Institutional Ownership and Corporate Takeovers

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Abstract

We study the role played by institutional investors in the U.S. takeover market. An increase in a firm's institutional ownership raises the likelihood that the firm receives a takeover bid, mainly driven by stock offers. We support the causal relationship using Russell index reconstitutions as the instrument. Our additional analysis shows that institutional investors help mitigate the information asymmetry between bidder and target firms, allowing target firms to accept a larger fraction of stock payment. The positive relationship between a target's institutional ownership and a stock-based offer is pronounced when information asymmetries associated with the bidder and the transaction are higher, suggesting that institutional investors act as an information conduit between the two parties. Moreover, the positive impact is stronger when the bidder's shares–the currency of the transaction–are correctly priced. Our evidence suggests that institutional investors play an important role in alleviating information asymmetry in takeover transactions and assessing the associated values.

Keywords: institutional ownership, mergers and acquisitions, payment methods, information asymmetry

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1. Introduction

A volume of research has investigated economic impacts of institutional ownership on corporate policies and outcomes. The central question in this line of literature is whether institutional money managers are an effective agent in policing and advising their portfolio firms on behalf of atomistic investors who own the firms either directly or indirectly. The issue has received increasing interest from both academic scholars and the media for several reasons. By now institutional investors hold over 50% of equity shares of the U.S. public firms (see, e.g., Grinstein and Michaely (2005)), implying that corporate ownership is effectively in the hand of these institutions. Moreover, with the rise of index strategies, recent years have seen an unprecedented increase in the ownership held by indexed funds (see, e.g., Appel et al. (2016); Schmidt and Fahlenbrach (2017)). Although institutional investors are often considered to be sophisticated investors and act as delegated monitors of firms (Jensen, 1993), it is arguably questionable whether indexed institutions actively process the information of thousands of firms in their portfolios.[1]

The debate in the extant literature on the effectiveness of institutional investors and indexed institutions in particular has persisted. Recent studies show that indexed institutions, albeit their passive strategies, have positive impacts on voluntary information disclosure by firm management (Boone and White, 2015), payout for firms with higher agency costs (Crane et al., 2016), and board independence (Appel et al., 2016). Aghion et al. (2013) similarly document a positive incremental role played by institutional investors

[1]Since their main objective is to minimize the tracking errors with respect to benchmark indices, index funds might not have strong incentives to monitor or advise their portfolio firms. Bebchuk and Hirst (2019) argue that indexed institutions, with highly diversified portfolios under their management, have very limited resources to interact with their portfolio firms, regardless of their ability or incentive to do so. For example, the "Big Three" asset managers (Blackrock, Vanguard, and State Street) are reported to hold over 17 thousand stocks globally, while the number of their stewardship personnel ranges from 11 to 33 (Bebchuk and Hirst (2019), Table 1).

in spurring innovation activities. On the contrary, Schmidt and Fahlenbrach (2017) find that an increase in indexed ownership leads to fewer independent directors and worse acquisition outcomes. Bebchuk et al. (2017) and Heath et al. (2019) similarly document a negative association between indexed ownership and the monitoring effectiveness. Appel et al. (2016), despite documenting positive effects on board independence, find little evidence as to indexed institutions' influence on corporate investment and cash-holding policies. Such mixed evidence suggests that institutions are likely to selectively engage in firms' policies, arguably when the engagement is less costly and the consequences are far-reaching. To assess whether institutional investors are an effective player in capital markets, it seems important to identify when they are incentivized to exert effort.

In this paper, we aim to offer a novel insight into this debate by studying institutional investors' role played in mergers and acquisitions (M&As). M&As provide an ideal empirical setting in assessing the corporate policy implications of institutional ownership, particularly for target firms. Although recent studies examine the role of institutional investors in corporate takeovers, their focus—unlike ours—is primarily on the acquirer side (Chen et al., 2007; Schmidt and Fahlenbrach, 2017). From the owners' perspective, an M&A decision carries different weights, depending on which side of the transaction they are involved in. Presumably, a takeover bid received gives rise to a strong incentive for institutional shareholders—or any shareholders—to process the information and act upon it.

Institutional shareholders of a target firm have reasons to engage in information production and play an advisory role. It is well-documented that institutions allocate their monitoring effort to a firm based proportionally on the relative importance of the firm's stock in their portfolio (Fich et al., 2015). Moreover, for the bidder shareholders, an

acquisition decision is analogous to evaluating one of investment projects; in contrast, the target shareholders' decision amounts to whether or not to transfer their entire ownership and the disposed ownership is irrevocable. Target shareholders sell their shares for immediate cash payments or exchange their shares for the shares of the acquiring firm and in both cases, the wealth effect is stronger for the target side. In addition, the legal setting in the U.S. similarly reflects the greater significance to target shareholders of M&A decisions.[2] Since the M&A negotiation process takes place behind closed doors, the influence on takeover deals of the target institutional shareholders and their underlying motivation are not observable.[3] We therefore examine how an increase in a firm's institutional ownership affects the likelihood that the firm receives a takeover bid and whether this effect varies across the level of information asymmetries associated with the transaction.

Using a U.S sample of 5,556 M&As from 1984–2018, we find that there is a positive association between the probability that a firm becomes an acquisition target and the increase in presence of institutional investors, especially quasi-indexed institutions.[4] Importantly, we show that the higher takeover probability following a change in institutional ownership is concentrated in the bids with stock offers. This relationship holds in both the entire panel of firms and the deal sample. We address endogeneity concerns

[2]In most states, the law requires that a takeover proposal be evaluated by the board and approved by shareholders. In contrast, submitting a bid is not subject to a shareholder approval unless the bidding firm chooses to issue new shares more than 20% of outstanding shares to finance its takeover transaction.

[3]The survey analysis of McCahery et al. (2016) find that there exists behind-the-scenes interventions of the long-term investors and the use of proxy advisors by most investors to improve their voting decisions. Additionally, active and passive funds are reported to have influence on corporate strategies of the holding firms based on their direct insight into the firm and connection with firm management (see Reuters `https://www.reuters.com/article/us-usa-companies-funds-analysis/mutual-funds-start-to-put-their-mouth-where-their-money-is-idUSKCN1QW1C8`).

[4]We begin our analysis with a sample consisting of U.S. public targets and U.S. public and private bidders, both from non-regulated industries. When we zoom into various deal-level tests that require the bidder characteristics, our sample size reduces to 3,236 M&A transactions that involve U.S. public bidders.

by exploiting exogenous variation in institutional ownership associated with Russell index annual reconstitutions. As Russell's index membership assignment relies only on the market capitalization of stocks, an event of Russell 1000/2000 membership switch is plausibly exogenous to firm characteristics and other confounding factors, conditional on the end-of-May market value (Russell, 2016).[5] This exogenous variation allows us to estimate the effect of institutional ownership using an instrumental variable (IV) estimation approach. Our IV results provide strong support to the causal interpretation of our main findings.

We further investigate the economic mechanism through which institutional owners affect the likelihood that a firm is being targeted. Prior literature on stock acquisitions has devoted great deal of attention to the problem of information asymmetry (see, e.g, Hansen (1987); Fishman (1989); Eckbo et al. (1990) for theoretical analyses of payment method under two-sided information asymmetry). In a recent study, Eckbo et al. (2018) show that the more informed about the bidder a target is, the higher is the fraction of stock in the deal payment. Our work complements theirs by showing a positive relationship between a target's institutional ownership and a stock-based offer is *pronounced when* information asymmetries associated with the bidder and the transaction are higher. Our evidence, in support of their rational payment hypothesis, suggests that institutional investors act as an information conduit between the two parties and help mitigate the information asymmetry problem. Our results are robust to different measures of information asymmetry including a composite proxy for bidder's information asymmetry (Karpoff et al., 2013), bidders' prior activities related to the use of stocks, and the proxies

[5]Prior studies have employed this approach to establish the causal effect of the institutional ownership (Crane et al., 2016) and specific types of institutional ownership (Appel et al., 2016; Schmidt and Fahlenbrach, 2017; Fich et al., 2015; Cremers et al., 2019) on various corporate outcomes.

of information asymmetry at the transaction level (Eckbo et al., 2018).

To further corroborate the notion that indexed institutions process the information of their portfolio firms being targeted and enable a stock-based offer more feasible, we examine whether the institutions have the ability to identify when bidders' shares—the means of the payment used—are misvalued. Our evidence shows that the fraction of the stock in the deal payment is not driven the misvaluation (bidder opportunism) where there is a greater presence of the target institutional shareholders. It instead indicates that the targets are more resilient to the overpriced stock offers following the change in institutional ownership. That is, the positive relationship between the change in institutional ownership and the fraction of stock in the deal payment is stronger when the bidder's shares are relatively correctly priced. Our results are robust to alternative proxies of misvaluation of bidder's shares, including the mispricing component measures developed by Rhodes-Kropf et al. (2005) and the short-selling interest for the bidders' shares before a deal announcement (Ben-David et al., 2015).

Overall, our results lend strong support to the notion that institutional shareholders act upon their acquisition of information and play an advisory role when profound corporate events like M&As take place. Consistent with the rational payment design argument, the deal-consideration structure suggests that such a role played by the institutions is needed the most when the asymmetric information problem is the greatest.

Our study extends the extant literature in two important ways. First, it contributes to the M&A literature on takeover probability, where the increasing ownership stake by institutional as a whole and quasi-index institutions have a significantly positive relation with a firm takeover probability (Ambrose and Megginson (1992); Song and Walkling (1993); Palepu (1986) among others). Second, our study complements the existing liter-

ature on the role played by institutional investors in assisting the portfolio firms where the firms are acquisition targets, and in pivotal events such as a takeover (Fich et al., 2015; Greenwood and Schor, 2009). In particular, our evidence sheds new light on the channels through which institutional investors exert their influence on the deal consideration, notably on stock-based bids where uncertainty exists due to information asymmetry between target and bidder firms and consequently the valuation of bidder shares (Eckbo et al., 2018). Our paper contributes to the line of literature about the method of payment under two-sided information asymmetry, where the bidder and target are asymmetrically informed about the true value of their respective shares.

The remainder of our paper proceeds as follows. Section 2 develops our hypotheses. Section 3 describes our data and the sample construction. Section 4 presents our baseline results on the effect of the change in target's institutional ownership on the takeover likelihood and the deal payment structure. Section 5 investigates the information channel and the misvaluation of bidder shares. Section 6 concludes. Appendix A provides the definition of all variables used in this study.

2. Hypothesis development

Institutional investors could improve firm transparency (Boone and White, 2015), improve firm public disclosure (Bird and Karolyi, 2016) and act as an information conduit between the target and the bidder firm. This facilitates higher probability of takeover bids. The increase in institutional ownership also means that a larger fraction of firm shares is in "neutral" hands as discussed in Song and Walkling (1993), thus higher takeover probability. The change in institutional ownership level can imply major changes in the firms. One of the most significant resulting changes is the change in firm entire

ownership structure through takeover.

Method of payment in M&A could shed a light on the behind-the-closed door involvement of these investors in major corporate decisions. Institutional investors on the target side have motivation to get involved with the deal structure because of the benefits derived from the takeover on their holdings in most cases (Fich et al., 2015). However, the exertion of effort towards portfolio firms is selective as these institutional investors operate based on the cost-benefit framework, especially index institutional investors whose objective is minimisation of management fees (Bebchuk et al., 2017; Appel et al., 2016; Schmidt and Fahlenbrach, 2017). In cash deals where the target shareholders are paid with relatively high certainty, it is difficult to examine whether the institutional investors exert effort in the deal negotiation process. In contrast, uncertainty associated with stock-deals or mixed deals is a great concern under information asymmetry(Eckbo et al., 1990; Schlingemann, 2004), where the target and bidder firms need to assess the ratio, type and value of stocks offered.Under this line of reasoning, institutional investors would exert most effort when their it is needed the most, i.e. in consideration of stock-bids. We hypothesize that there is positive association between the institutional investors in the target firms and the fraction of stock in the deal consideration.

Hypothesis 1: The increase in institutional ownership is positively correlated with takeover likelihood since the institutional investors act as an information conduit between the target and bidder firms. The positive effect is concentrated in stock deal probability.

There are two mutually exclusive implications of the positive association of institutional investors and the fraction of stock under information asymmetry. The rational payment hypothesis justifies the fraction of stock in the deal payment when bidder firms concern about the adverse selection of the target (Eckbo et al., 1990). If bidders are

subjected to negative market reaction to stock-offer under the information asymmetry, bidder announcement-induced abnormal stock returns are on average negative in all-stock offers (Emery and Switzer, 1999; Schlingemann, 2004). In Eckbo et al. (1990) separating equilibrium model under two-sided information asymmetry, target adverse selection pushes the bidder towards the use of higher fraction of stock, while target undervaluation of bidder shares pushes the bidder towards using cash as a payment method in mergers and acquisitions. We posit that the increase in institutional ownership in the target firm helps to mitigate the two-sided information asymmetry problem, reducing bidder concerns with the adverse selection of the target. This allows for higher fraction of stock in the deal payment.

Hypothesis 2: The increase in institutional ownership allows for higher fraction of stock in the deal payment when the bidder and/or the transaction involved greater information asymmetry problem.

