firms with a high Tobin's q. Because liquidity drives decreases in ownership, high Tobin's q firms tend to have low managerial ownership. Similarly, firms with high managerial ownership are firms whose stock has lacked liquidity. Such firms have typically not been consistently successful, and therefore have high managerial ownership and low q. With this theory, the relation between Tobin's q and managerial ownership is an outcome of the past history of the firm and several testable hypotheses can be derived from it:

H1: The negative relation between Tobin's q and managerial ownership is concentrated in firms with a history of stock illiquidity.

We first test H1 by splitting the sample between firms that have high past stock liquidity and firms that have low past stock liquidity and estimate Tobin's q – managerial ownership regressions for each of those subsamples.

A more direct test of our theory that the relation between Tobin's q and managerial ownership reflects past history is simply to regress Tobin's q on the change in managerial ownership since the IPO or first available managerial ownership observation. If the change in managerial ownership is large, we expect the value of the firm to be high because the firm has performed well enough to create a liquid market for its stock for a number of years. Our prediction is that

H2: Firms whose managerial ownership fell more since the IPO / initial sample observation have a higher Tobin's q.

An important component of our theory is that managerial ownership should be decreasing in past cumulative stock liquidity. We test:

H3: If a firm had more years of high liquidity in the past, its current managerial ownership should be lower.

Finally, we examine whether the history of past performance influences both liquidity and firm value:

H4a: Firms that performed more often in the top quartile of firms during their lives have more liquid stocks today.

H4b: Firms that performed more often in the top quartile of firms during their lives have higher (forward looking) firm value today.

5. Liquidity history and the Tobin's q - managerial ownership relationship

In this section, we test our first hypothesis, namely that the relation between Tobin's q and managerial ownership depends on the liquidity history of the firm. Table 4 conditions on the liquidity history before estimating the Tobin's q – managerial ownership regressions. We estimate Tobin's q – managerial ownership regressions on the subset of firms with the highest and lowest past liquidity, where our liquidity measures are constructed from a firm's entire liquidity history. Columns labeled "high liquidity" include observations if the firm-year observation is in the top quartile of the normalized liquidity

distribution, and columns labeled "low liquidity" include observations if the firm-year observation is in the bottom quartile of the normalized liquidity distribution. Columns 1 to 4 show Fama-MacBeth regression results, and Columns 5 to 8 show OLS regression results. It is evident from both sets of regressions that the relation between Tobin's q and managerial ownership is dramatically different depending on the liquidity history. For firms with a history of low liquidity, the correlation between q and managerial ownership is consistently negative, no matter whether we use adjusted Fama-MacBeth standard errors or clustered standard errors or whether we use the Amihud or FHT liquidity measures (Columns 3 and 4; Columns 7 and 8). For the high liquidity sample, the relationship looks completely different. There is no evidence of a negative relation between Tobin's q and managerial ownership in Columns 1 and 2 or Columns 5 and 6. The results using the Amihud liquidity history (Column 1) show the familiar hump-shaped relationship.

Overall, these results provide strong support for our first hypothesis and confirm that firms with a poor liquidity history have a fundamentally different relation between Tobin's q and managerial ownership than firms with a good liquidity history.

6. Tobin's q and decreases in managerial ownership since IPO / first appearance in data

We now test our second hypothesis: Firms whose managerial ownership fell more since the IPO / initial sample observation have a higher Tobin's q. Table 5 shows results. The table reports estimates of OLS regressions of Tobin's q on the difference between initial managerial ownership and managerial ownership in period *t*-1. The difference, which we call the ownership wedge, measures how much the ownership share of insiders fell since the IPO (Column 4) or since the company first appeared in the sample. The regressions include industry- and year-fixed effects. The first column shows results for the entire sample and demonstrates that the ownership wedge has a large and statistically significant correlation with Tobin's q. The more managerial ownership decreased since the firm initially appeared in the sample, the higher is Tobin's q. These results hold for both young firms, which have been listed for fewer than 10 years, and more mature firms (listed for more than 10 years).

In Column 4, we only analyze firms that had their initial public offering during our time period and for which we have a complete history of managerial ownership. We observe the same positive association between Tobin's q and the ownership wedge - the more ownership fell after the IPO to period *t*-1, the higher firm value in year *t*.

The economic magnitude in Columns 1 to 3 can be gauged as follows. A decrease of managerial ownership from 30% to 10% is associated with an increase in Tobin's q by approximately 4%. The effect for IPO firms is about twice as large. Taken at face value, these results run counter to decades of agency research: Reducing managerial ownership and thus the alignment of incentives between managers and shareholders is associated with increases in firm value. Instead, we argue, and will show in the next sections, that a more plausible interpretation of the result is that liquidity and performance drive both Tobin's q and managerial ownership.

7. Managerial ownership and liquidity

We now turn to hypothesis 3 that managerial ownership is lower for firms with more past liquidity. In this Section, we use both panel data evidence on our entire sample to show that there is a robust relation between the liquidity history of firms and decreases in managerial ownership (Section 7.1) and a more focused approach that permits us to make progress towards a causal interpretation, but for which the external validity is more limited (Section 7.2). In that section, we focus on two events that led to exogenous changes in liquidity to show that increases in liquidity indeed cause decreases in managerial ownership.

7.1. Managerial ownership and past stock liquidity

Table 6 shows regression results from regressions of managerial ownership on the liquidity history of sample firms. The key dependent variable is the fraction of years that a company spent in the high liquidity bracket, where high liquidity means top quartile of the annual liquidity distribution. We use both the Amihud measure of liquidity (Columns 1 through 4) and the FHT measure (Columns 5 through 8). Uneven columns show results using the adjusted Fama-MacBeth methodology, and even columns show

OLS regressions with clustered standard errors. We choose the same control variables as Himmelberg, Hubbard, and Palia (1999) in their "determinants of managerial ownership" regressions.

The table shows a remarkable asymmetry. Firms with a history of high liquidity have statistically significantly lower managerial ownership, independent of the liquidity measure or the estimation method. The economic significance is large: Firms that were every year in the top liquidity quartile have managerial ownership levels between 10.7% (Column 5) and 12.5% (Column 1) lower than firms that never had a year in the top liquidity quartile. Firms with a history of low liquidity have much higher managerial ownership, across all measures and econometric methods. The economic effect is even larger: Firms that were every year of their history in the bottom liquidity quartile have between 11.2% and 19.2% more managerial ownership than firms that never had a year in the bottom liquidity quartile.

We followed Himmelberg, Hubbard, and Palia (1999) in the choice of control variables to make our results comparable to the literature, and to reduce concerns related to data mining. However, several variables have been shown by the subsequent literature to affect managerial ownership. In unreported regressions, we therefore also include the natural log of market value of equity instead of log of sales as a control for size, since we know that past stock market performance is a driver of decreases in ownership (e.g., Jenter (2005) or Fahlenbrach and Stulz (2009)). Indeed, we find that the log of market value has a strongly statistically negative effect on managerial ownership, which is persistent across all specifications. Importantly, the coefficients for liquidity are quantitatively and qualitatively similar to those reported in Table 6. In an additional unreported robustness regression, we control for the natural logarithm of the age of the firm because younger firms have higher managerial ownership (e.g., Helwege, Pirinsky, and Stulz (2007)) and managerial ownership decreases more quickly for younger firms. Indeed, firm age has a strongly significantly negative effect on managerial ownership. Yet, including firm age does not change the conclusions we draw from Table 6 with respect to the liquidity history. The coefficients on the liquidity history variables stay economically similar and remain statistically strongly significant.

7.2. Towards a causal interpretation of increases in liquidity to decreases in managerial ownership

We now exploit two changes in capital markets that affected liquidity but had no obvious effect on managerial ownership except through their indirect impact via liquidity. In Section 7.2.1, we use changes to the market structure on Nasdaq in 1997, and in Section 7.2.2, we use the introduction of decimalization on the main US stock exchanges in 2001.

7.2.1. Nasdaq market reforms

Several papers have argued that competition on Nasdaq in the 1990s was weaker due to structural differences or possibly tacit collusion compared to NYSE or Amex (e.g., Christie and Schultz (1994), Godek (1996), or Huang and Stoll (1996)). As a reaction, the Securities and Exchange Commission (SEC) imposed multiple changes to the rules governing trading on Nasdaq in 1997. Bessembinder (1999) shows that the difference in trading execution costs between NASDAQ and NYSE/AMEX listed firms is smaller post-reform. In a difference-in-differences setting, we study whether increased stock liquidity brought about by the Nasdaq market reforms of 1997 led to a drop in managerial ownership in Nasdaq-listed firms compared to NYSE- and Amex-listed firms.

A detailed description of these rules (Nasdaq market reforms of 1997 from hereon) can be found, for instance, in Barclay et al. (1999) or Weston (2000). The SEC's new order-handling rules, which were implemented in multiple phases starting in January 20, 1997 and ending in October 13, 1997, constituted a substantial part of the reform. The year of implementation of the Nasdaq market reforms also coincides with the year of implementation of the Sixteenths Minimum Increment Rule, which reduced the quotation increments from eighths to sixteenths. The Sixteenths Minimum Increment Rule was implemented within a very short time frame on all stock exchanges and therefore affects all firms in our sample. Based on the rules' implementation schedule provided in, for instance, He (2013), we find it difficult to determine which of the rules caused the largest liquidity improvement and we therefore set the year 1997 to be the treatment year.[10]

[10] Amex, NYSE, and Nasdaq adopted the reform on May 7, 1997, June 24, 1997, and June 2, 1997, respectively.

In our analysis, we follow the diff-in-diff methodology implemented by Barrot (2016). We use a seven-year window centered on the trading reform event. We control for firms' initial characteristics in 1994, three years prior to the reform. The control variables include the log of assets, book leverage, inverse stock price, sales growth, systematic risk, dividend yield, past returns, return volatility, and a dummy variable indicating whether a firm belongs to the S&P 500 index. We estimate the following difference-in-differences specification:

$$\text{Ownership}_{i,t} = \alpha_1 + \alpha_2 \text{Post} \times \text{Treated}_i + \alpha_3 \text{Post} \times X_i + \eta_t + \delta_i + \varepsilon_{i,t} \quad (3)$$

where $\text{Ownership}_{i,t}$ is the managerial ownership in year t for firm i, Post is a dummy variable set to one in 1997 and the years following the implementation of the reform and zero otherwise, Treated_i is an indicator variable indicating whether firm i belongs to the treatment or the control group, X_i is a vector of firm-level control variables, η_t and δ_i are year- and firm-fixed effects, respectively, and $\varepsilon_{i,t}$ is an error term.[11]

Table 7 presents the results. Column 1 shows that Nasdaq firms had approximately 1.5% lower managerial ownership in the three years after the Nasdaq market reforms than firms listed on the other exchanges. Because Nasdaq-listed firms and other firms may have different characteristics that could have an impact on managerial ownership, we include interactions of initial characteristics with the post-reform indicator variable in Column 2 of the table. Including these characteristics reduces the number of observations and thus the statistical significance of the effect is reduced to a 5% significance level. The economic effect remains large and is virtually unchanged at -1.4%. Finally, Column 4 examines the effect on the treated companies in the three years surrounding the reform. We find that, reassuringly, there is no reaction of ownership in the year prior to the reform. Firms react to the reform in the year after it was passed.

