The Role of Stock Liquidity in Mergers and Acquisitions: Evidence from a Quasi-natural Experiment*

Nishant Dass
Georgia Institute of Technology
Email: nishant.dass@scheller.gatech.edu

Sheng Huang
Singapore Management University
Email: shenghuang@smu.edu.sg

Johan Maharjan
Rensselaer Polytechnic Institute
Email: maharj2@rpi.edu

Vikram Nanda
University of Texas at Dallas
Email: vikram.nanda@utdallas.edu

May 2016

*We thank Itay Goldstein, Todd Gormley, Jarrad Harford, and seminar participants at Singapore Management University and Tshinghua University for helpful comments. All remaining errors are our own.

The Role of Stock Liquidity in Mergers and Acquisitions: Evidence from a Quasi-natural Experiment

Abstract

We examine how stock liquidity – of both acquirers and targets – affects acquisitions. We contend, relying on a simple model, that liquidity enhances acquirer stock value as an acquisition currency, especially when target stock is less liquid. Supportive of this acquisition-currency hypothesis: greater acquirer (lower target) liquidity increases acquisition likelihood and payment with stock, reduces acquisition premium, and improves acquirer announcement returns in equity deals. Our identification strategy relies on the exogenous variation in stock liquidity induced by changes in the composition of Russell-1000/2000 indices to establish causality. Consistent with the beneficial role of stock liquidity, firms take steps to improve stock liquidity prior to acquisitions.

JEL classification: G30, G34

Keywords: Stock liquidity, mergers and acquisitions, Russell index reconstitution

"The Covance board also discussed with Goldman Sachs [its financial advisor] the liquid market for LabCorp stock, which would allow Covance stockholders to either keep or trade the stock portion of the consideration."

From Board of Directors of Covance Inc. on its
proposed merger with Laboratory Corp of America

1. Introduction

In well over half of the acquisitions in the US, the payment is fully or partially made with acquirer stock.[1] In this paper, we explore the role of stock liquidity – both of the acquirer and the target – in the merger and acquisition process. Anecdotes, like the quoted one above, abound suggesting that targets value the liquidity of acquirers' stock.[2] Our contention is that liquidity makes stock more valuable as an acquisition currency, especially when the target firm's stock is less liquid. We propose a simple model of stock liquidity in the context of mergers and test its predictions. Our empirical identification exploits the exogenous variation in stock liquidity of firms induced by the annual Russell index reconstitution. Supportive of this acquisition currency hypothesis, we find that stock liquidity of the acquirer relative to that of the target significantly affects the ability of firms to make acquisitions, the method of payment, the acquisition premiums, and ultimately, shareholder value. Further, we document that firms take measures to manage their stock liquidity prior to undertaking acquisitions.

Stock liquidity can affect the takeover process via different channels. In addition to the acquisition currency channel, we consider (in broad terms) two alternative types of channels through which liquidity can impact takeovers. We label these as the governance and the valuation channels. While some of the predictions of our hypothesis overlap with those of the alternative channels, others are specific to the acquisition currency channel. Hence, our empirical approach

[1] A majority of the acquisitions over the 1990-2014 period in the US have been paid for using at least some acquirer stock i.e., all-stock or mixed stock-and-cash (e.g., Boone, Lie, and Liu, 2014).
[2] More can be seen from cases where Northwest Bancshares Inc. acquired LNB Bancorp Inc., FNB Corp. acquired PVF Capital Corp., and Pacific Premier Bancorp Inc. acquired San Diego Trust Bank. In all these deals, the acquirers' stock liquidity was considered to be an important factor in the merger and acquisition consideration by the targets. According to the disclosures on the deal negotiation process, comments such as "the lack of liquidity in acquirer B's stock" and "the liquidity of each party's stock" are often made in the boards' explanations on either accepting or rejecting a deal.

is to provide evidence that is best explained by the acquisition currency channel, but not by the alternative channels. In other words, while liquidity could affect acquisition through different channels, our evidence indicates that the acquisition currency has a significant and discernible effect on the acquisition process.

Our hypothesis is that higher liquidity of the acquirer's stock, and correspondingly lower target liquidity, can render an acquirer more attractive to the target and increase the likelihood that the target will accept stock as the acquisition currency. We propose a stylized model to argue that greater liquidity of the merged firm would allow shorter-term target investors to trade their stock more quickly and with lower price impact. For most target shareholders, greater liquidity of the acquirer's stock mitigates the key difference between stock and cash payment in terms of liquidity provision while maintaining benefits that are unique to stock payment (such as deferred capital gains taxes). We refer to this as the Acquisition Currency (or Currency) hypothesis or channel.

Our acquisition currency model delivers a number of predictions that we subsequently subject to empirical testing. First, since firms with more liquid stock (relative to target) are likely to make stock acquisitions on better terms, they are more likely to make acquisitions and to make them by paying stock, *ceteris paribus*. Second, more liquid acquirers are expected to pay lower premiums in stock acquisitions, but not in cash acquisitions. This is because target shareholders will be willing to pay a "liquidity premium" for an acquirer's more liquid stock. Third, anticipating the benefits of using more liquid stock in stock acquisitions, firms will take deliberate steps to improve stock liquidity prior to stock acquisitions. Finally, the more liquid the acquirer's stock (relative to target), the more favorable the acquirer's deal announcement abnormal returns are expected to be for stock acquisitions. This is because acquirers' shareholders gain more (or lose less) from acquisitions paid with more liquid stock as they pay lower deal premiums.

Of the alternative modes through which liquidity could affect acquisitions, we label the first as the Governance channel. The notion is that greater stock liquidity could reduce the noise in stock prices, and thus make it optimal for firms to give managers stronger stock-based incentives, thereby reducing agency problems. Greater stock liquidity could also facilitate the creation of blockholders and lead to better monitoring of managers (e.g., Edmans, Fang, and Zur, 2013). The reduction in agency problems, whether through stronger incentive contracting or through better monitoring, could enhance the quality of the acquisitions made by the firm.[3] Empirical tests allow us to distinguish between the governance and the acquisition currency channels. In particular, the governance channel has no prediction in terms of the effect of target liquidity on the acquisition premium or on the greater reliance on stock-for-stock acquisitions, as predicted by the acquisition currency hypothesis.

The second alternative we label as the Valuation channel. The notion is that liquidity could affect acquisitions because of the greater price informativeness or lower information asymmetry that is usually associated with greater stock liquidity. Hence, target shareholders may be less concerned about being paid with overvalued stock when the acquirer's stock is highly liquid. The literature suggests that stock acquisitions can often be motivated by the perceived overvaluation of acquirer stock (e.g., Shleifer and Vishny, 2003).[4] The more favorable valuation of firms with more liquid stocks (Fang, Noe, and Tice, 2009) could also increase firms' incentives to make acquisitions with stock swaps. We note that while the valuation channel could induce firms to rely more on stock-for-stock acquisitions, there is no prediction that the acquisition premium would be affected by the target firm's stock liquidity, as is predicted by the acquisition currency hypothesis.

To test the predictions of our acquisition currency model, we use a sample of M&As by publicly listed acquirers over 1985-2012 and a variety of measures for stock liquidity. We find strong empirical support for our empirical predictions. In discussing our findings, we briefly

[3] A paper that finds support for greater stock liquidity enhancing the acquisition process through the governance channel is Roosenboom, Schlingemann, and Vasconcelos(2013).
[4] Several papers deal with overvalued stock in acquisitions: Rhodes-Kropf, Robinson, and Viswanathan (2005), Ang and Cheng (2006), and Dong, Hirshleifer, Richardson, and Teoh (2006).

present our findings and then discuss our methodological approach to deal with the endogeneity inherent in the relation between a firm's stock liquidity and its decision to make acquisitions. Our first empirical result is that the likelihood of a firm making an acquisition and, in particular, making a stock acquisition, is positively related to the firm's stock liquidity. This relationship is not only statistically significant, but also economically meaningful. The odds of making an acquisition are 0.95-3.97 times higher following a one-standard-deviation increase in liquidity (the odds of making a stock acquisition are even higher), depending on the liquidity measure. Consistent with liquid stock being a valuable acquisition currency, the effect of liquidity on the likelihood of making a stock acquisition is stronger for firms that are financially more constrained.

Also, the fraction of the acquisition payment that is made with stock increases with the acquirer's stock liquidity relative to the target's in deals involving public targets. Furthermore, because investors with short investment horizons have more need for relatively immediate trading after the deal completion than longer-term investors, we would expect them to value the relative stock liquidity more if the deal is paid in stock. Consistent with this notion, we find a stronger stock-payment-relative-liquidity sensitivity in deals where targets have more short-term investors in their investor base.

Second, for stock deals, the premium paid by the acquirer to the target as a percentage of the target's stock price two days prior to the deal announcement is negatively related to the acquirer's stock liquidity relative to the target's.[5] A one-standard-deviation increase of the acquirer-target liquidity difference is associated with a reduction of 1.68%-4.25% in the premium paid, depending on the liquidity measure. This is economically significant, when compared with the average premium of 25.9% in stock-paid acquisitions of public targets in our sample.

[5] We examine the impact of the acquirer's relative liquidity to the target's because target shareholders would care more about the acquirer's liquidity incremental to the target's or the expected change in liquidity brought by the deal. Our results remain qualitatively similar if we look at the acquirer's own liquidity.

Interestingly, consistent with the irrelevance of the acquirer's stock liquidity for target shareholders in cash-paid deals, a similar relation is not found in these deals.

Third, firms tend to increase the frequency of earnings guidance provisions and conduct stock splits prior to making stock acquisitions. By voluntarily disclosing more information than regulations mandate, these firms can reduce information asymmetry between insiders and investors, which leads to higher liquidity (e.g., Diamond and Verrecchia, 1991; Beyer, Cohen, Lys, and Walther, 2010). Stock splits can lead to more trading and thus more informative stock prices, because an increase in uninformed trading attracts more informed trading (e.g., Kyle, 1985). As the literature shows, and we also confirm, these actions help to increase stock liquidity.[6]

Finally, for stock deals, acquirers' three-day [-1, 1] cumulative abnormal returns (CARs) around deal announcements are positively related to the acquirer's liquidity (relative to the target's). For instance, a one-standard-deviation increase in the acquirer-target liquidity difference is associated with an increase in CARs by 0.51%-0.95%, depending on the liquidity measures. The average (median) three-day CARs for stock deals involving public targets in the sample are -3.86% (-2.94%). And thus the effect of the liquidity difference is economically substantial. The value gains associated with more liquid acquirers are consistent with the lower premiums they pay for the targets.

We briefly describe our identification strategy. Since both stock liquidity and acquisition decisions are endogenous, an important contribution of our paper is to exploit the variation in stock liquidity that occurs to a narrow bandwidth of firms around the Russell 1000/2000 cutoff threshold following the annual Russell index reconstitution to identify the causal impact of liquidity on M&As. Since Russell 1000/2000 index portfolio weights are value weighted, stocks at the top of Russell 2000 receive significantly higher weights than stocks at the bottom of

---

[6] For instance, Muscarella and Vetsuypens (1996), Coller and Yohn (1997), Lin, Singh, and Yu (2009), and Balakrishnan, Billings, Kelly, and Ljungqvist (2014).

Russell 1000. This would lead to substantially higher liquidity of the stocks at the top of Russell 2000, due possibly to two reasons as follows.

The first corresponds to the market microstructure component of stock liquidity (the compensation to the market makers for holding inventory and facilitating trades (e.g., Amihud and Mendelson, 1991)). There is disproportionately more money passively tracking Russell 2000 relative to its total market capitalization and also a substantially greater number of products and dollar amount actively benchmarked to Russell 2000 than to Russell 1000 (see more details in Section 4.2). Thus, in stocks at the top of Russell 2000 (relative to stocks at the bottom of Russell 1000), there is more passive trading in response to fund flows by passive funds (who will match their portfolio weights more closely for stocks at the top of an index to minimize tracking errors) and more active trading due to benchmarking strategies. This contributes to the higher liquidity of stocks at the top of Russell 2000. The other reason relates to the adverse selection component of stock liquidity (the information-related price impact of a trade as described by Kyle (1985)). The greater institutional ownership in stocks at the top of Russell 2000 than in stocks at the bottom of Russell 1000 (see, e.g., Crane, Michenaud, and Weston, 2014; Appel, Gormley, and Keim, 2016c) incentivizes firms to increase information disclosure and improve firm transparency, and hence reduces the adverse selection part of trading cost (Boone and White, 2015).[7]

However, because Russell computes index constituent's portfolio weights using its proprietary float-adjusted end-of-June market capitalization that is meant to account for stock liquidity (shares not publicly tradable are excluded in the float adjustment), the difference in liquidity for the bottom stocks of the Russell 1000 and the top stocks of the Russell 2000 is likely to not be exogenous (but is affected by Russell's float adjustment). Therefore, we adopt an instrument variable estimation approach following Appel, Gormley, and Keim (2016c). Specifically, we rank stocks based on their end-of-May market capitalization, and select the sample using a bandwidth of firms ranked around the 1000th midway point for each year of the

[7] See also Diamond and Verrecchia (1991) and Beyer, Cohen, Lys, and Walther (2010).

sample. We instrument for stock liquidity with an indicator of a stock being in the right bandwidth (ranked below the 1000th midway point) in a given year, and identify the impact of the instrumented stock liquidity on firm acquisition decisions and deal characteristics. Our identification assumption is that, for firms ranked close to the 1000th midway point, being ranked slightly below or above the midway point does not directly affect M&As except through its impact on stock liquidity. This is reasonable because the variation in stock liquidity in those firms is likely to be exogenous after controlling for their market capitalization that determines their ranking.

We confirm with strong supportive results from the instrument variable estimation that the effects of stock liquidity are causal. The results are robust to the number of firms included in the bandwidth and the functional form of the control for market capitalization. We also show that our findings are unlikely to be caused by the change in acquirers' corporate governance associated with the index reconstitution (Appel, Gormley, and Keim, 2016c). Specifically, this governance interpretation cannot explain why a firm being assigned into Russell 2000 is more likely to make (stock) acquisitions and pay for the acquisitions more in stock, especially when it is more financially constrained. Nor would it explain why stock acquisitions and premiums are affected by target stock liquidity. Moreover, when focusing on a subsample of firms that are unlikely to observe a contrasting effect of index reconstitution on their governance across the 1000th midway point, we find that the results of our IV regressions still hold.

Our study contributes to several different strands of the literature. First, we add to the literature on the effect of stock liquidity on firms' decisions, governance, and performance. Existing empirical studies have shown that stock liquidity is positively associated with firm value (Fang, Noe, and Tice, 2009), and can affect executive compensation (Jayaraman and Milbourn, 2012), corporate governance (e.g., Bharath, Jayaraman, and Nagar, 2013; Edmans, Fang, and Zur, 2013; Back, Li, Ljungqvist, 2014), and corporate innovations (Fang, Tian, and Tice, 2014; Dass et al., 2015). More generally, our findings are consistent with the stock market having real effects, as suggested by a burgeoning literature (see Bond, Edmans, and Goldstein (2012) for a summary).

We show that stock liquidity has real implications on firms' acquisition decisions and helps to lower deal premiums paid, which enhances value for acquirers. Prior studies have focused primarily on the (il)liquidity of *targets* and examined its implication on deal characteristics and pricing (e.g., Shleifer and Vishny, 1992; Koeplin, Sarin, and Shapiro, 2000; Schlingemann, Stulz, Walkling, 2002; Officer, 2007; Massa and Xu, 2013). This is in contrast to our focus on stock liquidity of *public* acquirers jointly with the liquidity of targets. For instance, Koeplin, Sarin, and Shapiro (2000) and Officer (2007) document a price discount for unlisted targets because sellers cannot trade their equity easily.[8] Massa and Xu (2013) find that acquiring a more liquid target is associated with an increase in the liquidity of the combined firm, and public acquirers prefer more liquid targets and are willing to pay more for them. They, however, do not consider the impact of acquirers' liquidity.

Our finding that acquirer's stock liquidity is positively related to acquirer's announcement returns in stock acquisitions of publicly-listed targets is consistent with Roosenboom, Schlingemann, and Vasconcelos (2013). However, they focus primarily on the relation between stock liquidity and acquirer returns in acquisitions of unlisted targets, scenarios where they argue that institutional monitoring through voice is more important than the threat of exit. More importantly, unlike all of the above studies, we also examine how acquirers' stock liquidity affects the method of payment and how firms act proactively to manage stock liquidity prior to M&As in anticipation of the impact of stock liquidity on M&As. Moreover, we are among the first to address the potential endogeneity concerns by exploiting an exogenous shock to stock liquidity due to Russell index reconstitution.

The study also improves our understanding of the determinants of M&A financing decisions. The literature has examined acquisition payment choice based on adverse selection, corporate

[8] Fuller, Netter, and Stegemoller (2002) posit that the better market reactions to acquisitions of private and subsidiary targets than to acquisitions of public targets may be due to such a liquidity discount to private and subsidiary targets.

control, and financial capacity.[9] As per this literature, factors that bidders consider include debt capacity when financing with cash, loss of corporate control from ownership dilution, the informational opaqueness of target assets, and whether they perceive their stock as being overvalued when financing with stock. For targets, uncertainty with acquirers' growth opportunities and valuations as well as the tax liability deference benefits with stock payment are among the main considerations when deciding whether to accept stock financing. The listing status of targets is often used as a proxy for the liquidity needs of target shareholders in the examination of their cash preference (e.g., Faccio and Masulis, 2005). But there is little known about how acquirers' stock liquidity may affect corporate M&A activity and acquisition payment choice.