Under information asymmetry between the bidder and the target firms, behavioural motive for the payment method choice may arise –bidder opportunism (Eckbo, 2008)– where the bidders are able to sell overpriced stocks to less overpriced target. Bidders can succeed in selling overpriced stock to target managers with a short time horizon (Schwert, 2003) or based on market-timing when the overall market is overvalued (Rhodes-Kropf and Viswanathan, 2004). Extant literature on *misvaluation theory* in stock acquisitions suggest that bidder firm uses overvalued stocks to finance the takeovers (Shleifer and Vishny, 2003; Rhodes-Kropf et al., 2005). Unlike cash offers, stock offer exposes the target firms to the risk of misvaluation of the bidder's shares. If the target firm's shareholders can be worse off by receiving stock payment when the bidder's stocks are overvalued, they are more likely to reject the deal. If the increase in the fraction of more informed shareholders

helps to mitigate value-destroying decisions in takeover by the correct valuation of the stock offer, we would expect that the effect is only significant for the sample of deals where the bidder shares are more correctly priced to their fundamental value.

Hypothesis 3: The increase in institutional ownership allows for higher fraction of stock in the deal payment where the misvaluation of bidder's shares is relatively small.

Overall, we expect that combining the effect of the increase in the fraction of institutional investors under information asymmetry, pricing condition and the value of deal serves as a reasonable indication of the meaningful role played by the institutional investors.

3. Data, sample and empirial method

3.1. Deal sample overview

Our deal sample is obtained from the Thomson Securities Data Corporation (SDC) Mergers and Acquisitions database. We start with all U.S. domestic M&A deals announced between 1984-2018. Our sample begins in 1984 because Chen et al. (2007) finds that M&A information tracked in SDC is relatively incomplete before 1984. We restrict our sample using the similar criteria to Moeller et al. (2004). Our deal sample selection criteria are as follows:

- Targets and bidders are U.S firms,
- Targets are public firms and bidders are public, private or subsidiary, [6]
- Deal value is at least $1 million and accounts for at least 1% of the bidder's market value at the fiscal-year end prior to the announcement date,

[6]We restrict the bidder to be public firms for most of the deal-level tests to control for bidder's characteristics. This also eliminate the effect of different type of bidders on deal structure and deal outcomes.

- Deal is either completed or withdrawn,
- Deal is classified as merger or acquisition of majority interest,
- More than 50% of the outstanding shares of the target are sought in a withdrawn deal or acquired in a completed deal,
- Time to complete successful bids is within 1000 days,
- Target firms are non-financial (SIC codes between 6000-6999) and non-utility firms (SIC codes between 4900-4999),[7]
- Targets have accounting data available on Compustat Annual File and stock market data from Center for Research in Security Prices (CRSP)[8]

We also require that target firms have institutional holdings data reported on Thomson Reuters Institutional Holdings S34 database, based on 13F filings.[9] The firm's institutional ownership ratio is the total shares owned by all institutional investors in every quarter, divided by total number of shares outstanding on CRSP. Following Bushee (1998), we classify institutional investors into three categories based on portfolio turnover and portfolio concentration: Quasi-indexer institutions are long horizon, low portfolio turnover and highly diversified investors; Dedicated institutions are characterized as having concentrated portfolio holdings and low turnover; and Transient institutions are those holding diversified portfolios and high turnover ratios. We construct our measure of change in institutional ownership as the change in fraction of total institutional ownership for the

[7]Excluding target firms in the financial and utility industries because the regulatory requirements in these industries have a pronounced effect on the probability of a firm becoming a target firm in a takeover and the deal consideration.

[8]We restrict the sample to firms with positive book value of assets and sales and with U.S common shares only (share code 10 or 11). For the matching process, the initial match was based on the historical CUSIP from CRSP. For the remaining unmatched, we manually matched firms using Ticker codes and Company names because of differences in CUSIP recorded in SDC database and CRSP/Compustat database.

[9]The Thomson Reuters holdings database covers investment companies with $100 million or more in assets under management and their security holdings as reported on 13F forms filed with the Securities and Exchange Commission (SEC) on a quarterly basis.

fiscal year-end prior to the date of announcement. The breakdown of the sample criteria is reported in the Appendix B1.

3.2. Measurement of information asymmetry

We employ several proxies for information asymmetry associated with the bidder and the deal-level transactions.

The first proxy of information asymmetry is a composite measure based on eight measures of *bidder's characteristics*. This proxy is constructed based on the principle-component analysis following Karpoff et al. (2013). Our eight primitive measure of the bidder's characteristics to construct a single information asymmetry are: firm size, tangible assets, firm age, number of analysts providing earnings forecasts in the year before the date of bid announcement, number of stocks previously issued before the date of bid announcement, daily bid-ask spread, daily return volatility and a measure of bidder abnormal accruals.[10] Appendix C1 provides detailed construction of a composite information asymmetry. Factor 1 is used as a measure of information symmetry for the following reasons. First, its eigenvalue of 2.55 suggesting that it summarizes a significant amount of variation in the eight factor loadings. Second, each factor loading has opposite sign to the predicted sign of information asymmetry. And last, the Kaiser-Meyer-Olkin (KMO) statistics measuring the sampling adequacy are sufficiently high for each factor loading and for the composite factor with the overall value of 0.72, all suggesting that Factor 1 is the adequate measure of information symmetry of the bidder in our sample.

For robustness tests, we further use other proxies of information asymmetry of the

[10]Instead of the component variable *Time since IPO* as in Karpoff et al. (2013), we employ firm's age as the number of years since firm's stocks were first listed on, since some of the bidder firms in our sample do not have information about the IPO dates available. The definitions of these components are presented in the Appendix C1.

bidder firms. Our second set of proxies are based on *bidder's activities* before deal announcement such as recent seasoned equity offered and recent bidder. Recent bidder indicates that the bidder announced the deal within two years prior to the bid announcement. This variable indicates that bidder has revealed information to the outsiders or attracted attention from the market to the firm, hence making it less opaque. Recent equity offering (SEO) is a dummy variable indicating that the bidder has issued common equity within two years prior to the deal announcement.[11]

Finally, we construct deal-level information asymmetry proxies following Eckbo et al. (2018), including the degree of industry complementarity and geographic proximity between the bidder and target firms. *Industry complementarity* is a proxy for information asymmetry measuring the overlap of the bidder-target input-output industries.[12] The higher the value of industry complementarity, the more related are the target and bidder firms, thus the less information asymmetry the bidder firm is to the target firm. The variable *Local deal*, capturing the effect of the physical closeness between the bidder and target, takes value of 1 if the bidder and target are located within 30 miles of each other.[13] The coordinates are looked up using zip codes from SDC, when zip code is missing, we use the city centre of firm's location. This variable indicates that as the target and bidder firms are closer to each other, the more informed bidder and target are about each other,

[11]We also use the cut-off point of 18-months as in Eckbo et al. (2018) and our results are robust to this cut-off point.

[12]We employ the data from Fan and Lang (2000) where they compute, for each BEA industry i, the percentage $b_{ik}(v_{ik})$ of its output(input) supplied to(purchased from) each intermediate BEA industry k. For each pair of industry, we then calculate the correlation coefficient between b_{ik} and b_{jk} across all k except i and j. We then map the BEA industries with the 4-digit SIC codes of the target and bidder firms, and for each target-bidder pair, we calculate the average input and output correlation and our measure of complementarity.

[13]The physical distance between them is calculated using the spherical law of cosine following Cai et al. (2016), where the latitude and longitude coordinates of the bidder and targets are obtained from the 2000 US Census Gazetteer Files. The results of the geographical proximity is similar when using the 1987 US Census Gazetteer File as in Eckbo et al. (2018). We also test for different cut-off point to define local deal as in Kedia et al. (2008) where the bidder and the target are located within 100 km of each other and our result for the sub-sample tests are still robust using this cut-off point.

the less severe is the information asymmetry problem between them. In general, bidder and target firms are closer in physical distance, have higher industry complementarity and previously reveals more information related to their share value in the stock deal sub-sample.

3.3. Misvaluation measures

We employ two different proxies for misvaluation of the bidder shares including the misvaluation component of log market-to-book ratio and short-selling position in the bidder firms prior to the deal announcement.

We decompose the log of market-to-book ratio into components consisting of misvaluation and long run true value-to-book following Rhodes-Kropf et al. (2005).[14]. The misvaluation is the component of ln(M/B) that results from firm-specific and current-sector deviation from the firm long-run value to book. The detailed description of the decomposition of bidder market-to-book ratio and summary statistics are reported in the Appendix C2. We split our sample into above and below year median of firm's misvaluation component of ln(M/V), *High misvaluation* and *Low misvaluation*, respectively. We expect that the bidder's shares are relatively less mispriced in the *Low misvaluation* group prior to the date of bid announcement.

Our second measure is based on the short-selling of bidder stocks before the deal announcement date. Ben-David et al. (2015) point out that short-position in a certain stock is a fitting indication for overvaluation of the stock for two reasons. First, the estimation of mispricing based on measure of firm's fundamentals such as market-to-book

[14]The criteria to choose the sample which forms the basis of the valuation model estimation for the decomposition of log market-to-book is similar to those in Golubov and Konstantinidi (2018) We only include firms where the market-to-book is within 0 and 100, return on equity is within -1 and 1 and book leverage is between 0 and 1 and non-missing values of all components used to in Model III. The exclusions of these observations are to restrict the effect of the outliers on the long-run value estimation.

in Rhodes-Kropf et al. (2005) could be a confounding factor as it relies on the future productivity of the firm. And second, because short-positions are costly and often employed by informed investors, high short position in a stock implies that short-selling only occurs when it is lucrative. High short selling position in the bidder firm prior to deal announcement coincides with overvaluation of bidder shares and greater probability of becoming stock bidder (Ben-David et al., 2015). Under information asymmetry environment, short demand for a stock is an important signal for private information revelation (Cohen et al., 2007). Therefore, we expect that high short positions in bidder firms prior to the deal announcement is an indication of overvaluation of their shares. Our short interest data comes from Compustat Monthly Securities Database. The *Short interest ratio* is the short positions on the settlement date of 15th each month divided by the number of shares outstanding at the month-end as reported on CRSP. We use the *Adjusted short interest ratio* 6-month prior to the announcement date.[15], which is the adjusted short interest to account for the trend of short interest over time, as a proxy for bidder's overvaluation before the announcement date of the bid. We expect that the bidder's shares in the below-median adjusted short-sales are less overvalued prior to the acquisition.

3.4. Summary statistics

The final sample consists of 111,825 firm-year observations with data span from 1984-2018. In the unconditional sample where the bidder firms can either be public, private or subsidiary firms, there are 5,556 deals corresponding to 5,411 firm-year observations. In the restricted sample for our deal sample study, we focus on the sample of 3,236

[15]The difference between a firm's Short Interest Ratio and the mean Short Interest Ratio for all firms traded on NYSE,AMEX and NASDAG (Ben-David et al., 2015) We also test the adjusted short-interest rate 1-month prior to the announcement date and the result is robust in this valuation test.

deals where the bidder is U.S public firms and have accounting and stock information available on Compustat and CRSP. All continuous independent variables are winsorized at 1^{st} and 99^{th} percentiles. All financial variables are measured at the end of fiscal year prior to the announcement date of the takeover bid. Table 1 reports the summary statistics of our samples for both the unconditional tests at the firm-year level and the conditional test at the deal-level. Panel A reports summary statistics at the firm-year level, that corresponding to 5,556 deals. Panel B of Table 1 presents the summary statistics for the deal, bidder and target characteristics. Our summary statistics for the deal sample of U.S public target and bidders resembles deal characteristics of previous studies employing the similar deal criteria. On average, the completion rate in our sample is 82.1% which is similar to that of 83% in Fich et al. (2015). Above 37.8% of target and bidder operate in the same 4-digit SIC industry. The proportion of tender offer in our sample is approximately 24%, that would be comparable to 18% if not excluding utility and financial targets as in Officer (2003) and Fich et al. (2015). The average fraction of stock in the payment for our sample is 46%. On average, the bidder firms are bigger in size and have higher market-to-book value. In our sample, the R&D ratios (R&D to total value of assets) for the target firms are slightly higher compared to the bidder firms. Figure 1 shows the annual distribution of bids in our final sample, by total bids and by payment method type. Appendix B2 describes distribution of bids across bidder's Fama and French 48 industries, sorted by the total of bids within each industry from highest to lowest.

[Insert Table 1 here]

We also reports the distribution of bidders over the sample period and across payment method types. The distribution is also comparable to the sample used in study of Eckbo

et al. (2018), although their sample also includes U.S private targets. The total number of bids decreases significantly after 2000 because of the significant reduction in the number of public U.S firms, so does the fraction of stock bids. About two-third of the takeover bids is concentrated in the top 10 of Fama and French 48 Industry. These patterns are consistent and representative of the takeover markets in the U.S between public targets and bidder firms (Boone et al., 2014; Fich et al., 2015).

4. Empirical Results

4.1. Firm-year level analysis

In this section, we examine the probability of becoming a target firm and the probability of receiving each payment method type against the probability of not receiving a takeover bid.