7.2.2. Decimalization

[11] The direct effects of Treated_i and Post are subsumed by the firm- and year-fixed effects and hence are not shown in Equation (3).

We now use the shift from a fractional pricing system to the decimal pricing system as an exogenous shock to stock liquidity, in a similar setup as the one used in the previous section. Prior to its full implementation in April 2001, the U.S. equity markets used fractions as pricing increments with $1/16 being the minimum tick size. We study decimalization on three major stock exchanges: NYSE, Amex, and Nasdaq. The exchanges opted for a phased-in approach that led to several different event dates depending on the stocks' inclusion in the pilot programs. To ensure that we use the correct event date in our analysis, we collect the names and tickers of the Amex, NYSE and Nasdaq stocks that were part of the decimal pilot programs from newspaper articles and press releases during the period. On August 28, 2000, decimal pricing began in six NYSE-listed stocks with seven associated securities and six Amex-listed stocks with an identical number of associated securities. On September 25, 2000, decimal pricing expanded to 52 NYSE-listed companies with 57 associated securities and 38 Amex-listed companies with 46 associated securities. On Dec 4, 2000, NYSE further expanded the pilot list with an additional 94 securities. On January 29, 2001, all remaining non-pilot securities listed on the NYSE and Amex were converted to decimals. On Nasdaq, stocks were phased into decimal pricing in pilot programs during the first quarter of 2001. The initial decimal pilot program on Nasdaq began on March 12, 2001 and consisted of 15 securities. It was followed by a second pilot containing 177 listed companies with 199 associated securities on March 26, 2001. The remaining non-pilot Nasdaq securities underwent decimalization on April 9, 2001. We match the securities' tickers to CRSP PERMNO numbers. To verify the accuracy of our ticker-PERMNO matches, we manually check company names for all pilot securities.[12]

We wish to study whether increased stock liquidity brought about by the change of the minimum price increment led to a bigger drop in managerial ownership in firms with a larger increase in liquidity than those with a smaller increase in liquidity. To do so, we need to assign stocks to treatment and control groups. Based on the findings of Bessembinder (2003), Furfine (2003) and Chakravarty, Wood, and van Hess (2004) who show that the largest percentage reductions in average quoted spreads before and after decimalization are for more actively traded large capitalization stocks, we sort firms into terciles based

[12] The list of company names, tickers, and PERMNO numbers is available upon request.

on their market capitalization in 1998, the first year of the pre-decimalization period in our sample. We assign companies in the top (bottom) market capitalization tercile to the treatment (control) group, and again use a seven-year window centered on the decimalization event.[13] We control for firms' initial characteristics in 1998, three years prior to the reform. We define the Post indicator variable to be equal to one in the second month following the implementation of the reform and zero otherwise. We introduce the lag of one month to allow for some time between the decimalization and the record date. Because of the phased-in approach, the Post indicator variable differs across stocks and exchanges.

Table 8 shows results. We do not observe a drop in managerial ownership in all years post reform (Column 1). However, we see from Column 2 that managerial ownership of treated firms drops by a meaningful 1.4% in the year of decimalization. We also observe a drop in managerial ownership in the period *t+1* which is likely driven by the fact that 63.9% of our firm-year observations have a record date in the months of January to March and thus that there was very little time for managerial ownership to respond to the increases in liquidity in year *t*. In Columns 3 and 4, we repeat the analysis with an alternative sample. During the decimalization period, there were many young IPO firms with high ownership that did poorly and eventually disappeared in the post-internet bubble period, and we want to reduce concerns that these firms drive our results. We hence implement a filter and only use firms with a market capitalization of more than $100 million before we calculate terciles, and re-estimate our regressions. Columns 3 and 4 show results that are similar to those using all firms. We do not observe a drop in managerial ownership across all post-reform years, but managerial ownership drops in year *t* and year *t*+1 thus providing supporting evidence that increased liquidity leads to lower managerial ownership.

8. Cumulative past performance, liquidity and Tobin's q

We now test the final hypotheses 4a and 4b, that cumulative past performance can explain both current liquidity and current Tobin's q. To that end, we use the measures of cumulative performance based on sales growth and ROA defined in Section 2. A given firm-year observation is categorized as

[13] Norli, Ostergaard, and Schindele (2015) employ a similar sorting method, based on the same arguments.

high performance (low performance) if the value is in the top (bottom) quartile relative to the entire CRSP-Compustat universe of firms in a given year. We then create a normalized measure of performance history by counting how many years each firm has experienced in a high performance state and dividing by the number of years of firm-year observations. Section 8.1 examines the effect of cumulative past performance on liquidity, and Section 8.2 measures its effect on Tobin's q.

8.1. Cumulative past performance and liquidity

Table 9, Panel A shows results when we use sales growth as a performance measure, and Panel B shows results when we use ROA. The dependent variable in Columns 1 to 4 is the Amihud measure of illiquidity, and the dependent variable in Columns 5 through 8 is the FHT measure. Recall that an increase in both measures means less liquidity or, alternatively, more illiquidity. The even columns show results for OLS regressions, and the uneven columns show results for adjusted Fama-MacBeth regressions.

We learn from Columns 1 and 2 of Panels A and B that high cumulative past performance has large and important effects on liquidity. A company that had high past performance is much more liquid according to the Amihud measure. The economic effect is large, and larger for the sales growth measure than the ROA measure. In Panel A, a one standard deviation increase in the normalized high sales growth measure is associated with a 0.132 standard deviation decrease in Amihud illiquidity. In Panel B, a one standard deviation increase in the normalized ROA measure is associated with a 0.041 standard deviation decrease in Amihud illiquidity. We learn from the control variables that larger firms and firms with high past stock returns all have higher liquidity. We find similarly strong effects of cumulative past performance for the FHT measure. The more years a company spent among the top quartile performers, the higher is its liquidity today. The economic magnitude is similar. For example, in Column 6 of Panel A, a one standard deviation increase in the normalized high sales growth variable is associated with a 0.072 decrease in standard deviation for the FHT illiquidity measure.

We also estimate regressions with the normalized cumulative poor performance metric. In Panel A, we find very symmetric effects. Companies that suffered from persistently low sales growth in the past

have higher illiquidity today, with large economic magnitudes. The effects are present for both of our measures of illiquidity. In Panel B, we observe an asymmetry. Columns 3 and 4 suggest that companies that have a history of poor ROA actually have less illiquid stocks than other companies. Because the result is somewhat counterintuitive, we explore it further. First, when we just estimate a regression of illiquidity on the normalized low performance years, we find a very strong and positive coefficient. Second, poor cumulative past performance is highly correlated with the inverse price and leverage, which raises the issue of collinearity. Regarding the FHT measure and normalized low ROA, the effect is inconclusive.

Finally, the positive relation between high past performance and liquidity is very robust. In unreported robustness tests, we also use the logarithm of market value of equity instead of the logarithm of total assets to control for the size of the company. The conclusions regarding our central hypothesis are unchanged: firms with cumulative good past performance have higher liquidity today. Similarly, controlling for the age of the company (logarithm of years since first listing) does not change our conclusion that cumulative past performance improves liquidity.

Overall, we learn from Table 9 that high cumulative past performance measured either by sales growth or ROA has economically large effects on current liquidity.

8.2. Cumulative past performance and Tobin's q

We have shown so far that firms with higher past sales growth have higher liquidity, and that firms with higher liquidity have lower managerial ownership. We now estimate a regression of Tobin's q on characteristics that include cumulative past sales growth to test hypothesis 4b. Hypothesis 4b predicts that firms with more years of high sales growth have higher Tobin's q. Table 10 includes the normalized sales growth measure of high cumulative past performance in the Tobin's q regressions. All regressions include the same Himmelberg, Hubbard, and Palia (1999) controls as Table 2 but we do not report them for brevity.

Table 10, Panel A shows the adjusted Fama-MacBeth regressions. Panel B shows the panel regressions. We report specifications for all firms and for the 500 largest firms. Across both specifications, we observe a strong, positive effect of normalized past high sales growth on Tobin's q. The effects are larger for all firms; a one standard deviation increase in normalized high sales growth is associated with an increase in Tobin's q of 0.157 (Column 1 of Panel A). For the 500 largest sample firms, we find that a one standard deviation increase in normalized high sales growth is associated with an increase in Tobin's q of 0.090 (Column 2 of Panel A). The results of Panel B for the panel regressions are very similar in magnitude and significance. Overall, past operating performance is strongly associated with current Tobin's q.[14]

9. Conclusion

The hump-shaped relation between firm value and managerial ownership has drawn considerable attention in the corporate finance literature. In this paper, we show that the concave relation between Tobin's q and managerial ownership documented in the literature does not hold for larger samples that include a greater number of smaller firms. For our large dataset, the relation between Tobin's q and managerial ownership is reliably negative. However, for the subset of the largest firms, our estimates are similar to those found in Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) even though our sample period does not overlap with the years studied in these earlier papers.

We show that these seemingly contradictory results can be reconciled by taking the frictions caused by stock illiquidity seriously. It is expensive for insiders to adjust their holdings in firms whose shares trade in an illiquid market. These frictions are unimportant for the largest firms, but they become a first-order consideration for small firms. In illiquid firms, insiders typically hold more shares than they would like because it is costly for them to reduce their stake without incurring a significant price impact. It follows that managerial ownership is higher in illiquid firms. Furthermore, we show that illiquid firms

[14] In unreported additional regressions, we show that using ROA instead of sales growth leads to qualitatively and quantitatively similar conclusions.

are more likely to be firms with poor past performance, and poor past performance is strongly associated with a low Tobin's q. Consequently, illiquid firms are more likely to be low Tobin's q firms with high managerial ownership. For these illiquid firms, the negative relationship between Tobin's q and high managerial ownership reflects information about the past, not the future.

Overall, we find support for the predictions associated with the view that the relation between Tobin's q and managerial ownership is affected by frictions that affect the cost of trading. It is only for firms where frictions have been unimportant in past years that the observed relationship between firm value and managerial ownership is positive and concave. Our evidence suggests that frictions that impede adjustments in managerial ownership have to be taken seriously in theories of firm value and managerial ownership.