We also contribute to the literature in understanding acquirers' behavior prior to acquisitions. The literature has shown that, in order to increase their stock price prior to making stock acquisitions, acquirers tend to manage earnings up (Erickson and Wang, 1999; Louis, 2004), disclose good news or withhold bad news (Ge and Lennox, 2011), or manipulate financial media coverage (Ahern and Sosyura, 2014). We find that firms are likely to take more direct actions that improve stock liquidity prior to a stock acquisition.

Finally, our paper joins several other recent studies that use the annual Russell index reconstitution to analyze institutional ownership and its impact on corporate decisions and governance (e.g., Schmidt, 2012; Lu, 2013; Crane, Michenaud, and Weston, 2014; Mullins, 2014; Boone and White, 2015; Fich, Harford, and Tran, 2015; Appel, Gormley, and Keim, 2016b and 2016c). Our study differs in that it examines the impact of Russell index reconstitution on firms' acquisition decisions through its effect on stock liquidity. Chang, Hong, and Liskovich (2015) show a significant impact of index assignment in the end of May on constituent stocks' liquidity

[9] There is a large literature on acquisition payment method (e.g., Hansen, 1987; Travlos, 1987; Stulz, 1988; Fishman, 1989; Amihud, Lev, and Travlos, 1990; Berkovitch and Narayanan, 1990; Eckbo, Giammarino, and Heinkel, 1990; Brown and Ryngaert, 1991; Martin, 1996; Ghosh and Ruland, 1998; Eckbo and Thorburn, 2000; and Fuller, Netter, and Stegemoller, 2002). See Faccio and Masulis (2005) for a literature review.

in June. We extend the examination period and find the liquidity impact persists during the reconstitution year.

The rest of the paper is organized as follows. Section 2 develops the testable predictions with a simple stylized model. Section 3 describes the data and the variables. Section 4 discusses the empirical methodology of the analysis. Main results of the empirical analysis are in Section 5. Section 6 takes up issues about the robustness of the empirical analysis. Concluding remarks are presented in Section 7.

2. Liquid Stock As Acquisition Currency: Model and Testable Predictions

Liquidity is generally considered to be a desirable feature of assets (e.g., Easley and O'Hara, 2003). Amihud and Mendelson (1980) argue that firms with illiquid stocks will tend to have a lower valuation and higher expected returns to compensate investors for anticipated trading costs. Over the last several years, a large literature has emerged, theoretical as well as empirical, that explores the relation between stock liquidity, trading between heterogeneously informed investors, incentive contracting, and governance. Among the better-known papers in the area are Grossman and Stiglitz (1980), Kyle (1985), Holmstrom and Tirole (1993), and Maug (1998).

Our focus in the paper is on the effect of stock liquidity on the take-over process. As we discuss, there are several channels through which stock liquidity could potentially affect mergers, the method of payment and the acquisition premium. We propose and test a particular liquidity channel that we refer to as the *Acquisition Currency* hypothesis. We offer a simple model to sharpen intuition and to develop predictions that are tested in our empirical analysis. We also discuss alternative ways in which liquidity could impact the takeover process and elaborate on tests that allow us to distinguish Acquisition Currency hypothesis from alternative liquidity channels.

2.1. Liquidity Channels

Acquisition Currency Hypothesis: Our hypothesis is basically that, for stock-for-stock acquisitions, target shareholders prefer stock that is more liquid. This preference derives from future trading costs that target shareholders expect to bear. We use a stylized model to argue that, on account of a preference for liquid stock, target shareholders would be willing to accept a lower acquisition premium from acquirers with more liquid stock. *Ceteris paribus*, we expect the acquisition premium to be decreasing in the liquidity of acquirer stock, while increasing in the liquidity of target stock. As a consequence, acquirers with liquid stock are more likely to engage in acquisitions and to pay in stock when they acquire. We also expect acquirers to take steps, such as stocks splits and enhanced information flow to investors, in an effort to improve stock liquidity. Other predictions of our hypothesis are discussed in the context of our model developed below.

Alternative Liquidity Channels

As noted, there are alternative channels through which liquidity could affect the merger process. We briefly outline two types of alternative channels. A channel that has received theoretical and empirical attention in the extant literature is the potential effect of liquidity on firm governance and incentive contracting. A second channel could operate through the effect of stock liquidly on acquirer valuation and reduction in asymmetric information.

Governance: It is argued (e.g., Holmstrom and Tirole, 1993) that greater stock liquidity would lead to stock prices that are more accurate in terms of reflecting firm value and managerial performance. As a result managers could be offered stronger stock-based incentive contracts, thereby reducing agency problems and enhancing firm value. Greater stock liquidity could also ease the formation of blockholdings and strengthen managerial incentives (e.g., Edmans, Fang, and Zur, 2013). The reduction in agency problems, whether through stronger managerial incentives or better monitoring, would be expected to improve the quality of the acquisitions made by the firm. A paper that finds support for greater stock liquidity enhancing the acquisition process through the governance channel is Roosenboom, Schlingemann, and Vasconcelos (2013).

As we discuss below, the acquisition currency channel has predictions that are distinct from those of the governance channel. For instance, the governance channel has no predictions in terms of the effect of target liquidity on the acquisition premium or on the greater reliance on stock-for-stock acquisitions, as predicted by the acquisition currency hypothesis. Our empirical test allows us to distinguish between these two channels.

V*aluation:* An alternative effect of liquidity could be through the improved price informativeness or reduction in information asymmetry that is expected to occur when the stock is more liquid. Hence, with greater liquidity target shareholders may be less concerned about being paid with overvalued stock. It has been argued that stock overvaluation can sometimes motivate stock acquisitions (e.g., Shleifer and Vishny, 2003).[10] The higher valuation of firms with more liquid stock (Fang, Noe, and Tice, 2009) could also increase their incentive to make acquisitions with stock.. We note that the empirical predictions differ between the channels: while the valuation channel could induce firms to rely more on stock-for-stock acquisitions, there is no prediction that the acquisition premium would be affected by the target firm's stock liquidity, as is predicted by the acquisition currency hypothesis.

2.2. A simple model of liquid stock as acquisition currency

We develop a simple model to illustrate the potential effect of stock liquidity – of publicly traded acquirers and targets -- on the market for corporate control where acquirer stock is used as the acquisition currency (or medium of exchange). We begin by describing the timing of events in our single-period model. There are three salient dates $t = 0,1 \& 2.$ On date t=0, acquirer firm A decides on whether to acquire target firm T. If there is an acquisition, its terms are negotiated and the acquisition is completed on date 0 as well. As we explain below, the premium paid for the acquisition depends on a number of factors, including trading costs.

[10] Other papers dealing with stock acquisitions with overvalued acquirer stock include Rhodes-Kropf, Robinson, and Viswanathan (2005), Ang and Cheng (2006), and Dong, Hirshleifer, Richardson, and Teoh (2006).

Date 1 is an intermediate date on which the stock market is open and trading occurs. It is intended to capture the possibility of liquidity benefits to target shareholders from the merger. We assume that a fraction η of the shareholders in T, A expect to trade on date 1; they are fully cognizant of the effect of a merger on the cost of trading on date 1. The rest of the shareholders, fraction $1 - \eta$, do not expect to trade on date 1; they expect to maintain their holdings till the terminal date. Date 2 represents the terminal date on which any uncertainty regarding firm values is resolved. All market participants are taken to be risk-neutral. There is no discounting of value between dates.

We next characterize the date 1 value and anticipated stock trading of A, T firms as stand-alone firms and as a merged entity. The terminal values of the shares of the two firms are stochastic and drawn from normal distributions $\widetilde{V_i} \sim N(V_i, \sigma_{Vi}^2)$ for $i \in T, A$. We assume a trading structure that is similar to that in Kyle (1985), in which order flow from liquidity (or noise) and informed traders is batched and cleared by a market maker. The market-clearing price is set competitively and is equal to the expected value of the shares, conditional on aggregate order flow. Specifically, in our context, if the aggregate order flow to the market-maker is denoted y_1, then, following Kyle (1985), the market clearing price P_1 will be set such that:

$$P_{i1} = E\left(\widetilde{V_i} \middle| y_i\right) = V_i + \lambda_i y_i, \quad i \in T, A \qquad \text{(E-1)}$$

In equation (E-1) above, V_i is the unconditional expected share value, while λ_i is the 'liquidity parameter' that represents the price impact per unit of order flow. Kyle (1985) shows that in a single-period setting, if the order flow from liquidity traders is $u_i \sim N(0, \sigma_u^2)$ and there is a single informed trader with private information about security value $v_i \sim N(v_i, \sigma_{vi}^2)$, then, in equilibrium, the liquidity parameter will be: $\lambda_i = \frac{\sigma_{vi}}{2\sigma_u}$. The expression for λ_i indicates that trading costs decrease in the trading activity of liquidity traders (σ_u) and increase in the information advantage of the informed trader (σ_{vi}).

In adapting the Kyle model to our setting, the primary difference is that there are two types of liquidity traders *internal* (existing shareholders) and *external* (not current shareholders). The order flow submitted to the market maker is taken to come from the following sources:

1. External liquidity traders: submit an aggregate order flow $\tilde{u}_i \sim N(0, \sigma_{ui}^2), i \in T, A$. A larger σ_{ui}^2 will be associated with greater liquidity and lower trading costs.
2. Internal liquidity traders: As noted, a fraction η of firms' existing shareholders expect to trade for liquidity reasons on date 1. We assume that these shareholders are equally likely to submit buy or sell orders of 1 share each. Taking the number of shareholders in each firm to be relatively large, the aggregate order flow from existing shareholders can be modeled as being normally distributed. For expositional simplicity, we assume that *A*, *T* have an equal number of *N* shares outstanding. Hence, the internal liquidity order flow from both *T*, *A* is distributed: $\tilde{S} \sim N(0, \eta N)$. The variance ηN follows since the variance of the trades from each shareholder is 1 and there are ηN shareholders.
3. There is an informed trader with private information about the terminal firm value. To simplify expressions, we assume that uncertainty (or private information) about *T*,*A* terminal values is similar i.e., $\sigma_{VA}^2 = \sigma_{VT}^2 = \sigma_V^2$.

Given, the above set-up, the Kyle model gives us liquidity parameters: $\lambda_i = \frac{\sigma_V}{2\sqrt{(\sigma_{ui}^2 + \eta N)}}$ for T, A. Note that the difference in liquidity between *T*,*A* is determined by noise trader variance σ_{ui}^2. From the perspective of shareholders that expect to trade ± 1 shares on date 1, their anticipated cost of trading is given by λ_i.

We turn next to the merger decisions and the anticipated effect of the merger on trading costs. We assume that a factor affecting the merger decision is that it entails a non-pecuniary effort cost C (e.g., search for a suitable target) borne by the management of firm *A* prior to any merger negotiations (hence, cost C is sunk and does not affect acquisition terms). Our assumption is that for synergistic reasons, the merger of the two firms results in a non-stochastic value enhancement of V_0, in addition to the pre-merger firm values V_T, V_A. Hence, the value of the merged firm on terminal date 2 will be: $V_M = V_0 + \widetilde{V_A} + \widetilde{V_T}$. We simplify expressions by assuming that the combination of *A*, *T* results in *2N* shareholders and, as with stand-alone firms, a fraction η expect to trade ± 1 shares on date 1. Further, the variance of the aggregate external liquidity trading is: $\sigma_{uM}^2 = \sigma_{uT}^2 + \sigma_{uA}^2$. Finally, variance in firm value of the merged firm (and scale of private information) is $2\sigma_V^2$. Assuming a single informed trader, these assumptions imply, as above, that a Kyle-model liquidity parameter for the combined firm is given by:

$$\lambda_M = \frac{\sqrt{2}\,\sigma_V}{2\sqrt{\sigma_{uT}^2+\sigma_{uA}^2+2N}} = \frac{\sigma_V}{2\sqrt{\frac{1}{2}(\sigma_{uT}^2+\sigma_{uA}^2)+N}}. \qquad \text{(E-2)}$$

The above expression is intuitive, since in the expression for liquidity parameter λ_M, the external liquidity trader variance is the average of the external liquidity trader variances of the stand-alone firms *T, A*. It follows that, if $\sigma_{uA}^2 > \sigma_{uT}^2$, we will have $\lambda_T > \lambda_M > \lambda_A$.

To obtain the premium that is paid, we assume that the boards of *T, A* seek to maximize the total wealth of their existing shareholders, taking account of the anticipated trading costs of their respective shareholders. A fraction η of existing shareholders expect to trade and anticipate a trading cost equal to their stock's liquidity parameter. Hence, the average valuation of a firm's shares, proportional to the total shareholder wealth, is $V_i^{\#} = V_i - \eta\lambda_i$ for $i \in T, A$. The superscript # denotes average share value. The total surplus value that would be created by the merger relative to the stand-alone value of the firms is then given by:[11]

$$\Delta = V_M^{\#} - V_T^{\#} - V_A^{\#} = V_0 - 2\eta\lambda_M + \eta\lambda_T + \eta\lambda_A \qquad \text{(E-3)}$$

The liquidity cost associated with the merged firm are $2\eta\lambda_M$ because as firms *T,A* are merged, the number of shareholders are correspondingly aggregated. To economize on symbols, the Nash bargaining power of the acquirer and target is taken to be equal, i.e., the surplus that is created

[11] Cost C, as indicated, is sunk and does not affect the surplus from the merger decision.

from the merger will be equally shared between T, A. Hence, the negotiated share price at which firm T is acquired will be given by:

$$P^* = V_T - \eta\lambda_T + \frac{1}{2}(\Delta V) = V_T + \frac{1}{2}V_0 - \frac{1}{2}\eta\lambda_T + \frac{1}{2}\eta\lambda_A - \eta\lambda_M \qquad \text{(E-4)}$$

Hence, the premium that is paid for the target, in terms of the price paid by investors that expect to maintain their positions in the stock, can be expressed (from E-4) as:

$$P^* - V_T = \frac{1}{2}(V_0 - \eta\lambda_T + \eta\lambda_A) - \eta\lambda_M \qquad \text{(E-5)}$$

It is clear that the acquisition premium is decreasing in the liquidity of the acquirer, while it is increasing in the target's stock liquidity.

From the perspective of the acquirers, they will be willing to spend resources C (recall that this is non-pecuniary managerial effort) as long as:

$$V_A - \eta\lambda_A + \frac{1}{2}(\Delta V) \geq C. \qquad \text{(E-6)}$$

The above (weak) inequality implies that an increase in acquirer stock liquidity and decrease in target stock liquidity (which increases the left-hand-side of (E-6)), makes it more likely that the inequality is satisfied and, hence, increases the likelihood of a stock-for-stock acquisition.

Our simple model above yields a number of empirical predictions that we test in our empirical analysis. We note that some of these predictions are specific to the acquisition currency hypothesis and allow us to distinguish this channel from the two alternatives we have discussed.

Prediction 1: Firms with more liquid stock are more likely to make acquisitions and have the acquisitions paid with stock, ceteris paribus. Also, the more liquid is acquirers' stock relative to targets', the more is paid in stock in the overall payment for the acquisitions.

Prediction 1 follows directly from equations (E-5) and (E-6) that, as discussed, imply that greater (lower) acquirer (target) stock liquidity lowers the premium paid and, thereby, increases the likelihood of a stock-for-stock acquisition. While we have not explicitly considered acquisitions using cash, the above arguments imply that if a firm is cash constrained, the likelihood of an acquisition and the fraction of purchase price paid in stock will also be increasing when the acquirer's stock is relatively more liquid than that of the target.

Prediction 1 provides a test that separates the acquisition currency hypothesis from the alternatives. This is because our hypothesis predicts that the method of payment and the acquisition premium will depend on the liquidity of *both* the acquirer and the target. In other words, the preference for stock versus cash in acquisition payments will depend also on characteristics of target shareholders, which in turn affects the impact of acquirer's stock liquidity on acquisition payment. The alternative governance and valuation hypotheses have no such predictions.

The investment horizons of shareholders in targets are expected to matter as well. Due to their relatively short horizon, short-term investors are likely to value acquirer's stock liquidity more. Hence, we expect that, *ceteris paribus*, the sensitivity of stock payment to the acquirer's stock liquidity will increase in shareholding by short-term investors in the target.

Our next prediction follows from equation (E-5) that the acquisition premium is lower (higher) if the acquirer's (target's) stock is highly liquid. We note that this prediction applies only to stock-for-stock acquisitions: It does not apply to cash deals, because acquirers' stock liquidity is irrelevant to target shareholders in cash deals. We can state the second testable prediction:

Prediction 2: In stock-financed acquisitions, the higher the liquidity of acquirers' stock relative to that of targets', the lower will be the acquisition premium paid. This is <u>*not*</u> *the case in cash-financed acquisitions.*

Knowing that target shareholders will prefer more liquid stock in a stock exchange deal, which can in turn put acquirers' shareholders in a more favorable position in the exchange (e.g., paying lower premium), acquirers have incentive to increase their stock liquidity in anticipation of a stock deal in the near future. They can, for instance, increase transparency by disclosing more information than what regulations mandate (e.g., providing more informative earnings guidance). They can also conduct stock splits to encourage more trading by uninformed investors.

Market makers can thus provide liquidity services at lower cost, which would result in higher propensity of trading and increase in liquidity. With a higher level of trading, the stock price can become more informative if the greater presence of uninformed trading attracts more trading from informed investors (Kyle, 1985).

The extant literature provides evidence that enhanced information disclosure and stock splits help to increase stock liquidity. For instance, Coller and Yohn (1997) find that bid-ask spread reduces following management forecasts, while Lin, Singh, and Yu (2009) find declining incidence of no trading and lower liquidity risk following stock splits.[12] We thus have the third prediction:

Prediction 3: Acquirers in stock deals are more likely to take actions, such as providing earnings guidance and conducting stock splits, to increase their stock liquidity prior to stock deals.