Panel A of Table 2 presents estimates from logistic probability model that examine the likelihood of becoming a target. We control for the firm characteristics that could predict the takeover probability as identified in Palepu (1986) such as firm size, growth-resource mismatch, compounded excess return, Tobin's Q, return on assets, sale growth, industry acquisition and cash flow. We also control for R&D ratio as there has been a record of mergers involving technology firms with high R&D costs. Additionally, we include the industry and year fixed effects to account for the variations in merger waves over time and across industries. The estimated sign of our control variables is comparable to those in Palepu (1986). Generally, firms with smaller size, undervalued, high return, lower cash flow and have high R&D costs have higher takeover probability. Acquisitions within industry has significantly positive effect on firm's takeover likelihood. The results show that the increase in institutional ownership in the target firm has positive effect on

the takeover likelihood of the firm, with the average marginal effect of 1.3%. The overall fit measured by the Pseudo-R squared of the logit models, albeit low at 3% with fixed effect controls, is similar to previous studies on takeover probability (Cremers et al., 2008; Ambrose and Megginson, 1992). Interestingly, the finding in out study is different from prior study that used the change in institutional ownership on the likelihood of a firm becomes an acquisition target. Ambrose and Megginson (1992) find that the change in fraction of institutional shareholdings, rather than the absolute level of such holdings, is negatively correlated to the takeover probability, suggesting that institutions are not large buyers before takeover attempts. This difference arise because of many reasons, of which the most obvious one is due to the inequivalent sample. The sample employed in Ambrose and Megginson (1992) spans from Jan 1^{st} 1981 to December 1986 whereas our study covers much longer time period where bids are announced between 1984 and 2018. There are significant differences of the level of and the growth of institutional ownership between 1984 and 2018, as well as the takeover activities in these periods.[16] Our results therefore suggest that firms are significantly more likely to become a target following the change in institutional ownership. When examining the effect by each type of institutional investors as classified in Bushee (1998), the prominent effect of takeover probability comes from the change in quasi-indexer institutional owners in the year prior to the bid announcement.

Panel B of Table 2 reports the multinomial logit regression results of the effect of change in institutional ownership and the probability of each payment method type unconditional on the bidder's characteristics except the bidder being U.S public, private or subsidiary firms. The dependent variable takes value of 1 if firm did not receive takeover

[16]The mean of the quarterly institutional holdings grows from about 20% to approximately 52% during this period, and the speed of the growth over the year surge especially after 2000.

bid in a given (baseline), 2 if receiving cash-only bid, 3 if received mixed bid and 4 if receive stock bid. The findings suggest that the positive associsation of institutional ownership and takeover likelihood on the target side is concentrated in the stock deal sample. Taken together, the results presented in table 2 provides a ground to support the hypothesis that institutional owners have an effect on the target firm that allows for stock-related offers. We further examine the specific economic mechanism through which these institutional owners affect the takeover likelihood in section 5.

[Insert Table 2 here]

4.2. Deal-level analysis

We first begin our analysis by examining the univariate comparison the probability of stock deal following the change in fraction of institutional ownership (and fraction of stock in the deal payment). Figure 3 provides the descriptive analysis of the effect of the change in institutional ownership for the target firm prior to the bid announcement to the payment method. The figure shows the distribution of stock-only deals for the sample where the bidder is U.S public, private or subsidiary firms and the sample where the bidder is U.S public firm only. The fraction of stock-only deals and the percentage of stock in the deal payment are higher for the targets that experienced largest change in the percentage of institutional ownership in the fiscal year prior to the deal announcement. The upper part of figure 3 illustrates that the fraction of stock-only deals increase from 16% to 21% following the largest increase in institutional ownership for the sample of U.S non-financial, non-utility public targets and U.S public, private or subsidiary bidder firms. The increase is from 26% to 33% as shown in the lower part of the figure 3 for the sample where the bidder is restricted to be public firms only. The distribution of the

fraction of stock in the deal payment also shows an interesting result that the fraction of stocks is higher for the sample of deals announced following the largest increase in the institutional ownership.

We further assess the effect of institutional owners on the target firms in greater details with deal-level multivariate analysis. We employ the deal sample where the bidder firms are U.S publicly listed firms that have accounting and stock market information available to reassess the effect of institutional ownership on method of payment. This sample of individual M&A transactions allow us to investigate the effect of the institutional investors on the payment method more closely. Specifically, we control for the target characteristics, as well as the bidder and deal characteristics that are directly related to the percentage of stock payment. Our control variables for the deal-level analysis are similar to those employed in Fich et al. (2015). We control for five firm's characteristics including firm size, market-to-book, leverage, cash flow and R&D ratio. We also control for six deal characteristics including dummy variables for hostile deal, target termination fee, multiple competing bids, tender offer, same 4-digit SIC industry and a control variable for the relative size of the deal value to the value of the bidder market capitalisation at the fiscal year-end prior to the bid announcement.[17]

Panel A of table 3 reports the coefficient estimates from the multinomial logit regressions for the choice of payment method. On average, bidders who offer higher fraction of stocks are smaller in size and have lower cash flows, whereas the targets of the stock-deals are relative bigger in size in comparison to target size in the sample of cash-only takeovers. Our findings at the deal-level analysis is consistent with the previous findings at the firm-year level analysis, showing that bidder are more like to offer all-stock deals

[17]Our results are robust to alternative set of control variables for deal characteristics including a dummy variable for lockup, toehold, high-tech industry, competitive industry as in Fich et al. (2015).

following the change in fraction of institutional ownership in the target firms prior to the bid announcement. Panel B of table 3 presents estimates from Tobit regressions for the fraction of stock in the takeover bids based on the deal-level sample. We control for characteristics of deal, bidder and target firms that are directly related to both stock payment probability (and stock percentage) and the change in institutional investors prior to the deal announcement. The signs of these control variables are consistent with previous research findings. These findings augment our results in panel A in support of the hypothesis 1 that institutional investors in the target firm is one of the determinants of the deal consideration in mergers and acquisitions.

In summary, we show that the change in institutional ownership has a statistically significant and economically meaningful effect on the deal payment structure. Target firms are more likely to offer all-stock deals and offer higher percentage of stock in the deal consideration following the change in institutional ownership level.

[Insert Table 3 here]

4.3. Endogeneity problem between institutional ownership and payment method

In this subsection, we use an instrumental variable (IV) approach to support the causal interpretation of our findings. As our baseline estimation examines the effect of a change in institutional ownership, a mechanistic correlation between the level of institutional ownership and a takeover outcome is mitigated to some extent. However, endogeneity concerns arguably remain, because some unobservable factors might affect both firms' institutional ownership and the likelihood that they become a takeover target. For example, cost effective firms or innovative firms might attract institutional money more, while bidders are more likely to target such a firm. Similarly, some institutions

might actively chasing firms that are likely to be a takeover target.

To address these concerns, we use Russell index reconstitutions as a source of exogenous variation in institutional ownership. Like in the growing literature employing this approach (Appel et al., 2016; Chang et al., 2015; Crane et al., 2016; Schmidt and Fahlenbrach, 2017), our identification strategy exploits shocks to institutional ownership associated with index membership switches between the Russell 1000 and Russell 2000 indexes. To elaborate, on the "rank day," which is at the end of May each year, Russell assigns index membership based on the market capitalization of stocks (Russell, 2016). The larget 1,000 stocks (ranked from first to 1,000th) and the next 2,000 stocks (from 1,001th to 3,000th), respectively, compose Russell 1000 and Russell 2000. The annual reconstitution takes place at the end of June using index weights that are based on the float-adjusted market capitalization of the member stocks.[18] Since the membership assignment relies only on stocks' market capitalization, an event of Russell 1000/2000 membership switch is plausibly exogenous to firm characteristics and other confounding factors, conditional on the end-of-May market value. That is, certain attributes linked with the likelihood of becoming a takeover target are unlikely to induce a change in a stock's index membership status. Moreover, as index weights are determined within each index, the top-tier members of Russell 2000 get larger weights than the bottom tiers of Russell 1000. Therefore, a change of a stock's membership from Russell 1000 to Russell 2000 leads to increases in holdings of the stock by institutional tracking Russell indexes, whereas a switch from Russell 2000 to Russell 1000 results in decreases in such holdings.

Following (Fich et al., 2015) and (Schmidt and Fahlenbrach, 2017), among others, we

[18]The purpose of Russell's float adjustment is to "include only those shares available to the public" (FTSE Russell, 2015, pp.23-24). Each constituent's shares outstanding at the end of June is adjusted based on Russell's proprietary criteria.

estimate our takeover likelihood equations in the 2SLS framework. In Panel A of Table 4, we provide our IV estimation results using the whole sample (including firm-years without a takeover deal). The first-stage results reported in Columns 1 and 3 show that the index membership switches generate the effects consistent with the predictions discussed above: a switch from Russell 1000 to Russell 2000 (from Russell 2000 to Russell 1000) results in an increase (decrease) in institutional ownership. As Russell began the banding policy in 2007, we perform a robustness check using the pre-banding policy period (Column 3).[19] In addition to membership switches, we include change in the May market-cap rank and its squared term to capture variation in institutional ownership associated with market capitalization. That is, a positive relationship between the market-cap rank (inverse of the rank value) and institutional ownership is generally expected. Our second-stage results reported in Columns 2 and 4 are consistent with our baseline results presented in Table 2.

Similarly, the results in Panel B of Table 5 confirm that an increase in a firm's institutional ownership has a positive impact on the likelihood that the firm receives a stock offer. Table 5 reports the results using our deal sample. These results again support our finding that an increase in institutional ownership leads to an increase in the likelihood of an all-stock offer and the fraction of stock in a deal payment. Overall, our IV results lend strong support to the causal interpretation of our main findings.

[Insert Table 4 here]

[Insert Table 5 here]

[19]Since 2007, Russell initiated the banding policy for reconstitution where firms close to the cut-off threshold do not automatically switch to the new index if its market capitalisation does not deviate beyond the 2.5% banding thresholds on either side of the cut-off threshold. As the robustness check for the alternative sample choice, we perform the IV tests for the period before 2007 only (pre-banding policy sample).

5. The role of institutional investors

In this section, we investigate mechanisms through which institutional investors have influence in mergers and acquisitions under two-sided information asymmetry between bidder and target firms.

5.1. Informational role

Institutional investors could utilise their higher quality information to value the offer made by the bidder firm. The increase in institutional ownership is associated with higher fraction of stock in the deal payment, suggesting that the institutional investors of the target firms are collectively willing to accept stock deals based on their assessment of the proprietary information about the bidder that is not revealed to the market. Results from Table 6 show that the role of institution investors diminishes with the degree of information about the bidder being revealed to the market. In Panel A of table 6, we split our deal sample into the high and low information asymmetry based on the proxy for information asymmetry created based on eight bidder characteristics. The result shows that the change in proportion of institutional investors has pronounced effect on the fraction of stock in the deal payment when the bidder firms are more opaque. In untabulated tests, we find that the increase in institutional ownership is associated with average marginal effect of 18% higher probability of target receiving stock-only deals. Our findings support the hypothesis that the importance of institutional investors are more prevalent when the level of information asymmetry between the bidder and the target firm is high.

In Panel B, we examine the effect of institutional investors on stock payment across alternative proxies for the bidder's information asymmetry as employed in Eckbo et al.

(2018). The degree of information asymmetry about the bidder is lower when there are more bidder' activities associated with the use of stocks prior to the bid announcement such as recent equity offerings and recent acquisitions.[20] Our results show reasonably consistent positive association of institutional ownership and the fraction of stock payment in the deal consideration across alternative proxies of information asymmetry about the bidder firm, suggesting that the role of institutional investors in the deal consideration is more prevalent when there is a higher level of uncertainty about the bidder's share price.

We supplemented our measure of information asymmetry with more direct measures of the relation between the target and bidder firm. Results from panel C of table 6 reinforces our conjecture that the institutional investors in the target firm can act as an intermediary to bridge the gap of the information asymmetry that would otherwise discourage stock payment. We document that the impact of the institutional investors in reducing information asymmetry and allowing for higher fraction of stock in the deal payment is greatest when the target is relatively less informed about the bidder firm.

Overall, our results on the effect of institutional investors on the fraction of stock offered remain qualitatively similar across various proxies for information asymmetry, providing evidence for the information quality provided by the institutional investors as a substitute for the information problem hindering the use of stock in deal payment.

[Insert Table 6 here]

5.2. Monitoring role

Our findings suggest that the effect of institutional investors on the fraction of stock in the deal payment is only prevalent when the bidder's shares are relatively less mispriced.

[20]Eckbo et al. (2018) discuss that regardless of the outcome and the method of payment of the most recent acquisition, information about the bidder disclosed has allowed the outside investors to assess the bidder's shares.

We partition our sample into the low and high misvaluation groups by the median of proxy of misvaluation of the bidder's shares, constructed by decomposing the log of market-to-book ratio (Rhodes-Kropf et al., 2005). Estimated coefficients from Panel A of Table 7 suggest that institutional holdings in the target firm associates with higher fraction of stock offers when the bidder's shares are less mispriced and the results are robust across models used to decompose the market-to-book value of the bidder's shares. The findings support our hypothesis that the institutional investors play an important role in monitoring the deal and assessing the value of the deal for the target firm, hence assisting the target management to avoid the value-reducing decisions to its shareholders.