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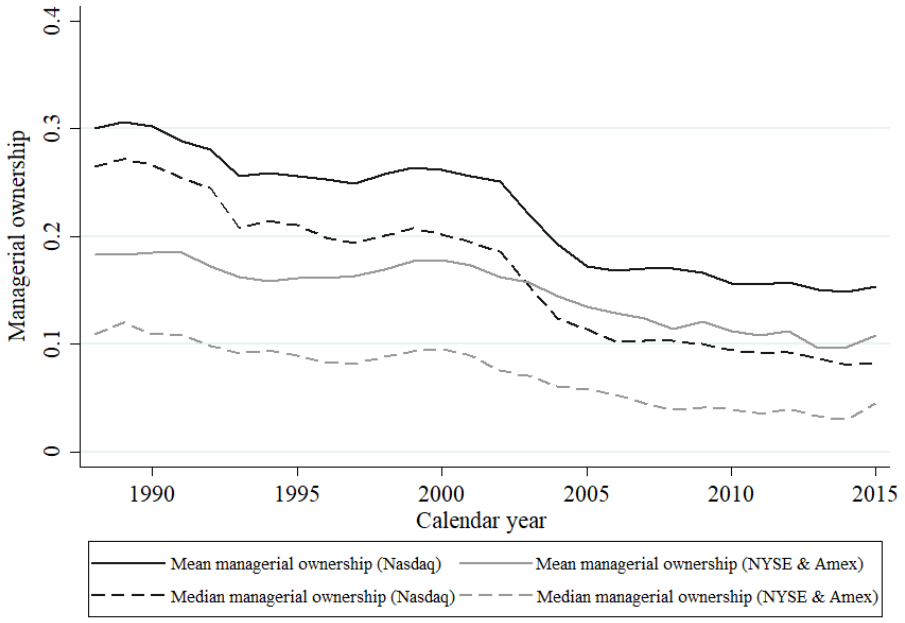

Figure 1: Managerial ownership of stocks traded on NYSE & Amex vs. Nasdaq over the period 1988-2015. The solid (dashed) black line represents yearly managerial ownership averages (medians) of firms traded on Nasdaq. The solid (dashed) gray line represents yearly managerial ownership averages (medians) of firms traded on NYSE & Amex.

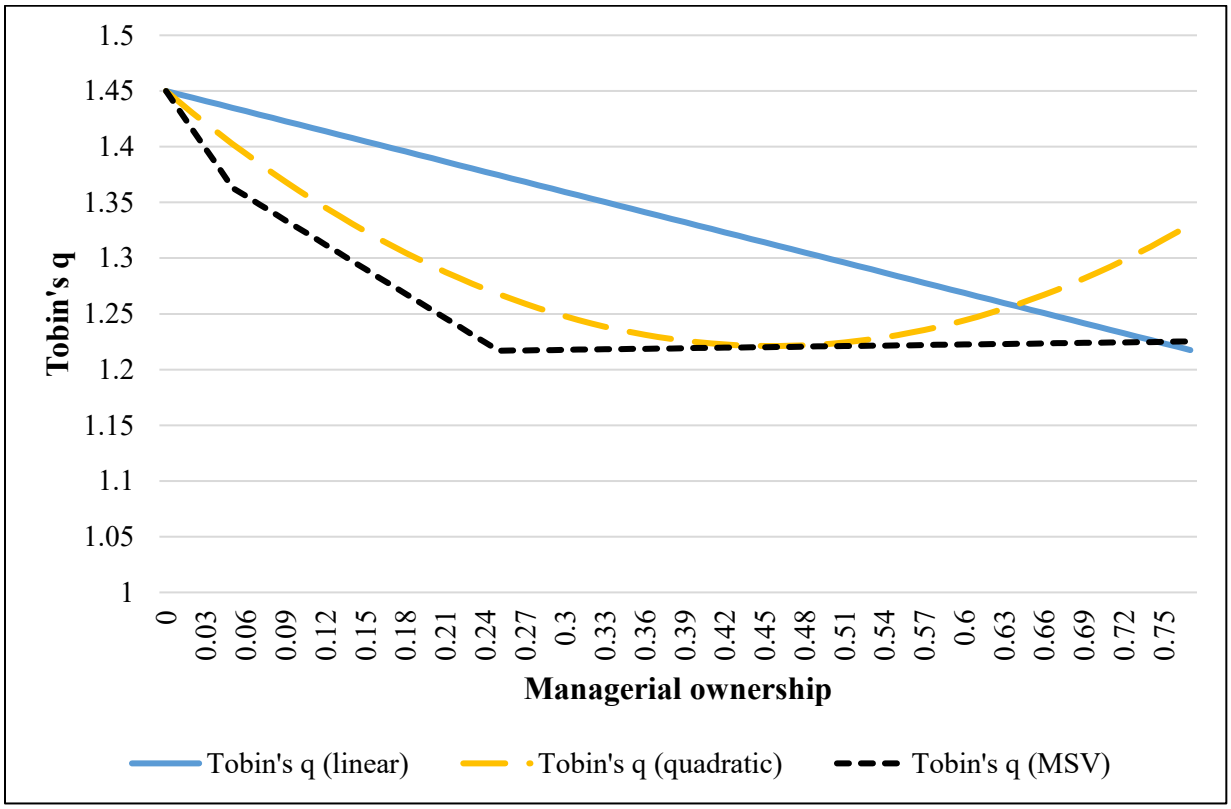

Figure 2: The relation between Tobin's q and managerial ownership under different specifications for all sample firms. The sample consists of 49,972 firm-year observations between 1988 and 2015.

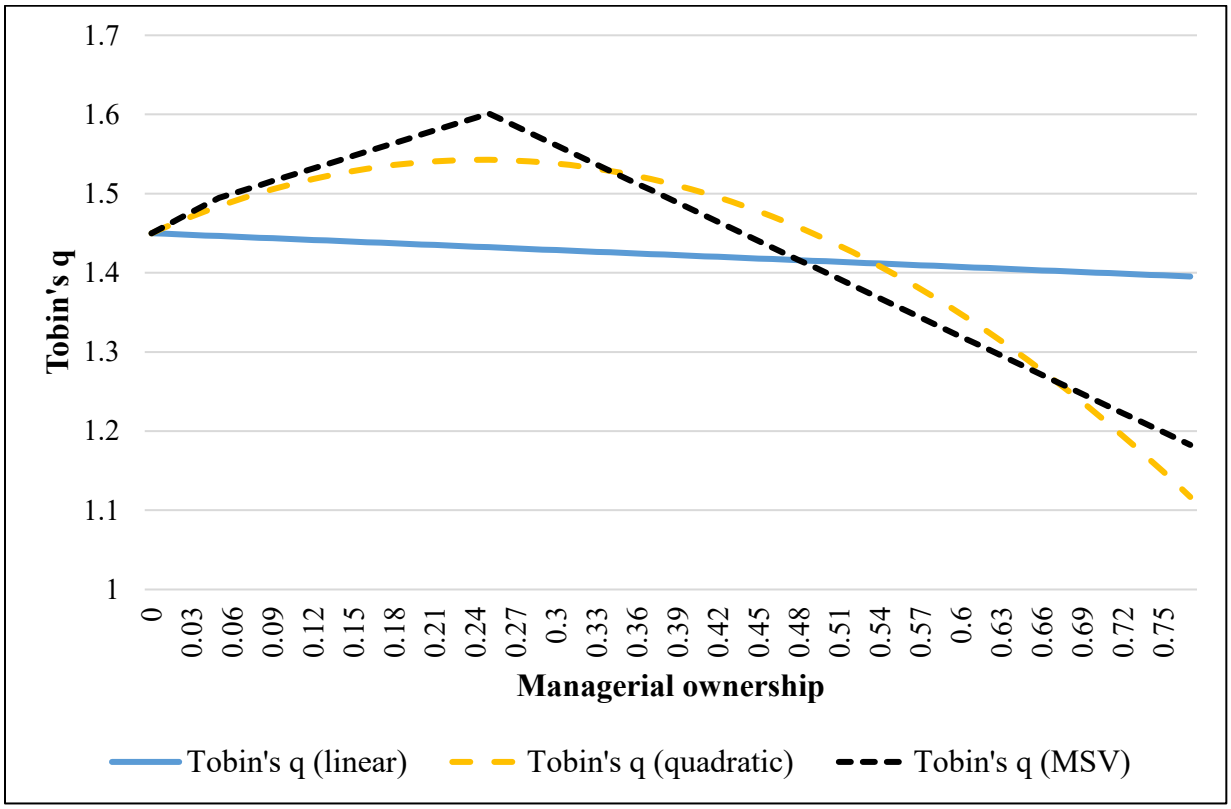

Figure 3: The relation between Tobin's q and managerial ownership under different specifications for the 500 largest firms by total sales. The sample consists of 12,632 firm-year observations between 1988 and 2015.

Appendix A: Variable descriptions

Variable	Description and Compustat variable names
Himmelberg, Hubbard, and Palia (1998) control variables	
LN(S)	The logarithm of total sales – *log(sale).*
$(LN(S))^2$	The square of LN(S).
K/S	The ratio of property, plant, and equipment to sales – *ppent/sale.*
$(K/S)^2$	The square of K/S.
Y/S	The ratio of operating income to sales – *ebitda/sale.*
(R&D)/K	The ratio of research and development expenditures to the stock of property, plant, and equipment – *xrd/ppent.*
RDUM	An indicator variable equal to one if R&D data are available, and zero otherwise.
A/K	The ratio of advertising expenditures to the stock of property, plant, and equipment – *xad/ppent.*
ADUM	An indicator variable equal to one if advertising expenditures data are available, and zero otherwise.
I/K	The ratio of capital expenditures to the stock of property, plant, and equipment – *capex/ppent.*
SIGMA	The standard deviation of idiosyncratic stock price risk, calculated as the standard error of the residuals from a CAPM model estimated each year using daily data.
SIGDUM	An indicator variable equal to one if the data required to estimated SIGMA are available, and zero otherwise (if SIGMA is missing).
Other variables	
Age	The number of years a firm is in the CRSP database.
Amihud illiquidity measure	For each stock i in year y the measure is defined as $\text{Amihud}_{iy} = \frac{1}{D_{iy}} \sum_{t=1}^{D_{iy}} \frac{\lvert R_{it} \rvert}{VOLD_{it}}$, where D_{iy} is the number of days for which data are available for stock i in year y, R_{it} is the return on stock i on day t, and $VOLD_{it}$ is the respective daily dollar volume.
Book leverage	The ratio of debt (total debt in current liabilities plus total long-term debt) to total book assets – *(dlc + dltt)/at*.
Dividend yield	The annual dividend yield – *dvc/prcc_f.*
D&O Ownership	The level of director and officer ownership as of the record date.
FHT illiquidity measure	For each stock i in year y, the measure is defined as $\text{FHT}_{iy} = 2\sigma N^{-1}\left(\frac{1+z}{2}\right)$, where σ is the return volatility, $N^{-1}()$ is the inverse function of the cumulative normal distribution, and z is the empirically observed frequency of a zero return day. The empirically observed frequency of a zero return is computed as $z = \frac{ZRD}{TD}$, where ZRD is the number of zero returns days, TD is the total number of trading days (zero and non-zero returns days) in a given stock-year.
Inverse price	One divided by the year-end stock price – *1/prcc_f.*
Log(book value of assets)	The logarithm of total book assets – *log(at).*
Nasdaq indicator	An indicator variable equal to one if the firm is traded on the Nasdaq exchange as of the year end according to CRSP, and zero otherwise.
Normalized high (low) liquidity years [Amihud]	The ratio of the accumulated high liquidity years since 1963 to the number of years in the CRSP universe. A given firm-year observation is categorized as "high (low) liquidity" if the value of its Amihud measure is in the bottom (top) quartile of the respective illiquidity measure relative to the entire CRSP universe of firms in a given year.
Normalized high (low) liquidity years [FHT]	The ratio of the accumulated high liquidity years since 1963 to the number of years in the CRSP universe. A given firm-year observation is categorized as "high (low) liquidity" if the value of its FHT measure is in the bottom (top) quartile of the respective illiquidity measure relative to the entire CRSP universe of firms in a given year.