It follows from our model that firms with more liquid stocks will be better positioned to make acquisitions and pay lower premiums than firms that are otherwise similar, but have less liquid stocks. Hence, the more liquid an acquirer's stock is relative to the target's, the more the gains to the acquirer's shareholders in a stock deal, ceteris paribus. This leads to our fourth testable prediction:

Prediction 4: The more liquid the acquirer's stock is relative to that of the target, the more the gains to acquirer shareholders in a stock deal, ceteris paribus.

3. Data and Summary Statistics

3.1. Data and sample

[12] Several other papers provide related evidence. Balakrishnan, Billings, Kelly, and Ljungqvist (2014) show that firms respond to an exogenous loss of public information by providing more timely and informative earnings guidance, which results in an improvement in liquidity. Also, Muscarella and Vetsuypens (1996) study splits of American Depositary Receipts (ADRs) that are not associated with splits in their home-country stock, and argue that the positive announcement return of stock splits reflect the increase in liquidity.

We obtain our data on mergers and acquisitions from Thomson One Securities Data Corporation's (SDC) U.S. Mergers and Acquisitions database. We start with all M&As that occurred between January 1, 1985 and December 31, 2012. We then impose the following selection criteria in reaching the final sample of 4966 deals: (1) the acquirer is publicly listed and has accounting and financial information in Compustat and CRSP, (2) the acquirer is acquiring more than 50% of the target, (3) the target is either a public or a private firm, (4) the deal value is at least $50 million, and (5) information on deal payment method and status, acquirers' characteristics (to be discussed below), and target characteristics (for public targets) is available. We exclude subsidiary targets because the payment of acquisitions of subsidiary targets is mostly in cash and, thus, acquirer's stock liquidity is less likely to play a significant role in the acquisition.

For tests that involve publicly-listed firms, we require data on a sample firm's main characteristics to be available in Compustat/CRSP in order for the firm to be included in the sample. These characteristics include three measures of stock liquidity, total assets, market-to-book ratio, leverage, asset tangibility, stock return, and return volatility. The final sample consists of 13,899 firms and 118,229 firm-years for the period of 1984-2012.[13]

In analyses involving the annual Russell index reconstitution, we obtain data from Russell on the Russell 1000 and Russell 2000 indexes. We start the sample period in 1998 because data on Russell's proprietary end-of-June float-adjusted market capitalization of index constituents are available only from then. The sample ends in 2006 because Russell implemented a new methodology in index assignment that mitigates index turnover but also makes index assignment

[13] We start the sample one year earlier than the M&A sample starting year, because our tests involve the examination of the impact of a firm's lagged stock liquidity on its acquisition decision.

not dependent solely on end-of-May market capitalization, which would invalidate the use of Russell index assignment as an instrument for stock liquidity (more details follow in Section 4).[14]

3.2. Summary statistics

We use three different measures of stock liquidity that are common in the literature: Amihud's (2002) illiquidity ratio, bid-ask spread, and share turnover. Major M&A deal characteristics such as method of payment and deal premium are constructed following the convention in the literature. We also use a set of control variables that have been shown in the literature to affect a firm's acquisition decisions, method of payment, and deal premium. Details on definitions of all variables can be seen in the Appendix A. To reduce the impact of outliers, we follow the literature and winsorize all continuous variables at the 1st and 99th percentiles.

Table 1 reports summary statistics of key firm and deal characteristics for sample firms. Panel A presents simple statistics of sample firms' characteristics. The average (median) Amihud's Illiquidity ratio is -4.79 (-4.63), while the average (median) bid-ask spread is 4.19 (3.97). The average share turnover is 63.6%. Acquisitions occur in about 10% of the firm-years, while slightly less than half of them are paid in stock. Panel B presents characteristics of acquirers of both public and private targets across a total of 4,966 deals. Consistent with *Prediction 1*, acquirers have higher stock liquidity than average Compustat-CRSP firms (reported in Panel A) for all three measures of liquidity, and their differences in both means and medians are statistically significant (results of statistical tests are untabulated). Also, acquirers have higher prior-year industry-adjusted stock returns and market-to-book ratios, but lower stock return volatility than average Compustat-CRSP firms.

Panel C reports characteristics of public targets in the 2,501 deals. On average, public targets appear to have lower liquidity, but significantly higher market-to-book ratios, than acquirers.

[14] Results of our main sample analyses (not limited to this Russell sample) in this subperiod 1998-2006 also hold, and are available upon request.

Panel D presents deal characteristics for all deals involving public targets. In an average deal, over 60% of the payment is in stock and the acquirer pays a premium of 25.9% over the target's stock price as of two days prior to the deal announcement. The average (median) three-day announcement abnormal returns for acquirers are -2.3% (-1.7%). 15% of the deals are tender offers, and in 7.7% of the deals, there are competing bidders involved.

4. Empirical strategy

4.1. Empirical design and specification

To test *Prediction 1* about the effect of stock liquidity on the likelihood of firms making acquisitions and the likelihood of acquisitions being paid in stock, we use the sample of all Compustat-CRSP firms and estimate the following logit regression of a firm's acquisition decision on its stock liquidity:

$$Y_{it} = \alpha_0 + \alpha_1 \, Liquidity_{it-1} + \alpha_2 \, Controls_{it-1} + \mu_t + \varepsilon_{it} \, . \tag{1}$$

Y_{it} is an indicator variable that equals one if firm *i* makes an acquisition (stock acquisition) in year *t* and zero otherwise; $Liquidity_{it-1}$ is firm *i*'s stock liquidity as of year *t–1*; and $Controls_{it-1}$ include a set of firm *i* characteristics as of year *t–1*, such as *Leverage*, *Δ Leverage*, *PPE/Asset*, *Market-to-Book*, *Ind_stock_return*, *Firm Size*, and *Volatility*. Definitions of these variables are provided in Appendix A. The first three variables capture a firm's ability to issue debt in financing a potential acquisition and the next two variables indicate the valuation and performance of the firm. We use a firm's stock volatility, *Volatility*, to capture its information environment that may affect the firm's acquisition decision. To our main interest, we expect a significantly positive coefficient on $Liquidity_{i,t-1}$ for both of the dependent variables – the acquisition indicator and the stock acquisition indicator. As a robustness check, we also estimate

Equation (1) using a linear probability model with firm fixed effects.[15] All the findings continue to hold. For brevity, we leave them unreported.

To test the other implication of *Prediction 1* regarding the effect of liquidity on the extent to which stock is used to pay for an acquisition, we focus on the sample of acquisitions that involve public targets and estimate regressions based on the following Tobit model:

$$Stockpay_{it} = \beta_0 + \beta_1\, Relative\ Liquidity_{it-1} + \beta_2\, Controls_{it-1} + \mu_t + \varepsilon_{it}\ . \qquad (2)$$

$Stockpay_{it}$ is the fraction of equity in the payment of the acquisition by firm *i* in year *t*; it takes a value between 0 and 1. $Relative\ Liqudity_{it-1}$ is the difference of stock liquidity between acquirer *i* and its target, both as of year *t*-1; and $Controls_{it-1}$ include the same set of variables as in Equation (1) and several additional variables that are meant to capture deal characteristics such as *Ln(deal size)*, *Relative Size*, *Cash/Deal*, and *Tender Offer*. If the deal size is large, the target is large relative to the acquirer, or the acquirer has small cash holding relative to the deal size, it is more likely that stock swap is used. Stock financing is also more likely in tender offers (Martin, 1996).

We focus on public targets due to the availability of data on their stock liquidity and other characteristics. Our model suggests that target shareholders will take into account both acquirer's liquidity and target's liquidity when considering the form of acquisition payment. The coefficient β_1 is to capture the preference for any incremental liquidity that target shareholders expect to have as shareholders of the merged firm, relative to their status-quo liquidity.[16] We expect β_1 to be significantly positive; that is, the more liquid the acquirer's stock is relative to the target's, the more stock will be paid for the acquisition. Alternatively, we include acquirer's and target's liquidity separately in the regressions and expect a positive coefficient on acquirer's liquidity and a negative coefficient on target's liquidity.

[15] Note that firm fixed effects cannot be applied to the logit model.
[16] A further discussion of this is in Section 6.1.

Similarly, we examine the effect of the acquirer-target difference in stock liquidity on deal premium to test *Prediction 2* using the same sample of acquisitions that involve public targets. In particular, we estimate an OLS regression using Equation (2) except that the dependent variable is deal premium. Because the deal premium implication of *Prediction 2* applies to stock deals but not cash deals, we estimate regressions separately for the two types of deals. In these regressions, we control for both acquirer's and target's characteristics as well as deal characteristics used in the tests of *Prediction 1*. We expect the coefficient β_1 to be significantly negative for stock deals, but we expect no such relation for cash deals. Alternatively, we include acquirer's and target's liquidity separately in the regressions and, for stock deals (but not in cash deals), we expect a negative coefficient on acquirer's liquidity and a positive coefficient on target's liquidity.

To test *Prediction 3*, we investigate whether potential acquirers exhibit a greater propensity to undertake liquidity-enhancing steps prior to making stock acquisitions. Our test is based on the following model specification:

$$Liqenhance_{it} = \gamma_0 + \gamma_1 \, Stockacq_{it+1} + \gamma_2 \, Controls_{it} + \mu_t + \varepsilon_{it}. \tag{3}$$

$Liqenhance_{it}$ represents the liquidity-enhancing steps that acquirer *i* undertakes in year *t*. The first we consider is a stock split, which is defined as a dummy variable that equals one if a stock split is conducted in year *t* and zero otherwise. We estimate the coefficients of Equation (3) using a logit model. The second action that we consider is the earnings guidance provided by the firm; in this case, the coefficients are estimated using an OLS regression. We define the measures of earnings guidance in two ways: first as the natural logarithm of one plus the frequency of earnings guidance provided by the management in year *t*, and then as the difference in the frequency of earnings guidance provided by the management from year *t*-1 to *t*. For both measures based on earnings guidance, the sample period is from 1994 to 2012; this is governed by the availability of data on earnings guidance from *First Call*. $Stockacq_{i,t+1}$ is a dummy that equals one if a stock acquisition is made by firm *i* in year *t*+1 and zero otherwise. We test *Prediction 3* using the sample of all Compustat-CRSP firms. We expect the estimated coefficient γ_1 on $Stockacq_{i,t+1}$ to be significantly positive.

Lastly, we test *Prediction 4* using an OLS regression model based on equation (1), except that the dependent variable is the three-day [-1, 1] deal announcement cumulative abnormal returns (CARs) and the explanatory variable of interest is $Relative\ Liqudity_{it-1}$.[17] Because we need to control for the effect of both acquirer and target characteristics, and because liquidity is relevant only in stock acquisitions, we conduct the test using the sample of stock acquisitions involving public targets. We estimate the three-day CARs using the CRSP equally weighted index and the market model, where the parameters for the market model are estimated over the (–120, –30) day interval. We control for both acquirer's and target's characteristics (described earlier) as well as other relevant deal characteristics. In particular, we add two additional controls of deal characteristics: *Competing_Bid* and *Related Deal*. Acquirers may pay higher premiums in competing bids as well as in diversification deals that are not related to the acquirer's primary industry. We expect the estimated coefficient on the main variable of interest, $Liquidity_{it-1}$, to be significantly positive.

In all the regressions above, we include both year and 3-digit SIC industry fixed effects to ensure that we identify the estimates using within-year and within-industry variations in firm decisions and deal characteristics. Robust standard errors are clustered at the industry level.

4.2. Endogeneity of stock liquidity and identification strategy

The above empirical design helps to establish a correlation between liquidity and firms' acquisition decisions as well as deal characteristics. However, stock liquidity is not exogenously

[17] In unreported tests, we include acquirer's and target's liquidity separately in the regressions.

given. Indeed, we even hypothesize that firms may take deliberate actions to endogenously increase stock liquidity prior to making acquisitions. Also, failure to control for any omitted factor that is related to both liquidity and firms' acquisition decisions can result in a biased estimate of the effect of liquidity. To address this empirical challenge, we exploit an exogenous shock to firms' stock liquidity that arises from the annual Russell 1000/2000 index reconstitution. We next discuss the empirical identification strategy in details.

4.2.1. Russell index construction and stock liquidity

Every year Russell ranks all exchange-listed U.S. common stocks by their market capitalization that is calculated using their last traded price on the last trading day of May.[18] The largest 1000 stocks are assigned into the Russell 1000 index, and the next 2000 stocks into the Russell 2000 index, the combination of which forms the Russell 3000 index. Index reconstitution then takes place annually on the last Friday of June.[19] Except for certain circumstances, index constituents will remain in their respective indices for the next full year (July 1st till the end of next June).[20] The fact that firms around the cutoff of Russell 1000/2000 exhibit a local continuity of their end-of-May market cap holds true until the 2007 reconstitution when Russell initiated a "banding" policy to mitigate index turnover. Under the new policy, stocks would switch from their index only if their market capitalization deviates significantly enough from the cutoff threshold.[21] It is thus likely that some firms in Russell 2000 (Russell 1000) may have larger (smaller) end-of-May market cap than the 1000 cutoff threshold since 2007.

Russell determines each stock's weight in an index upon reconstitution using its proprietary float-adjusted market cap as of the end of June. The float-adjustment accounts for a stock's actual

---

[18] Stocks with a price below $1 or a market cap lower than $30 million are excluded. ADRs, preferred stocks, rights, warrants, trust receipts, partnerships, and closed-end mutual funds are also excluded.

[19] It is unlikely that firms can have perfect control over the index assignment by taking actions that affect their market capitalizations, because it is the relative rank, rather than the absolute value of market cap, that matters.

[20] During the next twelve months following reconstitution, stocks are deleted from an index if the related firms have Chapter 7 bankruptcy filings, get delisted, or are acquired, while firms that have had an initial public offering or been spun-off are added into an index based on the market capitalization break of the most recent reconstitution.

[21] See more details in Russell Investments (2015).

shares available for the public to trade; this excludes shares held by a blockholder, an employee stock ownership plan that owns more than 10% of the shares outstanding, shares owned by government or another company in a Russell index, and shares locked up in an IPO. As such, the actual ranking within an index (based on index weights) can be different from the ranking based on the end-of-May total market cap that determines the index assignment.

Since Russell indices are value-weighted, we expect to observe a large discontinuity of index weights around the 1000 cutoff point in that firms in the bottom of Russell 1000 will be given smallest weights while firms in the top of Russell 2000 will be given largest weights. This is confirmed in Figure 1, where we plot the average index weights for 1000 firms on either side of the 1000 cutoff point during the sample period. For example, the average index weight for the top ten firms in Russell 2000 is 0.2%, while that for the bottom ten firms in Russell 1000 is 0.003%. The difference in index weights persists over a wider range of stocks around the 1000 cutoff point, although this difference declines in magnitude.

The large difference in index weights for firms around the 1000 cutoff threshold has significant implication for their stock liquidity. In particular, we expect to see substantially greater liquidity in stocks in the top of Russell 2000 than in stocks in the bottom of Russell 1000. First, institutional trading in response to fund flows that arises from indexing and benchmarking strategies improves stock liquidity, and the intensity of such trading activity is positively related to index weights. Chang, Hong, and Liskovich (2015) document the total assets benchmarked, both passively and actively, for Russell 1000 and Russell 2000 (Table 1, pp. 223). The amount of assets passively tracking Russell 1000 is around 2 to 3.5 times of that tracking Russell 2000 (e.g., $175.9 billion vs. $51.7 billion in 2007). Given the significantly larger market cap of Russell 1000 (about 9 times of that of Russell 2000), there is disproportionally more money tracking Russell 2000. Moreover, because passive funds seek to minimize their tracking errors, their holding weights will closely mimic the index weights of the respective index. To the extent that the reduction of tracking error may be lower than the transaction costs of trading stocks with the smallest index weights and exclusion of stocks with smallest index weights will have little impact on fund performance (Roll, 1992; Frino and Gallagher, 2001), passive funds will match their portfolio weights more closely for stocks at the top of the index and assign even lower weights to stocks at the bottom of the index. Therefore, there shall be significantly more trading of stocks at the top of Russell 2000 than of stocks at the bottom of Russell 1000 by passive funds in response to fund flows.

The more active trading in stocks at the top of Russell 2000 is further strengthened by the more popular active benchmarking on Russell 2000. The total number of products and dollar amount benchmarked to Russell 2000 are substantially higher than those benchmarked to Russell 1000. For example, in 2007, there were 511 vs. 52 products and $291.4 billion vs. $172.7 billion benchmarked to Russell 2000 and Russell 1000, respectively. Overall, due to institutional tracking and benchmarking strategies, there is greater trading demand for stocks at the top of Russell 2000 than stocks at the bottom of Russell 1000.

Second, a recent literature shows that assignment to the top of Russell 2000 is associated with an increase in passive institutional ownership relative to assignment to the bottom of Russell 1000 (e.g., Appel, Gormley, and Keim, 2016c). The greater presence of institutional ownership can induce firms to disclose more information and increase transparency (Boone and White, 2015), which in turn helps to improve a stock's trading environment and its liquidity, as discussed above.