The results shown in Panel B reveal that when the bidder shares are overpriced as indicated by the high short-positions prior to the deal announcement, the effect of institutional investors is not significant, whereas fraction of stock is a positive function of the increase in institutional ownership in the target firm when the short-selling positions is lower than sample median, confirming our findings above that the effect of institutional investors is significant when the bidder shares are less overpriced. Our results are robust across subsample tests: excluding 2008 to account for effect of staggered introduction of short-selling ban that might have caused biased because of the observed regulatory effect on larger (bidder) firms (Boehmer et al., 2013), excluding the hot market period 1995-2000 to ensure that the short-position proxy for overvaluation market-wide overvaluation. Overall, these findings are consistent with the notion that institutional investors perform their monitoring role in evaluating the stock-offer in deal payment.

In summary, our combined evidence suggests that institutional investors act as an information conduit and thus, play a meaningful monitoring role in M&As. The role played by these institutions is imperative when the information asymmetry problem is

more severe. A reduction in the degree of information asymmetry following the change in institutional ownership of the target firm allows for a significantly higher fraction of stock in the deal payment. Therefore, our results yield support for the rational payment method against the bidder opportunism conditional on the presence of the institutional owners in the target firm.

[Insert Table 7 here]

6. Conclusion

This study explores the effect of institutional investors in the mergers and acquisition setting as it is one of the most pivotal decisions to the firm. We find that firms have higher likelihood of receiving takeover bids following the change in its institutional ownership, and this increased in takeover likelihood is concentrated in stock deals. Our deal-level analysis reveals that the increase in institutional ownership in the target firms is associated with higher fraction of stock in the deal consideration, where the uncertainty about the pay-off from accepting the deal to the target shareholders is higher. We support the causal relationship using Russell index reconstitutions as the instrument. To understand the economic mechanism through which institutional owners influence the firm or takeover consideration, we perform the cross-section analyses regarding information asymmetry and the valuation of bidder shares prior to the deal announcement. Our results shows that the positive relationship between a target's institutional ownership and a stock-based offer is pronounced when the information asymmetry between the bidder and target firms are more severe, hence suggesting that institutional investors act as an information conduit between the two parties. Our study complements the line of literature on stock acquisitions by providing evidence to support the *rational payment hypothesis*.

Additional analysis finds that the positive association between institutional owners and fraction of stock is stronger when the bidder's shares–the currency of the transaction–are correctly priced. Taken together, our evidence lends support for the notion that institutional investors play an important role in alleviating information asymmetry in takeover transactions and assessing the associated values, hence help to mitigate the contracting problem of payment method between the target and bidder firms in M&A.

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Table 1 – Sample characteristics

This table presents the summary statistics of our samples for the period 1984-2017. Panel A shows the statistics for the same where the bidder can be U.S public, private or subsidiary bidders. In Panel B, the sample consists of 3236 merger bids for US public targets by only US public bidders. The deal criteria are reported in Appendix B. The target are non-financial and non-utility firms. All variables are defined in the Appendix A.

Panel A: Whole sample	**N**	**Mean**	**p25**	**Median**	**p75**	**S.D.**
Change in total IO	111825	0.016	-0.023	0.005	0.051	0.096
Change in QIX IO	111825	0.012	-0.019	0.004	0.043	0.073
Change in TRA IO	111825	0.003	-0.018	0.000	0.022	0.061
Change in DED IO	111825	0.000	-0.001	0.000	0.000	0.023
Size	111825	5.259	3.719	5.130	6.684	2.106
Tobin's Q	111825	1.981	1.088	1.449	2.191	1.598
Leverage	111825	0.179	0.004	0.124	0.287	0.195
Return on assets	111825	0.054	0.028	0.107	0.167	0.227
Sale growth	111825	0.188	-0.028	0.082	0.237	0.572
R&D	111825	0.053	0.000	0.001	0.062	0.104
Cash flow	111825	0.002	-0.003	0.071	0.119	0.250
Compounded excess return	111825	0.121	0.018	0.148	0.238	0.161
Growth-resource mismatch [0;1]	111825	0.331	0.000	0.000	1.000	0.471
Industry acquisition [0;1]	111825	0.041	0.000	0.000	0.000	0.197

Panel B: Deal sample	**N**	**Mean**	**p25**	**Median**	**p75**	**S.D.**
Deal characteristics						
Completion [0;1]	3236	0.821	1.000	1.000	1.000	0.384
Cash-only deals	3236	0.396	0.000	0.000	1.000	0.489
Stock-only deals	3236	0.300	0.000	0.000	1.000	0.458
Hostile deal [0;1]	3236	0.095	0.000	0.000	0.000	0.294
Target termination fee [0;1]	3236	0.592	0.000	1.000	1.000	0.492
Competed Bid [0;1]	3236	0.116	0.000	0.000	0.000	0.321
Tender offer [0;1]	3236	0.239	0.000	0.000	0.000	0.426
Same industry [0;1]	3236	0.378	0.000	0.000	1.000	0.485
Relative size	3236	0.387	0.064	0.186	0.474	0.614
Percentage of stock	3236	0.459	0.000	0.395	1.000	0.449
Target characteristics						
Size	3236	5.379	4.082	5.218	6.571	1.794
Market-to-book	3236	2.886	1.187	1.947	3.300	4.448
Leverage	3236	0.191	0.004	0.134	0.314	0.206
Cash flow	3236	0.016	0.008	0.074	0.119	0.220
R&D	3236	0.063	0.000	0.006	0.086	0.108
Bidder characteristics						
Size	3236	6.949	5.508	6.985	8.353	2.078
Market-to-book	3236	3.760	1.621	2.512	4.140	4.934
Leverage	3236	0.200	0.034	0.167	0.300	0.185
Cash flow	3236	0.066	0.047	0.090	0.132	0.140
R&D	3236	0.042	0.000	0.006	0.058	0.068

Table 2 – Takeover likelihood and payment type (Whole sample)
Panel A presents estimates from logistic regressions that examine the likelihood of becoming a target for a sample of US public target firms by US public, private or subsidiary bidder firms. This was based on a sample of 5556 deals announced in the period 1984-2017. The dependent variable equals 0 if the firm did not receive takeover bid in a given year, 1 if is a target, once or multiple times in a given year. Panel B reports estimates from multinomial logistic regressions that examine the likelihood of cash-only, mixed and stock-only deals for a sample of US public target firms by US public, private or subsidiary bidder firms. This was based on a sample of 3,301 cash-only deals, 1,088 mixed deals and 1,167 stock-only deals for the period 1984-2017. The dependent variable in Panel B takes a value of 1 if the firm did not receive takeover bid in a given year, 2 if received cash-only deals, 3 if received mixed deals and 4 if received stock-only deals. All continuous independent variables are measured at the end of previous fiscal year and winsorized at 1% and 99%. Intercept is included in regressions but not reported. Standard errors are clustered at the firm level. p-values are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A:Logit model	**Dependent variable = Target [0;1]**			
Change in total IO	0.290*	0.290*		
	(0.077)	(0.072)		
Change in QIX IO			0.395*	0.235
			(0.066)	(0.271)
Change in TRA IO			0.010	0.148
			(0.969)	(0.561)
Change in DED IO			0.829	0.810
			(0.205)	(0.211)
Size	-0.009	-0.007	-0.009	-0.007
	(0.227)	(0.463)	(0.223)	(0.459)
Tobin's Q	-0.167***	-0.192***	-0.165***	-0.190***
	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.390***	0.227***	0.391***	0.226***
	(0.000)	(0.006)	(0.000)	(0.006)
Return on assets	1.191***	1.128***	1.186***	1.127***
	(0.000)	(0.000)	(0.000)	(0.000)
Sale growth	-0.017	-0.070**	-0.017	-0.069**
	(0.507)	(0.012)	(0.518)	(0.014)
R&D	1.455***	1.769***	1.449***	1.765***
	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow	-0.639***	-0.530***	-0.634***	-0.524***
	(0.000)	(0.000)	(0.000)	(0.000)
Compounded excess return	0.508***	0.207	0.511***	0.208
	(0.000)	(0.248)	(0.000)	(0.246)
Growth-resource mismatch [0;1]	0.068**	0.032	0.068**	0.032
	(0.022)	(0.288)	(0.024)	(0.291)
Industry acquisition [0;1]	0.389***	0.134**	0.389***	0.134**
	(0.000)	(0.041)	(0.000)	(0.041)
Average marginal effect				
Change in total IO	0.013*	0.013*		
	(0.077)	(0.072)		
Change in QIX IO			0.018*	0.010
			(0.066)	(0.271)
Change in TRA IO			0.000	0.007
			(0.969)	(0.561)
Change in DED IO			0.037	0.036
			(0.205)	(0.212)
Industry and Year FE	No	Yes	No	Yes
Number of deals	5556	5556	5556	5556
Number of target-year	5411	5411	5411	5411
Number of firm-year	111825	111825	111825	111825
Pseudo R-squared	0.01	0.03	0.01	0.03

Table 2 – Unconditional takeover likelihood and payment type (continue)

Panel B:Multinomial logit	**All-cash deals**		**Mixed deals**		**All-stock deals**	
Change in total IO	0.313		0.074		0.661**	
	(0.170)		(0.838)		(0.047)	
Change in QIX IO		0.375		-0.693		1.089**
		(0.201)		(0.142)		(0.018)
Change in TRA IO		0.204		0.431		0.200
		(0.564)		(0.438)		(0.706)
Change in DED IO		1.139		2.170		0.001
		(0.214)		(0.104)		(0.999)
Size	-0.057***	-0.057***	0.191***	0.191***	0.009	0.008
	(0.000)	(0.000)	(0.000)	(0.000)	(0.608)	(0.651)
Tobin's Q	-0.395***	-0.394***	-0.181***	-0.179***	-0.036*	-0.035*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.069)	(0.083)
Leverage	0.256**	0.256**	0.857***	0.853***	-0.454**	-0.450**
	(0.024)	(0.024)	(0.000)	(0.000)	(0.016)	(0.017)
Return on assets	1.989***	1.988***	0.978***	0.988***	0.629**	0.618**
	(0.000)	(0.000)	(0.008)	(0.008)	(0.038)	(0.042)
Sale growth	-0.269***	-0.269***	-0.042	-0.036	0.106**	0.105**
	(0.000)	(0.000)	(0.494)	(0.553)	(0.010)	(0.011)
R&D	2.517***	2.514***	1.239**	1.246**	1.856***	1.844***
	(0.000)	(0.000)	(0.036)	(0.035)	(0.000)	(0.000)
Cash flow	-0.505***	-0.505***	-0.823***	-0.805***	-0.308	-0.301
	(0.003)	(0.003)	(0.002)	(0.003)	(0.251)	(0.262)
Compounded excess return	0.313	0.314	0.320	0.310	0.286	0.293
	(0.192)	(0.191)	(0.472)	(0.487)	(0.453)	(0.442)
Growth-resource mismatch [0;1]	0.083**	0.083**	0.132**	0.134**	-0.123*	-0.124*
	(0.039)	(0.040)	(0.045)	(0.043)	(0.064)	(0.062)
Industry acquisition [0;1]	0.035	0.035	0.272*	0.275*	0.186	0.186
	(0.710)	(0.707)	(0.059)	(0.056)	(0.121)	(0.119)
Average marginal effect (robust SE)						
Change in total IO	0.008		0.001		0.006*	
	(0.180)		(0.877)		(0.051)	
Change in QIX IO		0.010		-0.007		0.011**
		(0.204)		(0.129)		(0.018)
Change in TRA IO		0.005		0.004		0.002
		(0.576)		(0.447)		(0.721)
Change in DED IO		0.031		0.020		-0.001
		(0.224)		(0.110)		(0.967)
Industry and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of deals	3301	3301	1088	1088	1167	1167
Number of firm-year	111825	111825	111825	111825	111825	111825
Likelihood ratio	15297.02	15297.78	15348.66	15343.73	15297.02	15297.78

Table 3 – Institutional ownership and stock payment (Deal sample)
This table reports estimates from Tobit regressions for the fraction of stock in takeover bids (column 1 to 4) and the multinomial logit regressions for the payment method(column 5-8). The number of deals where the bidder can be either U.S. public, private and subsidiary is 5,706, more than that of 5,566 deals in the takeover probability test as presented in Table 2 is because of the difference in the set of control variables for target characteristics. In the multinomial logit regressions, the dependent variables takes value of 1 if bids are cash-only (baseline), equal to 2 if mixed deals and 3 if stock deals. All the independent variables are lagged by one year before deal announcement. The constant term was included but not reported. The definitions of explanatory variables are reported in the Appendix A. p-values are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