Normalized high (low) performance years [ROA]	The ratio of the accumulated high (low) performance years since 1963 to the number of years in the CRSP-Compustat universe. A given firm-year observation is categorized as "high (low) performance" if its ROA is in the top (bottom) quartile relative to the entire CRSP-Compustat universe of firms in a given year.
Normalized high (low) performance years [sales growth]	The ratio of the accumulated high (low) performance years since 1963 to the number of years in the CRSP-Compustat universe. A given firm-year observation is categorized as "high (low) performance" if its sales growth is in the top (bottom) quartile relative to the entire CRSP-Compustat universe of firms in a given year.
Ownership 0% to 5%	= managerial ownership if managerial ownership < 0.05 = 0.05 if managerial ownership ≥ 0.05.
Ownership 5% to 25%	= 0 if managerial ownership < 0.05, = managerial ownership minus 0.05 if 0.05 ≤ managerial ownership < 0.25, = 0.20 if managerial ownership ≥ 0.25.
Ownership over 25%	= 0 if managerial ownership < 0.25, = managerial ownership minus 0.25 if managerial ownership ≥ 0.25.
Ownership wedge	The difference between the initial managerial ownership (ownership observation reported in the year of an IPO or the first ownership observation for a firm in our sample) and the managerial ownership lagged by one period.
Return on assets (ROA)	The ratio of profits before extraordinary items plus interest expense to total assets – $(ib + xint)/at$.
Sales growth	Sales growth – $[sale_t - sale_{t-1}]/sale_{t-1}$.
Stock return	The annual stock return calculated using monthly data from CRSP.
Systematic risk	Rolling five-year window estimates of betas using monthly stock returns and the value-weighted market returns.
S&P 500 indicator	An indicator variable equal to one if the firm is in the S&P 500 as of the year end, and zero otherwise.
Tobin's q	The ratio of market assets to book assets – $(csho \times prcc\_f + at - ceq - txdb)/at$.
Total q	The ratio of firm value to the sum of physical and intangible capital – $(csho \times prcc\_f + dltt + dlc - act)/(K^{int} + ppegt)$. A detailed description of the intangible capital measure, K^{int}, can be found in Peters and Taylor (2017).
Volatility of monthly stock	The standard deviation of stock returns using monthly data on stock returns from CRSP over the previous 48 months (excluding firm-year observations with less than 24 months of prior return data)

Appendix B

Appendix B is organized as follows. In Section B.1, we describe the parsing algorithm used to construct our data set. Our algorithm designed to identify dual class firms is described in Section B.2. In Section B.3, we describe the algorithm that extracts the record date from documents we parse.

B.1. Description of the managerial ownership algorithm

For the period 2004-2016, we download and parse all proxy and information statements from the U.S. Securities and Exchange Commission's (SEC) EDGAR (Electronic Data Gathering, Analysis, and Retrieval system) website. We identify patterns in the beneficial ownership section disclosure that allow us to use regular expressions to capture the director and officer (D&O) ownership percentage. In Table B.1, we provide a description of the 23 different filings that we parse. Every company registered under Section 12 of the Securities Exchange Act of 1934 is required to file its proxy statement with the SEC prior to an annual or special shareholder meeting. The filing that represents the most common source of ownership information in our final sample (accounting for 88.54% of firm-year observations resulting from our algorithm) is the final proxy statement abbreviated as "Form DEF 14A". "DEF" stands for "definitive" and "14A" refers to the fact that proxy statements are filed pursuant to Section 14(a) of the Securities Exchange Act of 1934. In Table B.2, we provide absolute and relative frequencies of the above-mentioned filings to illustrate their representation in our sample. In cases where management does not solicit proxies in connection with an annual or special shareholder meeting, a company may satisfy the Section 14 requirements by filing an information statement with the SEC and mailing it to shareholders ("Form DEF 14C"). Schedule 14C thus serves to inform shareholders of an approval already obtained and corporate actions that are imminent. We therefore parse information statements as well.

We first look for patterns in the D&O ownership disclosure in proxy and information statements and recognize that the most common formulation that occurs in the beneficial ownership table is a variation of *"All directors and officers as a group"* followed by the total number of shares and the overall percentage owned by the company's insiders. We first require our algorithm to find the beneficial ownership section

in each filing. We specify the most common names under which the section occurs such as “Beneficial ownership”, “Amount and nature of beneficial ownership”, “Stock ownership”, “Common stock ownership”, “Ownership of securities”, “Security ownership of management”, “Total shares”, etc. Below, we provide a simplified example of a beneficial ownership table.

OWNERSHIP OF SECURITIES

Beneficial Owner Name	Shares Beneficially Owned	Percentage of Shares Beneficially Owned
…	…	…
All current executive officers and directors as a group (11 persons) (14)	37,185,231	28.0%

Source: https://www.sec.gov/Archives/edgar/data/1318605/000119312515142116/d909857ddef14a.htm, accessed March 28, 2018.

Since the disclosure is not standardized, we account for as many variations of the D&O ownership disclosure as possible. We design a total of 66 non-redundant regular expressions many of which are aimed to address the most common special cases. We discuss and illustrate some of them in the following.

1. We account for typos, capitalized words, additional words, simplifications, and many other versions of the key formulation.

All directors and executive	5,224,210 (8)	4,110,946	50,000	1,063,264	54.4%

Source: https://www.sec.gov/Archives/edgar/data/1019272/000114420416103763/v440418_def14a.htm, accessed March 28, 2018.

Additional examples include: “All directors and named executive officers”, “Total Continuing Directors & Executive Officers”, “Total of all directors, nominees for director, named executive

officers and other executive officers of the Company as a group", "All directors and executives", "All of our Directors and Officers as a Group of seven (7) persons", "Total as a group", etc.

2. Whenever directors and officers together as group own less than one percent of the outstanding stock, the ownership percentage is often substituted by a footnote. In such cases, we directly set the ownership to be zero percent if we cannot extract the number of shares held by directors and officers.

All directors and executive officers as a group (13 persons)	1,253,341(5)	(*)

* *Less than 1%*

Source: https://www.sec.gov/Archives/edgar/data/4127/000104746915003292/a2224006zdef14a.htm, accessed March 28, 2018.

All Directors and Executive Officers as a Group (19 Persons)	935,186(16)	*

* *Less than one percent of the outstanding shares.*

Source: https://www.sec.gov/Archives/edgar/data/54480/000119312516530157/d128505ddef14a.htm, accessed March 28, 2018.

3. We also adjust the algorithm to deal with D&O ownership percentages without leading zeros or with additional text.

All directors and executive officers of the Company as a group (20 persons)	235,319	.19% or less

Source: https://www.sec.gov/Archives/edgar/data/3673/000104746903003330/a2101107zdef14a.htm, accessed March 28, 2018.

4. For companies that do not report the final ownership percentage, we collect the number of shares owned by directors and officers which we divide by the number of shares outstanding as of the record date to arrive at the D&O ownership in percentage terms.

All directors and executive officers as a group (6 persons)[10]	73,112,212,703	4,727,984[11]

Source: https://www.sec.gov/Archives/edgar/data/4127/000104746915003292/a2224006zdef14a.htm, accessed March 28, 2018.

5. We adapt our algorithm for cases in which the 5% stockholders section is combined with the director and executive officer section in one table, such as in the example presented below. We direct the algorithm to skip the "All 5% stockholders as a group" line and to proceed to the next occurrence of the regular expression in the table.

5% Stockholders, Directors and Officers	Shares Beneficially Owned(1)	Percentage Beneficially Owned(1)(2)
5% Stockholders		
…	…	…
All 5% stockholders as a group	13,580,409	52.7
Directors and Named Officers		
…	…	…
All directors and named executive officers as a group (11 persons)(16)	10,878,422	42.2

Source: https://www.sec.gov/Archives/edgar/data/1002225/000104746910003844/a2198026zdef14a.htm, accessed March 28, 2018.

6. We similarly adapt our algorithm to skip sections that could be misclassified as beneficial ownership sections, but contain information about option grants instead. In the example below, the weighted average exercise price could be mistaken for D&O ownership percentage if the algorithm was designed to look for numbers following the "as a group" keyword without any refinements.

Therefore, we always screen the beneficial ownership table identified by the algorithm for words such as “grant date”, ”exercise price” or “expiration date” or “options granted”, etc. and exclude such sections from further consideration.

Name	Number of Shares Underlying Options	Weighted Average Exercise Price of Options	Number of Shares Underlying Restricted Stock Awards
…	…	…	…
All Executive Officers as a Group (8 people)	440,820	$ 13.13	597,844

Source: https://www.sec.gov/Archives/edgar/data/1267201/000095012310035584/v55201dedef14a.htm, accessed March 28, 2018.