Figure 2 illustrates the impact of Russell index assignment on the liquidity of constituent stocks. The sample includes the top 300 stocks of Russell 2000 and the bottom 300 stocks of Russell 1000 for each year during 1998-2006, as determined by Russell's proprietary end-of-June market capitalization. We sort these stocks based on their end-of-May market capitalization, as provided in CRSP, and then plot their average end-of-September (one quarter following the index reconstitution in June) liquidity by this stock ranking. Clearly, for all of the three liquidity measures, there is a jump in stock liquidity around the midway point from the bottom 300 stocks of Russell 1000 to the top 300 stocks of Russell 2000. In results that are not shown for brevity, we find similar jumps in liquidity during the two-quarter and three-quarter time periods following index reconstitution.[22] It suggests that the jump in liquidity for firms at the top of Russell 2000 is persistent over time in the year following reconstitution.

4.2.2. Identification strategy and empirical specifications

As discussed earlier, Russell computes index portfolio weights using stocks' end-of-June market capitalizations that are float-adjusted, which is specifically meant to account for stock liquidity (shares not publicly tradable are excluded in the float adjustment). The best empirical identification thus cannot ideally utilize the difference in liquidity for a narrow bandwidth of stocks with the smallest portfolio weights in the Russell 1000 and stocks with the largest portfolio weights in the Russell 2000, because the difference in liquidity is likely to be not exogenous (it is affected by Russell's float adjustment). Instead, we rank stocks based on their end-of-May market capitalization, as reported in CRSP, and select the sample using firms ranked 701st through 1300th for each year of the sample.[23] We then instrument for stock liquidity with an indicator of a stock's rank between 1001st and 1300th (labeled as "*R2000*") in a given year, and identify the impact of the instrumented stock liquidity on firm acquisition decisions. This instrument variable approach follows that adopted in Appel, Gormley, and Keim (2016c, see their section 7.3 on page

[22] Our finding is not affected if we extend the examination period to the end of next June. However, we choose not do so because stock liquidity in June may be affected by the expected change in the new index assignment, which is based on the end-of-May market cap (see Chang, Hong, and Liskovich (2015)).

[23] In robustness checks, however, we find that our results continue to hold if we select the sample to be the bottom 300 stocks with the smallest index weights in the Russell 1000 and the top 300 stocks with the largest index weights in the Russell 2000, and control for float-adjusted end-of-June market capitalization in the regressions. More details are in Section 6.3.

133 and Appendix Table 9 on page 138) in examining the effect of passive institutional ownership on corporate governance.[24,25]

In the first stage, we regress a firm's stock liquidity on the instrument variable, *R2000*, and a set of control variables based on the following specification:

$$Liquidity_{it} = \alpha + \beta\, R2000_{it} + \sum_{n=1}^{N} \gamma_n \, (Ln(May\, market\, cap)_{it})^n + \rho\, Ln(June\, float\, adj.\ market\, map)_{it} + \mu_t + \varepsilon_{it}. \quad (4)$$

$Liquidity_{it}$ is firm i's stock liquidity as of the end of September in year t, where year t is the index reconstitution year.[26] $R2000_{it}$ is an indicator variable that equals one if firm *i's* end-of-May market capitalization, as reported in CRSP, is ranked between 1001st through 1300th in year *t* and zero otherwise. $Ln(May\, market\, cap)_{it}$ is the natural logarithm of firm *i*'s end-of-May market capitalization in year *t*. $Ln(June\, float\, adj. market\, cap)_{it}$ is the natural logarithm of firm *i*'s float-adjusted end-of-June market capitalization in year *t*, as provided by Russell.

We control for the end-of-May market capitalization because it determines index assignment and can also affect stock liquidity for reasons other than index assignment. As robustness checks, we use polynomials of different orders to capture the impact of market capitalization. We use CRSP end-of-May market capitalization as in Appel, Gormley, and Keim (2016c) because Russell does not provide its proprietary end-of-May market capitalization. They show (in their Figure 3) that there is a large jump in the probability of a firm being assigned to Russell 2000 around the cutoff threshold based on CRSP end-of-May market capitalization. Chang, Hong, and Liskovich (2015) find a jump in index weights around the same cutoff threshold (shown in their Figure 2). We also control for the end-of-June float-adjusted market capitalization because it directly affects liquidity through the channel of index weights. We include year fixed effect, μ_t, to ensure that the variation in stock liquidity is not due to the increasing trend of liquidity that is

[24] We are grateful to Todd Gormley for suggesting this approach to us.
[25] See also Appel, Gormley, and Keim (2016a, 2016b) for a discussion of this IV approach using Russell index assignment.
[26] The results are robust to the use of stock liquidity as of a later time point during the period of July 1st to the end of next May following the reconstitution in the end of June.

possibly related to a secular increase in institutional ownership and trading as suggested in Chordia, Roll, and Subrahmanyam (2011). The standard errors are clustered at the firm level.

In the second stage, we estimate the following:

$$Y_{it} = \tau + \theta \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \ (Ln(May\ market\ cap)_{it})^n + \varphi\ Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it.} \quad (5)$$

where Y_{it} is the outcome variables pertaining to acquisition decisions and deal characteristics for firm i in the period of July 1st in year t to the end of next May, and $\widehat{Liquidity}_{it}$ is the instrumented liquidity of firm *i* that is estimated in the first stage. In this IV estimation, we use a bandwidth of 300 firms around the 1000th firm midway point (300 on each side for the sample of firms ranked 701st through 1300th) and the first-order polynomial (N=1). In additional tests, we show that our findings are robust to variations in both the number of firms taken in the bandwidth (e.g., 400) and the polynomial order *N* (e.g., 1, 2, or 3).

Our IV estimation relies on the relevance condition that inclusion in the right bandwidth of firms around the 1000th firm midway point is associated with higher stock liquidity, which we will verify in the first stage estimation. Further, the critical exclusion assumption for IV estimation is that the outcome variables regarding firms' acquisition decisions and deal characteristics are unrelated to the inclusion in the right bandwidth of firms, except through its impact on stock liquidity. Since sample firms around the midway point are similar in firm fundamentals except for the small difference in market capitalization, this exclusion restriction seems to be satisfied too once we control for market capitalization.

Table 2 presents the results of the first stage estimation. They confirm the validity of the relevance condition for the IV estimation that stock liquidity is related to *R2000*. Using a bandwidth of 300 firms around the midway point and a first-order polynomial on $Ln(May\ market\ cap)$, we find that firms included in the right bandwidth exhibit significantly higher stock liquidity than firms in the left bandwidth. The difference is statistically significant for all three measures of liquidity. In additional checks with results tabulated in Table B.1 of Appendix B, the relation between liquidity and *R2000* is shown to be robust to using higher order polynomials and a wider bandwidth of firms.

In a related study, Boone and White (2015) also examine the liquidity implication of the annual Russell index reconstitution. However, our empirical approach differs from theirs in that, unlike them, we do not take the regression discontinuity approach (RDD) using the actual rankings within each index that are assigned by Russell as the forcing variable. One critical identification assumption of RDD is local continuity, such that potential outcomes, conditional on the forcing variable, are continuous at threshold of the forcing variable (Angrist and Pischke, 2009; Lee and Lemieux, 2009; Roberts and Whited, 2013). The actual rankings are calculated based on Russell's proprietary float-adjusted market cap (rather than on end-of-May market cap) after the index assignment is determined. Thus, there will be a *discontinuity* of float-adjusted market cap and other variables at the threshold, which violates the local continuity assumption of RDD (see also Appel, Gormley, and Keim (2016a) for a related discussion).

5. Main Empirical Results

In this section, we discuss results of our empirical tests. We test our predictions regarding the effect of liquidity on firms' acquisition decisions and deal premiums. Where endogeneity of stock liquidity may be a concern, we provide results for the full sample, followed by instrumental variable (IV) regression estimates obtained using the Russell Index sample (henceforth, Russell-sample).

5.1. Acquisitions and Acquirer's Stock Liquidity

5.1.1. The decision to acquire and acquire with stock payment

Panel A of Table 3 presents the results obtained from estimating Equation (1) in the full sample. Here, the dependent variable is a dummy indicating the firm's decision to make an acquisition and the independent variable of interest is a firm's stock liquidity. The estimated coefficients on all three proxies for stock liquidity have the predicted positive sign and are statistically significant at 1% level. This suggests that, ceteris paribus, firms are more likely to make acquisitions when their stock liquidity is higher. In accordance with the odds ratios obtained from the logistic regressions, the odds of acquisition are 3.98 and 2.43 times higher after a one-standard-deviation decrease in Amihud's illiquidity ratio and bid-ask spread, respectively.[27] Also, the odds of acquisition increase by 0.95 times following a one-standard-deviation increase in share turnover.[28] Thus, the impact of stock liquidity on the odds of making an acquisition is economically significant. We also find that the likelihood of acquisition is positively related to prior-year industry-adjusted stock returns and negatively related to change in leverage, suggesting that firms with better stock performance and firms with a decline in leverage are more likely to make acquisitions.

Panel B of Table 3 presents regression results from the second-stage of the IV estimation – represented by Equation (5) – within the Russell-sample. The estimated coefficients on the instrumented liquidity measures are all positive and statistically significant at 1% level, confirming the findings in Panel A. For brevity, we do not report the coefficients on all the control variables. As shown in Table B.2 of Appendix B, the results are robust within a wider bandwidth of firms (400) and to the use of higher-order (2nd and 3rd) polynomials. These findings suggest that the effect of stock liquidity on a firm's acquisition decision is likely to be causal.

Next, we repeat the analysis by estimating Equations (1) and (5), except that the dependent variable is a dummy variable that equals one for stock acquisitions. We present the full-sample results in Panel A of Table 4. Consistent with our prediction, a firm's likelihood of making a

[27] The unconditional odds are 1.30 and 1.72, respectively.
[28] The unconditional odds are 1.26.

stock acquisition increases with its stock liquidity. Specifically, the estimated coefficients on stock liquidity measures are all positive and statistically significant at 1% level. Compared with its effect on the likelihood of acquisition (as reported in Table 3), the economic impact of stock liquidity on the likelihood of stock acquisition is even greater. The odds of stock acquisition are 4.19 and 2.57 times higher for a one-standard-deviation decrease in Amihud's illiquidity ratio and bid-ask spread, respectively, and are 0.95 times higher following a one-standard-deviation increase in share turnover. We also find that the likelihood of a stock acquisition is significantly related to certain firm characteristics. A firm is more likely to make stock acquisitions when its prior-year industry-adjusted stock returns and market-to-book ratio are higher, or when its assets are less tangible.

Panel B of Table 4 reports the Russell-sample IV regression results, which echo those reported in Panel A for the full sample. The coefficients on the instrumented liquidity measures are positive and statistically significant at 1% level across the three columns. Results in Table B.3 of Appendix B show that the finding is unaffected using a wider bandwidth of firms or including 2nd and 3rd-order polynomials. Overall, our findings suggest that firms with more liquid stock are more likely to pay for acquisitions with stock.

The beneficial role of stock liquidity should be more pronounced in firms that are financially constrained and, thus, have less access to cash to pay for acquisitions. As such, we examine whether the effect of stock liquidity on the decision to make stock acquisitions is stronger in firms that are financially constrained. We follow Kaplan and Zingales (1997) in constructing KZ index as a measure of financial constraints for each firm-year, and then augment Equation (1) by interacting $Liquidity_{it-1}$ with $KZ_{i,t-1}$. We predict a positive coefficient on the interaction term, indicating a stronger relation between stock liquidity and the likelihood of stock acquisition for financially-constrained firms. The regression results, reported in Table 5, are consistent with this prediction. The estimated coefficient on the interaction term is positive and statistically significant for the three liquidity measures, while the coefficients on the liquidity measures themselves remain strongly positive. This finding provides further support for our prediction about the beneficial role of stock liquidity in acquisitions.

5.1.2. Fraction of acquisition payment in stock

Next, we estimate Equation (2) and analyze the fraction of payment for an acquisition that is made in stock. The results from this analysis are presented in Table 6. The baseline results are in Panel A, which shows that stock liquidity has a significant positive effect on the fraction of acquisition payment made in stock. The dependent variable is the fraction of acquisition payment made in stock and the independent variable of interest is *Relative Liquidity*, which is the simple difference between the stock liquidity of the acquirer and the target. The estimated coefficient on *Relative Liquidity* is positive and statistically significant at 1% level. The more liquid the acquirer's stock is relative to the target's, the higher is the fraction of acquisition payment made in stock. For example, in column (1), a one-standard-deviation increase in *Relative Liquidity* is associated with a 17% increase from the average fraction of payment that is made in stock. In tests left unreported, we find that the results in Table 6 are robust if we also include both the acquirer's and the target's liquidity separately as explanatory variables. In particular, the coefficient on the acquirer's liquidity is significantly positive and the coefficient on the target's liquidity is significantly negative.[29] Moreover, we find that the fraction of payment in stock is also highly related with both firm and deal characteristics. For example, acquirers with higher return run-up, more volatile stock returns, lower asset tangibility, higher leverage, or less cash holding relative to the deal size pay more in stock. Also, more stock is paid in larger deals and when the target is large in size relative to the acquirer.

[29] The literature has established that most acquisitions made by private acquirers are paid with cash. For example, in their sample of M&As involving public targets during 1987-2007, Massa and Xu (2013) find that of all transactions involving a private (public) acquirer, 71% (35%) are paid for with cash, 2% (29%) with stock, and the rest with a mixture of both. Although we do not examine cases involving private acquirers due to the lack of data on their characteristics, this empirical regularity seems to be consistent with our finding that target shareholders tend to prefer cash over stock when acquirers' stock is "extremely illiquid" for private acquirers.

In Panel B of Table 6, we present the IV regression results on the Russell-sample, with instrumented liquidity of the acquirer as the main explanatory variable and the target's liquidity as an additional control. The findings are consistent with those in the full sample, suggesting that acquirers with more liquid stock tend to pay for acquisitions more in stock, *ceteris paribus*. In particular, the estimated coefficient on instrumented acquirer's liquidity measures is positive across all three specifications and statistically significant at least at the 5% level. In Table B.4 of Appendix B, we show that the results are robust to using a wider bandwidth of firms and to including higher order polynomials.

5.1.3. The effect of target shareholder characteristics

In this section, we examine the effect of target shareholder characteristics – such as ownership by blockholders and the investment horizon of investors – on the relation between payment for the acquisition in stock and *Relative Liquidity*. Specifically, in Panel C of Table 6, we interact *Relative Liquidity* with *Blockholder*, which is the number of blockholders with 5% or more stock ownership in the target in the quarter prior to deal announcement. The coefficients on *Relative Liquidity* remain significantly positive with a greater economic magnitude than those in Panel A, suggesting that the effect of the acquirer's stock liquidity (relative to the target's) on stock payment is greater for targets with no blockholders (*Blockholder* = 0). The coefficients on the interaction term *Relative Liquidity x Blockholder* are negative and statistically significant at the 1% level in columns (1) and (2). The results indicate that the impact of the acquirer's relative stock liquidity on stock payment for the acquisition becomes weaker when there are more blockholders in the target. A possible reason is that blockholders tend to be longer-term investors: following the logic of our model, since blockholders did not expect to exit the firm and bear trading costs, they would attach little value to acquirer stock liquidity. This would make cash offer more likely. Economically, each additional blockholder in the target reduces the sensitivity of stock-payment to *Relative Liquidity* by 12%-19% (depending on the liquidity measure), when compared with the benchmark case of no blockholders in the target.

In Panel D of Table 6, we analyze the effect of investor horizon on the sensitivity of stock-payment to *Relative Liquidity*. We interact *Relative Liquidity* with *Short Horizon*. *Short Horizon* is defined as the ratio of target's equity held by short-term institutional investors to that held by long-term institutional investors in the quarter prior to the announcement date. Our classification of institutional investors into short- and long-term investors follows Yan and Zhang (2009) and is based on their portfolio turnover over the past four quarters. The estimated coefficients on *Relative Liquidity* remain positive and statistically significant at the 1% level. Moreover, the coefficients on the interaction term between *Relative Liquidity* and *Short Horizon* are all positive and significant at the 1% level. This is consistent with our prediction that the impact of the acquirer's relative liquidity on stock payment increases in the presence of short-term institutional shareholders in the target, who value liquidity more due to their relatively frequent trading needs. Estimated coefficients on other variables in both Panels C and D are consistent with those in Panel A, and thus left unreported for brevity.

5.2. Acquisition Premium and Acquirer's Stock Liquidity

In this subsection, we present our analysis of the premium paid by the acquirer. As per our *Prediction 2*, if the acquirer's stock liquidity is higher relative to that of the target, then the premium paid would be lower. Panel A of Table 7 presents results that are consistent with this prediction. In the subsample of stock acquisitions, the estimated coefficient on *Relative Liquidity* is negative and statistically significant for the three liquidity measures. The more liquid acquirers' stock is relative to targets', the lower is the takeover premium paid to the target shareholders in a stock deal. In particular, the price premium is lower by 1.75%-4.25% (depending on liquidity measure) for a one-standard-deviation increase in *Relative Liquidity*. Note that the average premium is 25.9%, and thus the result is economically significant, ranging between 6.8% and

16.4% of the mean premium. In tests left unreported, we include both the acquirer's and the target's liquidity separately as explanatory variables. We find that the coefficient on the acquirer's liquidity is significantly negative and the coefficient on the target's liquidity is significantly positive.

Our finding complements Officer (2007) who finds that acquisition discounts in cash acquisitions are larger than in stock acquisitions, because cash provides immediate liquidity and stock does not. The regression estimates indicate that the premium is positively related to the acquirer's prior-year stock return and the target's leverage in stock deals. In the subsample of cash acquisitions, the estimated coefficient on *Relative Liquidity* is not statistically significant except in the last column; this is consistent with the notion that acquirer's stock liquidity is irrelevant for target shareholders in a cash deal.