Panel A:Multinomial	**Bidder=[Public,Private,Subsidiary]**				**Bidder=[Public]**			
logit results	Mixed		Stock-only		Mixed		Stock-only	
Institutional ownership								
Change in total IO	-0.035		0.893**		-0.005		1.126**	
	(0.926)		(0.023)		(0.992)		(0.036)	
Change in QIX IO		-0.597		1.039*		-0.531		1.657**
		(0.223)		(0.054)		(0.446)		(0.024)
Change in TRA IO		0.400		0.658		0.615		0.801
		(0.490)		(0.289)		(0.436)		(0.331)
Change in DED IO		0.792		-1.092		-0.417		-2.351
		(0.588)		(0.511)		(0.839)		(0.292)
Deal characteristics								
Hostile deal [0;1]	-0.500***	-0.501***	-1.158***	-1.151***	-0.907***	-0.901***	-1.723***	-1.708***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Target termination	0.192**	0.194**	0.368***	0.372***	0.322**	0.327**	0.329**	0.332**
fee [0;1]	(0.048)	(0.046)	(0.000)	(0.000)	(0.024)	(0.022)	(0.024)	(0.023)
Competed Bid [0;1]	-0.194*	-0.195*	-0.932***	-0.932***	-0.294*	-0.302*	-0.794***	-0.783***
	(0.093)	(0.091)	(0.000)	(0.000)	(0.097)	(0.090)	(0.000)	(0.000)
Tender offer [0;1]	-1.622***	-1.621***	-3.714***	-3.717***	-2.184***	-2.182***	-3.956***	-3.966***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Same industry [0;1]	0.749***	0.750***	0.835***	0.837***	0.238**	0.238**	0.123	0.124
	(0.000)	(0.000)	(0.000)	(0.000)	(0.043)	(0.044)	(0.312)	(0.310)
Relative size					0.177	0.174	0.030	0.023
					(0.143)	(0.149)	(0.823)	(0.859)
Target characteristics								
Size	0.431***	0.430***	0.188***	0.187***	0.629***	0.631***	0.520***	0.522***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.031***	0.031***	0.056***	0.057***	0.040***	0.040***	0.065***	0.066***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.005)	(0.005)	(0.000)	(0.000)
Leverage	0.311	0.318	-0.978***	-0.983***	0.115	0.121	-1.317***	-1.321***
	(0.130)	(0.122)	(0.000)	(0.000)	(0.708)	(0.695)	(0.000)	(0.000)
Cash flow	-0.938***	-0.915***	-0.830***	-0.833***	-0.359	-0.354	-0.304	-0.312
	(0.000)	(0.000)	(0.000)	(0.000)	(0.329)	(0.335)	(0.395)	(0.382)
R&D	0.811	0.822	1.179**	1.162**	0.340	0.302	0.604	0.598
	(0.196)	(0.190)	(0.032)	(0.035)	(0.719)	(0.750)	(0.496)	(0.500)
Bidder characteristics								
Size					-0.383***	-0.384***	-0.439***	-0.441***
					(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book					0.010	0.010	0.036***	0.036***
					(0.470)	(0.478)	(0.010)	(0.009)
Leverage					0.086	0.079	-0.443	-0.441
					(0.795)	(0.811)	(0.208)	(0.210)
Cash flow					-2.674***	-2.688***	-3.178***	-3.218***
					(0.000)	(0.000)	(0.000)	(0.000)
R&D					1.482	1.491	2.152	2.138
					(0.304)	(0.301)	(0.117)	(0.120)
Industry and Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	5706	5706	5706	5706	3236	3236	3236	3236
Pseudo R-squared	0.348	0.348	0.348	0.348	0.455	0.455	0.455	0.455

Table 3 – Institutional ownership and stock payment. (continue)

Panel B:Tobit regressions	**Bidder=[Pub,Priv,Sub]**		**Bidder=[Public]**	
	Dependent variable = Fraction of stock			
Institutional ownership				
Change in total IO	0.109**		0.146***	
	(0.016)		(0.010)	
Change in QIX IO		0.102*		0.164**
		(0.085)		(0.032)
Change in TRA IO		0.112		0.104
		(0.107)		(0.228)
Change in DED IO		-0.072		0.016
		(0.688)		(0.945)
Deal Characteristics				
Hostile deal [0;1]	-0.104***	-0.103***	-0.179***	-0.178***
	(0.000)	(0.000)	(0.000)	(0.000)
Target termination fee [0;1]	0.053***	0.053***	0.038**	0.038**
	(0.000)	(0.000)	(0.016)	(0.015)
Competed Bid [0;1]	-0.084***	-0.084***	-0.073***	-0.071***
	(0.000)	(0.000)	(0.000)	(0.000)
Tender offer [0;1]	-0.327***	-0.328***	-0.437***	-0.438***
	(0.000)	(0.000)	(0.000)	(0.000)
Same industry [0;1]	0.109***	0.109***	0.010	0.010
	(0.000)	(0.000)	(0.438)	(0.434)
Relative size			-0.026**	-0.025**
			(0.042)	(0.044)
Target Characteristics				
Size	0.025***	0.025***	0.058***	0.058***
	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.008***	0.008***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	-0.116***	-0.117***	-0.168***	-0.167***
	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow	-0.122***	-0.122***	-0.025	-0.024
	(0.000)	(0.000)	(0.501)	(0.519)
R&D	0.187***	0.186***	0.087	0.087
	(0.005)	(0.006)	(0.349)	(0.346)
Bidder Characteristics				
Size			-0.053***	-0.053***
			(0.000)	(0.000)
Market-to-book			0.004***	0.004***
			(0.007)	(0.007)
Leverage			-0.060	-0.060
			(0.115)	(0.116)
Cash flow			-0.265***	-0.265***
			(0.000)	(0.000)
R&D			0.197	0.195
			(0.134)	(0.137)
Industry and Year FE	Yes	Yes	Yes	Yes
N	5706	5706	3236	3236
Pseudo R-squared	0.348	0.348	0.455	0.455

Table 4 – Endogeneity of institutional ownership and takeover probability (Whole sample)

Panel A: This table presents the instrumental variable regression results of the takeover probability on the change in fraction of firms' institutional ownership. The instrumental variables employed are dummy variables indicating the switch between the Russell 1000 and Russell 2000 indices from year *(t-1)* to *t*, first and second polynomial order of the change in ranking based on end-of-May market capitalisation from year *(t-1)* to *t* and a control variable for the market capitalisation (*ln(end-of-May market capitalisation)*). Intercept is included in regressions but not reported. All continuous independent variables are measured at the end of previous fiscal year and winsorized at 1% and 99%. p-values are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A:Takeover likelihood	**Full sample**		**Pre-Banding policy**	
	1st stage	2st stage	1st stage	2st stage
Change in total IO		0.101**		0.129**
		(0.026)		(0.024)
$Russell1000_{t-1} \rightarrow Russell2000_t$	0.020***		0.019***	
	(0.000)		(0.000)	
$Russell2000_{t-1} \rightarrow Russell1000_t$	-0.033***		-0.031***	
	(0.000)		(0.000)	
$ChangeinRank_{t-1} \rightarrow Rank_t$	0.004***		0.004***	
	(0.000)		(0.000)	
$[ChangeinRank_{t-1} \rightarrow Rank_t]^2$	0.000***		0.000***	
	(0.000)		(0.000)	
ln(end-of-May mktcap)	-0.007***		-0.008***	
	(0.000)		(0.000)	
Size	0.004***	-0.004***	0.005***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Tobin's Q	0.010***	-0.008***	0.011***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	-0.004*	0.016***	-0.003	0.016***
	(0.058)	(0.000)	(0.294)	(0.006)
Return on assets	-0.026***	0.032***	-0.012**	0.035***
	(0.000)	(0.002)	(0.020)	(0.004)
Sale growth	0.010***	-0.004**	0.012***	-0.005**
	(0.000)	(0.022)	(0.000)	(0.026)
R&D	-0.006	0.047***	-0.017**	0.032**
	(0.272)	(0.000)	(0.016)	(0.050)
Cash flow	0.085***	-0.028***	0.081***	-0.034***
	(0.000)	(0.005)	(0.000)	(0.004)
Compounded excess return	0.016***	0.010	-0.007	0.008
	(0.001)	(0.324)	(0.207)	(0.553)
Growth-resource mismatch [0;1]	-0.001*	0.003*	-0.001	0.004*
	(0.075)	(0.099)	(0.112)	(0.079)
Industry acquisition [0;1]	0.005***	0.008*	0.005***	0.008*
	(0.006)	(0.062)	(0.007)	(0.074)
Industry and Year FE	Yes	Yes	Yes	Yes
Number of target-year	76728	76728	54070	54070
Adjusted R-squared		0.01		0.01
Kleibergen-Paap F-statistic				

Table 4 – (continue) Endogeneity of institutional ownership and stock-offer probability (Whole sample)

Panel B: This table presents the instrumental variable regression results of the stock-bid probability on the change in fraction of firms' institutional ownership. The instrumental variables employed are dummy variables indicating the switch between the Russell 1000 and Russell 2000 indices from year *(t-1)* to *t*, first and second polynomial order of the difference in ranks based on end-of-May market capitalisation of the firm from year *(t-1)* to *t* and a control variable for the market capitalisation (*ln(end-of-May market capitalisation)*). Intercept is included in regressions but not reported. All continuous independent variables are measured at the end of previous fiscal year and winsorized at 1% and 99%. p-values are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel B:Stock-bid likelihood	**Full sample**		**Pre-Banding policy**	
	1st stage	2st stage	1st stage	2st stage
Change in total IO		0.044**		0.063**
		(0.027)		(0.022)
$Russell1000_{t-1} \rightarrow Russell2000_t$	0.019***		0.019***	
	(0.000)		(0.000)	
$Russell2000_{t-1} \rightarrow Russell1000_t$	-0.033***		-0.031***	
	(0.000)		(0.000)	
$ChangeinRank_{t-1} \rightarrow Rank_t$	0.004***		0.004***	
	(0.000)		(0.000)	
$[ChangeinRank_{t-1} \rightarrow Rank_t]^2$	0.000***		0.000***	
	(0.000)		(0.000)	
ln(end-of-May mktcap)	-0.007***		-0.008***	
	(0.000)		(0.000)	
Size	0.004***	-0.001***	0.005***	-0.001***
	(0.000)	(0.001)	(0.000)	(0.002)
Tobin's Q	0.010***	-0.001**	0.011***	-0.001**
	(0.000)	(0.026)	(0.000)	(0.038)
Leverage	-0.004*	-0.004**	-0.003	-0.008***
	(0.064)	(0.033)	(0.325)	(0.004)
Return on assets	-0.027***	0.004	-0.013**	0.006
	(0.000)	(0.355)	(0.014)	(0.316)
Sale growth	0.011***	0.002***	0.012***	0.001
	(0.000)	(0.008)	(0.000)	(0.187)
R&D	-0.006	0.022***	-0.017**	0.034***
	(0.264)	(0.000)	(0.015)	(0.000)
Cash flow	0.086***	-0.004	0.082***	-0.005
	(0.000)	(0.304)	(0.000)	(0.371)
Compounded excess return	0.016***	0.004	-0.007	0.005
	(0.001)	(0.408)	(0.210)	(0.444)
Growth-resource mismatch [0;1]	-0.001*	-0.002***	-0.001	-0.003***
	(0.083)	(0.001)	(0.120)	(0.003)
Industry acquisition [0;1]	0.005***	0.003	0.005***	0.002
	(0.004)	(0.140)	(0.005)	(0.289)
Industry and Year FE	Yes	Yes	Yes	Yes
Number of target-year	76728	76728	54070	54070
Adjusted R-squared		0.01		0.01
Kleibergen-Paap F-statistic				

Table 5 – Endogeneity of institutional ownership and stock-deal probability (Deal sample)

Panel A of this table presents the instrumental variable regression results of the stock-deal probability on the change in fraction of firms' institutional ownership. Panel B presents the instrumental variable regression results of fraction of stock in the deal payment on the change in fraction of firms' institutional ownership. The instrumental variables employed are dummy variables indicating the switch between the Russell 1000 and Russell 2000 indices from year *(t-1)* to *t*, first and second polynomial order of the change in ranking based on end-of-May market capitalisation from year *(t-1)* to *t* and a control variable for the market capitalisation (*ln(end-of-May market capitalisation)*). Intercept is included in regressions but not reported. All continuous independent variables are measured at the end of previous fiscal year and winsorized at 1% and 99%. p-values are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1%, respectively.