Below, we provide several examples of our algorithm. The algorithm (written in Python) is available upon request.

```
regular_expression1 =
'All(,)?\s{0,3}\w{0,10}(,)?\s{0,3}(((D|d)irector(s)?)|((O|o)fficer(s)?))\s{0,3}(,)?\s{0,3}\w{0,10}(,)?\s{0,3}(and)?\s{0,3}(other)?\s{0,3}\w{0,10}(,)?\s{0,3}((E|e)xecutive)?\s{0,3}((((D|d)irector(s)?)|((O|o)fficer(s)?)))?\s{0,3}\w{0,10}(,)?\s{0,3}(A|a)s\s{0,3}(a)?\s{0,3}\w{0,10}(,)?\s{0,3}(G|g)roup\s{0,3}(:)?\s{0,3}(persons)?\s{0,3}\w{0,10}\s{0,3}\(\d+\s{0,3}(((P|p)erson(s)?)|((P|p)eople)|((I|i)ndividual(s)?)).{0,50}\)\s{0,3}\W{0,3}\w{0,3}\W{0,3}\s{0,3}((\d{1,3},)?(\d{1,3})(,\d{3})\s{0,3}){1,6}\s{0,3}((\d{1,2}(\.)?)\d+(%)?)?'


regular_expression2 =
'(((O|o)fficer(s)?)|((D|d)irector(s)?)|((N|n)ominee(s)?))\s{0,3}\/\s{0,3}(((O|o)fficer(s)?)|((D|d)irector(s)?)|((N|n)ominee(s)?))\s{0,3}\/\s{0,3}(((O|o)fficer(s)?)|((D|d)irector(s)?)|((N|n)ominee(s)?))\s{0,3}(A|a)s\s{0,3}(a)?\s{0,3}\w{0,10}(,)?\s{0,3}(G|g)roup\s{0,3}(persons)?\s{0,3}(:)\?s{0,3}\w{0,10}\s{0,3}(\(\d+\s{0,3}(((P|p)erson(s)?)|((P|p)eople)|((I|i)ndividual(s)?)).{0,50}\))?\s{0,3}\W{0,3}\w{0,3}\W{0,3}\s{0,3}((\d{1,3},)?(\d{1,3})(,\d{3})\s{0,3}){1,6}\s{0,3}((\d{1,2}(\.)?)\d+(%)?)?'
```

B.2. Description of the dual class algorithm

To identify firms with a dual class structure, we look for patterns in proxy materials and information statements. We look for terms such as "Class A Common and Class B Common", "Class A Common Stock and Common Stock", "Class A Common Shares and Common Voting Shares", and several other terms indicative of a firm's dual class status. We design regular expressions in Python such as:

rgx = '(C|c)lass\s{0,3}A\s{0,3}(C|c)ommon\s{0,3}(S|s)hares\s{0,3}and\s{0,3}(C|c)ommon \s{0,3}(V|v)oting\s{0,3}(S|s)hares' .

To avoid false matches, we require regular expressions to be matched at least five times across the whole document outside of footnotes. The reason for this restriction is to avoid false matches in cases where the proxy statement describes insider's holding in an affiliated company that itself has a dual class structure. We also make use of the voting structure. We include regular expressions based on the most common voting structure 1:10, but we also account for other voting rights proportions. An example of a regular expression follows below.

rgx = '(one tenth|Two|Three|Four|Five|Six|Seven|Eight|Nine|Ten|Eleven|Twelve|Thirteen|Fourteen| Fifteen|Sixteen|Seventeen|Eighteen|Nineteen|Twenty|Thirty|Forty|Fifty|Sixty|Seventy|Eighty|Ninety|t wo|three|four|five|six|seven|eight|nine|ten|eleven|twelve|thirteen|fourteen|fifteen|sixteen|seventeen|ei ghteen|nineteen|twenty|thirty|forty|fifty|sixty|seventy|eighty|ninety)\s{0,3}(\(\d+\))?\s{0,3}(of\s{0,3}a\ s{0,3})?(V|v)ote(s)?.{0,500}(O|o)ne\s{0,3}(\(\d+\))?\s{0,3}(V|v)ote(s)?'

We also come across a handful of firms that specify voting as a decimal number such as "0.08 vote per share" and account for this possibility in our set of final regular expressions.

rgx = '(((\d{1,2}\.)(\d+))|(\d{1,2}\s{0,2}))\s{0,3}(V|v)ote(s)?'

Our final algorithm contains five distinct groups of regular expressions and is available upon request.

B.3. Description of the record date algorithm

We develop an algorithm able to extract the record date from companies' proxy materials and information statements, because the record date is not available from standard databases. We use a total of 12 regular expressions and below, we present one of them as an example.

rgx = 'as of the record date,\s{0,2}(January|February|March|April|May|June|July|August|September|October|November|December)\s{0,2}\d+\s{0,2}(,)?\s{0,2}\d{4}' .

Table B.1: List of SEC forms parsed

The table describes SEC forms used to extract the managerial ownership information.

Definitive materials (proxy materials)

- DEF 14A: Definitive proxy statements
- DEFA14A: Definitive additional proxy soliciting materials including Rule 14(a)(12) material
- DEFC14A: Definitive proxy statement in connection with contested solicitations
- DEFN14A: Definitive proxy statement filed by non-management
- DEFM14A: Definitive proxy statement relating to a merger, acquisition, or disposition
- DEFR14A: Definitive revised proxy soliciting materials
- DFAN14A:Definitive additional proxy soliciting materials filed by non-management including Rule 14(a)(12) material
- DFRN14A: Revised definitive proxy statement filed by non-management

Definitive materials (information statements)

- DEF 14C: Definitive information statements
- DEFA14C: Definitive additional information statement materials including Rule 14(a)(12) material
- DEFC14C: Definitive information statement - contested solicitations
- DEFM14C: Definitive information statement relating to merger or acquisition
- DEFR14C: Definitive revised information statement materials

Preliminary proxy soliciting materials

- PRE 14A: Preliminary proxy statement not related to a contested matter or merger/acquisition
- PREC14A: Preliminary proxy statement in connection with contested solicitations
- PREM14A: Preliminary proxy statement relating to a merger, acquisition, or disposition
- PREN14A: Preliminary proxy statement filed by non-management

Preliminary information statements

- PRE 14C: Preliminary information statement not related to a contested matter or merger/acquisition
- PREC14C: Preliminary information statements - contested solicitations
- PREM14C: Preliminary information statements relating to merger or acquisition

Revised preliminary materials

- PRER14A: Preliminary revised proxy soliciting materials
- PRER14C: Preliminary revised information statements
- PRRN14A: Revised preliminary proxy statement filed by non-management

Table B.2: SEC forms as sources of the managerial ownership data

The table reports the source of managerial ownership data obtained from the parsing process.

	Abs. frequency	Rel. frequency (in %)
DEF 14A	21,759	88.54
DEF 14C	43	0.17
DEFA14A	48	0.20
DEFC14A	8	0.03
DEFM14A	164	0.67
DEFM14C	2	0.01
DEFN14A	1	0.00
DEFR14A	96	0.39
DFRN14A	1	0.00
PRE 14A	1,849	7.52
PRE 14C	34	0.14
PREC14A	58	0.24
PREM14A	256	1.04
PREM14C	12	0.05
PREN14A	2	0.01
PRER14A	121	0.49
PRER14C	5	0.02
PRRN14A	11	0.04
Other forms	106	0.43
Total	24,576	100

Table 1: Summary statistics by calendar year

The table reports the annual means and medians of the key variables used in the study. Tobin's q is defined as the ratio of the market value of assets to the book value of the assets, where the market value is calculated as the sum of the book value of assets and the market value of common stock less the book value of common stock and deferred taxes. Managerial ownership is defined as the sum of director and officer ownership stakes as reported in the proxy material of corporations. The Amihud and FHT illiquidity measures are defined in Section 2. Age is equal to the number of years a firm is in the CRSP database. N is the number of observations.

	Tobin's q			Managerial ownership			Amihud			FHT			Age		
Year	N	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median
1988	1,448	1.52	1.23	1,579	0.25	0.20	1,545	2.29	0.65	1,579	3.28	2.76	1,579	13.19	13.00
1989	1,547	1.43	1.13	1,650	0.25	0.21	1,604	2.10	0.48	1,647	3.14	2.46	1,650	13.46	12.00
1990	1,537	1.65	1.20	1,612	0.25	0.20	1,555	2.40	0.64	1,611	3.33	2.68	1,612	13.85	11.00
1991	1,616	1.70	1.29	1,688	0.24	0.19	1,619	2.31	0.51	1,688	3.30	2.63	1,688	14.45	12.00
1992	1,613	1.81	1.40	1,728	0.23	0.18	1,683	2.18	0.38	1,728	3.08	2.44	1,728	15.12	12.00
1993	1,696	1.73	1.37	1,856	0.21	0.16	1,828	1.78	0.24	1,856	2.74	2.17	1,856	14.97	12.00
1994	1,839	1.91	1.45	2,044	0.22	0.16	2,010	1.74	0.24	2,044	2.65	2.08	2,044	14.64	12.00
1995	1,885	1.95	1.50	2,096	0.22	0.16	2,080	1.61	0.17	2,096	2.54	1.92	2,096	13.77	10.00
1996	1,712	1.99	1.55	1,926	0.22	0.15	1,915	1.39	0.12	1,926	2.36	1.75	1,926	13.19	10.00
1997	1,862	1.88	1.39	2,126	0.22	0.15	2,112	1.28	0.10	2,126	2.10	1.46	2,126	13.28	10.00
1998	2,157	2.09	1.34	2,506	0.23	0.16	2,493	1.24	0.10	2,506	1.92	1.28	2,506	13.44	9.00
1999	2,273	1.97	1.27	2,605	0.23	0.17	2,598	1.34	0.11	2,605	1.99	1.30	2,605	13.80	9.00
2000	2,139	1.80	1.30	2,464	0.23	0.16	2,461	1.36	0.10	2,464	1.91	1.27	2,464	14.28	10.00
2001	2,091	1.59	1.25	2,291	0.23	0.15	2,278	1.67	0.10	2,291	1.28	0.64	2,291	14.75	10.00
2002	2,320	2.14	1.60	2,549	0.22	0.15	2,489	1.64	0.10	2,505	0.88	0.39	2,515	13.90	10.00
2003	2,532	2.21	1.73	2,772	0.20	0.12	2,668	1.18	0.05	2,679	0.62	0.26	2,718	15.10	11.00
2004	2,151	2.18	1.72	2,336	0.18	0.11	2,226	0.56	0.02	2,230	0.38	0.18	2,277	15.31	11.00
2005	2,002	2.21	1.78	2,175	0.16	0.10	2,080	0.38	0.01	2,084	0.33	0.15	2,129	15.48	12.00
2006	1,929	2.16	1.71	2,154	0.16	0.09	2,054	0.36	0.01	2,056	0.28	0.13	2,105	15.67	12.00
2007	1,900	1.57	1.23	2,101	0.15	0.08	2,006	0.30	0.01	2,007	0.26	0.12	2,063	16.01	13.00
2008	1,777	1.75	1.37	1,960	0.15	0.08	1,926	0.78	0.02	1,928	0.42	0.15	1,940	16.90	14.00
2009	1,709	1.97	1.49	1,907	0.15	0.08	1,844	0.95	0.02	1,845	0.49	0.18	1,883	17.57	14.00
2010	1,682	1.83	1.42	1,873	0.14	0.07	1,813	0.56	0.01	1,813	0.31	0.13	1,842	18.17	15.00
2011	1,616	1.85	1.43	1,795	0.14	0.07	1,760	0.49	0.01	1,760	0.26	0.11	1,777	18.87	16.00
2012	1,590	2.22	1.67	1,771	0.14	0.07	1,719	0.55	0.01	1,719	0.26	0.11	1,747	19.22	16.00
2013	1,608	2.23	1.71	1,790	0.14	0.06	1,702	0.46	0.00	1,702	0.24	0.09	1,749	19.54	17.00
2014	1,631	2.08	1.61	1,835	0.13	0.06	1,767	0.25	0.00	1,768	0.19	0.08	1,804	19.48	17.00
2015	1,512	2.14	1.65	1,714	0.14	0.06	1,664	0.35	0.00	1,664	0.21	0.08	1,686	19.21	17.00
Full sample	51,374	1.93	1.45	56,903	0.20	0.12	55,499	1.18	0.05	55,927	1.43	0.58	56,406	15.47	12.00