Panel B of Table 7 reports the IV regression results in the Russell-sample. These results are aligned with those obtained from the full sample in Panel A. The coefficients on the instrumented acquirer liquidity are negative and statistically significant for all three liquidity measures in the subsample of stock acquisitions, but they are positive and statistically insignificant in the subsample of cash acquisitions. In the regressions, we have controlled for the target's liquidity and various other deal characteristics, including *Related Deal*, *Relative Size, Competing Bid*, *Tender Offer*, and *ln(deal size)*. Coefficients on these variables are left unreported. In Table B.5 of Appendix B, we show the robustness of our results in a wider bandwidth of firms and with higher order of polynomials included in the regression.

5.3. Acquirers Enhance Their Stock Liquidity Before Acquisitions

The prior literature discussed earlier has shown that stock splits and other actions that can mitigate information-asymmetry, such as providing earnings guidance, are associated with a subsequent improvement in a firm's stock liquidity. In *Prediction 3*, we argue that firms are likely to undertake such liquidity-enhancing actions prior to embarking on an acquisition. Before testing *Prediction 3*, we verify that the findings in the prior literature on the impact of stock-splits and earnings guidance on stock liquidity hold in our sample. To that end, we regress the liquidity measures as of year *t* on a dummy variable indicating whether the firm split its stock in year *t–1* and on the frequency of earnings guidance in year *t–1*, while controlling for various characteristics of the firm and its information environment.

We obtain data on earnings guidance from First Call and these data are available starting from 1994. The results, presented in Table B.6 of Appendix B, show that stock splits and the frequency of earnings guidance are both strongly associated with greater stock liquidity in the following year. The estimated coefficients on the two main variables of interest are positive and statistically significant for all three measures of stock liquidity. As expected, firms with larger size, higher market-to-book ratios, more cash holding, lower leverage, better operating performance, lower stock return volatility, and more analysts' coverage have higher stock liquidity.

Next, we test *Prediction 3*, which is whether firms tend to conduct stock splits or provide more earnings guidance prior to making stock acquisitions. Panel A of Table 8 presents the baseline results from estimating Equation (3). In Column (1), we estimate a logit regression where the dependent variable is an indicator that equals one if a firm splits its stock in year *t*, while in Column (2) we estimate an OLS regression where the dependent variable is the difference between the number of earnings guidance provided in years *t* and *t–1*. In both cases, consistent with our prediction, the estimated coefficients on the main variable of interest, $Stockacq_{it+1}$, are positive and significant at 1% level.

One might be concerned that both stock splits/earnings guidance provisions and the decision to engage in stock acquisitions are endogenous, and thus the estimated coefficients on $Stockacq_{it+1}$ might be biased. To address this concern, we instrument $Stockacq_{it+1}$ with the total number of acquisitions that occurred in the same year and three-digit SIC industry. To the extent that acquisitions occur in waves (e.g., Harford, 2005) and it is reasonable to assume that acquisitions made in the industry are unlikely to be related to an individual firm's stock split/earnings guidance decisions except through its decision to make stock acquisitions, this instrument satisfies both the relevance and exclusion conditions for the IV estimation.

Panel B of Table 8 reports both first- and second-stage estimates from this IV regression. In the first stage, the decision of stock acquisitions is shown to be positively related to the number of acquisitions made in the industry and the correlation is statistically significant at 1% level. We also find that the number of acquisitions made in the industry is a strong instrument as seen from the large F-value for the first stage regression.[30] The second-stage results confirm those in Panel A that the coefficients on the instrumented $Stockacq_{it+1}$ remain positive and statistically significant. In sum, the evidence provides support to *Prediction 3* that firms tend to take steps to improve stock liquidity prior to making stock acquisitions.

5.4. Announcement Returns and Acquirer's Stock Liquidity

According to *Prediction 4*, greater stock liquidity of the acquirer will improve the gains to the acquirer from stock acquisitions. We test this prediction next and present the results in Table 9. We find that, for all three liquidity measures, the acquirer's announcement CARs are positively and statistically significantly related to *Relative Liquidity* in a stock deal. The more liquid acquirers' stock is relative to targets', the higher (or less negative) are the acquirers' announcement CARs. For a one-standard-deviation increase in *Relative Liquidity*, the CARs increase by 0.51%-0.95% depending on the measure of liquidity. This improvement in acquirer's announcement returns is economically significant, given that the average (median) CARs for stock deals in our sample of public targets is –3.86% (–2.94%). Consistent with prior literature, acquirers' CARs are negatively related to their price run-up, market-to-book ratio, and stock return volatility, but positively related to the target's market-to-book ratio.

[30] Note that an F-value over 10 is typically considered as a sign of a strong instrument.

6. Discussion and Robustness Tests

We discuss further extensions of our hypothesis as well as various robustness checks to ensure that our results are not specific to our sampling choice and are robust to an alternative approach to dealing with endogeneity.

6.1. The expected stock liquidity of the combined firm

We have shown that the acquirer's stock liquidity relative to the target's prior to the deal has a significant impact on the method of payment and deal premium. As suggested by the model, the anticipated stock liquidity in the combined firm after deal completion (relative to the target's current stock liquidity) will affect target shareholders' decisions on the deal's terms. If we assume that the expected stock liquidity of the post-deal new firm is size-weighted average of the acquirer's and the target's pre-deal liquidity:

$$Liquidity_{new} = w\ Liquidity_{Acquirer} + (1 - w)\ Liquidity_{Target}$$

where $w = \frac{Size_{Acquirer}}{Size_{Acquirer} + Size_{Target}}$ and *Size* is market capitalization.[31] If target shareholders are mainly concerned with the expected liquidity after the deal relative to the target's current liquidity, we have

$$Liquidity_{new} - Liquidity_{Target} = w(Liquidity_{Acquirer} - Liquidity_{Target}).$$

Therefore, the expected difference in stock liquidity for target shareholders is proportional to the acquirer-target liquidity difference (*Relative Liquidity*) that we have used in examining its impact on deal payment in stock and deal premium, with the proportion being positively (negatively) related to the acquirer's (target's) size.

[31] This assumption is consistent with the finding in Massa and Xu (2013) that the post-deal combined firm's stock liquidity is positively related to the target's stock liquidity prior to the deal. The combined liquidity measure from our theoretical model is difficult to estimate directly and requires information about the composition of liquidity investors.

We repeat the estimations in Tables 6 and 7 by replacing the acquirer-target liquidity difference with the expected difference in stock liquidity. All of our earlier findings continue to hold qualitatively. For brevity, we do not tabulate the results but they are available upon request. This validates our use of the acquirer-target liquidity difference (*Relative Liquidity*) in examining its impact on deal payment and pricing.

6.2. An alternative interpretation of the IV estimation results

Using the same Russell index reconstitution setting, Appel, Gormley, and Keim (2016c) show that assignment into Russell 2000 is associated with an improvement in corporate governance around the Russell 1000/2000 cutoff threshold. One may thus be concerned that our IV estimation results in the Russell-sample may be explained by an improvement in corporate governance instead of an improvement in stock liquidity of firms at the top of Russell 2000. In particular, the lower price premium paid by a more liquid acquirer assigned into Russell 2000 might be simply due to the improvement in corporate governance of the acquirer.

This governance-based interpretation, however, cannot explain why a firm being assigned into Russell 2000 is more likely to make (stock) acquisitions and pay more for the acquisitions in stock as opposed to cash, especially when it is more financially constrained. Nor would it explain why stock acquisitions and premiums are affected by target stock liquidity. We nevertheless conduct a test to address this concern more formally. Specifically, we exclude from the original Russell-sample of our IV estimation (firms ranked 701st through 1300th each year based on their end-of-May market capitalization) firms ranked 1001st through 1300th each year that show an improvement in corporate governance following reconstitution and firms ranked 701st through 1000th each year that show a decline in corporate governance following reconstitution. In particular, a firm that is ranked 1001st through 1300th (a firm that is ranked 701st through 1000th) will be dropped if any of the following holds in the year following reconstitution, compared with the year prior to reconstitution: (i) there is an increase (decrease) in the fraction of outsiders on the board; (ii) the CEO-duality role is separated (combined); (iii) the number of proxy proposals submitted declines (increases). We therefore ensure that we are not comparing firms with improved governance and firms with worsened governance.

We then re-estimate the IV regressions for this reduced subsample. Results presented in Table B.7 of Appendix B show that our findings with the IV estimations continue to hold even for this subsample of firms. Although the three aspects of governance available in our data cannot fully capture aspect of the firm's corporate governance, the evidence suggests that our findings are unlikely to result solely from the improvement in governance in firms at the top of Russell 2000.

6.3. Robustness to alternative sampling choices in the IV estimation

In the IV regression results reported in the tables above, our sample consists of firms that are ranked 701st through 1300th based on end-of-May market capitalization. This helps deal with the potential endogeneity concern that Russell's ranking of constituent stocks within an index based on the stocks' float-adjusted end-of-June market capitalization is related to stock liquidity. One disadvantage of this approach is that we are not necessarily comparing the very bottom firms in the Russell 1000 with the very top firms in the Russell 2000, from which we expect to observe the most significant difference in stock liquidity. Moreover, controlling for float-adjusted end-of-June market capitalization, as we have done in the main analysis, can mitigate the endogeneity concern. As such, we repeat the analyses with a sample of the bottom 300 stocks with the smallest index weights in the Russell 1000 and the top 300 stocks with the largest index weights in the Russell 2000, and control for float-adjusted end-of-June market capitalization in the regressions. We find that our results on the IV estimations continue to hold for this sample, and they do not change qualitatively if we expand the bandwidth to 400 stocks on each side. The findings are not tabulated for brevity, but are available upon request.

6.4. An alternative approach to address the endogeneity of stock liquidity

We take an alternative and more straightforward approach to address the issue of stock liquidity endogeneity by replacing the stock liquidity measures with their corresponding measures as of three years ago. It is reasonable to assume that a firm's liquidity three years ago is less likely to be related to its current acquisition decisions and deal characteristics. We repeat the main tests with liquidity measures as of three years ago and find that our findings hold. Again, we leave these results untabulated but they are available upon request. This is complementary to the evidence with the Russell-sample IV estimation and further mitigates the endogeneity concerns with our findings.

7. Conclusion

We claim, with the aid of a simple model, that liquidity can enhance the role of acquirer stock as an acquisition currency. Firms with more liquid stocks are more likely to make acquisitions and pay for them with equity, especially when the target's stock liquidity is relatively low. Acquirers with liquid stock pay lower price premiums and experience less negative deal announcement abnormal returns in stock deals. To exploit the benefits of more liquid stock in M&As, firms tend to take actions to enhance their information environment and improve stock liquidity prior to acquisitions, such as conducting stock splits and providing more earnings guidance.

We exploit the exogenous variation in stock liquidity induced by annual changes in the composition of the Russell1000 and the Russell 2000 indices to identify the impact of stock liquidity. We find a significant and time-persistent impact of Russell index assignment on the liquidity of constituent stocks. There is a jump in stock liquidity around the midway point from the bottom stocks of Russell 1000 to the top stocks of Russell 2000 even when we rank these stocks based on their end-of-May market capitalization. With this identification, we claim that the impact of stock liquidity on acquisitions and deal characteristics is causal.

References

Ahern, K. R., & Sosyura, D., 2014. Who writes the news? Corporate press releases during merger negotiations. *Journal of Finance*, *69*(1), 241-291.

Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. *Journal of Financial Markets*, *5*(1), 31-56.

Amihud, Y., Lev, B., & Travlos, N. G., 1990. Corporate control and the choice of investment financing: The case of corporate acquisitions, *Journal of Finance, 45*, 603–616

Amihud, Y., & Mendelson, H., 1980. Dealership market: Market-making with inventory. *Journal of Financial Economics*, *8*(1), 31-53.

Amihud, Y., & Mendelson, H., 1991. Liquidity, asset prices and financial policy. *Financial Analysts Journal*, 47(6), 56-66.

Angrist, J., & Pischke, J., 2009. Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press, Princeton

Ang, J. S., & Cheng, Y., 2006. Direct evidence on the market-driven acquisition theory. *Journal of Financial Research*, *29*(2), 199-216.

Appel, I., Gormley, T., & Keim, D., 2016a. Identification using Russell 1000/2000 index assignments: A discussion of methodologies. Unpublished working paper.

Appel, I., Gormley, T., & Keim, D., 2016b. Standing on the shoulders of giants: The effect of passive investors on activism. Unpublished working paper.

Appel, I., Gormley, T., & Keim, D., 2016c. Passive investors, not passive owners. *Journal of Financial Economics*, 121(1), 111-141.

Back, K., Li, T., & Ljungqvist, A., 2014. Liquidity and governance. Unpublished working paper.

Balakrishnan, K., Billings, M., Kelly, B., & Ljungqvist, A., 2014. Shaping Liquidity: On the Causal Effects of Voluntary Disclosure, *Journal of Finance*, *69*, 2237-2278.

Berkovitch, E., & Narayanan, M. P., 1990. Competition and the medium of exchange in takeovers. *Review of Financial Studies*, *3*(2), 153-174.

Beyer, A., Cohen, D. A., Lys, T. Z., & Walther, B. R., 2010. The financial reporting environment: Review of the recent literature. *Journal of Accounting and Economics*, *50*,179–234.

Bharath, S. T., Jayaraman, S., & Nagar, V., 2013. Exit as governance: An empirical analysis. *Journal of Finance*, *68*(6), 2515-2547.

Bond, P., Edmans, A., & Goldstein, I., 2012. The real effects of financial market. *Annual Review of Financial Economics*, *4*, 339-360.

Boone, A. L., Lie, E., & Liu, Y., 2014. Time trends and determinants of the method of payment in M&As. *Journal of Corporate Finance*, 27, 296-304.

Boone, A. L., & White, J. T., 2015. The effect of institutional ownership on firm transparency and information production. *Journal of Financial Economics*, *117*, 508-533.

Brown, D. T., & Ryngaert, M. D., 1991. The mode of acquisition in takeovers: Taxes and asymmetric information, *Journal of Finance*, *46*, 653–669.

Chang, Y., Hong, H., & Liskovich, I., 2015. Regression discontinuity and the price effects of stock market indexing. *Review of Financial Studies*, *28*, 212–246.

Chordia T., Roll R., & Subrahmanyam A., 2011. Recent trends in trading activity and market quality. *Journal of Financial Economics*, *101*(2), 243-263.

Coller, M., & Yohn, T. L., 1997. Management Forecasts and Information Asymmetry: An examination of bid-ask spreads. *Journal of Accounting Research*, *35*(2), 181-191.

Crane, A., Michenaud, S., & Weston, J., 2014. The effect of institutional ownership on payout policy: Evidence from index thresholds. Unpublished working paper.

Dass, N., Huang, S., Maharjan, J., Nanda, V., & Xiao, S., 2015. The effect of stock liquidity on corporate innovation. Unpublished working paper.

Diamond, D. W., & Verrecchia, R. E., 1991. Disclosure, Liquidity, and the Cost of Capital. *Journal of Finance*, *46*(4), 1325-1359.

Dong, M., Hirshleifer, D., Richardson, S., & Teoh, S. H., 2006. Does investor misvaluation drive the takeover market? *Journal of Finance*, *61*(2), 725-762.

Easley, D., & O'Hara, M., 2003. Microstructure and asset pricing. *Handbook of the Economics of Finance*, *1*, 1021-1051.

Eckbo, B. E., Giammarino, R. M., & Heinkel, R. L., 1990, Asymmetric information and the medium of exchange in takeovers: Theory and tests. *Review of Financial Studies*, *3*, 651–675.

Eckbo, B. E., & Thorburn, K. S., 2000. Gains to bidder firms revisited: domestic and foreign acquisitions in Canada. *Journal of Financial and Quantitative Analysis*, *35*(1), 1-25.

Edmans, A., Fang, V., & Zur, E., 2013. The effect of liquidity on governance. *Review of Financial Studies*, *26*, 1443–1482.

Erickson, M., & Wang, S. W., 1999. Earnings management by acquiring firms in stock for stock mergers. *Journal of Accounting and Economics*, *27*(2), 149-176.

Faccio, M., & Masulis, R. W., 2005. The choice of payment method in European mergers and acquisitions. *Journal of Finance*, *60*(3), 1345-1388.

Fang, V. W., Noe, T. H., & Tice, S., 2009. Stock market liquidity and firm value. *Journal of Financial Economics*, *94*(1), 150-169.

Fang, V. W., Tian, X., & Tice, S., 2014. Does stock liquidity enhance or impede firm innovation? *Journal of Finance*, *69*(5), 2085-2125.

Fich, E., Harford, J., & Tran, A., 2015. Motivated monitors: the importance of institutional investors' portfolio weights. *Journal of Financial Economics*, forthcoming.

Fishman, M. J., 1989. Preemptive bidding and the role of the medium of exchange in acquisitions. *Journal of Finance*, 41-57.

Frino, A., & Gallagher, D. R., 2001. Tracking S&P 500 index funds. *Journal of Portfolio Management, 28*, 44–55.

Fuller, K., Netter, J., & Stegemoller, M., 2002. What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions, *Journal of Finance, 57*, 1763–1793.

Ge, R., & Lennox, C., 2011. Do acquirers disclose good news or withhold bad news when they finance their acquisitions using equity? *Review of Accounting Studies*, *16*(1), 183-217.

Ghosh, A., & Ruland, W., 1998, Managerial ownership, the method of payment for acquisitions, and executive job retention, *Journal of Finance, 53*, 785–798.

Grossman, S. J., & Stiglitz, J. E., 1980. On the impossibility of informationally efficient markets. *The American Economic Review*, 393-408.

Hansen, R. G., 1987. A theory for the choice of exchange medium in mergers and acquisitions, *Journal of Business, 60*, 75–95.