Panel A:Stock-bid likelihood	**Full sample**		**Pre-Banding policy**	
	1st stage	2nd stage	1st stage	2nd stage
Change in total IO		1.414***		1.730***
		(0.001)		(0.000)
$Russell1000_{t-1} \rightarrow Russell2000_t$	-0.014		-0.010	
	(0.327)		(0.495)	
$Russell2000_{t-1} \rightarrow Russell1000_t$	-0.019		-0.017	
	(0.214)		(0.305)	
$ChangeinRank_{t-1} \rightarrow Rank_t$	0.004***		0.004***	
	(0.000)		(0.000)	
$[ChangeinRank_{t-1} \rightarrow Rank_t]^2$	0.000		0.000	
	(0.226)		(0.485)	
ln(end-of-May mktcap)	0.001		0.003	
	(0.807)		(0.467)	
Deal characteristics	Yes	Yes	Yes	Yes
Target characteristics	Yes	Yes	Yes	Yes
Bidder characteristics	Yes	Yes	Yes	Yes
Industry and Year FE	Yes	Yes	Yes	Yes
N	2427	2427	1878	1878
Adjusted R-squared		0.170		0.159

Panel B: % of stock	**Full sample**		**Pre-Banding policy**	
	1st stage	2nd stage	1st stage	2nd stage
Change in total IO		0.890**		1.145***
		(0.017)		(0.004)
$Russell1000_{t-1} \rightarrow Russell2000_t$	-0.017		-0.013	
	(0.243)		(0.392)	
$Russell2000_{t-1} \rightarrow Russell1000_t$	-0.019		-0.016	
	(0.225)		(0.325)	
$ChangeinRank_{t-1} \rightarrow Rank_t$	0.004***		0.004***	
	(0.000)		(0.000)	
$[ChangeinRank_{t-1} \rightarrow Rank_t]^2$	0.000		0.000	
	(0.230)		(0.468)	
ln(end-of-May mktcap)	0.001		0.004	
	(0.775)		(0.394)	
Deal characteristics	Yes	Yes	Yes	Yes
Target characteristics	Yes	Yes	Yes	Yes
Bidder characteristics	Yes	Yes	Yes	Yes
Industry and Year FE	Yes	Yes	Yes	Yes
N	2376	2376	1829	1829
Adjusted R-squared		0.390		0.396

Table 6 – Effect of institutional investor under information asymmetry.
This table presents the results from cross-section test of the information asymmetry. In Panel A, the dependent variable is the fraction of stock in the deal payment. Our sample was split based on the median of the composite information asymmetry proxy of the acquirer. The table in Panel B presents the results from alternative proxies for information asymmetry between the target and bidder. The dependent variables are *local deals(0,1), recent acquisition(0,1),recent equity offerings(0,1), industry complementarity.* All regressions have control variables for deal, bidder, target characteristics and including industry and year fixed-effects. p-values are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

Panel A: Bidder	**Low info.asym**		**High info.asym**	
composite info.asym. proxy	Dependent variable = Fraction of stock			
Institutional ownership				
Change in total IO	0.043		0.274***	
	(0.582)		(0.001)	
Change in QIX IO		0.022		0.386***
		(0.826)		(0.001)
Change in TRA IO		0.072		0.177
		(0.524)		(0.165)
Change in DED IO		-0.075		-0.010
		(0.799)		(0.977)
Deal characteristics				
Hostile deal [0;1]	-0.147***	-0.146***	-0.176***	-0.175***
	(0.000)	(0.000)	(0.000)	(0.000)
Target termination fee [0;1]	-0.006	-0.006	0.069***	0.070***
	(0.787)	(0.804)	(0.001)	(0.001)
Competed Bid [0;1]	-0.069**	-0.069**	-0.082***	-0.079***
	(0.012)	(0.012)	(0.005)	(0.007)
Tender offer [0;1]	-0.359***	-0.359***	-0.537***	-0.539***
	(0.000)	(0.000)	(0.000)	(0.000)
Lockup [0;1]	0.108***	0.108***	0.096***	0.096***
	(0.000)	(0.000)	(0.001)	(0.001)
Same industry [0;1]	-0.005	-0.005	0.030	0.029
	(0.770)	(0.784)	(0.104)	(0.115)
Relative size	-0.014	-0.014	-0.018	-0.018
	(0.585)	(0.581)	(0.217)	(0.233)
Target characteristics				
Size	0.066***	0.065***	0.040***	0.039***
	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.006***	0.006***	0.005**	0.006***
	(0.002)	(0.001)	(0.011)	(0.008)
Leverage	-0.142***	-0.142***	-0.213***	-0.212***
	(0.003)	(0.003)	(0.000)	(0.000)
Cash flow	-0.092	-0.093	0.032	0.032
	(0.135)	(0.134)	(0.481)	(0.482)
R&D	-0.029	-0.030	0.139	0.142
	(0.837)	(0.836)	(0.238)	(0.229)
Bidder characteristics				
Size	-0.060***	-0.060***	-0.038***	-0.037***
	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.004**	0.004**	0.003*	0.003
	(0.038)	(0.038)	(0.095)	(0.105)
Leverage	-0.047	-0.047	-0.037	-0.036
	(0.423)	(0.419)	(0.473)	(0.476)
Cash flow	-0.500***	-0.502***	-0.212***	-0.211***
	(0.000)	(0.000)	(0.000)	(0.000)
R&D	0.138	0.132	0.141	0.131
	(0.562)	(0.579)	(0.370)	(0.405)
Industry and Year FE	Yes	Yes	Yes	Yes
N	1659	1659	1577	1577
Pseudo R-squared	0.478	0.478	0.492	0.492
Chow-test	IO	QIX	TRA	DED
Chow-test p-value	0.0007***	0.0044***	0.2336	0.1346

Table 6 – Effect of institutional investor under information asymmetry (continue)

Panel B: Other bidder's info.asym.	Dependent variable = Fraction of stock			
Bidder acquisitions [*0,1*]	**Recent**		**Non-recent**	
Change in total IO	0.044		0.174***	
	(0.691)		(0.007)	
Change in QIX IO		0.036		0.194**
		(0.813)		(0.027)
Change in TRA IO		0.162		0.106
		(0.317)		(0.286)
Change in DED IO		-0.017		0.003
		(0.972)		(0.991)
N	740	740	2496	2496
Pseudo R-squared	0.635	0.636	0.460	0.460
Bidder equity offerings [*0,1*]	**Recent**		**Non-recent**	
Change in total IO	0.076		0.154**	
	(0.498)		(0.017)	
Change in QIX IO		0.165		0.152*
		(0.285)		(0.079)
Change in TRA IO		0.100		0.088
		(0.549)		(0.369)
Change in DED IO		-0.301		0.052
		(0.485)		(0.847)
N	720	720	2516	2516
Pseudo R-squared	0.592	0.594	0.461	0.461

Panel C: Deal-level info.asym.	Dependent variable = Fraction of stock			
Bidder-target distance	**Local**		**Non-local**	
Change in total IO	0.055		0.170***	
	(0.653)		(0.007)	
Change in QIX IO		0.075		0.159*
		(0.630)		(0.067)
Change in TRA IO		-0.022		0.171*
		(0.911)		(0.072)
Change in DED IO		0.039		0.019
		(0.940)		(0.943)
N	615	615	2621	2621
Pseudo R-squared	0.632	0.632	0.459	0.458
Industry complementarity	**High**		**Low**	
Change in total IO	0.089		0.187**	
	(0.222)		(0.035)	
Change in QIX IO		0.138		0.122
		(0.162)		(0.307)
Change in TRA IO		0.014		0.263*
		(0.895)		(0.054)
Change in DED IO		-0.064		0.167
		(0.833)		(0.637)
N	1725	1725	1511	1511
Pseudo R-squared	0.514	0.515	0.454	0.454

Table 7 – Effect of institutional investor under misvaluation of bidder's shares
This table presents the results from cross-section test of bidder market-to-book valuation. The dependent variable is the fraction of stock in the deal consideration. In Panel A, the subsamples are split by the year-median of the misvaluation component of the ln(M/V) ratio, which is the sum of firm-specific error and time-series sector error. In Panel B, the sample is split by the bidder's short interest ratio 6-month prior the announcement date of the bid. All regressions have control variables for deal, bidder, target characteristics and including industry and year fixed-effects. p-value are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% respectively. p-value of the Chow-test of the difference between two sub-groups are reported are also reported.

Panel A: MTB decomposition	Dependent variable = Fraction of stock			
Misvaluation *Model I*	**High**		**Low**	
Change in total IO	0.052		0.267***	
	(0.451)		(0.005)	
Change in QIX IO		0.153		0.167
		(0.108)		(0.182)
Change in TRA IO		-0.015		0.338**
		(0.887)		(0.019)
Change in DED IO		-0.496*		0.514
		(0.095)		(0.155)
N	1817	1817	1419	1419
Pseudo R-squared	0.549	0.551	0.420	0.420
Misvaluation *Model II*	**High**		**Low**	
Change in total IO	-0.006		0.354***	
	(0.932)		(0.000)	
Change in QIX IO		0.076		0.274**
		(0.425)		(0.027)
Change in TRA IO		-0.031		0.288**
		(0.771)		(0.040)
Change in DED IO		-0.541*		0.462
		(0.074)		(0.188)
N	1826	1826	1410	1410
Pseudo R-squared	0.538	0.539	0.440	0.437
Misvaluation *Model III*	**High**		**Low**	
Change in total IO	0.031		0.307***	
	(0.657)		(0.001)	
Change in QIX IO		0.112		0.219*
		(0.236)		(0.078)
Change in TRA IO		0.017		0.226
		(0.868)		(0.114)
Change in DED IO		-0.507*		0.381
		(0.092)		(0.282)
N	1825	1825	1411	1411
Pseudo R-squared	0.540	0.542	0.437	0.434
Panel B: Acquirer short-selling [t-0.5]	**High**		**Low**	
Change in total IO	-0.010		0.329***	
	(0.896)		(0.000)	
Change in QIX IO		-0.037		0.437***
		(0.717)		(0.000)
Change in TRA IO		0.064		0.237*
		(0.578)		(0.064)
Change in DED IO		-0.084		0.003
		(0.783)		(0.993)
N	1635	1635	1601	1601
Pseudo R-squared	0.463	0.464	0.509	0.510

Figure 1 – *Panel A: Annual total number of bids and the distribution across payment methods.*
The number of bids and distribution across payment methods for the sample of 3,236 takeover bids for U.S public targets by U.S bidders for the period 1984-2017. Both targets and bidders are non-financial and non-utility firms and the target firms have institutional ownership reported on 13F.

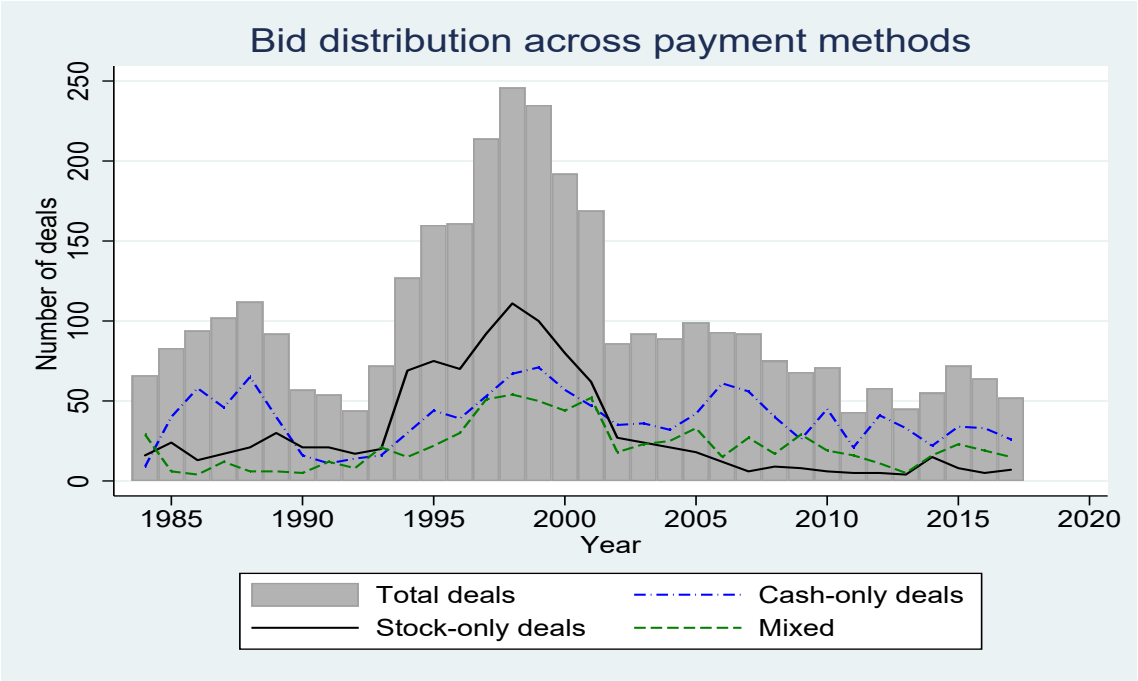


Figure 2 – *Times-series of institutional ownership, by total and across type*
The times-series of total institutional ownership and by type for the sample of 3,236 takeover bids for U.S public targets by U.S bidders for the period 1984-2017. Both targets and bidders are non-financial and non-utility firms and the target firms have institutional ownership reported on 13F.