Table 2: Firm value (Tobin's q) and managerial ownership

The table reports estimates of adjusted Fama-MacBeth and OLS regressions of Tobin's q on managerial ownership and additional control variables used by Himmelberg, Hubbard, and Palia (1999) over the period 1988-2015. Piecewise linear ordinary least squares regressions use the breakpoints of Morck, Schleifer, and Vishny (1988). All specifications include Fama-French 49 industry indicators and year fixed effects. Panel A shows results from adjusted Fama-MacBeth regressions, and Panel B shows results from OLS regressions. The *t*-statistics in Panel B (reported in parentheses) are computed using standard errors robust to both clustering at the firm level and heteroscedasticity. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

Panel A: Fama-MacBeth regressions

	All firms			500 largest firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Ownership	-0.302***		-1.005***	-0.071		0.757***
	(-5.70)		(-6.84)	(-0.79)		(2.99)
Ownership^2			1.103***			-1.545***
			(5.14)			(-3.29)
Ownership 0% to 5%		-1.738**			0.892**	
		(-2.48)			(2.28)	
Ownership 5% to 25%		-0.731***			0.533**	
		(-6.12)			(2.11)	
Ownership over 25%		0.016			-0.805***	
		(0.18)			(-3.08)	
LN(S)	-0.074	-0.073	-0.078*	0.284**	0.295**	0.298**
	(-1.69)	(-1.68)	(-1.80)	(2.34)	(2.48)	(2.49)
$(LN(S))^2$	0.006*	0.005	0.006*	-0.014*	-0.014*	-0.015**
	(1.83)	(1.57)	(1.71)	(-2.00)	(-2.03)	(-2.05)
K/S	-0.241***	-0.249***	-0.248***	-1.276***	-1.270***	-1.272***
	(-6.29)	(-6.60)	(-6.57)	(-12.15)	(-12.12)	(-12.16)
$(K/S)^2$	0.041***	0.043***	0.042***	0.169***	0.170***	0.169***
	(4.66)	(4.96)	(4.87)	(6.27)	(6.45)	(6.38)
Y/S	-0.086	-0.086	-0.085	5.369***	5.379***	5.388***
	(-1.62)	(-1.60)	(-1.61)	(9.53)	(9.62)	(9.62)
(RD)/K	0.097***	0.097***	0.097***	0.454***	0.451***	0.452***
	(6.80)	(6.77)	(6.77)	(4.77)	(4.74)	(4.79)
RDUM	0.190***	0.187***	0.188***	0.094***	0.103***	0.101***
	(10.32)	(10.20)	(10.28)	(7.92)	(8.46)	(8.22)
A/K	0.077**	0.077**	0.076**	0.050	0.064	0.063
	(2.40)	(2.41)	(2.39)	(0.47)	(0.61)	(0.59)
ADUM	0.042**	0.042**	0.043**	0.075***	0.072***	0.074***
	(2.39)	(2.38)	(2.44)	(2.91)	(2.78)	(2.82)
I/K	15.878***	15.903***	15.911***	545.274***	539.699***	540.775***
	(8.65)	(8.73)	(8.72)	(4.04)	(3.98)	(4.01)
SIGMA	-9.141***	-9.232***	-9.240***	-7.743***	-7.598***	-7.532***
	(-10.70)	(-11.02)	(-10.98)	(-3.52)	(-3.39)	(-3.36)
SIGDUM	0.139**	0.141**	0.141**	0.074*	0.075*	0.074*
	(2.51)	(2.54)	(2.53)	(1.76)	(1.77)	(1.74)
Observations	49,972	49,972	49,972	12,632	12,632	12,632
R-squared	0.23	0.23	0.23	0.46	0.46	0.46
Year FE	No	No	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 2 (continued)

Panel B: OLS regressions

	All firms			500 largest firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Ownership	-0.388***		-0.967***	-0.129		0.359
	(-5.81)		(-4.58)	(-1.01)		(0.99)
Ownership^2			0.884***			-0.889
			(3.05)			(-1.59)
Ownership 0% to 5%		-1.383			-0.559	
		(-1.49)			(-0.47)	
Ownership 5% to 25%		-0.774***			0.514	
		(-3.89)			(1.38)	
Ownership over 25%		-0.130			-0.673***	
		(-1.20)			(-2.64)	
LN(S)	-0.108***	-0.107***	-0.110***	0.438**	0.464**	0.451**
	(-2.83)	(-2.76)	(-2.89)	(2.33)	(2.46)	(2.39)
$(LN(S))^2$	0.009***	0.008***	0.008***	-0.025**	-0.026**	-0.025**
	(2.97)	(2.59)	(2.79)	(-2.18)	(-2.30)	(-2.22)
K/S	-0.249***	-0.256***	-0.255***	-1.076***	-1.075***	-1.072***
	(-4.72)	(-4.85)	(-4.84)	(-6.61)	(-6.67)	(-6.58)
$(K/S)^2$	0.038***	0.039***	0.039***	0.195***	0.196***	0.195***
	(2.89)	(2.99)	(2.97)	(5.09)	(5.14)	(5.08)
Y/S	-0.139***	-0.139***	-0.138***	3.286***	3.290***	3.298***
	(-4.13)	(-4.16)	(-4.13)	(5.22)	(5.20)	(5.21)
(RD)/K	0.066***	0.066***	0.066***	0.260***	0.258***	0.259***
	(7.65)	(7.61)	(7.60)	(3.69)	(3.65)	(3.67)
RDUM	0.186***	0.184***	0.184***	0.089**	0.091**	0.091**
	(6.51)	(6.44)	(6.45)	(2.15)	(2.19)	(2.20)
A/K	0.086*	0.085*	0.085*	0.140	0.140	0.142
	(1.96)	(1.94)	(1.95)	(1.01)	(1.01)	(1.03)
ADUM	0.042	0.043	0.043	0.076	0.078	0.077
	(1.42)	(1.45)	(1.44)	(1.55)	(1.59)	(1.57)
I/K	14.542***	14.518***	14.519***	191.078***	188.478***	190.182***
	(10.76)	(10.75)	(10.74)	(4.22)	(4.16)	(4.20)
SIGMA	-8.165***	-8.253***	-8.265***	-5.910***	-5.713***	-5.756***
	(-13.53)	(-13.68)	(-13.70)	(-3.28)	(-3.15)	(-3.16)
SIGDUM	0.234***	0.238***	0.239***	-0.012	-0.017	-0.015
	(3.59)	(3.64)	(3.65)	(-0.09)	(-0.13)	(-0.11)
Observations	49,972	49,972	49,972	12,632	12,632	12,632
R-squared	0.20	0.20	0.20	0.30	0.30	0.30
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: Firm value (Tobin's q) and managerial ownership – additional results

The table reports estimates of OLS regressions of Tobin's q on managerial ownership and additional control variables used by Himmelberg, Hubbard, and Palia (1999) over the period 1988-2015. The first column reproduces results of the baseline specification in Table 2, Panel A, Column 3. The baseline specification includes industry and year fixed effects, and standard errors robust to both clustering at the firm level and heteroscedasticity. In comparison to the first column, the standard errors in Column 2 are clustered by firm and year. In Column 3, year- and industry fixed effects are replaced by industry x year fixed effects. Column 4 shows the results of a median regression, and Column 5 reports the results of an estimation in which the dependent variable is the natural logarithm of Tobin's q. Columns 6 and 7 show the results of estimation in which the dependent variable is the Total q defined as in Peters and Taylor (2017). The *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

	Tobin's q				LN(Tobin's q)	Total q	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ownership	-0.967***	-0.967***	-0.962***	-0.576***	-0.477***	-0.797*	-0.460***
	(-4.58)	(-4.44)	(-4.51)	(-11.11)	(-5.58)	(-1.94)	(-3.98)
Ownership^2	0.884***	0.884***	0.918***	0.475***	0.428***	0.514	
	(3.05)	(3.10)	(3.14)	(6.95)	(3.58)	(0.93)	
LN(S)	-0.110***	-0.110**	-0.093**	-0.027**	-0.031**	-0.273***	-0.271***
	(-2.89)	(-2.54)	(-2.41)	(-2.53)	(-1.99)	(-3.91)	(-3.90)
(LN(S))^2	0.008***	0.008**	0.007**	0.004***	0.003***	0.016***	0.016***
	(2.79)	(2.37)	(2.28)	(4.61)	(2.63)	(3.14)	(3.17)
K/S	-0.255***	-0.255***	-0.249***	-0.169***	-0.133***	-0.210**	-0.207**
	(-4.84)	(-4.53)	(-4.66)	(-11.83)	(-5.74)	(-2.28)	(-2.25)
(K/S)^2	0.039***	0.039***	0.040***	0.024***	0.021***	0.045**	0.045**
	(2.97)	(2.96)	(3.02)	(6.15)	(3.50)	(2.09)	(2.07)
Y /S	-0.138***	-0.138***	-0.157***	-0.052***	-0.046***	0.315***	0.315***
	(-4.13)	(-3.76)	(-4.56)	(-3.25)	(-4.12)	(6.18)	(6.17)
(R&D)/K	0.066***	0.066***	0.070***	0.074***	0.024***	0.015	0.015
	(7.60)	(5.69)	(7.88)	(15.21)	(8.36)	(1.24)	(1.26)
RDUM	0.184***	0.184***	0.195***	0.086***	0.090***	0.062	0.063
	(6.45)	(5.96)	(6.79)	(11.60)	(7.09)	(1.31)	(1.35)
A/K	0.085*	0.085*	0.080*	0.036***	0.029*	0.299**	0.300**
	(1.95)	(1.87)	(1.84)	(3.69)	(1.79)	(2.53)	(2.53)
ADUM	0.043	0.043	0.049	0.047***	0.023*	-0.055	-0.055
	(1.44)	(1.34)	(1.62)	(5.78)	(1.95)	(-1.16)	(-1.16)
I/K	14.519***	14.519***	14.786***	9.048***	5.768***	6.401***	6.415***
	(10.74)	(8.75)	(10.82)	(15.12)	(12.25)	(2.61)	(2.62)
SIGMA	-8.265***	-8.265***	-8.772***	-4.835***	-4.003***	-16.677***	-16.618***
	(-13.70)	(-10.00)	(-13.92)	(-32.82)	(-16.37)	(-15.29)	(-15.35)
SIGDUM	0.239***	0.239***	0.249***	0.129***	0.115***	0.461***	0.458***
	(3.65)	(3.01)	(3.74)	(6.23)	(4.41)	(5.03)	(5.01)
Inflection point	54.7	54.7	52.4	60.6	55.8	77.5	-
Observations	49,972	49,972	49,972	49,972	49,972	50,662	50,662
Year FE	Yes	Yes	No	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	No	Yes	Yes	Yes	Yes
Industry x Year FE	No	No	Yes	No	No	No	No
Double-clustered SE	No	Yes	No	No	No	No	No