Harford, J., 2005. What drives merger waves? *Journal of Financial Economics, 77*, 529-560.

Holmström, B., & Tirole, J., 1993. Market liquidity and performance monitoring. *Journal of Political Economy*, 678-709.

Jayaraman, S., & Milbourn, T. T., 2012. The effect of auditor expertise on executive compensation. *Available at SSRN 1955488*.

Kaplan, S. N., & Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics*, 169-215.

Koeplin, J., Sarin, A., & Shapiro, A., 2000. The private company discount. *Journal of Applied Corporate Finance, 12*, 94-101.

Kyle, A. S., 1985. Continuous auctions and insider trading. *Econometrica: Journal of the Econometric Society*, 1315-1335.

Lee, D. S., & Lemieux, T., 2009. Regression discontinuity designs in economics (No. w14723). National Bureau of Economic Research.

Lin, J. C., Singh, A. K., & Yu, W., 2009. Stock splits, trading continuity, and the cost of equity capital. *Journal of Financial Economics*, *93*(3), 474-489.

Louis, H., 2004. Earnings management and the market performance of acquiring firms. *Journal of Financial Economics, 74*, 121-148.

Lu, R., 2013. How does institutional ownership affect bank loan pricing: Evidence from a regression discontinuity design. Unpublished working paper.

Martin, K. J., 1996. The method of payment in corporate acquisitions, investment opportunities, and management ownership, *Journal of Finance, 51*, 1227–1246.

Massa, M., & Xu, M., 2013. The value of (stock) liquidity in the M&A market. *Journal of Financial and Quantitative Analysis*, *48*, 1463-1497.

Maug, E., 1998. Large shareholders as monitors: is there a trade-off between liquidity and control? *Journal of Finance*, 53(1), 65-98.

Moeller, S. B., Schlingemann, F. P., & Stulz, R. M., 2007. How do diversity of opinion and information asymmetry affect acquirer returns? *Review of Financial Studies*, *20*(6), 2047-2078.

Mullins, W., 2014. The governance impact of index funds: evidence from a regression discontinuity. Unpublished working paper.

Muscarella, C. J., & Vetsuypens, M. R., 1996. Stock Splits: Signaling or Liquidity? The case of ADR solo-splits. *Journal of Financial Economics*, *42*(1), 3-26.

Roll, R., 1992. A Mean/Variance Analysis of Tracking Error. *Journal of Portfolio Management*, *18*(4), 13-22.

Officer, M. S., 2007. The price of corporate liquidity: Acquisition discounts for unlisted targets. *Journal of Financial Economics*, *83*(3), 571-598.

Officer, M. S., Poulsen, A. B., & Stegemoller, M., 2009. Target-firm information asymmetry and acquirer returns. *Review of Finance*, *13*(3), 467-493.

Rhodes–Kropf, M., Robinson, D. T., & Viswanathan, S., 2005. Valuation waves and merger activity: The empirical evidence. *Journal of Financial Economics*, *77*(3), 561-603.

Roberts, M. R., & Whited, T. M., 2013. Handbook of the Economics of Finance. *Corporate Finance*, *2*, 493-572.

Roll, R., 1992. Industrial structure and the comparative behavior of international stock market indices. *Journal of Finance*, *47*(1), 3-41.

Roosenboom, P., Schlingemann, F. P., & Vasconcelos, M., 2013. Does stock liquidity affect incentives to monitor? Evidence from corporate takeovers. *Review of Financial Studies*, *27*(8), 2392-2433.

Schlingemann, F. P., Stulz, R. M., & Walkling, R. A., 2002. Divestitures and the liquidity of the market for corporate assets. *Journal of Financial Economics*, *64*(1), 117-144.

Schmidt, C., 2012. Shareholding monitoring incentives and corporate policies. Unpublished working paper.

Shleifer, A., & Vishny, R. W., 1992. Liquidation values and debt capacity: A market equilibrium approach. *Journal of Finance*, *47*(4), 1343-1366.

Shleifer, A., & Vishny, R. W., 2003, Stock market driven acquisitions, *Journal of Financial Economics*, *70*, 295–311.

Stulz, R., 1988. Managerial control of voting rights: Financing policies and the market for corporate control. *Journal of Financial Economics*, *20*, 25-54.

Travlos, N. G., 1987, Corporate takeover bids, method of payment, and bidding firms' stock returns, *Journal of Finance*, *42*, 943–963.

Yan, S., & Zhang, Z., 2009. Institutional Investors and Equity Returns: Are Short-term Institutions Better Informed? *Review of Financial Studies*, *22*(2), 893-924.

Figure 1: Russell Index Weights and Rank of Constituent Stocks within an Index

This figure presents the average index weights for 1000 firms on each side of the Russell 1000/2000 cutoff for the period of 1998 to 2006. Stock rank is the integer distance of a firm from the index cutoff which is centered at zero around the Russell 1000/2000 threshold. It is determined by the ranking of each constituent within each index, which is assigned by Russell based on its proprietary float-adjusted end-of-June market capitalization. A negative (positive) value is assigned to firms in Russell 1000 (2000) in the left-hand (right-hand) side of the cutoff. Each dot represents an average index weight calculated using bins of 50 firms in the sample. Firms are assigned to the Russell 1000 or 2000 based on the market capitalization as of the end of the last trading day in May. The index reconstitution takes place at the end of June with index weights being determined by Russell's proprietary float-adjusted market capitalization.

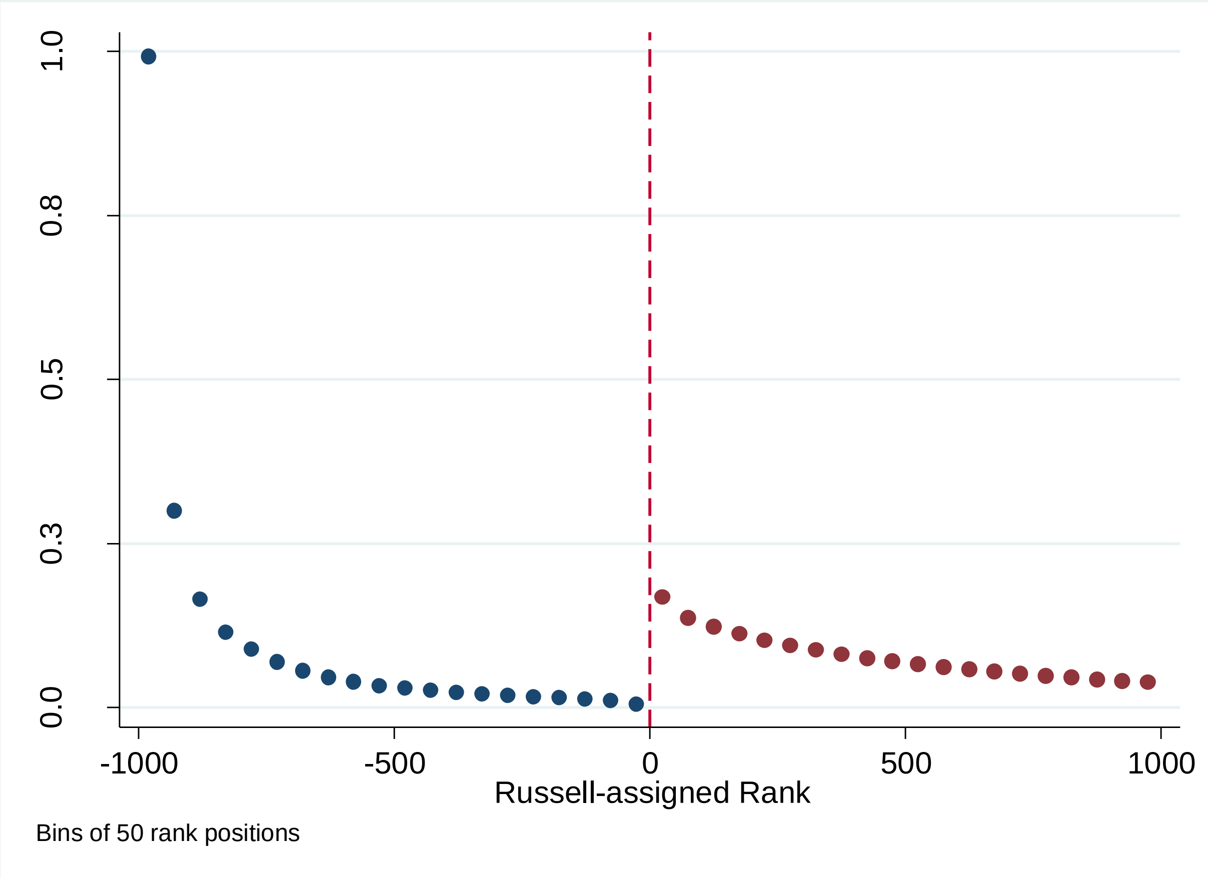
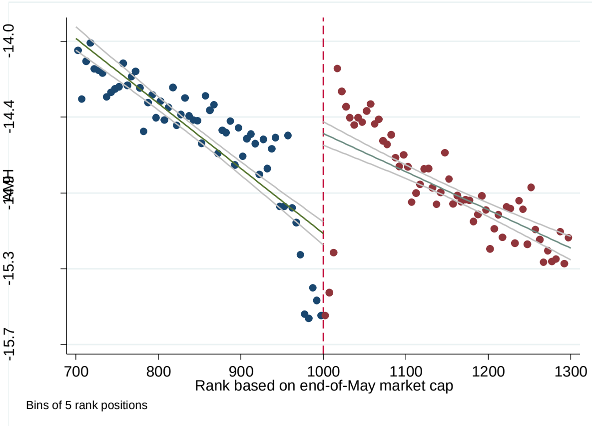


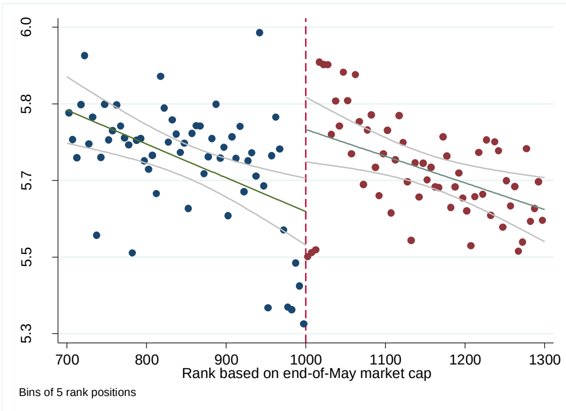
Figure 2: Stock Liquidity of Firms by End-of-May Market Capitalization Rankings for the Bottom 300 Firms of Russell 1000 and Top 300 Firms of Russell 2000

The graphs present the stock liquidity by firm ranking, which is based on firms' end-of-May market capitalization, as reported in CRSP. The sample includes the bottom 300 firms of the Russell 1000 and the top 300 firms of the Russell 2000, as determined using end-of-June Russell-assigned portfolio weights for each index. Liquidity is measured as of one quarter after the Russell indexes are reconstitutaed annually (each September). The plots represent local sample means using sixty non-overlapping evenly-spaced bins on each side of the 1000th firm. The lines drawn, with the associated 90% confidence bands, fit linear regression curves on either side.

(a) AMH



(b) Spread



(c) Turnover

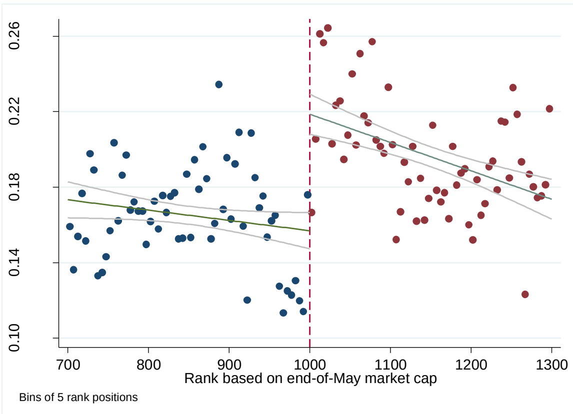


Table 1: Summary Statistics

This table presents summary statistics of firm and deal characteristics. Panel A is for the overall sample of Compustat-CRSP firms in the sample period 1984-2012, while panel B is for acquirers of both private and public targets. Panel C is for public targets, and Panel D is for deals involving public targets.

Variable	N	Mean	SD	Median
Panel A: Overall Sample of Compustat-CRSP Firms				
AMH	118229	-4.790	3.056	-4.629
Spread	118229	4.189	1.411	3.974
Sturnover	118229	0.636	0.747	0.383
Acquisition (Dummy)	118229	0.096	0.294	0
Stockacq (Dummy)	118229	0.044	0.205	0
Firm Size	118229	5.615	2.216	5.478
Ind_Stock_Return	118229	-0.001	0.605	-0.074
Leverage	118229	0.338	0.349	0.294
Δ Leverage	118229	-0.001	0.299	0
Market-to-Book	118229	2.065	2.499	1.348
Tangibility	118229	0.243	0.243	0.157
Volatility	118229	0.627	0.391	0.525
Panel B: Acquirers of both public and private targets				
AMH	4966	-2.133	1.988	-1.495
Spread	4966	5.055	1.286	4.772
Sturnover	4966	0.798	0.731	0.550
Ind_Stock_Return	4966	0.158	0.677	0.040
Leverage	4966	0.374	0.277	0.363
Δ Leverage	4966	-0.010	0.171	-0.003
Market-to-Book	4966	2.262	2.117	1.566
Runup	4966	0.055	0.276	0.019
Volatility	4966	0.456	0.261	0.386
Panel C: Public Targets				
AMH	2501	-3.954	2.423	-3.798
Spread	2501	4.339	1.188	4.091
Turnover	2501	0.689	0.692	0.446
Leverage	2501	0.361	0.294	0.357
Market-to-Book	2501	24.563	55.13	5.074
Panel D: Characteristics of deals involving public targets				
Acquirer's CAR	2471	-0.023	0.083	-0.017
Competing Bid	2501	0.077	0.266	0
Ln(deal size)	2501	6.134	1.425	5.908
Percent_stockPMT	2501	0.608	0.431	0.794
Premium	2306	0.259	0.404	0.253
Related Deal	2499	0.603	0.489	1
Relative Size	2501	-1.901	1.354	-1.781
Tender Offer	2501	0.150	0.357	0

Table 2: First Stage Estimation for Stock Liquidity

This table presents estimates of the first-stage IV regression of stock liquidity on an indicator of end-of-May market capitalization ranking. The sample is obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006. Specifically,

$$Liquidity_{it} = \alpha + \beta\, R2000_{it} + \sum_{n=1}^{N} \gamma_n \; (Ln(May\ market\ cap)_{it})^n + \rho\, Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \varepsilon_{it}$$

where *R2000* is an indicator variable that equals one if firm i's end-of-May market capitalization is ranked beyond 1001st in year t and zero otherwise; $Ln(May\ market\ cap)_{it}$ is the natural logarithm of firm i's end-of-May market capitalization in year t; $Ln(June\ float\ adj.market\ cap)_{it}$ is the natural logarithm of firm i's end-of-June float-adjusted market capitalization in year t, as provided by Russell. $Liquidity$ is firm i's stock liquidity at the end of September in reconstitution year t. The liquidity measure used in each regression is indicated at the top of the table. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

	AMH	Spread	Turnover
R2000	0.100**	0.080***	0.019**
	(0.047)	(0.026)	(0.009)
Observations	5271	5271	5271
Adjusted R^2	0.518	0.737	0.047
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Table 3: Stock Liquidity and Likelihood of Acquisition

Panel A of this table presents coefficient estimates from logit regressions that examine the impact of firms' stock liquidity on the likelihood of making acquisitions for the full sample during 1984-2012. The dependent variable is a dummy variable that takes a value of one if a firm makes an acquisition in the fiscal year, and zero otherwise. The liquidity measure used in each regression is indicated at the top of the table. Other explanatory variables are defined in Appendix A. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. Panel B reports estimates from the second-stage IV regression. The sample is obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006. Specifically,

$$Y_{it} = \tau + \theta\, \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \ (Ln(May\ market\ cap)_{it})^n + \varphi\, Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it}$$

where Y_{it} takes a value of one if firm *i* makes an acquisition in the period of July 1st in year *t* to the end of next May. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

Panel A: Full Sample			
	(1) AMH	(2) Spread	(3) Turnover
Liquidity	0.260***	0.540***	0.233***
	(0.019)	(0.042)	(0.027)
Leverage	-0.032	-0.048	-0.191***
	(0.051)	(0.049)	(0.055)
Δ Leverage	-0.214***	-0.238***	-0.181***
	(0.045)	(0.047)	(0.044)
Tangibility	-1.142***	-1.178***	-1.234***
	(0.203)	(0.205)	(0.225)
Market-to-Book	-0.025**	-0.009	0.023***
	(0.011)	(0.008)	(0.008)
Firm Size	-0.113***	-0.021	0.138***
	(0.029)	(0.023)	(0.028)
Ind_Stock_Return	0.375***	0.341***	0.319***
	(0.025)	(0.024)	(0.023)
Volatility	0.017	0.005	-0.480***
	(0.073)	(0.064)	(0.074)
Constant	-2.026***	-5.859***	-4.411***
	(0.599)	(0.372)	(0.428)
Observations	117214	117214	117214
Pseudo R^2	0.113	0.109	0.099
Year and Industry Fixed Effects	Yes	Yes	Yes

Panel B: IV regressions- Russell Sample			
	AMH	Spread	Turnover
Liquidity	0.242***	0.302***	1.277***
	(0.077)	(0.118)	(0.404)
Observations	5271	5271	5271
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Table 4: Stock Liquidity and Likelihood of Stock Acquisition