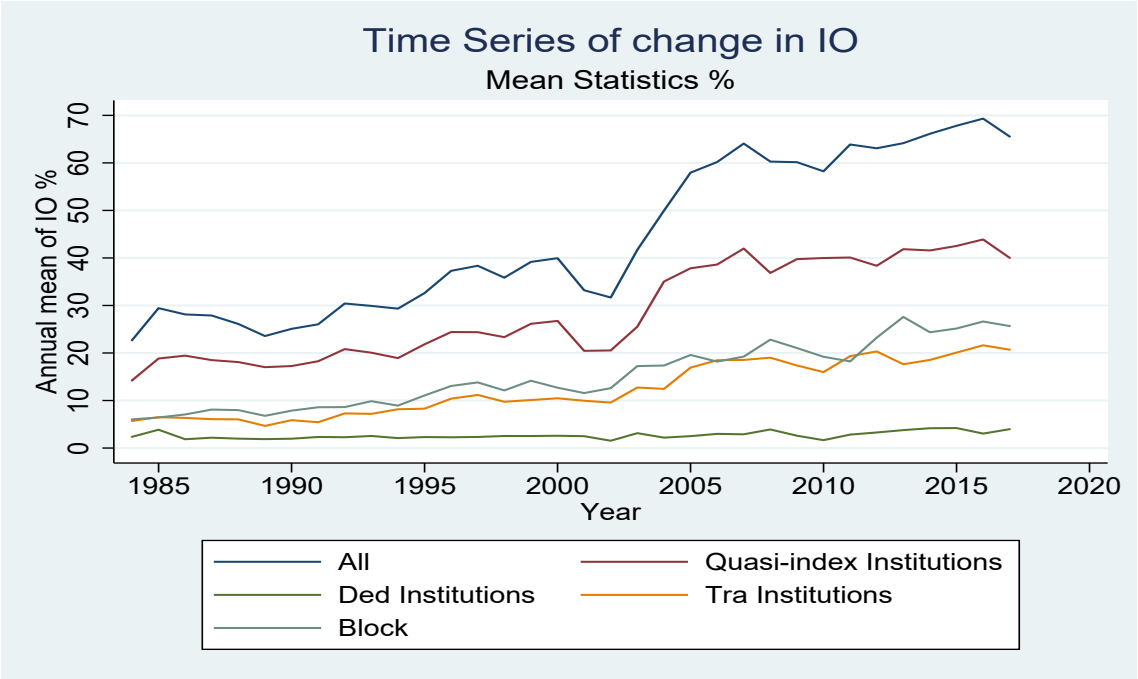
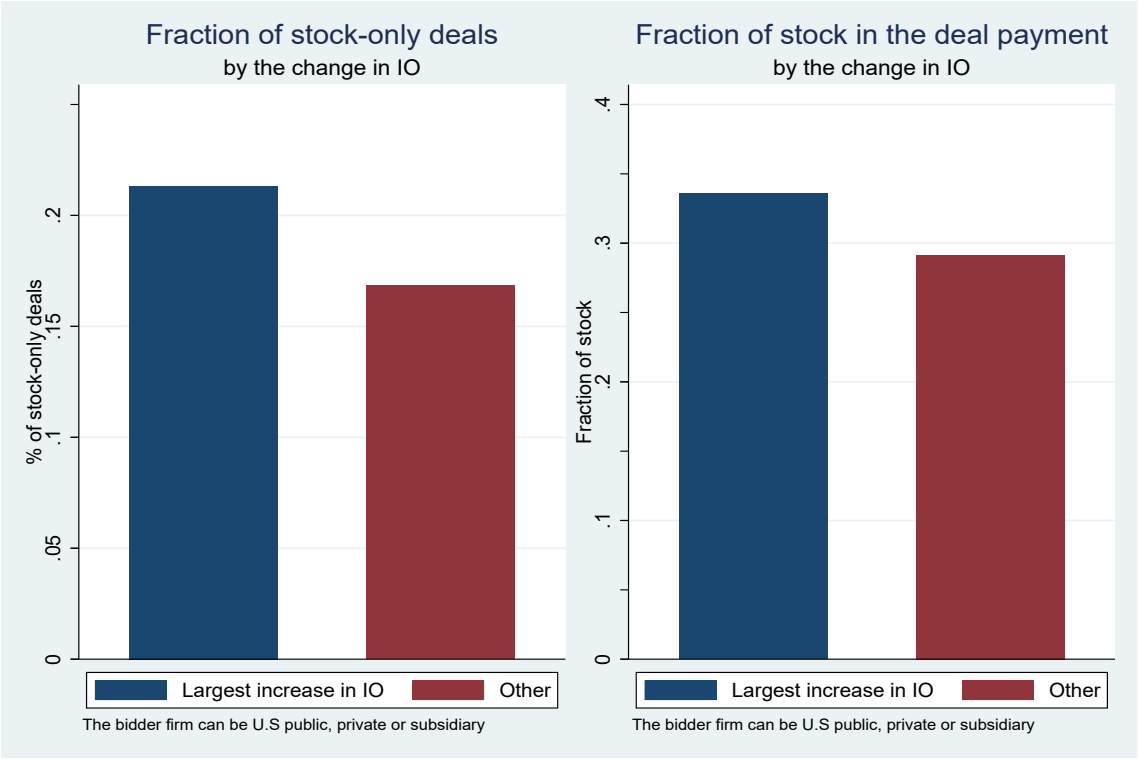
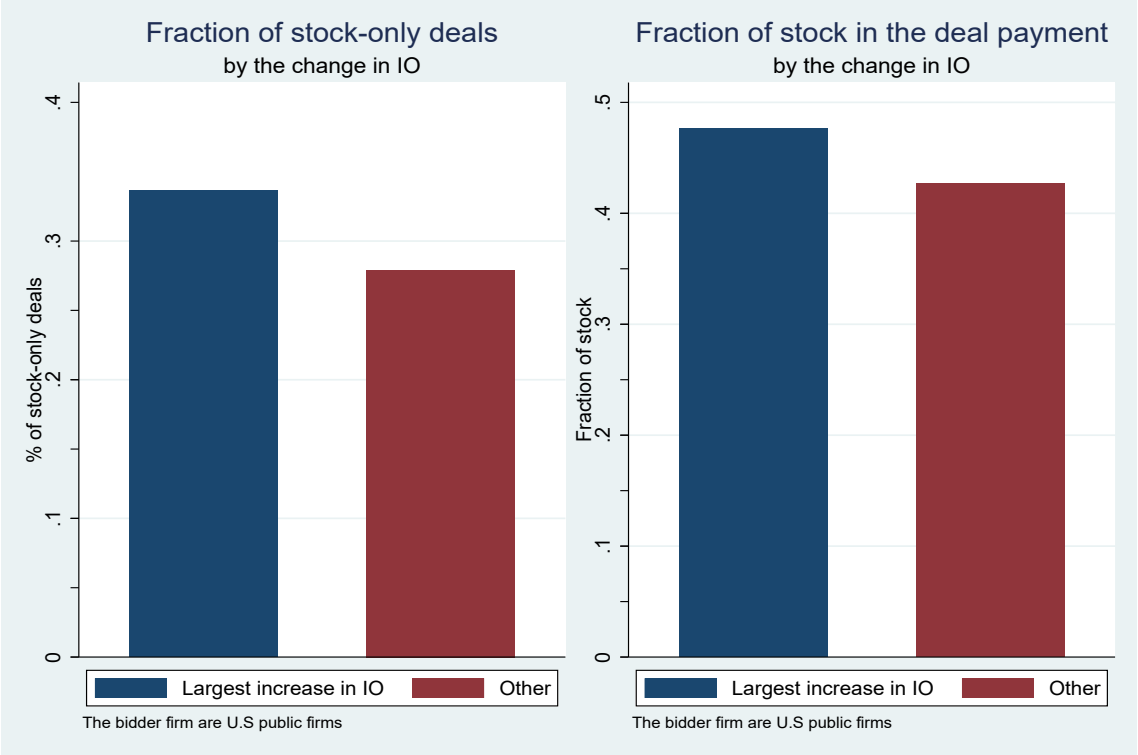


Figure 3 – *Distribution of stock deals and stock payment*
The figure shows the fraction of stock-only deals and the fraction of stock in deal payment when comparing the fifth quintile versus other quintiles of the change in institutional ownership. Figure 3a presents the sample where the bidder can be U.S public, private or subsidiary. Figure 3b presents the distribution for the sample where the bidder is U.S public firm only.





Appendices

Appendix A. Variable Definitions

	Variable	Definition	Data source
Firm characteristics	Firm size	Natural log of total book value of assets	Compustat
	Leverage	Long-term debt divided by book value of assets	Compustat
	Cash flow	(Income before extraordinary items + depreciation) divided by total assets	Compustat
	Return on asset	Earnings before interest divided by book value of assets	Compustat
	Market-to-book	Market value of equity divided by total book value of equity	Compustat
	R&D	Research and Development expense divided by total book value of assets	Compustat
	Cumulative excess return	Annual compounded return from monthly returns for in a given fiscal year (value weighted)	CRSP
	Sale growth	$(Sales_t$ - $Sale_{t-1})/Sale_{t-1}$	Compustat
	Growth-resource mismatch dummy variable	1 if there is a combination of low sale growth, high liquidity and low leverage or high sale growth, low liquidity and high leverage.	Compustat
	Industry acquisition	1 if there is at least one acquisition in the firm's 4-digit SIC the year prior to the year of bid announcement	Compustat
Information asymmetry factor	Tangible assets	Tangible asesets divided by total book value of assets	Compustat
	No of analysts following	Number of analysts forcasting firms EPS in the fiscal year before the annoucement date.	I/B/E/S
	Firm age	Age of firm since first listed on CRSP to the annoucement date	CRSP
	Return volatility	The standard deviation of daily stock return during the trading period (-90,-11) prior to the deal annoucement date	CRSP
	Bid-ask spread	The bid-ask spread of daily stock price scaled by its price for the trading period (-90,-11) prior to the deal annoucement date	CRSP
	Number of prior stock offers	Number of IPO and SEOs by the bidder prior the deal annoucement	SDC Equity
	Abnormal accruals	Absolute value of firm-specific abnormal accruals minus the median abnormal accruals for its respective industry-performance-matched portfolio (2 digit-SIC and ROA_{it-1}) following Kothari et al. (2005). The firm-specific abnormal accruals is the residuals obtained from the modified Jones model: $TA_{it}/Assets_{it-1}$ = α_0 + $\alpha_1/Assets_{it-1}$ + $\alpha_2 \times \Delta Sale_{it}/Assets_{it-1}$ + $\alpha_3 \times PPE_{it}/Assets_{it-1}$.	Compustat
Misvaluation proxies	• *ln(M/V) decomposition*	$m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ln(NI)^+_{it} + \alpha_{3jt} I_{<0} ln(NI)^+_{it} + \alpha_{4jt} LEV_{it} + \epsilon_{it}$, where m_{it} = ln(prccf*csho), b_{it}=ln(ceq), NI=Net Income, LEV=leverage, and I is an indicator variable for positive NI.	
	Misvaluation	Misvaluation of the bidder market-to-book that is specific to firm (firm-specific error, $m_{it} - v(\theta_{it}; \alpha_{jt})$ where α_{kjt} is the annual, sector-average multiples) & misvaluation within the firm's sector (time-series sector error, $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \bar{\alpha}_j)$ where α_{kj} is the long-run sector average multiples)	Compustat
	Long run value-to-book	Long-run value-to-book reflects firm's true value, $v(\theta_{it}; \bar{\alpha}_j) - b_{it}$	
	• *Adjusted short interest*	The difference between Short interest ratio, which is the short position at the settlement date of the 15th of each month, divided by shares outstanding of the same month, and the mean of short interest ratio of all firms (shrcd 10,11 and traded on NYSE, AMEX and NASDAG) in the same month.	Compustat, CRSP
	• *Analyst earnings forecast dispersion*	Standard deviation of earnings forecast for the bidder firms for the fiscal year-end prior to the bid announcement calculated from the monthly forecasts, divided by the annual average forecast for the firm.	I/B/E/S

Appendix A. Variable Definitions (continue)

	Variable	Definition	Data source
Deal characteristics	Stock-only deals	1 if consideration is Share-only	SDC M&A
	Cash-only deals	1 if consideration is Cash-only	SDC M&A
	Mixed deals	1 if consideration is mixed between shares and cash payment	SDC M&A
	Hostile deals	1 if deal attitude is hostile or unsolicited	SDC M&A
	Toehold	1 if bidder owns a fraction of target shares	SDC M&A
	Termination fee	1 if the target has termination fee provision in the merged contract	SDC M&A
	Local deals	1 if bidder and target are located within 30 miles. The spherical law of cosines formula: 3963 miles $\times$ acos[sin(lat_a) $\times$ sin(lat_t) + cos(lat_a) $\times$ cos(lat_t) $\times$ cos($long_a$-$long_t$)], where (lat_a,$long_a$), (lat_t,$long_t$) are (latitude,longitude) measured in radians, of the bidder and target location, respectively.	SDC M&A & US Census Gazetteer 2000 & city coordinates (from `https://simplemaps.com/data/us-cities`).
	Recent acquirer	1 if bidder announced another merger bid within 2 years prior to the sample bid	SDC M&A
	Recent equity offerings	1 if bidder issued common stocks within 2 years prior to the sample bid	SDC Equity
	Industry complementarity	The degree to which the target and bidder input and output industries overlap	US Bureau of Economic Analysis, Joseph Fan's website, SDC M&A
	Same industry	1 if target and acquirer are in the same 4-digit SIC industry	Compustat
	Tender offer	1 if the tender merger flag is "YES"	SDC M&A
	Competed bids	1 if there are more than 1 bidder for the deal	SDC M&A
	Lockup	1 if deal includes a lockup of target or acquirer shares	SDC M&A
	Relative size	Deal value divided by market capitalisation of acquirer	SDC M&A
	Completion	1 if the announced deal is completed	SDC M&A
Institutional ownership	Total institutional ownership	Change in fraction of total institutional ownership for the fiscal year-end prior to the announcement date of takeover bid	Thomson Reuters 13F/ S34 Database
	QIX institutional ownership	Change in fraction of quasi-indexer institutional ownership for the fiscal year-end prior to the bid announcement date	
	DED institutional ownership	Change in fraction of dedicated institutional ownership for the fiscal year-end prior to the bid announcement date	13F/S34 Database & Bushee institutional investor classification
	TRA institutional ownership	Change in fraction of transient institutional ownership for the fiscal year-end prior to the bid announcement date	
	Blockholder dummy	1 if target firm has at least one blockholder in the fiscal-year end before the deal announcement. A blockholder is institution that holds at least 5% share ownership at any reporting quarter in firm's fiscal year.	Thomson Reuters 13F/ S34 Database
	Common-ownership	The proportion of target firm ownership hold by the same institution within a reporting quarter	Thomson Reuters 13F/ S34 Database