Table 4: Firm value (Tobin's q) and managerial ownership conditioning on past liquidity

The table reports estimates of adjusted Fama-MacBeth and OLS regressions of Tobin's q on managerial ownership, its squared term and additional control variables used by Himmelberg, Hubbard, and Palia (1999) over the period 1988-2015 when conditioning on liquidity history. All specifications include Fama-French 49 industry indicators. The panel regressions include year fixed effects and standard errors robust to both clustering at the firm level and heteroscedasticity. The *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

	Fama-MacBeth regressions				OLS regressions			
	High liquidity		Low liquidity		High liquidity		Low liquidity	
	Amihud	FHT	Amihud	FHT	Amihud	FHT	Amihud	FHT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ownership	1.219***	0.325	-0.636***	-1.249***	0.918*	0.120	-0.640**	-1.233***
	(4.39)	(1.51)	(-3.39)	(-4.89)	(1.70)	(0.24)	(-2.14)	(-3.38)
$Ownership^2$	-1.062**	-0.591	0.667**	1.147***	-0.680	-0.481	0.617	0.986**
	(-2.14)	(-1.57)	(2.72)	(3.71)	(-0.71)	(-0.55)	(1.64)	(2.21)
LN(S)	-0.492***	-0.195*	-0.248***	-0.228***	-0.649***	-0.260	-0.291***	-0.275***
	(-3.35)	(-1.87)	(-4.66)	(-3.83)	(-4.55)	(-1.58)	(-3.63)	(-2.68)
$(LN(S))^2$	0.028***	0.011	0.028***	0.023***	0.035***	0.014	0.032***	0.028**
	(3.04)	(1.54)	(4.39)	(3.66)	(3.90)	(1.31)	(3.71)	(2.34)
K/S	-0.755***	-0.824***	-0.271***	-0.179	-0.735***	-0.707***	-0.258***	-0.231**
	(-10.57)	(-10.62)	(-3.36)	(-1.60)	(-6.24)	(-6.12)	(-3.23)	(-2.32)
$(K/S)^2$	0.154***	0.161***	0.054**	0.027	0.145***	0.150***	0.041**	0.029
	(8.68)	(5.68)	(2.72)	(1.05)	(4.93)	(4.79)	(2.02)	(1.19)
Y /S	1.102***	2.000***	-0.261***	-0.478***	0.599***	0.821***	-0.236***	-0.331***
	(4.72)	(4.78)	(-2.92)	(-4.49)	(5.52)	(5.67)	(-4.46)	(-6.16)
(R&D)/K	0.066*	0.191**	0.062***	0.119***	0.045	0.080***	0.066***	0.074***
	(1.98)	(2.62)	(4.22)	(4.51)	(1.53)	(2.66)	(4.89)	(6.14)
RDUM	0.138***	0.222***	0.115***	0.132***	0.134**	0.227***	0.118***	0.154***
	(6.92)	(7.89)	(4.78)	(6.57)	(2.34)	(4.12)	(3.08)	(3.43)
A/K	-0.052	-0.043	0.131*	0.094	0.054	0.025	0.108*	0.148**
	(-0.66)	(-0.57)	(1.93)	(1.53)	(0.49)	(0.20)	(1.68)	(2.08)
ADUM	0.162***	0.169***	-0.089***	-0.123***	0.132**	0.158***	-0.069*	-0.100**
	(4.89)	(5.24)	(-3.18)	(-3.54)	(2.24)	(2.64)	(-1.80)	(-2.21)
I/K	350.915**	210.675***	14.527***	13.886***	42.401**	130.305***	13.185***	12.907***
	(2.75)	(5.70)	(8.17)	(8.01)	(2.11)	(3.04)	(7.70)	(8.23)
SIGMA	-20.040***	-12.845***	-4.191***	-5.491***	-15.273***	-8.433***	-3.465***	-4.301***
	(-10.57)	(-5.52)	(-3.73)	(-5.28)	(-8.49)	(-4.61)	(-5.21)	(-4.88)
SIGDUM	0.232***	0.168**	0.055	0.075*	0.351**	0.147	0.069	0.108
	(2.97)	(2.72)	(1.21)	(1.91)	(2.29)	(0.86)	(0.69)	(0.96)
Observations	13,521	13,758	11,493	10,702	13,521	13,758	11,493	10,702
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: The effect of the ownership wedge on Tobin's q

The table reports estimates of OLS regressions of Tobin's q on the ownership wedge and additional control variables used by Himmelberg, Hubbard, and Palia (1999). The ownership wedge in Columns 1-3 is defined as the difference between initial managerial ownership (first ownership observation for a firm) and the managerial ownership lagged by one period. The ownership wedge in columns 7 and 8 is defined as the difference between initial managerial ownership (ownership observation reported in the year of an IPO) and the managerial ownership lagged by one period. In both cases, a positive value for the wedge corresponds to a decrease in managerial ownership over time. The regressions include industry and year fixed effects and standard errors robust to both clustering at the firm level and heteroscedasticity. The *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

	All proxy statements			First post-IPO proxy statement
	All firms	Young firms	Mature firms	All firms
Ownership wedge	0.337***	0.355***	0.350***	0.543**
	(3.41)	(2.67)	(2.87)	(2.32)
LN(S)	-0.05	-0.159**	0.004	0.341**
	(-1.16)	(-2.17)	(0.09)	(2.18)
$(LN(S))^2$	0.006*	0.012*	0.004	-0.037***
	(1.95)	(1.88)	(1.15)	(-3.09)
K/S	-0.232***	-0.194**	-0.287***	-0.210
	(-3.92)	(-2.36)	(-3.84)	(-1.33)
$(K/S)^2$	0.037**	0.011	0.061***	0.016
	(2.47)	(0.56)	(3.11)	(0.39)
Y /S	-0.143***	-0.162***	-0.086	-0.182**
	(-3.26)	(-3.05)	(-1.25)	(-2.05)
(R&D)/K	0.070***	0.050***	0.082***	0.041
	(6.95)	(3.84)	(5.59)	(1.48)
RDUM	0.202***	0.234***	0.176***	0.230**
	(6.46)	(5.15)	(4.90)	(2.12)
A/K	0.061	0.113*	-0.022	-0.177
	(1.27)	(1.88)	(-0.35)	(-1.53)
ADUM	0.039	-0.031	0.076*	-0.122
	(1.18)	(-0.65)	(1.92)	(-1.01)
I/K	14.491***	14.561***	12.518***	21.937**
	(8.63)	(7.26)	(5.20)	(2.32)
SIGMA	-8.517***	-12.013***	-7.281***	-11.560***
	(-12.53)	(-12.77)	(-8.20)	(-4.23)
SIGDUM	0.278***	0.465***	0.201**	0.320
	(3.88)	(3.85)	(2.31)	(1.62)
Observations	39,478	15,774	23,704	2,957
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 6: Managerial ownership and past stock liquidity

The table reports estimates of adjusted Fama-MacBeth and OLS regressions of managerial ownership on measures of past stock liquidity over the period 1988-2015. The dependent variable is the managerial ownership percentage. It is regressed against a measure of past liquidity (Amihud and FHT measure) and additional control variables used by Himmelberg, Hubbard, and Palia (1999). All specifications include Fama-French 49 industry indicators. The panel regressions include year fixed effects and standard errors robust to both clustering at the firm level and heteroscedasticity. The *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Normalized high liquidity years (Amihud)	-0.125***	-0.129***						
	(-20.28)	(-17.62)						
Normalized low liquidity years (Amihud)			0.192***	0.187***				
			(22.56)	(21.05)				
Normalized high liquidity years (FHT)					-0.107***	-0.115***		
					(-13.73)	(-13.34)		
Normalized low liquidity years (FHT)							0.112***	0.111***
							(10.03)	(12.41)
LN(S)	-0.035***	-0.034***	0.006	0.001	-0.038***	-0.036***	-0.012**	-0.017***
	(-10.06)	(-6.99)	(1.64)	(0.14)	(-12.85)	(-7.30)	(-2.75)	(-3.17)
$(LN(S))^2$	0.001***	0.001***	-0.003***	-0.002***	0.001***	0.001*	-0.002***	-0.002***
	(3.49)	(2.76)	(-9.67)	(-6.19)	(3.66)	(1.90)	(-4.96)	(-3.92)
K/S	-0.017***	-0.017**	-0.018***	-0.019**	-0.023***	-0.023***	-0.029***	-0.030***
	(-2.94)	(-2.03)	(-2.87)	(-2.28)	(-4.11)	(-2.70)	(-4.29)	(-3.50)
$(K/S)^2$	0.002	0.002	0.002*	0.003	0.003**	0.003	0.004***	0.005**
	(1.53)	(1.22)	(1.96)	(1.58)	(2.48)	(1.63)	(3.10)	(2.31)
Y /S	0.042***	0.027***	0.016***	0.013***	0.042***	0.027***	0.029***	0.023***
	(8.93)	(8.32)	(4.22)	(4.16)	(8.58)	(8.21)	(7.01)	(6.95)
R&D/K	-0.012***	-0.006***	-0.008***	-0.004***	-0.013***	-0.006***	-0.012***	-0.007***
	(-5.16)	(-5.90)	(-4.01)	(-4.74)	(-5.21)	(-6.40)	(-4.81)	(-6.86)
RDUM	-0.018***	-0.021***	-0.017***	-0.021***	-0.021***	-0.024***	-0.021***	-0.025***
	(-8.02)	(-4.28)	(-8.57)	(-4.42)	(-8.87)	(-4.89)	(-10.46)	(-5.01)
A/K	0.005	0.003	0.005*	0.004	0.004	0.002	0.002	0.001
	(1.60)	(0.66)	(2.03)	(0.72)	(1.21)	(0.36)	(0.77)	(0.17)
ADUM	0.007***	0.007*	0.006**	0.005	0.005**	0.004	0.005**	0.004
	(3.23)	(1.65)	(2.74)	(1.33)	(2.22)	(1.10)	(2.21)	(0.96)
I/K	0.332***	0.225*	-0.007	0.168	0.288***	0.193	0.016	-0.001
	(3.94)	(1.70)	(-0.10)	(1.34)	(3.55)	(1.48)	(0.18)	(-0.00)
SIGMA	1.132***	0.921***	0.584***	0.480***	0.911***	0.682***	0.650***	0.528***
	(12.75)	(9.22)	(5.15)	(4.83)	(8.84)	(6.79)	(4.94)	(5.27)
SIGDUM	-0.027***	-0.051***	-0.025***	-0.040***	-0.024***	-0.042***	-0.022***	-0.040***
	(-3.50)	(-6.29)	(-3.47)	(-5.02)	(-3.28)	(-5.13)	(-3.18)	(-4.85)
Observations	53,302	53,302	53,302	53,302	53,715	53,715	53,715	53,715
Estimation approach	FM	OLS	FM	OLS	FM	OLS	FM	OLS
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes

Table 7: Effect of the Nasdaq market reforms on managerial ownership

The table presents difference-in-differences estimates of the effect of the Nasdaq market reforms of 1997 on managerial ownership. *Post* is an indicator variable equal to one for the years 1997-2000 and zero otherwise. *Treated* is an indicator variable equal to one if the firm is listed on the Nasdaq stock exchange. The control group is composed of firms listed on the NYSE or the Amex stock exchange. Initial control variables are measured in 1994 and include the logarithm of book value of assets, book leverage, sales growth, inverse stock price, systematic risk, dividend yield, past returns, return volatility, and an indicator variable equal to one if the firm is in the S&P 500. All specifications include firm- and year fixed effects. The *t*-statistics (reported in parentheses) are computed using standard errors robust to both clustering at the firm level and heteroscedasticity. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

	D&O ownership		
	(1)	(2)	(3)
Treated x Post	-0.015***	-0.014**	
	(-3.35)	(-2.08)	
Treated x Year = *t* - 1			-0.003
			(-0.49)
Treated x Year = *t*			-0.005
			(-1.09)
Treated x Year = *t* + 1			-0.008*
			(-1.78)
Observations	15,639	6,985	6,985
Adjusted R^2	0.887	0.893	0.893
Post x Initial controls	No	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table 8: Effect of decimalization on managerial ownership

The table presents difference-in-differences estimates of the effect of the decimalization (2001) mandated by the Security and Exchange Commission (SEC) on managerial ownership. *Post* is an indicator variable equal to one in the three years following decimalization and zero otherwise. *Treated* is an indicator variable equal to one if the firm belongs to the highest tercile of firms when sorted by market capitalization in 1998. The control group is composed of firms belonging to the lowest tercile of firms when sorted by market capitalization in 1998. Initial control variables are measured in 1998 and include the logarithm of book value of assets, book leverage, sales growth, inverse stock price, systematic risk, dividend yield, past returns, return volatility, and an indicator variable equal to one if the firm is in the S&P 500. Columns 1 and 2 show results for all firms. Columns 3 and 4 restrict the sample to firms with a market capitalization of at least $100 million before the terciles are calculated. All specifications include firm and year fixed effects. The *t*-statistics (reported in parentheses) are computed using standard errors robust to both clustering at the firm level and heteroscedasticity. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

	D&O ownership			
	(1)	(2)	(3)	(4)
Treated x Post	-0.016		-0.005	
	(-1.03)		(-0.57)	
Treated x Year = *t* - 1		-0.007		-0.003
		(-1.35)		(-0.89)
Treated x Year = *t*		-0.014**		-0.011**
		(-2.34)		(-2.14)
Treated x Year = *t* + 1		-0.011*		-0.008*
		(-1.85)		(-1.73)
Observations	4,974	4,974	3,182	3,182
Adjusted R^2	0.883	0.883	0.908	0.909
Post x Initial controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 9: Liquidity and cumulative past performance

The table provides estimates of adjusted Fama-MacBeth and OLS regressions of stock liquidity on cumulative past performance proxied by sales growth in Panel A (ROA in Panel B) over the period 1988-2015. The respective liquidity measure is regressed against normalized number of years in a high performance state and additional control variables which include the logarithm of book value of assets, book leverage, inverse stock price, past returns, return volatility, and a dummy variable identifying firms listed on the Nasdaq. Except for the Nasdaq indicator, control variables are lagged by one year. The number of years in a high performance state is determined as the sum of the years a firm's performance is ranked in the top quartile in the CRSP-Compustat universe since 1963. All specifications include Fama-French 49 industry indicators. The panel regressions include year fixed effects and standard errors robust to both clustering at the firm level and heteroscedasticity. The *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

Panel A: Past performance as proxied by sales growth

	Amihud				FHT			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Normalized high performance years (sales growth)	-1.572***	-1.578***			-0.683***	-0.673***		
	(-6.85)	(-18.74)			(-4.64)	(-14.63)		
Normalized low performance years (sales growth)			1.477***	1.331***			1.017***	0.886***
			(6.72)	(10.65)			(4.59)	(13.57)
Log(book value of assets)	-0.526***	-0.530***	-0.513***	-0.522***	-0.308***	-0.320***	-0.295***	-0.310***
	(-9.31)	(-34.42)	(-9.60)	(-33.25)	(-4.85)	(-42.78)	(-4.90)	(-41.17)
Book leverage	1.323***	1.557***	1.342***	1.572***	0.938***	1.239***	0.933***	1.239***
	(7.05)	(16.18)	(7.22)	(16.22)	(4.24)	(22.90)	(4.25)	(22.91)
Inverse price	2.196***	2.289***	2.220***	2.301***	1.460***	1.587***	1.447***	1.573***
	(7.87)	(31.79)	(7.97)	(31.66)	(7.22)	(43.22)	(7.37)	(43.00)
Lagged return	-0.352***	-0.316***	-0.370***	-0.327***	-0.323***	-0.311***	-0.323***	-0.311***
	(-3.65)	(-24.22)	(-3.67)	(-24.90)	(-4.25)	(-40.28)	(-4.27)	(-40.48)
Volatility of monthly stock	-2.173***	-2.709***	-3.594***	-3.820***	1.873***	0.997***	1.162***	0.448***
	(-5.34)	(-10.91)	(-13.25)	(-15.01)	(3.55)	(7.48)	(2.99)	(3.33)
Nasdaq indicator	0.087	0.168***	0.064	0.116***	0.121*	0.230***	0.139*	0.222***
	(1.49)	(3.91)	(0.98)	(2.75)	(1.86)	(10.30)	(1.88)	(10.20)
Observations	50,652	50,652	50,652	50,652	51,046	51,046	51,046	51,046
Estimation approach	FM	OLS	FM	OLS	FM	OLS	FM	OLS
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes

Panel B: Past performance as proxied by return on assets (ROA):

	Amihud				FHT			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Normalized high performance years (ROA)	-0.331***	-0.356***			-0.403***	-0.412***		
	(-3.68)	(-5.82)			(-4.28)	(-11.64)		
Normalized low performance years (ROA)			-0.732***	-0.847***			0.240**	0.038
			(-7.99)	(-10.69)			(2.63)	(0.86)
Log(book value of assets)	-0.535***	-0.542***	-0.559***	-0.570***	-0.309***	-0.321***	-0.308***	-0.326***
	(-9.49)	(-33.81)	(-9.85)	(-35.13)	(-4.89)	(-41.32)	(-4.92)	(-42.11)
Book leverage	1.237***	1.476***	1.310***	1.520***	0.850***	1.170***	0.946***	1.230***
	(6.99)	(15.06)	(6.65)	(15.67)	(4.27)	(21.39)	(4.15)	(22.11)
Inverse price	2.329***	2.401***	2.426***	2.497***	1.488***	1.621***	1.499***	1.646***
	(8.38)	(32.01)	(8.76)	(33.85)	(7.36)	(42.16)	(7.28)	(42.60)
Lagged return	-0.395***	-0.353***	-0.421***	-0.376***	-0.333***	-0.321***	-0.339***	-0.329***
	(-3.72)	(-25.02)	(-3.89)	(-26.26)	(-4.26)	(-39.13)	(-4.25)	(-39.62)
Volatility of monthly stock	-3.513***	-3.792***	-2.413***	-2.519***	1.090***	0.368**	1.094***	0.657***
	(-11.13)	(-13.88)	(-8.95)	(-9.41)	(2.88)	(2.57)	(3.55)	(4.42)
Nasdaq indicator	0.007	0.080*	-0.005	0.071*	0.097	0.204***	0.090	0.198***
	(0.13)	(1.85)	(-0.12)	(1.67)	(1.49)	(9.07)	(1.42)	(8.81)
Observations	47,051	47,051	47,051	47,051	47,435	47,435	47,435	47,435
Estimation approach	FM	OLS	FM	OLS	FM	OLS	FM	OLS
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes

Table 10: Firm value (Tobin's q) and past performance

The table reports estimates of adjusted Fama-MacBeth and OLS regressions of Tobin's q on the normalized number of years of high past performance and additional control variables used by Himmelberg, Hubbard, and Palia (1999) (HHP control variables) over the period 1988-2015. The measure of normalized cumulative past performance is based on sales growth. Column 1 contains the estimates of the specification for the full sample. Column 2 contains the estimates of the specification for the subsample of the top 500 firms when ranked by sales. Panel A shows results from adjusted Fama-MacBeth regressions, while Panel B shows results from time-series and cross-sectional panel regressions. All specifications include Fama-French 49 industry indicators. The panel regressions include year fixed effects and standard errors robust to both clustering at the firm level and heteroscedasticity. The *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significance of the underlying coefficient at the 1%, 5%, and 10% levels, respectively.

Panel A: Fama-MacBeth regressions

	All firms	500 largest firms
Normalized high performance years (sales growth)	1.100***	0.497***
	(23.42)	(5.95)
Observations	48,528	12,458
HHP control variables	Yes	Yes
Year FE	No	No
Industry FE	Yes	Yes

Panel B: OLS regressions

	All firms	500 largest firms
Normalized high performance years (sales growth)	1.088***	0.525***
	(14.56)	(3.61)
Observations	48,528	12,458
HHP control variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes

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