Panel A of this table presents coefficient estimates from logit regressions that examine the impact of firms' stock liquidity on the likelihood of making stock acquisitions for the full sample during 1984-2012. The dependent variable is a dummy variable that takes a value of one if a firm makes a stock acquisition in the fiscal year, and zero otherwise. The liquidity measure used in each regression is indicated at the top of the table. Other explanatory variables are defined in Appendix A. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. Panel B reports estimates from the second-stage IV regression. The sample is obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006. Specifically,

$$Y_{it} = \tau + \theta\, \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \; (Ln(May\ market\ cap)_{it})^n + \varphi\, Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it}$$

where Y_{it} takes a value of one if firm *i* makes a stock acquisition in the period of July 1st in year *t* to the end of next May. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

Panel A: Full Sample			
	(1) AMH	(2) Spread	(3) Turnover
Liquidity	0.310***	0.596***	0.228***
	(0.023)	(0.060)	(0.031)
Leverage	-0.056	-0.094	-0.236**
	(0.073)	(0.089)	(0.093)
Δ Leverage	-0.125**	-0.144***	-0.091*
	(0.050)	(0.048)	(0.047)
Tangibility	-1.050***	-1.130***	-1.226***
	(0.221)	(0.227)	(0.259)
Market-to-Book	0.013	0.030***	0.059***
	(0.010)	(0.009)	(0.011)
Firm Size	-0.124***	0.011	0.184***
	(0.026)	(0.018)	(0.023)
Ind_Stock_Return	0.391***	0.345***	0.333***
	(0.037)	(0.036)	(0.033)
Volatility	0.679***	0.618***	0.143
	(0.093)	(0.079)	(0.089)
Constant	-2.097***	-6.567***	-4.949***
	(0.531)	(0.318)	(0.354)
Observations	113888	113888	113888
Pseudo R^2	0.185	0.176	0.167
Year and Industry Fixed Effects	Yes	Yes	Yes

Panel B: IV regressions- Russell Sample			
	AMH	Spread	Turnover
Liquidity	0.223***	0.278***	1.174***
	(0.045)	(0.057)	(0.217)
Observations	5271	5271	5271
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Table 5: Stock Liquidity and Likelihood of Stock Acquisition: Effect of Firms' Financial Constraints

This table presents coefficient estimates from logit regressions that examine how the impact of firms' stock liquidity on the likelihood of making stock acquisitions varies in firms with varying extents of financial constraints for the full sample during 1984-2012. The dependent variable is a dummy variable that takes a value of one if a firm makes a stock acquisition in the fiscal year, and zero otherwise. The liquidity measure used in each regression is indicated at the top of the table. *KZ* is the Kaplan-Zingales Index that captures the extent of financial constraints that a firm encounters. Other explanatory variables are defined in Appendix A. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

	(1) AMH	(2) Spread	(3) Turnover
Liquidity	0.312***	0.598***	0.235***
	(0.022)	(0.035)	(0.025)
Liquidity X KZ	0.005**	0.009*	0.734*
	(0.002)	(0.005)	(0.417)
KZ	-0.016*	-0.015**	-0.023***
	(0.008)	(0.007)	(0.009)
Leverage	-0.003	-0.021	-0.145*
	(0.082)	(0.076)	(0.078)
Δ Leverage	-0.111**	-0.124**	-0.080
	(0.049)	(0.055)	(0.055)
Tangibility	-1.022***	-1.096***	-1.203***
	(0.215)	(0.165)	(0.168)
Market-to-Book	0.015	0.032***	0.061***
	(0.010)	(0.007)	(0.006)
Firm Size	-0.125***	0.011	0.184***
	(0.026)	(0.019)	(0.015)
Ind_Stock_Return	0.391***	0.347***	0.334***
	(0.037)	(0.025)	(0.025)
Volatility	0.683***	0.616***	0.148**
	(0.098)	(0.066)	(0.066)
Constant	-2.098***	-6.604***	-4.973***
	(0.523)	(0.614)	(0.609)
Observations	113879	113879	113879
Pseudo R^2	0.185	0.176	0.167
Year and Industry Fixed Effects	Yes	Yes	Yes

Table 6: Stock Liquidity and the Fraction of Acquisition Payment in Stock

Panel A of this table presents coefficient estimates from tobit regressions that examine the impact of liquidity on the fraction of deal payment in stock for the sample of deals involving public targets during 1984-2012. The liquidity measure used in each regression, indicated at the top of the table, is the difference between the acquirer's and the target's liquidity (*Relative Liquidity*). Other explanatory variables are defined in Appendix. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. Panel B reports estimates from the second-stage IV regression. The sample is first obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006 that were involved in acquisitions of public targets. Specifically,

$$Y_{it} = \tau + \theta \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \ (Ln(May\ market\ cap)_{it})^n + \varphi\ Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it}$$

where Y_{it} is the fraction of deal payment in stock if a deal involving a public target occurs during the period of July 1st of the reconstitution year to the end of next May. Panels C and D augment the tests in Panel A by interacting *Relative Liquidity* with *Blockholder* and *Short horizon*, respectively. *Blockholder* is defined as the number of blockholders with 5% or more stock ownership in the target in the quarter prior to deal announcement. *Short horizon* is defined as the ratio of shareholding by short-term investors to shareholding by long-term investors in the quarter prior to the announcement date. For brevity, coefficient estimates on other variables are not reported. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

Panel A: Full Sample			
	(1) AMH	(2) Spread	(3) Turnover
Relative Liquidity	0.048***	0.057***	0.013***
	(0.001)	(0.004)	(0.001)
Runup	0.346***	0.332***	0.318***
	(0.008)	(0.009)	(0.009)
Volatility	1.164***	1.122***	1.101***
	(0.006)	(0.006)	(0.006)
Relative Size	0.158***	0.134***	0.117***
	(0.002)	(0.002)	(0.002)
ln(deal size)	0.084***	0.067***	0.061***
	(0.001)	(0.001)	(0.001)
Cash/Deal	-0.010***	-0.010***	-0.010***
	(0.000)	(0.000)	(0.000)
Leverage	0.017***	0.043***	0.030***
	(0.006)	(0.006)	(0.006)
Δ Leverage	-0.309***	-0.321***	-0.323***
	(0.006)	(0.006)	(0.007)
PPE/Asset	-0.228***	-0.223***	-0.223***
	(0.006)	(0.006)	(0.005)
Market-to-Book	0.086***	0.084***	0.087***
	(0.001)	(0.001)	(0.001)
Tender Offer	-1.720***	-1.725***	-1.727***
	(0.008)	(0.008)	(0.008)
Observations	2501	2501	2501
Pseudo R^2	0.340	0.339	0.339
Year and Industry Fixed Effects	Yes	Yes	Yes

Panel B: IV regressions- Russell Sample			
	AMH	Spread	Turnover
Liquidity	0.334**	0.291***	0.013***
	(0.146)	(0.088)	(0.005)
Observations	278	278	278
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Panel C: Full Sample – Effect of Target Blockholding			
	AMH	Spread	Turnover
Relative Liquidity	0.063***	0.078***	0.016***
	(0.001)	(0.004)	(0.005)
Relative Liquidity X Blockholder	-0.012***	-0.015***	-0.002
	(0.001)	(0.001)	(0.001)
Blockholder	-0.026***	0.080***	0.109***
	(0.003)	(0.003)	(0.003)
Other controls	Yes	Yes	Yes
Observations	2501	2501	2501
Pseudo R^2	0.342	0.341	0.340
Year and Industry Fixed Effects	Yes	Yes	Yes

Panel D: Full Sample – Effect of Target Investor Horizon			
	AMH	Spread	Turnover
Relative Liquidity	0.052***	0.071***	0.011***
	(0.002)	(0.005)	(0.004)
Relative Liquidity X Short Horizon	0.003***	0.002***	0.004***
	(0.000)	(0.001)	(0.001)
Short Horizon	-0.008***	-0.004***	-0.002***
	(0.001)	(0.001)	(0.000)
Other controls	Yes	Yes	Yes
Observations	2051	2051	2051
Pseudo R^2	0.365	0.362	0.362
Year and Industry Fixed Effects	Yes	Yes	Yes

Table 7: Stock Liquidity and Deal Premium Paid

Panel A of this table presents the coefficient estimates from OLS regressions that examine the impact of stock liquidity on the deal premium for the subsamples of stock and cash acquisitions involving public targets, respectively. The dependent variable is *Premium* which is defined as the effective offer price as a percentage premium over the target firm's market share price as of two days prior to the takeover announcement. The liquidity measure used in each regression, indicated at the top of the table, is the difference between the acquirer's and the target's liquidity (*Relative Liquidity*). Other explanatory variables are defined in Appendix. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. Panel B reports estimates from the second-stage IV regression. The sample is first obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006 that were involved in acquisitions of public targets. Specifically,

$$Y_{it} = \tau + \theta\, \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n\ (Ln(May\ market\ cap)_{it})^n + \varphi\ Ln(June\ float\ adj.\ market\ map)_{it} + \rho\ Deal\ Characteristics_{it} + \mu_t + \eta_{it}$$

where Y_{it} is the deal premium paid for a deal involving a public target that occurs during the period of July 1st of the reconstitution year to the end of next May. Deal Characteristics included are *Related Deal, Competing Bid, Tender Offer,* and *ln(deal size).* *, **, and *** indicate significance at 10%, 5% and 1% respectively.

	Panel A					
	AMH		Spread		Turnover	
	(1) Stock	(2) Cash	(3) Stock	(4) Cash	(5) Stock	(6) Cash
Relative Liquidity	-0.017*	-0.011	-0.050***	0.022	-0.024**	-0.029**
	(0.009)	(0.013)	(0.018)	(0.025)	(0.011)	(0.014)
Runup	0.078**	-0.136	0.078**	-0.114	0.089***	-0.128
	(0.035)	(0.106)	(0.032)	(0.098)	(0.032)	(0.102)
Related Deal	-0.024	-0.033	-0.023	-0.031	-0.024	-0.030
	(0.016)	(0.042)	(0.016)	(0.042)	(0.016)	(0.042)
Competing Bid	-0.028	-0.121***	-0.032	-0.123***	-0.021	-0.114**
	(0.057)	(0.045)	(0.057)	(0.047)	(0.057)	(0.046)
Leverage_a	0.018	0.029	0.002	0.056	0.014	0.042
	(0.061)	(0.130)	(0.056)	(0.129)	(0.056)	(0.130)
Leverage_t	0.091**	0.066	0.102**	0.064	0.097**	0.058
	(0.042)	(0.120)	(0.042)	(0.121)	(0.046)	(0.118)
Tender Offer	-0.019	0.048	-0.025	0.051	-0.014	0.047
	(0.068)	(0.042)	(0.061)	(0.042)	(0.070)	(0.042)
ln(deal size)	-0.022	-0.028	-0.015	-0.001	0.012	-0.013
	(0.024)	(0.032)	(0.021)	(0.029)	(0.023)	(0.031)
Market-to-Book_a	-0.004	-0.003	-0.002	-0.003	-0.002	0.000
	(0.005)	(0.007)	(0.006)	(0.008)	(0.006)	(0.008)
Market-to-Book_t	-0.000	0.000	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.207*	0.374**	-0.208*	0.360**	-0.216**	0.360**
	(0.111)	(0.145)	(0.117)	(0.167)	(0.109)	(0.144)
Observations	1334	673	1334	673	1334	673
Adjusted R^2	0.017	-0.008	0.020	-0.009	0.015	-0.007
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: IV regressions- Russell Sample

	AMH		Spread		Turnover	
	Stock	Cash	Stock	Cash	Stock	Cash
Acquirer's Liquidity	-0.111***	0.568	-0.250**	0.295	-0.006***	0.023
	(0.047)	(0.518)	(0.110)	(0.178)	(0.002)	(0.019)
Observations	126	131	126	131	126	131
Bandwidth	300	300	300	300	300	300
Polynomial order	1	1	1	1	1	1
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Liquidity-enhancing Activity Prior to Stock Acquisitions

This table reports estimates on the effect of future stock acquisitions on a firm's liquidity-enhancing activities that include stock splits and increase in earnings guidance. In Column (1) of Panel A, a logit regression is run with the dependent variable being a dummy that equals one if there is a stock split conducted in year t. In Column (2) of Panel A, an OLS regression is run with the dependent variable being the difference between the number of earnings guidance provided by the firm in year t and t-1. The sample period for the regression of Column (2) is 1994-2012. The main explanatory variable, *Stockacq,* is a dummy variable that takes a value of one if the firm makes a stock acquisition in year t+1 and zero otherwise. Other explanatory variables are defined in Appendix. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. Panel B reports the IV estimation results of the regressions in Panel A with *Stockacq* being instrumented using the total number of M&As in the same industry (defined using three-digit SIC codes) of the firm in the year. Both the first-stage and second-stage estimation results are reported. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

Panel A		
	(1) Stock Split	(2) Earnings Guidance
Stockacq	0.216***	0.186***
	(0.081)	(0.058)
Leverage	-1.320***	-0.284***
	(0.090)	(0.055)
Δ Leverage	0.656***	0.210***
	(0.066)	(0.037)
Market-to-Book	0.113***	-0.002
	(0.006)	(0.006)
Firm Size	0.400***	0.353***
	(0.013)	(0.013)
Ind_Stock_Return	0.758***	-0.064***
	(0.027)	(0.015)
Volatility	-0.455***	-0.583***
	(0.092)	(0.049)
Constant	-5.825***	-5.523***
	(0.697)	(0.356)
Observations	116051	100971
Adjusted/ Pseudo R^2	0.158	0.191
Year and Industry Fixed Effects	Yes	Yes

	Panel B		
	1st Stage	2nd Stage	
	(1)	(2) Stock Split	(3) Earnings Guidance
Stockacq	0.001***		
	(0.000)		
IV		0.783***	0.421**
		(0.211)	(0.178)
Leverage	-0.013***	-0.014***	-0.027***
	(0.002)	(0.004)	(0.007)
Δ Leverage	-0.002	0.018***	-0.006
	(0.003)	(0.002)	(0.008)
Market-to-Book	0.006***	0.002*	0.004***
	(0.001)	(0.001)	(0.002)
Firm Size	0.009***	0.004**	0.009***
	(0.001)	(0.002)	(0.002)
Ind_Stock_Return	0.018***	0.008**	-0.022***
	(0.001)	(0.004)	(0.006)
Volatility	0.016***	-0.005	-0.032***
	(0.002)	(0.004)	(0.008)
Constant	-0.032***	0.013	-0.709***
	(0.011)	(0.023)	(0.033)
Observations	118208	118208	101291
Year Fixed Effects	Yes	Yes	Yes
F-Stats		31.60	
Adjusted R^2		0.065	

Table 9: Stock Liquidity and Acquirer's Announcement Returns in Stock Deals

This table presents coefficient estimates from OLS regressions that examine the effect of stock liquidity on the acquirer's three-day [-1, 1] cumulative abnormal returns around the announcements of stock acquisition involving public targets. The liquidity measure used in each regression, indicated at the top of the table, is the difference between the acquirer's and the target's liquidity (*Relative Liquidity*). Other explanatory variables are defined in Appendix. Year and industry (defined based on three-digit SIC codes) fixed effect are included in all regressions. Robust standard errors are clustered by industry and reported in parentheses. *, **, and *** indicate significance at 10%, 5% and 1% respectively.

	(1) AMH	(2) Spread	(3) Turnover
Relative Liquidity	0.004***	0.006**	0.013***
	(0.001)	(0.003)	(0.004)
Runup	-0.037***	-0.037***	-0.039***
	(0.012)	(0.012)	(0.012)
Tender Offer	0.025	0.025	0.025
	(0.021)	(0.021)	(0.021)
Competing Bid	0.003	0.001	-0.002
	(0.015)	(0.014)	(0.014)
Related Deal	0.001	0.000	0.001
	(0.007)	(0.007)	(0.007)
Volatility	-0.049**	-0.051**	-0.061***
	(0.024)	(0.024)	(0.022)
Market-to-Book_a	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)
Leverage_a	0.033**	0.035**	0.033**
	(0.015)	(0.014)	(0.014)
Market-to-Book_t	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Leverage_t	0.000	-0.003	-0.003
	(0.010)	(0.010)	(0.010)
Constant	-0.044***	-0.038***	-0.036**
	(0.014)	(0.014)	(0.016)
Observations	1433	1433	1433
Adjusted R^2	0.129	0.125	0.135
Year and Ind. Fixed Effects	Yes	Yes	Yes

Appendix A: Variable Definitions

A.1. Key variables

A.1.1. Stock liquidity

We use three different measures of liquidity in our analysis that are common in the literature. The first is Amihud's (2002) Illiquidity ratio. It is defined as the natural logarithm of $AvgILLIQ \times 10^9$ where *AvgILLIQ* is the yearly average of illiquidity, which is measured as the absolute return divided by dollar trading volume:

$$AvgILLIQ_{i,t} = \frac{1}{Days_{i,t}} \sum_{d=1}^{Days_{i,t}} \frac{|R_{i,t,d}|}{DolVol_{i,t,d}}.$$

Here $Days_{i,t}$ is the number of valid observation days for stock i in fiscal year t, and $R_{i,t,d}$ and $DolVol_{i,t,d}$ are the daily return and daily dollar trading volume, respectively, for stock i on day d of fiscal year t. This measure reflects the average stock price sensitivity to one dollar trading volume. Higher *AvgILLIQ* is interpreted as lower stock liquidity. In our analysis, we take a minus of the Amihud's Illiquidity ratio so that it measures a stock's liquidity instead of illiquidity.