Appendix B. Description of deal sample characteristics

B1. Selection criteria and sample distribution

N. denotes the total number of deals, C. denotes completed deal sample and W. denotes the withdrawn deal sample.

Sample	Sample Criteria	N.	C.	W.
Deal sample	Deals announced between 01/01/1984 -31/12/2018			
	All bidders and targets are U.S firms;	288,707		
	Targets are public firms;	56,458		
	Bidders are public, subsidiary or private firms;	55,679		
	Deal value is at least $1m U.S Dollar and account for at least 1% of the bidder's market capitalisation reported at the fiscal year-end date prior to the bid announcement date;	45,079		
	Deal is either completed or withdrawn;	24,891		
	Deal is classified as 'merger' or 'acquisition of majority interest';	12,639		
	More than 50% of outstanding shares of the target are sought in a withdrawn deal or acquired in a completed deal;	12,514		
	Time to complete successful bids is within 1000 days;	12,491	9,909 (79.33%)	2,582 (20.67%)
Deal-Compustat -CRSP merged	Deals where targets have stock market and accounting data available from CRSP and from Compustat	8,369		
	Deals where both target and bidder have information available from CRSP and Compustat	5,689		
Deal-Compustat -CRSP-S34	Deals where targets have ownership information available from Thomson Reuters Institutional Holdings (13F database)	5,269	4,416 (83.81%)	853 (16.19%)
	Exclude financial (SIC 6000-6999) and utility firms (4900-4999)	3,691	3,029 (82.06%)	662 (17.94%)
	Bidder is public firrm	3,505	2,878 (82.11%)	627 (17.89%)
	If payment consideration can be classified into 3 categories i.e drop unknown consideration	3,297	2,749 (83.38%)	548 (16.62%)
	If the fraction of stock payment is not missing	3,236	2,656 (82.08%)	580 (17.92%)

Sample unconditional on the bidder characteristics except bidders being U.S public, private or subsidiary firms. If there are multiple bids to a firm in a given year, only the first announcement is counted. This table presents both the number of deals and unique firm-year count for the firm-year level (whole sample) analysis.

Deal-Compustat	Deals where targets have stock market and accounting data available from CRSP and from Compustat	8,369	
Deal-Comp-CRSP S34	Deals where targets have ownership information available from Thomson Reuters Institutional Holdings (13F database)	8,099	
	Non-missing control variables for takeover probability tests & exclude financial (SIC 6000-6999) and utility firms (4900-4999)	6,015	(5,553) Firm-Year
	If payment consideration can be classified into 3 categories	5,556	(5,411) Firm-Year

B2. Industry distribution of sample bids and payment method.
The table reports the frequency of takeovers bids, and by payment method by the acquirer's Fama and French 48 Industry Classification. This table describes our deal sample consisting of 3083 takeover bids for the U.S public target firms by U.S public acquirer firms with all criteria as reported in the Appendix B1.

Fama-French 48 Industries	All deals	Stock-only	Mixed	Cash-only
34 Business Services	423	179	85	160
36 Electronic Equipment	237	97	42	98
35 Computers	218	95	34	90
32 Communication	212	72	83	54
13 Pharmaceutical Products	195	84	38	73
42 Retail	177	55	42	78
30 Petroleum and Natural Gas	147	43	81	24
12 Medical Equipment	124	54	19	51
21 Machinery	117	43	26	50
41 Wholesale	106	31	29	47
11 Healthcare	98	41	29	28
37 Measuring and Control Equipment	93	22	14	56
40 Transportation	88	20	22	45
14 Chemicals	69	11	20	38
2 Food Products	61	10	18	33
9 Consumer Goods	61	10	15	40
7 Entertainment	60	17	20	23
19 Steel Works Etc	54	12	17	25
17 Construction Materials	53	10	7	35
38 Business Supplies	48	11	9	28
23 Automobiles and Trucks	42	6	10	26
22 Electrical Equipment	41	13	5	23
24 Aircraft	41	3	8	30
43 Restaraunts, Hotels, Motels	39	17	12	10
45 Insurance	39	14	12	14
33 Personal Services	37	13	11	13
47 Trading	35	6	13	18
8 Printing and Publishing	31	4	4	23
18 Construction	31	7	17	7
6 Recreation	30	12	6	12
31 Utilities	28	11	7	10
10 Apparel	25	2	6	17
15 Rubber and Plastic Products	24	8	3	13
48 Almost Nothing	22	3	4	15
44 Banking	19	8	5	6
20 Fabricated Products	17	3	3	11
16 Textiles	15	2	5	8
25 Shipbuilding, Railroad Equipment	13	3	2	8
39 Shipping Containers	13	3	4	6
26 Defense	10	2	2	6
28 Non-Metallic and Industrial Metal Mining	9	2	5	2
4 Beer & Liquor	8	2	3	3
27 Precious Metals	7	6	1	0
5 Tobacco Products	6	0	1	5
1 Agriculture	4	1	1	2
3 Candy & Soda	3	0	3	0
29 Coal	3	1	1	1
46 Real Estate	3	1	1	2
Total	3236	1327	799	1070

Appendix C. Other measures for examining the mechanisms of the effect of institutional ownership

C1. Information asymmetry factor

This table presents the factor loadings from a factor analysis for the two factors with eigenvalue greater than 1. We construct a single information asymmetry proxy from the eight measures of the bidder firm characteristics, that are comparable to eight primitive measures of information asymmetry as employed in Karpoff et al. (2013). Previous studies have documented the relation between these component variables and information asymmetry. Firm size, firm age, number of analysts covering the firm, tangible assets and number of stocks previously issued are indicators of informative prices (Barth et al., 2001; Hong et al., 2000), we expect these measures to be negatively correlated to the information asymmetry proxy. The remaining three components are expected to be positively correlated to the information asymmetry based on previous findings in seasoned equity pricing studies: bid-ask spread and return volatility reflect the greater risk bearing of the outside uninformed investors about a firm (Corwin, 2003), and abnormal accruals measures the quality of accounting measures in financial statements that outside investors rely on to assess firm's value (Kothari et al., 2005; Lee and Masulis, 2009).

The final measure of the bidder information asymmetry proxy is constructed by multiplying Factor 1 by (-1). The Kaiser-Meyer-Olkin(KMO) measure of sampling adequacy statistics for each factor loading and the resulting factors are presented in the last column.

N.proxy	**Variable**	**Predicted correlation with info asymmetry**	**Factor1**	**Factor2**	**KMO measure of sampling adequacy**
1	Firm size	—	0.8657	-0.0936	0.6683
2	Tangible assets	—	0.2543	0.6807	0.6836
3	Firm age	—	0.6862	0.1816	0.7662
4	No.analysts	—	0.6645	-0.2501	0.7064
5	No.prior stock offered	—	0.3139	-0.2004	0.7311
6	Daily bid-ask spread	+	-0.3896	0.5200	0.7761
7	Daily return volatility	+	-0.6920	-0.0759	0.7813
8	Abnormal accruals	+	-0.3138	-0.5180	0.7035
	KMO overall				0.7195
	Eigenvalue		2.5541	1.1523	

C2. Summary statistics for market-to-book decomposition

The table reports the summary statistics for the MTB decomposition at firm-level across the three models proposed by Rhodes-Kropf et al. (2005). The Fama-French 12-industry classification is used to defined sectors. Model I corresponds to $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \epsilon_{it}$, where m_{it} is the natural logarithm of firm's market value of equity, b_{it} is the natural logarithm of the firm's book value of equity, α_{0jt} and α_{1jt} are estimated from the annual, cross-sectional regressions for each sector. The log of market to book $(m_{it} - b_{it})$ is decomposed into 3 components: firm-specific error $(m_{it} - v(\theta_{it}, \alpha_{jt}))$, time-series sector error $(v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \bar{\alpha}_j))$ and long-run value-to-book $(v(\theta_{it}; \bar{\alpha}_j) - b_{it})$. The fundamental value of firm $v(\theta_{it}, \alpha_{jt})$ is obtained by applying the annual, sector-average regression multiples to firm-level accounting variables: $v(\theta_{it}, \alpha_{jt}) = \hat{\alpha}_{0jt} + \hat{\alpha}_{1jt} b_{it}$, whereas $v(\theta_{it}; \bar{\alpha}_j)$ is obtained by applying the long-run sector-average regression multiples to firm-level accounting variables: $v(\theta_{it}, \alpha_j) = \bar{\alpha}_{0j} + \bar{\alpha}_{1j} b_{it}$ where $\bar{\alpha}_j = 1/T \sum \hat{\alpha}_{jt}$.

Model I: $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \epsilon_{it}$

Model II adds log of Net Income, where $ln(NI)^+_{it}$ is natural logarithm if the absolute value of firm's net income and $I_{(<0)}$ is an indicator variable for negative net income.

Model II: $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ln(NI)^+_{it} + \alpha_{3jt} I_{(<0)} ln(NI)^+_{it} + \epsilon_{it}$

Model III further adds firm's leverage ratio, which is defined as the long-term debt plus debt in short-term liabilities divided by the total book value of assets.

Model III: $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ln(NI)^+_{it} + \alpha_{3jt} I_{(<0)} ln(NI)^+_{it} + \alpha_{4jt} LEV_{it} + \epsilon_{it}$

	Cash-only	**Mixed**	**Stock-only**
	Mean	Mean	Mean
$m_{it} - b_{it}$	0.735	0.647	0.918
Model I			
Firm-specific error	0.136	0.119	0.309
Time-series sector error	0.062	0.070	0.097
Long-run value to book	0.537	0.456	0.512
Model II			
Firm-specific error	0.056	0.093	0.252
Time-series sector error	0.078	0.099	0.098
Long-run value to book	0.474	0.564	0.568
Model III			
Firm-specific error	0.063	0.091	0.248
Time-series sector error	0.051	0.078	0.098
Long-run value to book	0.622	0.475	0.572

C3. Russell Index switches and Russell rank proxy

The Russell 1000/2000 Index data between 1984-2018 are obtained from the FTSE Russell- U.S. Monthly Index Holdings.

To address the endogeneity concern about the institutional holdings, we rely on the Russell 1000/2000 Index Reconstitution for our identification strategy. Firms that are closed to either side of the Russell 1000/2000 threshold have similar market capitalisation at the 'rank date' in May. The assignment of stocks to Russell indices is as close as random. This is because first, Russell use their proprietary calculation of total market capitalisation reflecting only shares that are available to the public and second, index assignment depends solely total market capitalisation at the end of May and last, firms cannot directly control for the float-adjusted market capitalisation used for Russel index assignment (Crane et al., 2016). Since Russell Index are value-weighted, the random assignment of stocks into the Russell 1000/2000 Index has a great implication on the institutional shareholdings of firms with stocks that switch from their existing Russell Index inclusion. Institutions that benchmark against the Russell indices adjust their portfolio weights so that the smallest stocks in the Russell 1000 Index have significantly lower portfolio weights in comparison to the largest stocks in the Russell 2000 Index (Appel et al., 2016; Chang et al., 2015; Crane et al., 2016; Schmidt and Fahlenbrach, 2017). It therefore implies that firms that switch from Russell 2000 Index to Russell 1000 Index would experience a significant increase in institutional ownership and firms that switch from Russell 1000 to Russell 2000 would see a reduction in institutional ownership.

Since Russell does not provide the ranking data used to determine the index membership inclusion, we construct a ranking variable for approximating the actual ranking variable used by Russell. This ranking variable is based on a proxy for the float-adjusted

end-of-May total market capitalisation of the firm. We construct the approximation for Russell end-of-May total market capitalisation based on the CRSP-based and Compustat-based total market capitalisation at the firm level following Ben-David et al. (2019).[21] Specifically, the final approximation for end-of-May total market capitalisation used by Russell equals to CRSP-based total market capitalisation aggregated at the firm level but it equals to the Compustat-based total market capitalisation aggregated at the firm level where the CRSP-based proxy is smaller than the Compustat-based proxy.

Our IV estimation employ the Russell Index switches as instruments. The first stage is a regression of change in institutional ownership on a set of instruments, firm-specific characteristics, industry and time fixed effects.

$$\begin{aligned} \Delta IO_{it} = \alpha_j + \sigma_t + \beta_1 R1000_{t-1} \to R2000_t + \beta_2 R2000_{t-1} \to R1000_t \\ + \gamma_0 (Rank_t \to Rank_{t-1}) + \gamma_1 (Rank_t \to Rank_{t-1})^2 + \theta X_{it} + \epsilon_{it} \end{aligned} \tag{1}$$

where α_j is industry-fixed effects, σ_t is time-fixed effects, X_{it} are time-varying firm-specific characteristics. The second stage is a regression of the takeover likelihood on the predicted change in institutional ownership, firm-specific characteristics, industry and time fixed effects.

$$y_{i,t+1} = \omega_j + \eta_t + \lambda \widehat{\Delta IO_{it}} + \phi X_{it} + \mu_{it} \tag{2}$$

where $y_{i,t+1}$ indicates whether a firm receives at least one takeover offer (or a stock-bid offer) in the year following the change in institutional ownership.

[21] We thank Rabih Moussawi for kindly providing us the Russell 3000 constituent data between 2000 and 2006 for our initial analysis. We also thank the authors for providing code for generating the Russell Rank proxy in the Appendix B of Ben-David et al. (2019).