The second measure is the natural logarithm of the yearly average of daily bid-ask spread:

$$Bid - Ask\ Spread_{i,t} = \frac{1}{Days_{i,t}} \sum_{d=1}^{Days_{i,t}} \frac{Ask_{i,t,d} - Bid_{i,t,d}}{\frac{(Ask_{i,t,d} + Bid_{i,t,d})}{2}}$$

where $Days_{i,t}$ is the number of valid observation days for stock i in fiscal year t, and $Ask_{i,t,d}$ and $Bid_{i,t,d}$ are the closing ask and bid prices of stock i on day d of fiscal year t. Higher Bid-Ask Spread is interpreted as lower stock liquidity. Like the Amihud's Illiquidity ratio, we take a minus of Bid-Ask $Spread_{i,t}$ so that it measures a stock's liquidity instead of illiquidity.

The third measure is the yearly average of monthly trading turnover, which is calculated as:

$$Turnover_{i,t} = \frac{1}{12}\sum_{m=1}^{12}\frac{Vol_{i,t,m}}{Shrout_{i,t,m}}$$

where $Vol_{i,t,m}$ and $Shrout_{i,t,m}$ are the number of shares traded and shares outstanding of firm *i* in month *m* of fiscal year *t*, respectively.

A.1.2. Some major deal characteristics

Stock acquisition: In the literature, definitions of stock deals vary across studies. For example, some define deals paid by 100% of stocks and deals paid with a combination of stock and cash as "stock" deals (e.g., Chang, 1998; Officer, Poulsen, Stegemoller, 2009). In other studies, "stock" deals are defined as those containing only stock, and "cash" deals are defined similarly (e.g., Moeller, Schlingemann, and Stulz, 2007). We take two approaches in the examination of payment method. First, we take the proportion of stock paid in each deal. Second, we define a deal as "stock" deal if the proportion of stock in the total payment is no less than 60% (i.e., the majority of the payment is in the form of stock) and a deal as "cash" deal if the proportion of cash in the total payment is no less than 60%. In robustness checks, we also define "stock" ("cash") deals as those containing stock (cash) payment only and find that our results are qualitatively similar.

Deal premium: It is the market value acquisition premium offered to the target, defined as the effective offer price as a percentage premium over the target firm's market share price as of two days prior to the takeover announcement.

A.2. All other variables

- *Blockholder* is the number of blockholders with 5% or more stock ownership in the target in the quarter prior to deal announcement.

- *Cash* is the cash and short term investments to lagged asset ratio.

- *Cash/Deal* is the amount of acquirer cash plus marketable securities normalized by the value of the merger or acquisition.

- *Competing_Bid* is a binary variable that takes one if there was a competing bid, and zero otherwise.

- *Firm Size* is the natural log of book value of total assets.

- *Firm's Age* is the age of the firm in years.

- *Ind_stock_return* is the annual stock return in the prior year, adjusted for the mean contemporaneous industry stock return.

- $KZ_{i,t} = -1.002 \frac{CF_{i,t}}{AT_{i,t-1}} - 39.398 \frac{Div_{i,t}}{AT_{i,t-1}} - 1.315 \frac{C_{i,t}}{AT_{i,t-1}} + 3.319 Leverage_{i,t} + 0.283 Q_{i,t}$

  where cash flow (CF) is the sum of income before extraordinary items and depreciation and amortization, dividends (DIV) are measured as common and preferred dividends, C is cash and short term investments

- *Leverage* is the debt to assets ratio.

- *Ln(1+guidance)* is the natural logarithm of one plus the frequency of earnings guidance forecasts provided by the management.

- *Ln(deal size)* is the natural logarithm of value of transaction.

- *Log Number of Analysts* is the natural logarithm of one plus maximum number of analysts following the stock for the year. It is coded as 0 if there is no coverage from *I/B/E/S.*

- *Market-to-Book* is the market value to book value of total assets.

- *NYSE Dummy* is a binary variable that is equal to one if the firm is listed in the New York Stock Exchange and zero otherwise.

- *R&D* is a binary variable that takes one if the R&D expenditure to lagged assets is greater than zero, and zero otherwise.

- *Related Deal* is a binary variable that takes one if both firms (acquirer and target) are from the same two-digit SIC code; and zero otherwise.

- *Relative Liquidity* is the simple difference between the acquirer's and the target's stock liquidity.

- *Relative Size* is the natural logarithm of target market capitalization a month prior to acquisition divided by bidder market capitalization a month prior to acquisition.

- *ROA* is the earnings before extraordinary items to lagged asset ratio.

- *Runup* is the firm's market-adjusted cumulative return for the 90 trading days [-120, -30] prior to the acquisition announcement date.

- *Short horizon* is the ratio of shareholding by short-term investors to shareholding by long-term investors in the quarter prior to the announcement date.

- *Stock Split* is a binary variable that indicates whether or not there was a stock split.

- *Tangibility* is the net total value of property, plant and equipment, divided by total assets.

- *Tender Offer* is a binary variable that takes a value of one if the acquirer involves a tender offer as reported in SDC and zero otherwise.

- *Volatility* is the volatility in the firm's stock return over the 12 months preceding the acquisition.

- *Δ Leverage* is the change in leverage from t-2 to t-1.

Appendix B: Robustness Checks and Ancillary Tests

Table B.1: First Stage Estimation for Stock Liquidity

This table presents estimates of the first-stage IV regression of stock liquidity on an indicator of end-of-May market capitalization ranking. The sample is obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006. Specifically,

$$Liquidity_{it} = \alpha + \beta\, R2000_{it} + \sum_{n=1}^{N} \gamma_n \, (Ln(May\ market\ cap)_{it})^n + \rho\, Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \varepsilon_{it}$$

where *R2000* is an indicator variable that equals one if firm *i's* end-of-May market capitalization is ranked beyond 1001st in year *t* and zero otherwise; $Ln(May\ market\ cap)_{it}$ is the natural logarithm of firm *i*'s end-of-May market capitalization in year *t*; $Ln(June\ float\ adj.market\ cap)_{it}$ is the natural logarithm of firm *i*'s end-of-June float-adjusted market capitalization in year *t*, as provided by Russell. $Liquidity$ is firm *i*'s stock liquidity at the end of September in reconstitution year *t*. The liquidity measure used in each regression is indicated at the top of the table. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

	AMH			Spread			Turnover		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
R2000	0.139**	0.104**	0.101***	0.096***	0.082***	0.075***	0.023**	0.020**	0.018**
	(0.074)	(0.045)	(0.030)	(0.037)	(0.028)	(0.023)	(0.012)	(0.009)	(0.007)
Observations	7022	5271	5271	7022	5271	5271	7022	5271	5271
Adjusted R^2	0.542	0.518	0.518	0.735	0.737	0.737	0.040	0.047	0.047
Bandwidth	400	300	300	400	300	300	400	300	300
Polynomial order	1	2	3	1	2	3	1	2	3
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table B.2: Stock Liquidity and Likelihood of Acquisition

This table reports estimates from the second-stage IV regression. The sample is obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006. Specifically,

$$Y_{it} = \tau + \theta \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \ (Ln(May\ market\ cap)_{it})^n + \varphi\ Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it}$$

where Y_{it} takes a value of one if firm *i* makes an acquisition in the period of July 1st in year *t* to the end of next May. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

	AMH			Spread			Turnover		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Acquirer's Liquidity	0.182***	0.207***	0.242***	0.262***	0.262**	0.327**	1.097***	1.096***	1.342***
	(0.041)	(0.081)	(0.076)	(0.059)	(0.105)	(0.131)	(0.227)	(0.383)	(0.430)
Observations	7022	5271	5271	7022	5271	5271	7022	5271	5271
Bandwidth	400	300	300	400	300	300	400	300	300
Polynomial order	1	2	3	1	2	3	1	2	3
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table B.3: Stock Liquidity and Likelihood of Stock Acquisition

This table reports estimates from the second-stage IV regression. The sample is obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006. Specifically,

$$Y_{it} = \tau + \theta\ \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n\ (Ln(May\ market\ cap)_{it})^n + \varphi\ Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it}$$

where Y_{it} takes a value of one if firm *i* makes a stock acquisition in the period of July 1st in year *t* to the end of next May. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

	AMH			Spread			Turnover		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Acquirer's Liquidity	0.164***	0.193***	0.208***	0.236***	0.244***	0.280***	0.989***	1.022***	1.149***
	(0.044)	(0.041)	(0.047)	(0.018)	(0.040)	(0.085)	(0.230)	(0.165)	(0.241)
Observations	7022	5271	5271	7022	5271	5271	7022	5271	5271
Bandwidth	400	300	300	400	300	300	400	300	300
Polynomial order	1	2	3	1	2	3	1	2	3
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table B.4: Stock liquidity and the Fraction of Acquisition Payment in Stock

This table reports estimates from the second-stage IV regression. The sample is first obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006 that were involved in acquisitions of public targets. Specifically,

$$Y_{it} = \tau + \theta \, \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \, (Ln(May\ market\ cap)_{it})^n + \varphi \, Ln(June\ float\ adj.\ market\ map)_{it} + \mu_t + \omega_{it}$$

where Y_{it} is the fraction of deal payment in stock if a deal involving a public target occurs during the period of July 1st of the reconstitution year to the end of next May.

	AMH			Spread			Turnover		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Acquirer's	0.439**	0.348**	0.267	0.368***	0.252***	0.205	0.017***	0.014***	0.009
Liquidity	(0.187)	(0.137)	(0.222)	(0.044)	(0.102)	(0.145)	(0.006)	(0.005)	(0.007)
Observations	379	278	278	379	278	278	379	278	278
Bandwidth	400	300	300	400	300	300	400	300	300
Polynomial order	1	2	3	1	2	3	1	2	3
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table B.5: Stock Liquidity and Deal Premium Paid

This table reports estimates from the second-stage IV regression. The sample is first obtained by ranking stocks based on their end-of-May market capitalization, as reported in CRSP, and selecting firms ranked 701st through 1300th for each year of the sample during 1998-2006 that were involved in acquisitions of public targets. Specifically,

$$Y_{it} = \tau + \theta \widehat{Liquidity}_{it} + \sum_{n=1}^{N} \sigma_n \ (Ln(May\ market\ cap)_{it})^n + \varphi\ Ln(June\ float\ adj.\ market\ map)_{it} + \rho\ Deal\ Characteristics_{it} + \mu_t + \eta_{it}$$

where Y_{it} is the deal premium paid for a deal involving a public target that occurs during the period of July 1st of the reconstitution year to the end of next May. Deal Characteristics included are *Related Deal*, *Competing Bid*, *Tender Offer*, and *ln(deal size).* *, **, and *** indicate significance at 10%, 5% and 1% respectively.

Panel A

	AMH		Spread		Turnover	
	Stock	Cash	Stock	Cash	Stock	Cash
Acquirer's Liquidity	-0.090***	0.518	-0.166***	0.225	-0.005***	0.023
	(0.030)	(0.462)	(0.063)	(0.173)	(0.002)	(0.016)
Observations	169	184	169	184	169	184
Bandwidth	400	400	400	400	400	400
Polynomial order	1	1	1	1	1	1
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel B

	AMH		Spread		Turnover	
	Stock	Cash	Stock	Cash	Stock	Cash
Acquirer's Liquidity	-0.158***	1.935	-0.379**	0.530	-0.008***	0.025**
	(0.046)	(4.732)	(0.161)	(0.344)	(0.002)	(0.010)
Observations	126	131	126	131	126	131
Bandwidth	300	300	300	300	300	300
Polynomial order	3	3	3	3	3	3
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table B.6: The Effect of Stock Split and Earnings Guidance on Stock Liquidity

This table shows that stock split and frequency of earnings guidance forecasts provided by the management tend to increase a firm's stock liquidity. It presents estimates from regressions where the dependent variable is a measure of the firm's stock liquidity and the independent variables of interest are (1) a dummy variable that indicates whether or not there was a stock split in the prior year (in columns 1-3), and (2) logarithm of one plus the frequency of earnings guidance forecasts provided by the management in the previous fiscal year (column 4-6). The liquidity measures used in each regression is indicated at the top of the table. Other explanatory variables are defined in Appendix. All these independent variables are lagged by one year. Year and industry (defined based on three-digit SIC codes) fixed effects are also included. Robust standard errors are clustered by industry and reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1% respectively.

	AMH	Spread	Turnover	AMH	Spread	Turnover
Stock Split Dummy	0.209***	0.048**	0.079***			
	(0.048)	(0.020)	(0.021)			
Ln(1+guidance)				0.433***	0.181***	0.081***
				(0.030)	(0.010)	(0.008)
R&D	0.089	0.023	0.033**	0.075	0.020	0.031*
	(0.064)	(0.018)	(0.015)	(0.065)	(0.019)	(0.016)
Firm Size	0.992***	0.301***	0.085***	0.971***	0.294***	0.086***
	(0.027)	(0.011)	(0.007)	(0.027)	(0.011)	(0.007)
Leverage	-1.140***	-0.458***	-0.029	-1.084***	-0.457***	-0.021
	(0.134)	(0.060)	(0.040)	(0.144)	(0.068)	(0.044)
Cash	0.220***	0.095***	0.107***	0.213***	0.101***	0.106***
	(0.031)	(0.010)	(0.011)	(0.031)	(0.013)	(0.011)
Market-Book	0.451***	0.141***	0.068***	0.431***	0.138***	0.069***
	(0.026)	(0.008)	(0.007)	(0.023)	(0.008)	(0.007)
ROA	0.338***	0.224***	0.124***	0.266***	0.213***	0.125***
	(0.060)	(0.033)	(0.025)	(0.054)	(0.034)	(0.027)
Tangibility	-0.330**	-0.098*	-0.115***	-0.297**	-0.091	-0.108***
	(0.138)	(0.053)	(0.037)	(0.141)	(0.057)	(0.040)
NYSE Dummy	0.293	0.143**	0.005	0.653***	0.271***	0.046
	(0.212)	(0.068)	(0.043)	(0.236)	(0.086)	(0.053)
Firm's Age	0.003	-0.001	-0.009***	0.003	-0.002	-0.008***
	(0.004)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Volatility	-1.212***	-0.473***	0.376***	-1.070***	-0.418***	0.446***
	(0.063)	(0.033)	(0.021)	(0.069)	(0.034)	(0.025)
Log Number of Analysts	0.433***	0.171***	0.063***	0.391***	0.161***	0.056***
	(0.021)	(0.009)	(0.009)	(0.023)	(0.011)	(0.010)
Constant	-10.639***	2.179***	-0.423***	-10.752***	1.859***	-0.513***
	(0.144)	(0.063)	(0.058)	(0.156)	(0.079)	(0.056)
Observations	91851	91851	91851	78401	78401	78401
Adjusted R^2	0.753	0.798	0.304	0.754	0.799	0.311
Year and Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table B.7: Subsample Tests to Address the Governance Interpretation of IV Estimation Results

This table presents results on a subsample of Russell-sample that are obtained by repeating the first-stage IV regressions of stock liquidity on an indicator of end-of-May market capitalization ranking that are made in Table 2 (Panel A), the second-stage IV regressions made in Panel B of Table 3 on the effect of instrumented liquidity on the likelihood of acquisitions (Panel B), the second-stage IV regressions made in Panel B of Table 4 on the effect of instrumented liquidity on the likelihood of stock acquisitions (Panel C), the second-stage IV regressions made in Panel B of Table 6 on the effect of instrumented liquidity on the fraction of stock payment (Panel D), and the second-stage IV regressions made in Panel B of Table 7 on the effect of instrumented liquidity on deal premiums (Panel E). The subsample is obtained by excluding from the original Russell-sample (firms ranked 701st through 1300th each year based on their end-of-May market capitalization) firms ranked 1001st through 1300th each year that show an improvement in corporate governance following reconstitution and firms ranked 701st through 1000th each year that show a decline in corporate governance following reconstitution. In particular, a firm that is ranked 1001st through 1300th (a firm that is ranked 701st through 1000th) is dropped if any of the following holds in the year following reconstitution, compared with the year prior to reconstitution: (i) there is an increase (decrease) in the fraction of outsiders on the board; (ii) the CEO-duality role is separated (combined); (iii) the number of proxy proposals submitted declines (increases). *, **, and *** indicate significance at 10%, 5% and 1% respectively.

Panel A: First Stage Estimates			
	AMH	Spread	Turnover
R2000	0.045*	0.063***	0.016***
	(0.027)	(0.026)	(0.006)
Observations	3386	3386	3386
Adjusted R^2	0.520	0.743	0.044
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Panel B : 2^{nd} Stage- Likelihood of acquisition			
	AMH	Spread	Turnover
Liquidity	0.728*	0.523***	2.104***
	(0.408)	(0.136)	(0.646)
Observations	3386	3386	3386
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Panel C: 2nd Stage- Likelihood of stock acquisition			
	AMH	Spread	Turnover
Liquidity	0.663*	0.476***	1.915***
	(0.376)	(0.126)	(0.561)
Observations	3386	3386	3386
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Panel D: 2nd Stage- Fraction of acquisition payment in stock			
	AMH	Spread	Turnover
Liquidity	0.323***	0.358***	0.017***
	(0.045)	(0.075)	(0.004)
Observations	205	205	205
Bandwidth	300	300	300
Polynomial order	1	1	1
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Panel E: 2nd Stage- Deal premium paid						
	AMH		Spread		Turnover	
	Stock	Cash	Stock	Cash	Stock	Cash
Acquirer's Liquidity	-0.041***	0.484	-0.073***	0.371	-0.003***	-0.289
	(0.010)	(0.471)	(0.014)	(0.340)	(0.001)	(3.807)
Observations	93	87	93	87	93	87
Bandwidth	300	300	300	300	300	300
Polynomial order	1	1	1	1	1	1
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes