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Liquidity, Institutional Ownership and Regulation Fair Disclosure

By

Ji Lin

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ABSTRACT

There is a body of academic literature addressing two issues of importance for leveling the playing field for all classes of investors: 1) the impact of institutional investors on liquidity; and 2) the impact of Regulation Fair Disclosure on institutional investors and liquidity. Our study addresses both issues with the purpose of attaining a better understanding and explanation of this relationship. We classify institutional ownership according to Bushee's (1998, 2001) methodology; transient institutions, dedicated institutions and quasi-indexers. Our results indicate that while transient institutions and quasi-indexers have a positive impact on liquidity, dedicated institutional ownership is negatively associated with liquidity. This result is consistent with prior theoretical studies. We also find that the effectiveness of the Regulation Fair Disclosure in improving liquidity is limited to firms with higher transient institutional ownership, whereas quasi-indexed institutions have not been significantly affected by the regulations. In fact, the liquidity of firms is lower for firms with higher dedicated institutional holdings, which is evidence of the "chilling effect".

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I. Introduction

The U.S. equity market has undergone a shift in ownership structure over the past 50 years, from primarily individual direct holdings decades ago to institutional holding today. Institutional ownership of common stock has experienced a substantial increase, becoming a major component of equity markets. The Federal Reserve Board's Flow of Funds reports that institutions owned approximately 7 percent of US equities in 1950. In Graph I, we show the percentage of institutional owned stock shares from 1990 to 2009. The past two decades has seen a great relative increase in the ownership of publicly held shares by institutions. In 2007, institution ownership peaked, with 65.58% of stock shares. Consequently, the influence of institutional investors on the stock market and the country's economy has increased significantly. Friedman (1996) points out that institutionalization symbolizes concentration of investment decision making and discusses the potential consequences of this trend on the U.S. equity market on the financing for growth companies, on market volatility, on the market price for risk, and on corporate governance. He also contends that institutionalization impacts on the financing of emerging companies and raises volatility, mutual funds create an illusion of liquidity, defined contribution pension plans (e.g. 401-K plans) increase the market price of risk, and institutions have become more vocal in the governance of corporate business. Institutions impact the American capital markets in numerous ways. The first objective of this study is to examine the impact of institutional ownership on stock liquidity.

Why is liquidity so important? This topic has received substantial attention among academics and practitioners alike. The discussion on liquidity relates to important areas in finance such as corporate finance, asset pricing and market microstructure. And the impact of liquidity on financial market has a result on various aspects Demsetz (1968) applies the notion of economic efficiency and proposes that increase in liquidity can lead to improved sharing of financial risks and result in lower transaction costs, which explains the domination of NYSE in trading Amihud, Mendelson and Pedersen (2005) contend that illiquidity can be derived from transaction costs, inventory risk, information asymmetry, market frictions and can explain problems such as the equity premium puzzle, the risk-free rate puzzle and the small firm effect. Liquidity also plays an indispensable role in the price discovery process. Recent studies indicate that both the level of liquidity and liquidity risk are priced in the share values. As well recent empirical studies find that the effects of liquidity on asset prices are both statistically and economically significant (Easley and O'Hara 2004; O'Hara 2003).

While there is a general consensus on the importance of liquidity, and studies have shown that various aspects of institutional investors' influence on firms' decisions, both directly (Agrawal and Mendelker 1990; Bushee 1998; Hartzell and Starkes 2003; Almazan, Hartzell and Starks 2005; Borokhovich, Brunarski, Harman and Parrino 2006) and indirectly (Parrino, Sias and Starks 2003), less is known about whether institutions play a positive or negative role in the aggregate market and on the firm level. Likewise, much has been written in the literature examining the effect of informed traders on liquidity (Kyle, 1985; Subrahmanyam, 1991; Shari, Shastri and Shastri, 2000; Rubin, 2007; Agarwal, 2007). However, underlying differences in modeling the trading behavior of informed investors, the trading motives of uninformed investors and information structure result in different predictions for stock liquidity in the presence of multiple informed traders. For instance, under the risk-neutral assumption, Kyle's (1985) model predicts that an increase in the number of informed traders results in a more liquid market because of competition; Subrahmanyam (1991) takes risk-aversion of informed traders into consideration and demonstrates a non-monotonic relation between informed traders and liquidity. Empirical work on institutional ownership and liquidity also shows mixed results. Shari, Shastri and Shastri (2000) conduct cross-sectional analysis and find that higher insider and institutional ownership is associated with both wider spreads and smaller quoted depth. They also show evidence that information asymmetry faced by traders is caused by insider ownership instead of institutional holdings. Rubin (2007) finds that liquidity increases with the level of institutional holdings due to higher trading activity and decreases with institutions' block holdings due to higher adverse selection. Agarwal (2007) finds a U-shaped relationship between institution-owned shares and stock liquidity, which implies that both the adverse selection effect and the information efficiency effect of institutions exist. In addition, he points out that the relationship is subject to changes of investment horizons and risk aversion. In summary, the existing literature on the relationship between institutional ownership and stock liquidity seem to indicate mixed empirical results supporting different theoretical predictions.

The first objective of this study is to further test the relationship between institutional ownership and stock liquidity by separately examining the effects of different types of institutions. Institutions are not a homogeneous group and they differ in their trading motives and behaviors. Poster (1993) points out the unique U.S. institution pattern and classifies the capital provided by institutions into fluid capital and dedicated capital. Bushee (1998) sorts institutions into three categories: transient institutions, dedicated institutions, and quasi-indexed institutions, based on different trading behaviors and strategies employed. In this study, we adopt Bushee's classification scheme and examine to what extent different types of institutions may exert different impacts on stock liquidity. By doing so, we attempt to reconcile the mixed findings in the empirical literature on the relationship between institutional ownership on stock liquidity.

The second objective of this study is to further test the role of different types of institutions on liquidity, in the face of an exogenous shock to their information disclosure regulation, namely, the U.S. Securities and Exchange Commission's (SEC's) Fair Disclosure (FD). Implemented on October 23, 2000, Regulation FD mandated that all publicly traded companies to disclose material information to all investors at the same time. This regulation prohibits selective disclosure of material information to analyst and large institutional investors and aims to 'level the playing field' among investors and increases the confidence and fairness in public capital markets. The SEC was concerned that selective disclosure benefits a privileged few investors to profit at the expense of the investing public and this unfairness causes the loss of confidence in the integrity of the capital markets. FD intends to curtail selective disclosure and "encourage continued widespread investor participation in our markets, enhancing market efficiency and liquidity, and more effective capital raising" (SEC, 2000). There are two noteworthy points in the SEC mandate. First, the SEC believes that by 'leveling the playing field', liquidity can be improved. Verrecchia (2001) provides a theoretical argument to support this assertion. He contends that commitment to greater corporate disclosure can ameliorate the adverse selection component of the cost of capital and increase market liquidity, as more information in the public domain makes it more difficult and more costly for traders to become privately informed. Second, large institutional investors are one of the main target groups of Reg FD. It thus follows that the SEC carries out Reg FD to increase the liquidity of stock market through changing the information advantage of institutional investors. This motivates the second objective of our study, which is to test the impacts of Reg FD on liquidity through different institutional investors.

The implementation of Reg FD raises debates on the effect of this regulation. Proponents argue that a broader group of investors have greater access to market-moving information as information that was previously disclosed through the selective disclosure channel (e.g., analyst conference calls) is now open to the public after Reg FD (Bushee, Matsumoto, and Miller 2004), making the market more fair. On the other hand, opponents of Reg FD (especially large brokerage firms) contended that Reg FD would result in 'a chilling effect', fearing that the public would mishandle the information, thus resulting in decreased information flow to the market. Our study sheds light on this debate and examines whether or not Reg FD improves stock liquidity through decreased informed trading (lower information asymmetry). There has been no agreement on this debate as yet.

Early studies provide evidence of a decrease in bid-ask spreads after Reg FD. (Bushee, Matsumoto, and Miller, 2004; Gintschel and Markov, 2004; Eleswarapu, Thompson, and Venkataraman, 2004). Chiyachantana, Jiang , Taechapiroontong and Wood (2004) find that Reg FD improves liquidity and decreases the level of information asymmetry (adverse selection costs) in NYSE stocks. They confirm that before the implementation of FD, institutional trading activity, (measured by trade frequency, share volume and dollar volume,) increases in pre-announcement, which suggests institutions do trade on private information. These three measures of institutional trading activity drop in the post-FD period, even after adjusting for benchmarks. Furthermore, they show that decline in information asymmetry around earnings announcements is associated with less institutional activity in the pre-announcements period and a higher participation rate of retail investors after earnings releases. In a similar vein, Topaloglu (2003) finds that the reduction of effective bid-ask spread is up to 12.4% in the post-FD period for Nasdaq stocks. On the other hand, Sidhu, Smith, Whaley and Willis (2008) reach the opposite conclusion that Reg FD has curtailed the flow of information from firms to public capital markets and that private information becomes longer-lived. This indicates that privately informed traders have become more profitable, which is against the desired objective of Reg FD. The authors decompose volume-weighted effective spreads and find that the adverse selection cost component increases from 6.6% to 10.5% for a sample of NASDAQ stocks in the period surrounding the implementation of Reg FD (Similarly, there is about 36% increase in dollar terms). This works as evidence of the 'chilling effect'. Other studies find that decline in liquidity or information asymmetry (e.g., Straser, 2002) is insignificant or the impact is limited to a particular group of companies (e.g., Aslan, 2002) for Reg FD.

Our study differs from the existing literature in that we attempt to examine how Reg FD exerts its effect on liquidity through institutional investors. Evidence shows that institutional investors have an information advantage before Reg FD. Lee (1992) uses small and large trades as proxies of retail and institutional trading and report that the reaction of small trades to earnings announcements news is weaker and slower than that of the large trades. Frankel, Johnson, and Skinner (1999) investigate the effect of conference calls on trading activity. They report larger trade size, higher trading volume, and higher return variance during conference calls, suggesting that institutional investors trade based on information in real time, whereas small investors are disadvantaged because of the lack of access to material information.

Although institutions are the main target of Reg FD, research on how Reg FD affects institutional trading behavior is rather limited. Unger (2001) summarizes the results of several surveys on the effectiveness of Reg FD. American Bar Association (ABA) FD Task Force Survey on securities attorneys shows that the percentage of clients conducting one-on-one meetings falls from 77 before Reg FD to 27 post-Reg FD. Association for Investment Management and Research (AIMR) Survey #1 reports a decreasing ability to hold these meetings for both buy-side and sell-side analysts. Topaloglu (2003) shows that institutions trade in the direction of earnings surprises before the announcements pre-FD, but post-FD they primarily traded after the announcement. Institutional trading volume is higher around earnings announcements post FD. All these results indicate that institutions become less informed before earnings announcements after the implementation of Reg FD. Chiyachantana, Jiang and Taechapiroontong (2004) report a decline in institutional activity before earnings announcements after Reg FD. However, there is anecdotal evidence that Reg FD does not eliminate institutional investors' access to non-public information from management (NIRI, 2001). For example, Topaloglu (2003) shows that there is still information leakage before the announcements in the post-FD era. Thus, whether or not and to what extent Reg FD changes the trading behavior of institutional investors is still unclear. We conjecture that the mixed results may be explained by different types of institutions. Specifically, Reg FD might be effective in mitigating the information advantage of a certain group of institutions resulting in information asymmetry, thus resulting in companies with a high level of holdings in improving more in liquidity. Reg FD cannot prevent other types of institutions from getting material information from firms, so no or less increase of liquidity is expected.

In both parts of our study, we use Bushee's (1998) scheme to classify institutions. Bushee (1998) conducts factor analysis and cluster analysis to classify institutional investors in groups based on their past investment behavior. Institutions are sorted into three groups: transient institutions, quasi-indexed institutions and dedicated institutions based on two factors, including turnover and diversification. As a result, transient institutions display high turnover and high diversification. Quasi-indexed institutions show low turnover and high diversification. Dedicated institutions are defined as having low turnover and low diversification. Here, we interpret this scheme of classification as three typical trading strategies employed by institutions.

Previous research uses the above classification scheme to study the influences of different types of institutions on the market and firms. For example, Bushee (1998) finds that transient institutions create pressure for managers to sacrifice R&D for the sake of higher current earnings. Bushee and Noe (2000) discover that quasi-indexers are attracted to firms with higher disclosure ranking practices. When firms improve disclosure practices, transient institutions immediately increase their holding, whereas quasi-indexers do not, leading to a significant increase in firms' stock return volatility. Ke and Petroni (2004) find that transient institutions predict the break in a string of consecutive quarterly earnings at least one quarter in advance of the break quarter. This classification scheme is also widely used in the studies of FD. For instance, Ke, Petroni and Yu (2008) shows that there is reduction of transient institutions' abnormal selling before bad-news break in the post-FD period and Reg FD has changed the portfolio allocation of this group of institutions by shifting their shares away from closed-called firms. Chen, Dhaliwal and Xie provide evidence that cost of capital improves to a greater extent in the post-FD period for companies with higher transient institutional ownership.

In summary, we employ three different types of institutions as in Bushee (1998) in order to find support for different theoretical conjunctures and to explain conflicting empirical results in the previous literature. For liquidity (or illiquidity) measures, we use several measures based on the CRSP daily data. The first measure is the illiquidity measure initially developed by Amihud (2002), who estimates illiquidity as daily ratio of absolute stock return to its dollar volume, averaged over some period. This illiquidity measure can be interpreted as the daily price response associated with one dollar of trading volume, thus serving as a proxy of price impact. We also take market-adjusted Amihud illiquidity measure and the square root of this measure following Amihud (2002). The second liquidity measure we use is Gibbs Sampler estimate of trading costs in Roll's model (1984) and in the basic market adjusted model (Hasbrouck, 2009). In addition, we also use turnover and covariance estimates of Roll's model as liquidity measures. These measures are widely used in market microstructure studies and are proved to be highly correlated with intra-day liquidity measures (e.g. spread, price impact). All liquidity measures in annual frequency can be obtained from Hasbrouck's website. We also calculate liquidity measures in quarterly frequency.

Our findings can be summarized as follows. For the relationship between institutional ownership and liquidity, we find that while transient institutions and quasi-indexers have positive impact on liquidity, dedicated institutions affect liquidity negatively and the result is robust using several different liquidity measures and pooled regression and fixed regression. In the second part of study, we find evidence that firms with high transient institutional ownership impact even more positively on liquidity after Reg FD. However, the impact of FD on liquidity is only limited to transient institutions and is ineffective to reduce information advantage of other institutions, as firms with high ownership by quasi-indexers and dedicated institutions show either insignificant or opposite effect on liquidity. This result is consistent with that of Chen, Dhaliwal and Xie (2010), who suggest that the reduction in the cost of capital is significant for firms with high transient institutional ownership, but not for other institutions. In fact, we find that dedicated institutions are actually causing more information asymmetry after Reg FD. Topaloglu (2003) argues that there is still some information leakage before the announcements in the post-FD era and so some institutions can circumvent Reg FD's intent. Straser (2002) indicates that information asymmetry is more serious after Reg FD. We interpret this result as that "chilling effect" that circumvents the amount of information distributed to the market after Reg FD and unexpectedly increases the information advantage of dedicated institutions. Many concurrent events also lead to changes in liquidity for Reg FD study during our sample period. (e.g. decimalization, burst of internet bubble, Sarbanes-Oxley Act). To control for other these factors, we carry out the same test for American Depositary Receipts and U.S. listed foreign firms (hereafter, ADRs) and use these firms as a control group, as ADRs are exempt from Reg FD but are subject to the same confounding factors as other U.S. firms (Gomes, Gorton, and Madureira 2007a, 300-334). Used as a control group, ADRs can serve as a benchmark for the treatment group. We find that, in contrast to other U.S. firms, the increase of liquidity of ADRs with high transient institutions is insignificant. Thus, we conclude that our finding is caused by Reg FD instead other confounding factors.

This study makes two contributions. First, this research contributes to a growing body of literature on the relationship between institutional ownership and liquidity by showing that how institutions affect liquidity depends on different trading strategies institutions employ. Existing theoretical research generates different hypothesis on this relationship. Agency issues, regulatory concerns, information revealing function and competition theory suggest that institutions promote market liquidity (Admati and Pfleiderer, 1988; Holden and Subrahmanyam,1992, etc.), whereas large volume trading, herding trading, positive feedback trading, information asymmetry theory hold the view that institutions have negative impact on liquidity (Ho and Stoll, 1981; Easley and O'Hara, 1987). In this study, we classify institutional ownership using Bushee's (1998) scheme of three typical investment strategies used by institutions. Transient institutions are the group which makes active profits on short-term information or forecasts; dedicated institutions are involved in corporate governance and management and target on long-term profits; quasi-indexed institutions are based on market composition and are involved in rebalancing trading and demand liquidity trading. We identify these three institutions affect the liquidity differently, which can explain the inconsistent results from previous studies. We consider the heterogeneity across institutions as there is a growing body of literature which shed light on this issue (Ross, 1989; Merton, 1995; etc.)._Chan and Lakonishok (1995) and Lang and McNichols (1997) further demonstrate that trading style matters in discussing on the influence of institutions. Furthermore, our study provides empirical evidence for Subrahmanyam (1991), Admati and Pfleiderer (1988) and Glosten and Milgrom's (1985) theoretical models by. We find transient institutions act like informed trader depicted in Subrahmanyam's (1991) model and have a positive impact on liquidity as they possess correlated precise information and compete intensely to earn short-term profit; Quasi-indexed institutions can represent discretionary liquidity traders in Admati and Pfleiderer's (1988) model; dedicated institutions are most likely to create information asymmetry, acting as insiders described in Glosten and Milgrom's (1985) model.

Second, our research can be cast in the stream of Reg FD studies. There are five major channels through which information is transmitted from internal (firm) to external (market), namely, through mandatory disclosure, voluntary public disclosure, selective disclosure, sell-side analyst and informed trader (Gomes, Gorton and Madureira 2007). Reg FD aims to eliminate selective disclosure by making mandatory rules and encourage firms to use public disclosure to announce private information. However, Reg FD in fact has unexpected impact on other channels and thus far, studies on the efficacy of FD has mixed results (Leuz and Wysocki, 2008). Our study intends to contribute to the effect of Reg FD on informed trader (the fifth channel). Compared with studies on analysts' behaviour (Heflin, Subramanyam and Zhang 2001, 2003; Gintschel and Markov 2004; Gomes, Gorton and Madureira 2007; Bushee Matsumoto and Miller 2004; Eleswarapu, Thompson and Venkataraman 2004 and etc.), research on institutional investors' behaviour and how institutions affect liquidity is relatively small (Ke, Petroni and Yu 2008). Our results lend empirical support to the view of Chiyachantana, Jiang, Taechapiroontong and Wood (2004) that changes in liquidity are associated with changes in institutional activities. We suggest that varying types of informed traders be considered in assessing whether Reg FD results in lower information asymmetry between informed traders and the public or not. In this way, we can find evidence to both supporting and opposing views on Reg FD.

The rest of the paper is organized as follows. Section II reviews the literature. Section III presents the theoretical arguments, the empirical methodology, and the testable hypotheses. Section IV describes the sample and liquidity measures. Section V reports the empirical results, robustness checks and analysis of these results. We conclude in Section VI.

II. Literature Review

2.1 Institutional Ownership and Liquidity

Institutional investors include the depository sector (commercial banks, savings institutions and bank personal trust and estates), insurance companies (life, property and casualty insurances), pension funds (both private pension funds and state and local government employee retirement funds), the open-end mutual funds (excluding money market funds), and security brokers and dealers.

There is a body of knowledge in the literature that states that institutions have a positive impact on liquidity. First, from a functional perspective, financial institutions exist to provide services to individual investors including realizing efficiencies of evaluating financial data, lowering transaction cost and boosting liquidity (Merton, 1995). Grossman and Miller (1988) list institutional traders; stock markets such as NYSE, market makers and retail dealer market, as four forms of market organizations providing the immediacy functions necessary to support different segments of the U.S. stock market. Thereby, a greater institutional presence in the equity market suggests easier access to liquidity services, hence a better liquidity situation.

High-frequency uninformed trading is the second theoretical basis to explain why institutions will affect liquidity positively. The frequent trading of institutions is in part a result of extensive portfolio rebalancing needs. On one hand, activities of institutions are governed by agency relations in the financial market (Ross, 1989). The compensation offered to a fund manager largely depends on its peer performance or comparison with a baseline benchmark (e.g., returns of the S&P 500). For his self interest, a fund manager will seek a strategy that makes himself indistinguishable from his peers and use a strategy that is a passive replication of the index performance. To minimize tracking errors, rebalance trade is frequently involved. This is how agency issues arise and lead to high-frequency trading of financial institutions. On the other hand, fund managers are often required to act prudently or to perform with stability around a target level instead of swinging up and down. In this case, a passive strategy is a proper choice for fund managers. Together with the agency problem, regulation requirements also generate a large number of portfolio rebalancing needs of financial institutions. More importantly, such a passive strategy, or rebalancing trade, does not rely on private information at all. These liquidity-driven orders submitted by institutions reflect the liquidity needs of clients or for portfolio rebalancing reasons that do not add to the inventory risk or information asymmetry risk for market makers, who otherwise will demand significant price concessions to make the market (Admati and

Pfleiderer 1988). Thus, many institutions become pooling intermediaries (e.g., pension funds and mutual funds) and engage in passive and informless indexing or follow a constant portfolio allocation rule. The more institutions trade on these innocuous motives, the better the market liquidity situation is.

The third theory that supports the positive impact of institutions on liquidity is the role of competition among institutions plays in the price discovery process. This facilitates incorporation of information into prices and speeds up the convergence of stock prices to their fundamentals. The notion is captured by several models. Admati and Pfleiderer's (1988) model assumes that a group of liquidity traders have discretion over the timing of their trades. Under the condition of homogeneous information (at the same time and in the same amount), institutions' informed transactions induce the participation of discretionary liquidity trading, intensify the competition among institutions and speed up the information revelation process. This improves market liquidity and results in a more beneficial situation for nondiscretionary (retail) traders. In addition, the multi-period auction model with multiple informed traders developed by Holden and Subrahmanyam (1992) predicts an approximately strong-form efficient market even when only two informed traders take part in the auction procedure. Moreover, a market reveals information immediately when there are an infinite number of informed traders competing with each other perfectly. In recent studies, Mendelson and Tunca (2004) distinguish three types of information: tractable, intractable, and public information. He points out that informed traders take the reaction of liquidity traders into consideration when choosing the amount of information to acquire and to release. This acts as a facilitating mechanism server. Transactions initiated by insiders benefit liquidity traders and increase the welfare of the liquidity traders (though not optimally).

By contract, there is a body of literature that has an opposing position (negative) on the role of institutional ownership on liquidity. Intuitively, institutional investors' dominant equity positions lead to frequent and bulk trades. In practice, it is difficult for large orders to be executed without making a large price impact. Other things being equal, block trades have a large effect on liquidity (Easley and O'Hara, 1987). The possible increase in inventory risk due to large order sizes drives market makers away from desired inventory positions when there is no private information and thus forces market makers to make a higher price concession, leading to lower liquidity (Ho and Stoll, 1981).

The second stream of opposing theories postulates that the possible herding and positive feedback trading strategies from institutions and their potential to destabilize stock prices, thus reducing liquidity. "Herding" refers to the pattern that investors buy and sell the same stocks at the same time, results in turn increases order imbalance and tightens the liquidity situation. Wermers summarizes four explanations for this phenomenon: institutions might suffer from reputation risk; receive correlated private information; infer information from other block trading; or share the same the preference for a certain type of stocks. Positive feedback trading, also referred to as return-chasing behavior, captures the investment style that buys stocks when the prices rise and sells when prices fall (Devenow and Welch 1996). The purchasing demand for past winners possibly pushes prices even higher than rational expectations and away from the fundamental values, eventually resulting in overreaction, destabilization of stock prices and reduction of market liquidity (Hong and Stein, 1999). De Long, Shleifer, Summers and Waldman (1990) propose a model in which institutions (rational speculators) trigger noise traders to conduct such feedback trading and create price bubbles. In both settings, institutions are closely associated with feedback trading behavior. Many empirical studies also support the existence of either herding or feedback trading of institutions. Nofsinger and Sias (1999) show evidence that both herding and feedback trading behavior of institutional traders lead to a positive correlation between institutional ownership and returns. Chan and Lakonishok (1995) document sizeable returns for institutions that take advantage of either herding or positive feedback trading. Grinblatt, Titman and Wermers (1995) find a significant return-chasing behavior at the buy side only, in addition to weak evidence on herding. Wermers (1999) finds that herding is more likely to be observed in growth funds and in small stocks.

The third opposing theory is based on the potential diminishing impact on liquidity when institutions gain more information than retail investors and become better informed than the rest of the market. This happens as institutions usually incur lower costs for access to information, especially when institutions, as large shareholders, take an active role in corporate monitoring or management. These activities unavoidably create information asymmetry problems at the expense of market liquidity. Kyle (1985) assumes one risk-neutral informed trader in the market and proves that market depth is negatively related to both the amount of private information held by the informed traders and the reliance on the private information by the informed traders. Glosten and Milgrom (1985) present a model to show how bid-ask spreads arise when a group of traders have superior information to the rest of a specialist market. Easley and O'Hara's (1987) model explains why a higher transaction fee is imposed on block trades as market makers require compensation for the risk of transacting with informed traders. Studies also show that institutions are indeed the better informed group in the market. For example, Kothare and Laux (1995) contend that institutions' trades convey superior information in the Nasdaq market, which explains wider spreads in Nasdaq than the NYSE. Typically, if institutions had an information advantage, they would be expected to behave differently from other investors during special event periods such as earnings announcements and conference calls. As abnormal behavior of institutions is revealed around special events, many studies address the differential behavior between institutions and non-institutions during these events. For example, Lee (1992) uses small and large trades as proxies of retail and institutional trading and reports large trades are executed in the right direction (buying or selling) corresponding to good or bad news events. In short, institutions' trading on private information adds to the risk of the market maker, raises adverse selection costs and impairs market liquidity.

Some theoretical work posits that the influence of institutions on liquidity is non-monotonic. Subrahmanyam's (1991) model predicts that liquidity increases monotonically with the number of informed traders when informed traders are assumed to be risk neutral, while a unimodal relationship appears if informed traders are assumed to be risk-averse. Admati and Pfleiderer (1988) propose an innovative notion of discretionary liquidity traders. They demonstrate that the impact of ownership on liquidity depends on the degree of informativeness of market participants or relative informative level to market makers. In addition, other studies suggest instead of affecting liquidity directly, informed traders affect market liquidity by changing the information environment. For instance, Brennan and Subrahmanyam (1995) find that higher institutional ownership induces more analysts to follow and they offer a better explanation of the impact of the number of analysts following on market depth. In practice, since buy-side analysts regularly provide institutions with information, higher institutional ownership in a firm draws more attention from analysts and increases the competition for information production and evaluation, which eventually ameliorate information asymmetries.

Our first objective in the paper is to empirically study the impact of institutions on liquidity. The predicted impact on liquidity is ambiguous, so are empirical results. Researchers have shown that institutions cause changes to liquidity and not because institutions prefer liquid stocks (Jennings, Schnatterly and Seguin, 2002; Agarwal, 2007). Some studies find a positive relation between institutional ownership (trading) and liquidity. For example, Jennings, Schnatterly and Seguin (2002) use institutional holding and spread data for Nasdaq-listed firms (from the first quarter 1983 through the third quarter of 1991) and show that both spreads and adverse selection components are lower for firms with higher institutional holdings. Dey and Radhakrishna (2001) document a negative correlation between net institutional trading and spreads and show that the non-informational purpose of institutions' trading reduces order processing costs. However, the authors also find evidence that institutions' information-triggered trading increases the adverse select component of the spreads. Likewise, Sarin, Shastri and Shatri (1999) use a sample of 786 NYSE and AMEX securities listed in Value Line by year-end 1984 and find that spreads are positively related to the degree of institutional holdings (and insider holdings) and quoted depth is negatively associated with institutional ownership (and insider ownership). There are also studies that find no relation between institutional holdings and liquidity (e.g. Fabozzi, 1979; Chiang and Venkatesh, 1988). Consistent with some theoretical models, researchers have also detected a non-monotonic relation. Using various liquidity measures and a intra-day sample of stocks listed on NYSE and AMEX from January 1983 to December 2005, Agarwal (2007) detects a U-shaped relation between spreads and institutional holdings providing evidence for both adverse selection and information efficiency effects (Holden and Subrahmanyam 1992; Mendelson and Tunca, 2004) of institutional trading.

2.2 Regulation Fair Disclosure

On October 23rd, 2000, Reg FD was implemented by the SEC Regulation. Reg FD raises many controversies. Proponents show lower level of information asymmetry, thus leveling the playing field for all investors. Skeptics argue that Reg FD will have a "chilling effect" for firms, reducing the quality and quantity of information flowing to the market. It is also argued that Reg FD impedes the efficiency of informed traders (analysts and institutions) to incorporate information into prices. For example, Gomes, Gorton and Madureira (2007) find that Reg FD causes a significant shift in analyst attention, resulting in a welfare loss for small firms that face a higher cost of capital and the loss of the "selective disclosure" channel for information flows. Furthermore, Reg FD results in greater price volatility because information is being disseminated without the benefit of analysis and interpretation by intermediaries such as financial analysts.

The reasons for these conflicting statements are as follows. In addition to mandatory disclosures, information can be transmitted from firms to markets via four channels (Gomes, Gorton and Madureira 2007): (1) firms can disclose information to the public voluntarily (e.g., earnings pre-announcements); (2) firms can selectively disclose information, e.g., phone calls, or one-on-one meetings; (3) "sell-side" analysts can produce research which is released to the public, e.g., analysts reports; and (4) private information can be produced by outsiders, "informed traders".. Reg FD sought to eliminate the second channel of information flow, under the implicit assumption that the same information would still flow into markets but via the other channels, particularly channel (1). However, the unintended consequence is that Reg FD also affects other channels.

Research in the first three channels finds positive, negative and indifferent evidence. Healy and Palepu (2001) point out that in making a decision on disclosure, managers aim to maximize a firm's value. If the costs of changing from selective disclosure to a public release outweigh the benefits, public disclosure will not be delivered and information quantity and quality will decline. On whether firms change the manner of making voluntary public disclosures in the post-FD period, Heflin, Subrahmanyam and Zhang (2003) examine return variability around earnings announcements and find a significant reduction of price deviations in the event window due to the regulation. This implies an increasing quality and quantity of information dissemination through public disclosures after October 2000. Bailey, Li, Mao and Zhong (2003) show that after taking decimalization of stock market into consideration, return volatility did not experience a significant change, whereas trading volume increased after FD takes into effect. They also provide evidence that corporations increase the quantity of voluntary disclosures, but the increase is limited only to forthcoming quarterly earnings. Selective disclosure is distributed through channels such as one-on-one meetings with analysts and (earnings) conference calls. To answer the question whether Reg FD reduces selective disclosure, researchers exam the change of the level of information asymmetry, especially that related to selective disclosure events. Straser (2002) constructs the adverse selection component of spreads according to Huang and Stoll's (1997) method, and finds that while the quantity of public disclosure (8K Form filings) increases, the quality is lowered as information asymmetry rises after Reg FD. Sunder (2002) separates firms that hold conference calls from firms that do not, and finds that the difference in spreads, which exists before Reg FD, disappear in the post-FD period. This serves as evidence of a decrease in information asymmetry around conference calls for firms that employed restricted disclosure practices before the regulation. Eleswarapu, Thompson and Venkataraman (2004) show a decreased information asymmetry component of spreads during the earnings announcements. Collver (2007) constructs an informativeness statistic using Hasbrouck's (1991) model and shows a decrease in informed trading, but the decrease is attributed more to decimalization on the NYSE than to Reg FD; Also, there is a concentrated stream of literature that aims to examine the change of analyst groups, one of the major targets of Reg FD. Similarly, Heflin, Subrahmanyam, and Zhang (2001, 2003) study whether Reg FD is associated with changes in the information environment prior to earnings announcements by comparing market activity in the pre- and post- FD periods. After controlling for non-FD factors, they find no reliable evidence of changes in various aspects of analysts forecast bias, accuracy and dispersion around earning announcements. Bailey et al. (2003) find no increase in the analysts' accuracy in forecasting quarterly earnings, but find more difference in opinions among analysts on earnings beyond the current quarter. Using a sample for analysts' earnings forecasts and recommendations from October 23rd, 1999 to October 23rd, 2001, Gintschel and Markov (2004) discover that the average price impact of analysts' opinion is reduced by 28% in the post-FD period and this change is more significant for prestigious brokerage houses and optimistic analysts, who are supposed to have had privileged access to information before Reg FD. Mohanram and Sunder (2006) find that some analysts from large brokerage houses lose their forecasting superiority due to Reg FD, implying that Reg FD has served its intended purpose. They also show an increase in the number of firms followed by analysts and a switch from analysts' reliance on common information to idiosyncratic information.This study starts from the overall liquidity change caused by Reg FD, focuses on channel (4) and examines the impact of Reg FD on different groups of institutional investors. We attempt to determine to figure out whether Reg FD improves liquidity by mitigating the information advantage of institutional investors, and whether Reg FD impedes institutional investors to incorporate information into stock prices. We extend the current literature in two ways.

First, for all the above channels, studies on informed traders per se are rather limited. Limited literature on this aspect include Topaloglu's (2003) research, which uses the sample of negative earnings surprises in Nasdaq firms from May 2 to June 2001 and detects institutional buying activity both before and after positive earnings surprises is relatively higher after Reg FD than before. However, an informed trader is an important subject associated with the study of disclosure. Bushee and Noe (2000) argue that disclosure rankings affect the composition of company stock held by institutions and that disclosure has an impact on stock volatility through institutions' choice of portfolios. Beyer, Cohen, Lys and Walther (2009) point out that in making a decision of whether to make a disclosure or not, firms consider reducing the information asymmetry among uninformed investors and better informed investors as an important benefit of disclosure. Chen, Dhaliwal and Xie (2010) note that the cost of capital decreased after Reg FD and the decrease is generally significant for firms with characteristics indicative of more severe selective disclosure before Reg FD. One of the characteristics is the high percentage of transient ownership. In this study, we adopt Chen, Dhaliwal and Xie's methodology to exam the change in liquidity caused by institutional behaviors. This perspective is different from the studies that focus on analysts groups, and so is novel in our study

Second, previous studies show an increased level of market liquidity (measured by volume, spread, or market depth) or a decrease in information asymmetry. Eleswarapu, Thompson and Venkataraman (2004) find that the adverse selection component of spreads during earning announcement events is reduced significantly in the post-FD period. Several other studies including the aforementioned Sunder (2002), Collver's (2007) papers, all record either the shift of spreads or a certain component of spreads. However, most of these studies address the reduction of information asymmetry without providing a further explanation of how the information environment has changed after Reg FD. One of the few exceptions is the Chiyachantana, Jiang, Taechapiroontong and Wood's (2004) study, which examines earnings announcements in a sample of NYSE firms from November 1999 to July 2001. They find that Reg FD is associated with a decrease in the institutional investors' trading volume, and Reg FD is associated with a significant decline in institutional trading for thirteen hours around the earnings announcements period, particularly in the pre-announcement period (thirteen hours prior). Their results are a basis for our study, as they connect the decline in information asymmetry in the pre-announcement period with lower institutional trading and associate lower information risk in the event period with a higher participation of retail investors after announcements post-FD. In this study, we choose a longer period of sample to examine Reg FD effects, not just the earnings announcements period. We make the conjecture that before FD, market makers increase the spreads because of the risk of trading with informed traders. If information is simultaneously delivered to all investors, as is the intention of Reg FD, information asymmetry among market participants should be smaller. We show evidence that the change is through a particular group of institutional investors, which is one of main focuses of Reg FD.

2.3 Institutions Classification

Institutions have different features and trade differently. Previous studies classify institutions according different standards. For example, Ross (1989) classifies institutions into transparent, translucent and opaque ones depending on their ability to reflect retail forces. Merton (1995) extends this classification, listing the government bond market, stock market, future and option market as transparent, unit trusts, mutual funds, pension funds, and finance companies as translucent; and insurance companies, and commercial banks as opaque institutions. Chan and Lakonishok (1995) sort institutions according to their investment styles. To account for the possibility that there can be substantive differences in trading and governance behavior for different types of institutions, Lang and McNichols (1997) group institutions based on whether the institutions' incentives to trade on performance is strong or weak. According to their classification, banks, insurance companies, investment advisers and investment companies belong to the strong group, whereas colleges and universities, private foundation and private and public pension funds belong to the weak group. They record significant differences in portfolio turnover and earnings-based trading. Other studies document the behaviours and effects on various aspects of institutions across various types. For example, Almazan, Hartzell and Starks (2005) state that investment advisers and investment companies make up the group of "potentially active" institutions with lower cost monitoring, and that they have stronger influence on monitoring executive compensations. Woidtke (2002) shows that firm value is positively related to ownership by private pension funds but is negatively associated with public pension funds. Parrino, Sias and Starks (2003) conclude that rather than exerting effort to influence management, some institutional investors "vote with their feet" by selling their shares when they are dissatisfied with corporate performance.

Bushee (1998) proposes a new classification scheme. Institutions are classifies classified into three groups according to trading frequency, portfolio diversification and momentum strategy (The momentum factor is omitted in later studies). He shows that managers are less likely to cut R&D expenses when the investor base is dominated by dedicated or quasi-indexer institutions, but this is not case if the investor base is dominated by transient institutions. Bushee (1999) tests whether institutional investors focus more on expected near-term earnings rather than on long-run value (defined as any holding of more than four years). He finds transient institutions exhibit strong preferences for corporations with more value in expected near-term earnings and less in long-run value, while institutions as a whole do not exhibit a short-term focus on earnings. This classification is widely employed by other researchers. For example, Hribar et al. (2004) show that transient institutional investors sell shares in restating firms one quarter before accounting restatements. This could be due to either the transient institutional investors' superior ability in predicting accounting restatements, or their access to firms' executives who provide them with private information on accounting restatements.

We hypothesize that different types of institutions influence liquidity differently and Reg FD affects different types of institutions to a different extent. , Our hypothesis is based on by several previous studies. Jennings, Schnatterly and Seguin (2002) detect heterogeneous relations between institutional ownership and liquidity across the various types. They find that the negative relationship between institutional ownership and spreads is the strongest for commercial banks and insurance companies, while there is no discernible relation between spreads and holdings of pension funds, foundations, endowments and Employee Stock Ownership Plan (ESOP). They point out that the heterogeneity is consistent with the notion that the impact on the informational environment of institutional ownership depends crucially on the nature of the institutions. Following Bushee's classification scheme, Ke, Petroni and Yu (2008) show pre-FD transient institutions exhibit abnormal selling of stocks in the quarter prior to bad news breaks and this abnormal selling is confined to conference call firms. Chen, Dhaliwal and Xie (2010) also find that Reg FD lowered the cost of capital more in firms with higher transient institutional holdings. We will test all three categories of institutions and examine whether these institutions respond to Reg FD differently.

III. Methodology, Theory and Hypotheses

3.1 Theory and Hypotheses

The role played by investor institutions has been a question of substantial interest to studies on liquidity and Reg FD. We develop a hypothesis to test empirically the impact of institutions on liquidity and the impact of Reg FD on liquidity through institutional behavior. We argue that institutions are not a homogeneous group and by classifying institutions based on strategies they use, conflicting theories and empirical results can be reconciled and explained.

The first part of hypotheses tests the impact of institutions on liquidity. On one hand, several theories suggest that institutional investors may promote liquidity. Their efficient acquisition and precise interpretation of information help the market reveal the information withheld by insiders, thus reducing information asymmetry. Competition among informed traders enables institutions to exert a positive influence on liquidity. Mendelson and Tunca (2004) construct a variant of Kyle's (1985) one-period model with a single informed investor in a multi-period model and endogenize liquidity trading and classify information into three types. Their model predicts that even if the acquisition cost is zero, informed traders might not choose to acquire all of the private information available. The authors also indicate that with more informed trading, as prices reflect more information about the security's value, thus reducing the risk and promoting liquidity. In other words, the utility of liquidity traders is higher with the existence of informed trader than without it._Subrahmanyam (1991) considers the case where that both informed traders and market makers are risk averse, and shows that increasing the degree of information asymmetry can improve market liquidity when the number of informed traders is large, as informed traders could interpret information more precisely. Spiegel and Subrahmanyam (1992), Holden and Subrahmanyam (1992) introduce concepts such as strategic uninformed traders in Kyle's (1985) framework and predict that competition among informed traders improve market liquidity. Thus, we make the following hypothesis.

H1(a): Institutional ownership is associated with higher liquidity

On the other hand, institutions' large trading volume and information privilege add inventory risk, or adverse selection risk, to market makers and they have the potential and power to destabilize stock prices. Thus, the rebuttal to the above argument is that institutional ownership has a negative impact on liquidity. Ho and Stoll (1981) demonstrate a model with a single dealer in a single stock, facing a stochastic demand for his services, and find that bid-ask spreads increase with transaction size. Easley and O'Hara's model (1987) link the effect of large-sized trading with informed trading. They posit that large transaction size, presumably originated by institutions, is associated with wider spreads, and information asymmetry alone can explain the result. Kyle (1985) indicates that under the setting of a single risk neutral insider, random noise traders, and risk neutral market makers, market depth is inversely proportional to the amount of private information of the insider and the intensity of insider trading is based on private information. Assuming that specialists have unlimited inventory and the inventory cost is zero, Glosten and Milgrom (1985) establish a model to demonstrate that information-based trades widen bid-ask spreads by increasing ask prices and decreasing bid prices, because spreads might cause realized returns to be overestimated relative to observed returns. This leads us to the second hypothesis.

H1(b): Institutional ownership is associated with lower liquidity

We further study the institution-liquidity relationship by classifying institutions into transient, quasi-indexed and dedicated types following Bushee's (1998) scheme. These are three typical strategies employed by large institutions and that may have varying impact of institutional ownership on liquidity.

First, transient institutions are featured by high turnover and high diversification. They do have any information advantage. For example, Ke and Petroni (2004) found evidence that transient institutions can obtain information regarding the impending break from private communications with management and can predict earnings breaks at least one quarter in advance of the break quarter. However, Bushee and Noe (2000) characterize this group of institutions as trading aggressively based on a short-term strategy. It is justifiable to conjecture that the speed of transient institutions' incorporating information into price is fast and at a high frequency. Ke and Ramaliangegowda (2005) find current earnings are a harbinger of future earnings. This is reflected in the current price for firms with larger proportion of transient institutional holdings, which provides evidence of the accurate interpretation of information by transient institutions. As Subramanyam (1991) states "the precision of private information may improve terms of trades (market liquidity) because risk-averse traders who are precisely informed compete more aggressively than those who are imprecisely informed". Besides, previous studies show that this group of institutions is one of the subjects of selective disclosure (e.g., Chen, Dhaliwal and Xie, 2010) and respond to similar information such as quarterly disclosures and earning announcements (e.g. , Ke and Ramaliangegowda, 2005; Ke, Petroni and Yu, 2008). Thus we note that they are also a good representative group of informed traders who face intense competition, incorporate information into stock prices quickly and receive highly correlated information. Consistent with the work by Subrahmanyam (1991), Spiegel and Subrahmanyam (1992), Holden and Subrahmanyam (1992), Back, Cao and Willard (2000), we conjecture that intensified competition among informed traders and correlated signals have a positive impact on liquidity. Thus, we make the following hypothesis.

H2: Transient institutional ownership is associated with higher liquidity

Dedicated institutions are featured by low turnover and low diversification, which are opposite features of transient institutions. They represent the group of institutions that represent a "relationship" approach to investing (Porter, 1993). These institutions are supposed to participate in corporate management, hold block shares of stock and material information compared with other institutions. In a capital market in which information is heterogeneous and information collection and processing are costly, we believe that this group of investors are most likely to possess private information and to conduct insider trading. They are the group of institutions that are most aligned to the profile of informed traders who create information asymmetry as in Easley and O'Hara (1987) or Glosten and Milgrom's (1985) model. Unlike transient institutions, dedicated institutions focus on different companies and their trades induce diverse private information into the market. As Spiegel and Subrahmanyam's (1992) model suggests, with diverse signals in the market, liquidity decreases with the number of informed traders. Additionally, because they have low turnover, they should cause lower liquidity. Therefore, we make the hypothesis:

H3: Dedicated institutional ownership is associated with lower liquidity

The third group of institutions is a quasi-indexer, which makes up 70 percent of all institutions. They are featured by low portfolio turnover, high diversification. Many reasons such as regulatory concerns and agency issues prompt institutions to engage in strategies such as passive indexing or fixed ratio asset allocation targeting. These strategies generate a substantial amount of portfolio rebalancing trading. This implies that the higher the aggregate institutional ownership, the more active the trades are and hence more liquid the market becomes. Furthermore, their trading is associated with liquidity demand instead of private information. This strategy is prevalent among institutions like public pension funds and bank trusts, which have substantial amounts to invest and/or lack the resources to actively manage their portfolios. Admati and Pleiderer (1988) depict a group of discretionary liquidity traders in their model, who have liquidity needs and possess the right to determine when to trade. They argue that the assumption of nondiscretionary liquidity traders in Glosten and Milgrom's (1985) and Kyle's (1985) framework is unrealistic, especially when large institutions also have demand for liquidity and liquidity trading generally improves the efficiency of the market. Admati and Pleiderer (1988) forecast that the existence of discretionary liquidity traders induces more trading volume while at the same time not impeding the price discovery process. The quasi-indexers are such discretionary liquidity traders and we conjecture:

H4: Quasi-indexed institutional ownership is associated with higher liquidity

The second part of our study addresses Regulation FD. Unlike the works of Kyle (1985), Glosten and Milgrom (1985) and Admati and Plfeiderer (1988), the theoretical work of Diamond and Verrecchia (1991) assumes that the risk bearing capacity of market makers is limited. Their model suggests that a greater amount of disclosure reduces price impact and improves stock liquidity. Verrecchia (2001) suggests that companies make public disclosures as the release of information purports to reduce the information asymmetry component of the cost of capital. Researchers also provide empirical support for Diamond and Verrecchia's position. For example, Healy, Hutton and Palepu (1999) provide evidence that an increase in disclosure ratings is followed by an increase in stock liquidity. Leuz and Verrechia (2000) also study a regulation change, i.e., the switch from German to an international reporting regime of German firms and detect a reduction in spreads after the change with more information disclosed. The intention of FD is to encourage companies to make more public disclosures instead of selective disclosures, and the impact of this regulation in spreads and information asymmetry is provided by Collver

(2007), Sundar (2002) and Eleswarapu, Thompson and Venkataraman (2004) Reg FD also intends to provide equal access to firm disclosures. Topaloglu (2003) observes a change in institutional behavior. While institutional investors are targeted by Reg FD, the question remains is whether the change of liquidity is related to change in the behaviour of these investors? This is the question we try to answer. Mendelson and Tunca (2004) demonstrate that when the amount of intractable information is small, informed traders choose to acquire and release all information. And voluntary disclosure, under this circumstance, improves market liquidity. Bushee and Noe's result (2001) also indicates that disclosure has an indirect impact on the market through institutions. Chiyachantana, Jiang, Taechapiroontong and Wood's study (2004) of Reg FD links the improvement in liquidity with lower institutional activities. We can infer from these studies to make the statement that informed traders are a channel through which disclosure affects the term of the market. Is Reg FD effective in reducing the adverse selection effect of institutional investors? If it is, we will find support for the following hypothesis:

H5: The improvement of liquidity is greater for firms with high institutional ownership after Reg FD

While the above hypothesis is reasonable, other models and theories make counter arguments. For example, Diamond and Verrecchia (1991) suggest that sometimes disclosures may result in undesirable results such as driving out market makers and worsening the liquidity situation. Mendelson and Tunca (2004) argue that voluntary information disclosure does not always benefit the welfare of liquidity traders, especially when the amount of "intractable" information is large. As mentioned before, there are mixed findings on the implications of Reg FD. In particular, there is dispute on whether Reg FD effectively improves liquidity. Straser (2002) even detects a rise in information asymmetry after the regulation. However, evidence shows that Reg FD reduces the information advantage of transient institutional investors significantly. Ke, Petroni and Yu (2008) investigate the impact of Reg FD on trading behaviour of transient institutional investors prior to a bad news break in a string of consecutive earnings increase. They find that while transient institutional investors engage in abnormal selling of stocks in the quarter immediately preceding a bad news break in pre-FD period, but they no longer can do so in the post-FD period. Chen, Dhaliwal and Xie (2010) find that the cost of equity capital declines more for firms with high transient institutional holdings, while the change is not significant for firms with high non-transient institutional holdings. So we propose that the improvement of liquidity is greater for firms with high transient institutional holding than firms with high quasi-indexed institutional holdings or dedicated institutional holdings. Because quasi-indexed institutions do not rely on private information, we conjecture that Reg FD does not (or did not) significantly affect their behaviours. For dedicated investors, Reg FD does not effectively impede them from obtaining more information from firms, because they typically participate in the management of these firms. Therefore, we make the following three hypotheses which suggest that the impact of Reg FD is limited to only a group of, but not all of, the institutional investors.

H6: The improvement of liquidity is greater for firms with high transient institutional holdings

H7: The improvement of liquidity is not significant for firms with high dedicated institutional holdings

H8: The improvement of liquidity is not significant for firms with high ownership of quasi-indexers

3.2 Methodology

3.2.1 Institution Classification

Recently, academic research has begun to examine whether there are systematic differences in how different types of institutional investors influence the stock market and the decisions of corporate managers. Agarwal (2007) shows that liquidity increases with a shift in holdings from long-term to short term investors and decreases with risk aversion of institutions. Jennings, Schnatterly and Seguin (2002) document the heterogeneous relation between institutional ownership and liquidity across types of institutions. They discover that only commercial banks and insurance companies have significantly negative impact on spreads. Thus, it is reasonable to believe that different groups of institutional investors have different impacts on liquidity. In this paper, we employ Bushee's (1998, 2001) taxonomy of institutional investors. Bushee uses factor analysis and cluster analysis to classify institutional investors into groups based on their past investment behavior.

Initially Bushee (1998) conducted factor analysis. Bushee (1998) constructs nine variables that describe the past investment behavior of institutional investors based on prior research, among which four variables are proxy for the level of portfolio diversification of each institution, two are turnover measures of institutional trading and the other three are variables to measure the institution's trading sensitivity to current earnings (momentum factors). Principal factor analysis with oblique rotation is conducted to identify three factors. These three factors capture average size of the institution's stake in its portfolio firms, portfolio turnover and the degree of momentum trading respectively. However, the momentum variables were dropped in Bushee (2001).

Secondly, Bushee conducts cluster analysis on factor scores to obtain the final separation of institutions into groups. This was to group institutions into clusters so that institutions are more similar to institutions in the same cluster than they are to institutions in other clusters. Finally, institutional investors are sorted into three categories: transient institutions, quasi-indexed institutions and dedicated institutions according to two important metrics: portfolio turnover and diversification. Transient institutions are characterized by highest portfolio turnover and high diversification; dedicated institutions exhibit low portfolio turnover and low diversification (high concentration); while, quasi-indexer institutions have low portfolio turnover and high diversification.

3.2.2 Test of relation between institutional ownership and liquidity hypotheses (H1 to H4)

To test hypotheses H1 through H4 on the influence institutional ownership on firm's liquidity, we regress total ownership and classified ownership variables on liquidity measures.

$$\begin{aligned} \mathrm{Liq}_{it} = \delta_i + \delta_t + \theta INS + \gamma_1 ret_{it} + \gamma_2 retlag_{it} + \gamma_3 prc\mathrm{ln}_{it} + \gamma_4 size_{it} \\ + \gamma_5 prcsq_{it} + \gamma_6 volume_{it} + \gamma_7 volatility_{it} + \gamma_8 numtrd_{it} \\ + \epsilon_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} \mathrm{Liq}_{it} = \delta_i + \delta_t + \theta_1 TRA_{it} + \theta_2 QIX_{it} + \theta_3 DED_{it} + \gamma_1 ret_{it} + \gamma_2 retlag_{it} \\ + \gamma_3 prcln_{it} + \gamma_4 size_{it} + \gamma_5 prcsq_{it} + \gamma_6 volume_{it} \\ + \gamma_7 volatility_{it} + \gamma_8 numtrd_{it} + \epsilon_{it} \end{aligned} \quad (2)$$

where INS, TRA, QIX and DED are total institutional ownership percentages, transient institutional ownership percentage, quasi-indexed institutional ownership percentage and dedicated institutional ownership percentage for firm i at time t respectively. Although, we do not have a clear forecast of θ, we expect to detect that $\theta_1 > 0, \theta_2 > 0$ and $\theta_3 < 0$. The regression is conducted on both quarterly and annual data, both pooled regression and fixed-effect regression. δ_i denotes industry dummies according to the Kenneth French's industry classification scheme, while δ_t denotes annual/quarter dummies. We also include several control variables in the regression. ret_{it} is the return of stock i over the period t. $retlag_{it}$ represents the return of stock i over the last time period, t-1. $prclg_{it}$ is the log price of stock i at the end of time period t. We multiply outstanding shares at time t by the corresponding price of stock i to obtain the total market capitalization of firms, $size_{it}$. $prcsq_{it}$ is square of price of stock i at the end of time t. $volume_{it}$ is the sum of trading volume of stock i over time period t. $volatility_{it}$ is calculated by variance of returns of stock i over time period t. $numtrd_{it}$ denotes the total number of trades number over time period t.

3.2.3 Test of the FD hypotheses (H5 to H8)

Chen, Dhaliwal and Xie (2010) discover that the cost of capital declines in the post-FD period relative to pre-FD period and the decrease is mainly for medium and large firms. this decrease is more significant for firms with characteristics that lead to selective disclosure in the pre-FD period. High transient institutional holdings are one of these characteristics. Significant decline in the cost of capital does not happen for small firms being firms with high non-transient institutional holdings and American Depositary Receipts. To test the hypotheses H5 to H8, we refer to Chen et al's (2010) Difference-in-differences models on the effect of the FD on liquidity.

$$\mathrm{Liq_{it}} = \delta_i + \delta_t + \alpha_0 + \alpha_1 Post\ FD_{it} + \alpha_2 Z_{it} + \alpha_3 PostFD_{it} * Z_{it} + +\epsilon_t \qquad (3)$$

Our variable of interest is $PostFD_{it} * Z_{it}$, while Z_{it} represents INS, TRA, QIX and DED of stock i in quarter t respectively. If the coefficient on $PostFD_{it} * Z_{it}$ is significantly negative, this suggests that the increase in liquidity in post FD is greater for firms with high Z. If Reg FD doe have an overall influence on and does mitigate the information advantage of all institutions, α_4 should be significantly negative when Z_{it} is total institutional ownership. According to the hypotheses, we expect to observe significantly negative α_4 when Z refers to transient institutional holdings and less significant or positive α_4 when Z represents quasi-indexed or dedicated institutional holdings.

IV. Sample Construction and Data Description

We construct both annual and quarterly sample. We obtain data from the CRSP daily data file first, and then formulate annual measures. The annual sample includes all firm-years between 1995 and 2005 with available liquidity data from Hasbrouck's website. This data is restricted to ordinary common shares (CRSP share code 10 or 11) that have a valid price for the last trading day of the year, and have no changes of listing venues or large splits within the last 3 months of the year (Hasbrouck, 2009). The sample period is also restricted by the availability of institutional holdings data and the requirement of two years of data from which to calculate portfolio characteristics of institutions. At the end, we obtain 51,492 observations (4,681×11 on average).

The quarterly sample also spans over the period 1995~2005. We get original data from the CRSP daily data file and form quarterly measures. This sample is also restricted by the availability of institutional holdings data and the requirement of two years of data from which to calculate portfolio characteristics of institutions. We make the assumption that institutions do not change their strategy during a year. As a result, there are 208,229 observations (approximately 4,732×44 panel data sample), among which 200,383 are data of U.S. firms and 7,846 are American Depositary Receipts and foreign firms (ADRs). The FD was formally proposed by SEC on December 20, 1999, approved on August 10th, 2000, and went into effect on October 23rd, 2000. We define the first quarter of 1995 to the third quarter of 2000 as prior-FD period, while the fourth quarter of 2000 to fourth quarter of 2005 as post-FD period. The sample period is longer than most studies of the FD, but is similar to that of Be, Petroni and Yu's (2008) research on how the FD changed the behavior of transient institutions. Furthermore, we use the American Depository Receipts to control for compounding effects.

4.1 Main variables

4.1.1 Institutional Ownership

We obtained the institutional holdings data from the University of Michigan Spectrum database, which includes the all Thomson Reuters Institutional (13-f) Holdings database (Spectrum) for the period 1995 and 2005. The SEC Rule 13-f specifies that all institutions managing more than $100 million in equity must file a quarterly report listing all equity holdings that are greater than 10,000 shares or $200,000 in market value. Thus, for each firm total institutional holdings are defined as the sum of all end-of-calendar-quarter holdings by fund managers filing 13-f forms on the firm. The total outstanding shares are collected from CRSP Daily NYSE, AMEX and NASDAQ files for accuracy, as share outstanding data in Spectrum are rounded to millions. Using Bushee's classification scheme, we calculate the total institutional ownership, transient institutional ownership, quasi-indexer ownership, and dedicated institutional ownership for every firm at the end of each quarter.

4.1.2 Liquidity

We use several liquidity measures. Amihud's (2002) study employs for each stock i the average

$$amh_{it} = \frac{10^6}{D_{it}} \Sigma_{t=1}^{Dit} \frac{|R_{itd}|}{VOLD_{itd}}$$

Where D_{it} is the number of days for which data are available for stock i in the period t. $|R_{itd}|$ is the absolute return on stock i on day d of period t and $VOLD_{itd}$ is the respective daily volume in dollars. This ratio gives the absolute (percentage) price change per dollar of daily trading, or daily price impact of the order flow. Here, the time period refers to either quarter or year.

We also calculate the average market illiquidity across stocks in each time period as

$$amh_t = \frac{1}{N_t} \Sigma_{t=1}^{N_y} amh_{it}$$

where N_t is the number of stocks in time period t. Then the mean-adjusted value is

$$amh\_ma_{it} = \frac{amh_{it}}{amh_t}$$

$amh_{sq_{it}} = \sqrt{amh_t}$, the square root of amh_{it} is used to correct the skewness.

Roll(1984) model suggests

$$m_t = m_{t-1} + u_t$$

$$p_t = m_t + cq_t$$

where m_t is the log quote midpoint prevailing prior to the t^{th} trade, p_t is the log trade price, and the q_t are direction indicators, which take the values +1 (for a buy) or -1 (for a sale) with equal probability. Since the model applies to transaction prices, c is viewed as the effective cost

which implies

$$\Delta p_t = c\Delta q_t + u_t$$

where Δp_t is the price change and q_t refers to transaction direction. Using daily data, there are two ways to estimate this model. The first one is deducted from the above equation as

$$c = \sqrt{-Cov(\Delta p_t, \Delta p_{t-1})}$$

where $Cov(\Delta p_t, \Delta p_{t-1})$ is the first-order auto-covariance of the price changes. Hasbrouck (2009) estimates annual measures according to this methodology, *cmz and cmzAlt. cmz* is the moment estimate of c, based on all reported prices, including quote midpoints. *cmzAlt* is the moment estimate of c, excluding quote midpoints. For quarterly measure, we estimate *roll* based on this model. In the process of calculation, we include quote midpoints and treat positive covariance as zero. As noted, there are two problems associated with this moment estimate. First, CRSP assigns negative mid quote as the price for a stock if the no trades occur during the day. Second, first-order auto-covariance might be positive. The simplest way to solve the former problem is to assign zero in positive cases.

To address these two problems, Hasbrouck (2009) proposes the Gibbs Sampler estimation and then test the validity of the estimates. To improve the estimate of trading costs, Hasbouck (2009) applies Gibbs Sampler estimation to the basic market-adjusted model:

$$\Delta p_t = c\Delta q_t + \beta_m r_{mt} + u_t$$

r_{mt} is the market return. Appendix shows the details of the Gibbs Sampler estimation.

4.2 Control Variables

When testing the impact of institutional ownership on liquidity, several variables are used to control other factors which might influence the liquidity, as indicated in previous studies. These control variables can be calculated using data from Center for Research in Security Prices
Stoll and Whaley (1983) addresses the issue of small firm effect and show evidence that transaction costs decrease as firm size increases. This is not only because smaller firms trade less frequently but also because there is more information available about large firms (through media and analyst coverage) in the market. Amihud (2002) also shows that smaller firms demonstrate stronger illiquidity effects. Thus, we include *size* of firm as one of the control variables (shares outstanding times price). Amihud and Mendelson (1986) prove the positive relation between return and illiquidity both theoretically and empirically. High volatility is associated with high uncertainty, which also increase the risk of holding inventory borne by market makers. Chordia, Roll and Subrahmanyam (2000) document the change of spreads with equity market returns and market volatility. Therefore, return (*ret*) and *volatility* are both control variables and we calculate *volatility* as the variance of daily closing returns. Lagged return, *retlag*, is added as a control variable to isolate the effect of the herding behaviour or feedback trading from information-related effects, as institutions respond to past performance by chasing trends (Nofsinger & Sias, 1999; Wermers, 1999). Stock price reflects information and a number of studies showed that price explains variation in spread (Choi & Shastri, 1989; Sarin, Shastri &Shastri, 1999). Here, we use the natural logarithm of price as one control variable. The price squared variable, *prcsq*, is to control for any nonlinear relation between price and liquidity. For example, Jennings, Schnatterly and Seguin (2002) contend that liquidity increases with price but at a decreasing rate. Theoretical

work (e.g. Admati & Pfleiderer, 1988) shows that trading volume is positively associated with how informed the trader is. However, another stream of work shows that a larger size of transaction does not imply more information contained. On the contrary, informed traders break their large volume demand into medium sized trades to disguise them as liquidity traders and make "stealth trading" (Barclay & Warner, 1993; Alexander &Peterson, 2007). Jones, Kaul and Lipson (1994) propose that trading volume does not contain information beyond number of As both trading size and number of trades might have impacts on information and liquidity, we include *volume* and *numtrd* as control variables.

V. Empirical Evidence and Robustness Checks

5.1 Summary Statistics

Table 1 presents summary statistics of liquidity measures, institutional ownership (total and classified) and control variables. The means of annual *amh*, *c_BMA* and *cmz* are 3.5146, 0.0110, and 0.0.102. The median of annual *amh*, *c_BMA* and *cmz* are 0.0993, 0.0067 and 0.0064. These are similar to Hasbrouck's (2009) summary statistics. The means of annual *TRA_pct*, *DED_pct* and *QIX_pct* are 0.1180, 0.1019 and 0.1961. Similarly, in quarterly data, the means are 0.1101, 0.0982 and 0.1885. We conclude that while transient institutional ownership and dedicated institutional ownership are close to each other, average quasi-indexed ownership percentage exceeds the other two types.

In the correlation matrix, we can see that liquidity measures are correlated as they are expected to. For example, in the annual correlation matrix, the correlation coefficient between *amh* and *c_BMA* is 0.52. For quarterly data, the coefficient between *amh_ma* and *tnov* is negative. Panel B and Panel C also present the correlation coefficients between liquidity and institutional ownership percentage. We notice that for annual data, the coefficients between *INS_pct* and trading cost measures are negative, which suggests that, in general, institutions have a positive impact on liquidity. As expected in Bushee's (1998) classification scheme, the coefficients between *TRA_pct* and *tnov* are positive (0.24 annually and 0.15 quarterly), *QIX_pct* and *tnov* also have positive correlation coefficients (0.09 annually and 0.04 quarterly), whereas *DED_pct* and *tnov* have negative correlation coefficients in both annual and quarterly data. This is a proof that Bushee's classification is valid for quarterly frequency and under the assumption that institutions use consistent strategies throughout a calendar year.

5.2 The impact of institutional ownership on liquidity

As a homogenous group, how do institutions influence liquidity? Table 2 displays results of Eq. (1) using annual data and Table 3 displays results of Eq. (1) using quarterly data. Both tables support Hypothesis 1(a) instead of Hypothesis 1(b). *INS_pct* is negatively associated with trading cost measures and positively related to stock turnover. These relations remain unchanged after adding industry and time controls. These results show that institutions facilitate the process of price discovery, improve the welfare of liquidity traders and serve as empirical arguments for prior studies (e.g., Holden and Subrahmanyam, 1992; Mendelson and Tunca, 2004). Agarwal (2007) detects both adverse selection and information efficiency effects of institutions on liquidity, while we contend the latter is the dominant effect.

However, after classifying institutions according to Bushee's (1998) scheme, we also find evidence of adverse selection effect in one particular type of institution. We examine the impact of classified institutional ownership on liquidity using Eq. (3). Table 4 and Table 5 show the results for annual and quarterly data, respectively. Hasbrouck (2009) states that the CRSP/Gibbs estimate of trading costs achieves high correlation with TAQ estimate (0.965). Moreover, adding other explanatory variables aids in allocating transaction price changes between "true" (efficient price) returns and transient trading costs. This makes the basic market-adjusted model superior to Roll's model (1984) by adding market return as an additional regressor. Therefore, first we analyze the results using *c_BMA* as liquidity measure. Table 4 Panel A presents the finding from the pooled regressions. The coefficients of *TRA_pct* (-0.0120, t= -6.336) and *QIX_pct* (-0.0104, t= -3.432) are significantly negative, suggesting that transient institutional ownership and quasi-indexed ownership reduce trading costs. Admati and Pfleiderer (1988) incorporate, into Kyle's(1984) model, a group of liquidity traders who are uninformed and have discretionary to decide the timing to trade. The existence of large institutions justifies this innovation. These traders increased trading volumes and do not affect the information capacity of the price discovery process. This is a proper depiction of quasi-indexers, as their strategy is passive and they do not rely on private information. Our result of quasi-indexers' impact on liquidity is consistent with the prediction of the model.

Admati and Pfleiderer (1988) also contend that informed trading based on correlated signals would induce uninformed trading, thus improving the liquidity. Subrahmanyam's (1991) model also implies that liquidity will be improved with competition between precisely informed traders. Ke and Potroni (2004) point out transient institutional investors obtain information to predict a break in consecutive increases in earnings. Ke and Ramalingegowda (2005) find evidence that transient institutions exploit information from post-earnings announcement drift to make better future earnings forecast. Xue and Zhang (2008) discover that transient institutions trade on fundamental signals. All these previous studies imply that transient institutional investors conduct short-term transactions and rely on highly correlated signals and interpret information better than the public. On the other hand, the coefficient dedicated institutional ownership on trading cost is significantly positive (0.0026, t=4.613). This is consistent with our previous hypothesis that dedicated institutions possess private information as insiders and this is the group of institutions that create information asymmetry. As captured by Glosten and Milgrom's (1985) model, the presence of insiders leads to the increase of the bid-ask spread. Our result remains unchanged after adding industry controls, as coefficients on *TRA_pct*, *QIX_pct* and *DED_pct* are -0.0116 (t= -4.407), -0.0108 (t= -4.126) and 0.002 (t= 3.448), respectively.

More trading cost measures and quarterly data are used to check the robustness of the results. Amihud's illiquidity measures (*amh, amh_ma* and *amh_sq*) show similar results with those in previous paragraph. Almost all coefficients of *TRA_pct*, and *QIX_pct* are negative, however, for *DED_pct*, most coefficients are either positive or insignificant. For instance, using *amh_ma* as another liquidity measure, with a 1% increase in transient (quasi-index) institutional ownership, trading costs decrease significantly by 32.36% (14.75%). Table 5 show similar results using quarterly measures. For example, in pooled regressions (Table 5 Panel A), coefficients of *amh* on *TRA_pct*, *QIX_pct* and *DED_pct* are -2.28 (t= -4.766), -0.8181(t= -1.800) and 1.2695 (t= 2.195). After controlling for both time and industry effects, there is still supporting evidence, which show the different effects for different types of institutional ownership on liquidity. In summary, our test supports Hypothesis 2, Hypothesis 3 and Hypothesis 4.

5.3 The effect of Regulation Fair Disclosure

The above analysis leads us to the conclusion that institutions have a positive impact on liquidity as a homogenous group. After classification, we find that whereas transient institutions and quasi-indexed institutions have a positive influence on liquidity, dedicated institutions decrease liquidity. These results are consistent with previous studies. In this section, we continue to seek whether an external disclosure policy, Reg FD, will affect the relationship.

From another perspective, Eleswarapu, Thompson and Venkataraman (2004) examine the impact of Reg FD on trading costs and information asymmetry after Reg FD. Chiyachantana, Jiang, Taechapiroontong and Wood (2004) find that market liquidity has improved during the pre-announcement period post-FD in the form of lower spreads, higher depth and lower adverse selection cost component. Topaloglu (2003) reports less informed trading by examining institutional trading activities around Reg FD. Our test also intends to address this problem this issue of - Are the changes in trading costs related to changes in institutional investors?

Due to the unbalanced nature of the data, we run difference-in-indifference regressions with fixed industry and time effects. Our variable of interest is the interaction term in Eq. (3), i.e. α_3. In the first panel of Table 6, we see no significant coefficient of $FD_{it} * Z_{it}$ except for the case of *amh_ma*, as t-statistics of the interaction terms are -1.300, 1.485, -0.796 and 1.735 when liquidity is measured by *amh*, *amh_sq*, *roll* and *tnov*. We do not find reliable support for Hypothesis 6. We do detect some evidence of an overall decrease in trading cost after Reg FD, as the sum of α_1 and α_3 is negative. But in general, the effectiveness of Reg FD in ameliorating the information advantage of institutions is not found.

Previous studies do show a change in institutional behaviour around Reg FD. And our first part of this study proves different impacts from classified institutions. Therefore, we run further tests to see whether the effectiveness of Reg FD is limited to specific institutions only. The next three panels of Table 6 show the results of the three types of institutions respectively. When *Z* represents transient institutional ownership, we discover that coefficients of interactions between *FD* and *TRA_pct* are negative for all trading cost measures and the coefficients are significant in the cases of *amh*, *amh_ma* and *amh_sq*. The results indicate that Reg FD reduces the information advantage of transient institutions, as suggested in previous studies (e.g. Ke and Petroni, 2004). On the other hand, we can say that firms with high transient institutional holdings are subject to selective disclosure before Reg FD (Chen, Dhaliwal and Xie's, 2010) and Reg FD improves the fairness between transient institutions and the public. This result is consistent with Ke, Petroni and Yu's (2008) research, which finds transient institutions no longer possess the ability to predict a bad news break after Reg FD. We find support for Hypothesis 6.

In the case of quasi-indexers, we find that there is still a negative association with trading costs measures. There is not much evidence for firms with higher quasi-indexed ownership to support the argument that higher liquidity after Reg FD. For example, when liquidity is measured using *roll*, the t-statistics is -0.921 and -0.829 for *FD* ×*QIX_pct*. This can partly be explained by independence of private information in trades by this group of institutions, as mentioned in the first part of the study. For dedicated institutions, we find positively significant coefficients of interaction terms using *amh*, *amh_ma* and *amh_sq*. Straser (2002) contend that quality of disclosure is lower after the passing of Reg FD and information asymmetry is more severe. Sidhu, Smith, Shaley and Sillis (2008) suggest an increase in adverse selection component of the bid-ask spread in the post-FD period. These results can be explained by the "chilling effect" and multi-relationship between dedicated institutions and firms. Our findings suggest Reg FD is ineffective in limiting selective disclosure to dedicated institutions and the "chilling effect" of Reg FD is more obvious for firms with higher dedicated institutions. Hypothesis 7 and Hypothesis 8 are supported to the extent that the incentive of Reg FD to mitigate information asymmetry between institutional traders and the public is not realized for quasi-indexed and dedicated institutional institutions.

5.4 American Depositary Receipts and foreign firms

One of the most complicated issues in studying Reg FD is the compounding effect, as Reg FD was implemented to target all US public companies at the same time (October 23, 2000) by the Securities and Exchange Commission (SEC). Some of the changes might be caused by factors other than Reg FD. For example, reduced liquidity might be due to other factors. For example, some FD studies imposed controls for confounding events by including industry or macroeconomic variables (Heflin et al., 2003). Bailey et al. (2003) find an alternative explanation for changes observed pre- and post- FD, stating that market behavior around earnings releases displays no significant change in return volatility after controlling for decimalization of stock trading. Also, the economic recession may have influenced the effects. There are also cross sectional studies on the degree to which firms are affected by Reg FD. Prior studies show that Reg FD had a more pronounced effect on smaller firms (Gomes et al., 2004; Bailey et al., 2003), and size has been associated in prior research with the characteristics of firms' information environment (e.g., El-Gazzar, 1998; Bamber, 1987; Lang &Lundholm, 1996). Bushee et al. (2004) analyze relative effects of Reg FD on firms that had previously held open versus closed conference calls; Gintschel and Markev's (2004) investigation of variation in pre-versus post-differences in price responses to analyst reports based on brokerage and stock characteristics; and Mohanram and Sumder's (2001) analysis of Reg FD effects on the forecasting ability of all-star versus non-all-star analysts. All these studies allow for a stronger experimental design (using "control" group design with pre and post-tests).

Many events occurred in United States around Reg FD period. To rule out the confounding effects, we need one control group of companies that are not affected by Reg FD. Francis, Nanda and Wang (2006) use foreign firms listed on US exchanges with American Depository Receipts (ADRs) as a control group, as both US firms and ADRs are subject to other events that affect all firms traded in the US, but ADRs are exempt from Reg FD. With regard to analyst information effects, they find no difference between US and ADR firms pre- and post- FD in terms of analyst forecast accuracy or dispersion, return volatility, trading volume and informational efficiency. However, they report declined informativeness for US firms relative to ADRs. Using ADRs as the control group, we can examine the effects of broad information dissemination brought by Reg FD without the confounding effects.

ADRs are identified in CRSP by variable share code (SHRCD=30, 31 or 12). We identify 7,846 observations of ADR, approximately 178×44 firm-quarter data. Table 7 presents the results using this sample and the same regression equation as that of Table 6. In contrast with U.S. firm data, the coefficients of the interaction between *TRA_pct* and *FD* are no longer significant for all trading cost measures. For *QIX_pct* and *DED_pct*, the coefficients on interaction terms are also as significant as those using U.S. firms in the sample. This indicates that the impact of Reg FD on ADRs are much smaller, compared to U.S. firms, which is consistent with the fact that ADRs are exempt from Reg FD. The results here show that ADRs can be used as control group for Reg FD studies, contrary to Francis et al.'s (2006) study. Similarly, Chen, Dhaliwal and Xie (2010) also support the validity of using ADRs as the control group to study Reg FD, as they show that cost of capital does decrease for U.S. firms in the post-FD periods, but does not for ADRs on average. In this way, we confirm that liquidity change through institutions in Section 5.3 is caused by Reg FD instead of other factors.

5.5 Summary of results

All our results are summarized in the following table.

Hypothesis	**Results and Implications**
H1(a): Institutional ownership is associated with higher liquidity **H1(b): Institutional ownership is associated with lower liquidity**	The results in Table 2 and Table 3 support H1(a) instead of H1(b). The impact of aggregated institutional ownership on liquidity is positive. Institutions have information efficiency (Mendelson and Tunca, 2004) and adverse selection effects (Easley and O'Hara) and the former is the dominant one.
H2: Transient institutional ownership is associated with	Table 4 and Table 5 support this hypothesis.

higher liquidity	Subrahmanyam's (1991) model states traders who possess correlated precise information and compete intensely have positive impact on liquidity The results show evidence on this.
H3: Dedicated institutional ownership is associated with lower liquidity	Table 4 and Table 5 support this hypothesis. Glosten and Milgrom's (1985) model demonstrates how information advantage of insiders leads to positive bid-ask spread. The results show that dedicated institutions act as insiders.
H4: Quasi-indexed institutional ownership is associated with higher liquidity	Table 4 and Table 5 support this hypothesis. Admati and Pfleiderer's (1988) model assumes that there are a group of discretionary liquidity traders who can determine the timing of trading. The assumption insures the existence of equilibrium of minimize trading cost. Our results show these traders boost liquidity.
H5: The improvement of liquidity is greater for firms with higher institutional ownership after Reg FD	The first panel of Table 6 shows few supports for the hypothesis. The overall impact of Reg FD on liquidity through mitigating information advantage of institutional investors is insignificant.
H6: The improvement of liquidity is greater for firms with higher transient institutional holdings	The second panel of Table 6 supports this hypothesis. By preventing transient institutional investors from obtaining information in selective disclosure, Reg FD improves the liquidity of the firm stock. The results are consistent with works by Chen, Dhaliwal & Xie (2010 and Ke, Petroni and Yu (2008).
H7: The improvement of liquidity is not significant for	The third panel of Table 6 supports this hypothesis. The "chilling effect" of Reg FD has increased the

firms with higher dedicated institutional holdings	information privilege of insider and has resulted in even more serious information asymmetry. Our results are consistent with works by Straser (2002)
H8: The improvement of liquidity is not significant for firms with higher ownership of quasi-indexers	The fourth panel of Table 6 supports this hypothesis. Quasi-indexers use passive strategy and do not rely on private information a lot. Reg FD has no clear impact on this group of institutions.

VI. Conclusion

Whether institutions have a positive or negative impact on stock liquidity? Whether Reg FD is effective in reducing the information advantage of institutions? The extant studies on these two topics are inconclusive. We empirically test two opposite effects hypothesized in the previous literature by examining the effect of institutional ownership on liquidity, using both annual and quarterly sample from 1995 to 2005 and a number of trading costs and liquidity measures. We find strong evidence of a positive impact of institutional ownership on liquidity. After classifying institutions according to Bushee's (1998) scheme, we find that transient institutions have a positive impact on liquidity due to intense competition. This lends support to the theoretical work by Subrahmanyam (1991), Spiegel and Subrahmanyam (1992) Foster and Viswanathan (1996) and Back, Cao, and Willard (2000). We find that quasi-indexer improves liquidity due to uninformative and high frequency trading. In contrast, dedicated institutions create information asymmetry and inventory risk, thus lowering liquidity. Bushee's classification is applied in our study of Reg FD, too. Whereas, Reg FD is not effective in improving liquidity through reducing information asymmetry for institutions as a whole group, Reg FD does prevent transient institutions trading on material information ahead of the public. This phenomenon does not exist for the other two groups of institutional investors. We control for confounding effects by carrying out the same regressions on American Depositary Receipts. Our regression results suggest that Reg FD had unintended consequences and that "information" from firms to institutions may be more complicated than current studies find. Overall, Reg FD is effective but the effectiveness is only limited to a certain group of institutions.

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Graph 1 – Trend Graph of Institutional Share

The following graph shows the percentage of stock share held by institutions during 1990-2009. The percentage of stock share held by institutions is calculated as dividing institution-owned shares (from Spectrum Database) by total shares outstanding (from CRSP).

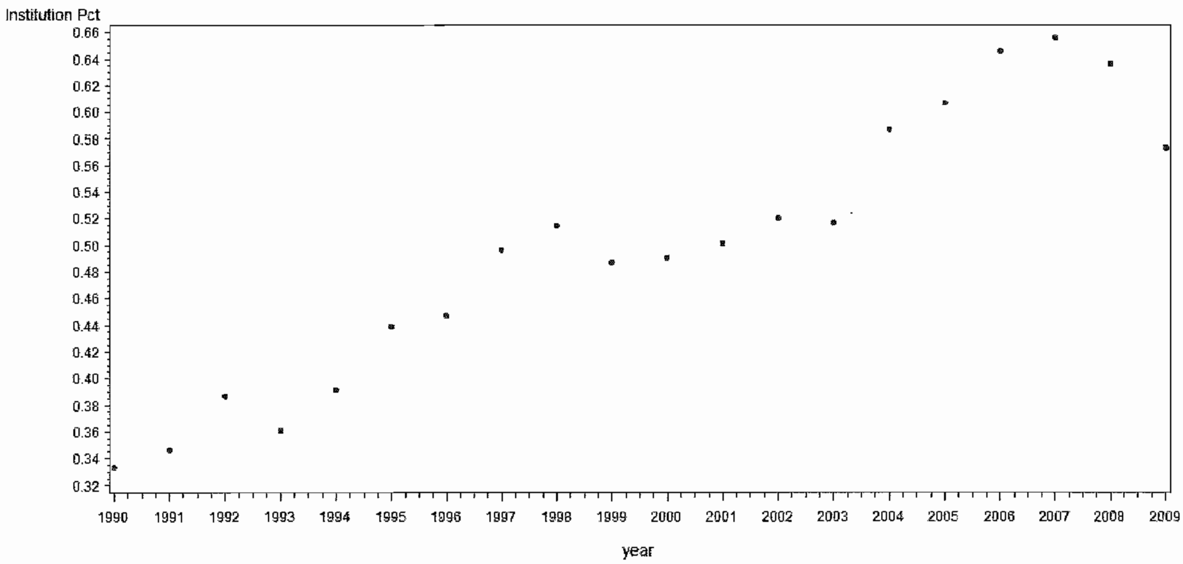

Table 1 – Summary Statistics

This table presents summary statistics of annual liquidity measures, annual institutional ownership measures and other annual control variable. Panel A is the descriptive statistics of annual data. Panel B is the correlation matrix of annual data. Panel C is the descriptive statistics of quarterly data. Panel D is the correlation matrix of quarterly data. We present summary statistics by pooling observations over the entire sample period of 1995~2005 for the following measures: *amh*, Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume); *amh_ma*, market adjusted Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume) over market average Amihud illiquidity measure; *amh_sq*, square root variant Amihud illiquidity measure, i.e. average over year of 1000 × sqrt(abs(return)/ abs(price) × volume); *c_BMA*, Gibbs estimate of trading cost from Basic Market-Adjusted model; *cmz*, Moment estimate of trading cost, based on all reported prices, including quoted midpoints; *cmzAlt*, Moment estimate of trading cost, excluding quote midpoints; *tnov*, turnover over the year, average trading volume over the year shares outstanding; *roll*, the quarterly version of *cmz*; *INS_pct*, amount of shares held by institutions that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *TRA_pct*, amount of shares held by transient institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *QIX_pct*, amount of shares held by quasi-indexed institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *DED_pct*, amount of shares held by dedicated institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding ; *ret*, return of the year; *retlag*, return of last year; *prcln*, log of the price at the end of the year; *size*, the total market capitalization of the firm calculated at the end of the year (shares outstanding×price); *prcsq*, square of price at the end of the year; *volume*, sum of the daily trading volume over the year; *volatility*, variance of daily return over the year; *numtrd*, sum of the daily trading number over the year

Panel A: Descriptive Statistics (Annual)

Variable	N	Mean	Median	Minimum	1st Pctl	99th Pctl	Maximum	Std Dev
amh	51492.00	3.51	0.10	0.00	0.00	58.52	3514.19	25.90
amh_ma	51492.00	0.50	0.01	0.00	0.00	8.53	223.95	3.08
amh_sq	51492.00	0.61	0.25	0.00	0.01	4.85	32.44	1.03
c_BMA	51492.00	0.01	0.01	0.00	0.00	0.06	0.30	0.01
cmz	51492.00	0.01	0.01	0.00	0.00	0.06	0.35	0.01
cmzAlt	51492.00	0.01	0.01	0.00	0.00	0.06	0.31	0.01
tnov	51492.00	0.01	0.00	0.00	0.00	0.04	0.64	0.01
INS_pct	51492.00	0.37	0.32	0.00	0.00	0.95	1.00	0.28
TRA_pct	51492.00	0.12	0.08	0.00	0.00	0.53	0.96	0.12

DED_pct	51492.00	0.10	0.07	0.00	0.00	0.46	0.92	0.11
QIX_pct	51492.00	0.20	0.15	0.00	0.00	0.75	0.97	0.18
ret	51492.00	0.20	0.07	-1.00	-0.89	3.46	32.00	0.91
retlag	51492.00	0.21	0.08	-0.99	-0.83	3.59	32.00	0.91
prcln	51492.00	2.43	2.64	-4.16	-1.05	4.51	11.39	1.20
size	51492.00	2097186.44	164228.75	43.89	2798.25	36081439.60	602432918.75	12379264.74
prcsq	51492.00	994308.47	196.28	0.00	0.12	8190.25	7853504400.00	76152555.82
volume	51492.00	90637711.66	13430659.00	24200.00	148552.00	1266421165.00	21295701488.00	426736868.81
volatility	51492.00	0.00	0.00	0.00	0.00	0.02	0.67	0.01
numtrd	51492.00	118006.49	9543.00	3.00	218.00	1973155.00	24006324.00	662206.17

Panel B: Correlation (Annual)

	amh	amh_ma	amh_sq	c_BMA	cmz	cmzAlt	tnov	ins_pct	tra_pct	ded_pct	qix_pct	retyr	retlagyr	prcln	size	prcsq	vol	volatility	numtrd
amh	1.00	0.74	0.69	0.52	0.45	0.46	-0.06	-0.14	-0.07	-0.04	-0.11	-0.03	-0.05	-0.26	-0.02	0.00	-0.03	0.38	-0.03
amh_ma	0.74	1.00	0.63	0.46	0.40	0.41	-0.07	-0.16	-0.10	-0.04	-0.12	-0.03	-0.05	-0.27	-0.03	0.00	-0.03	0.29	-0.04
amh_sq	0.69	0.63	1.00	0.83	0.72	0.74	-0.19	-0.45	-0.28	-0.08	-0.38	-0.05	-0.14	-0.56	-0.10	-0.01	-0.11	0.37	-0.11
c_BMA	0.52	0.46	0.83	1.00	0.89	0.90	-0.12	-0.46	-0.26	-0.07	-0.42	-0.08	-0.13	-0.60	-0.11	-0.01	-0.10	0.44	-0.11
cmz	0.45	0.40	0.72	0.89	1.00	0.98	-0.12	-0.41	-0.24	-0.08	-0.35	-0.09	-0.13	-0.58	-0.09	-0.01	-0.09	0.51	-0.10
cmzAlt	0.46	0.41	0.74	0.90	0.98	1.00	-0.12	-0.41	-0.24	-0.08	-0.35	-0.09	-0.13	-0.56	-0.09	-0.01	-0.09	0.47	-0.10
tnov	-0.06	-0.07	-0.19	-0.12	-0.12	-0.12	1.00	0.18	0.24	-0.01	0.09	0.11	0.23	0.06	0.01	-0.01	0.18	0.11	0.24
ins_pct	-0.14	-0.16	-0.45	-0.46	-0.41	-0.41	0.18	1.00	0.67	0.42	0.81	0.04	0.06	0.52	0.13	-0.01	0.16	-0.19	0.19
tra_pct	-0.07	-0.10	-0.28	-0.26	-0.24	-0.24	0.24	0.67	1.00	-0.01	0.25	0.11	0.07	0.29	0.03	-0.01	0.09	-0.07	0.11
ded_pct	-0.04	-0.04	-0.08	-0.07	-0.08	-0.08	-0.01	0.42	-0.01	1.00	0.00	-0.03	-0.01	0.11	-0.03	-0.01	-0.03	-0.10	-0.04
qix_pct	-0.11	-0.12	-0.38	-0.42	-0.35	-0.35	0.09	0.81	0.25	0.00	1.00	-0.02	0.06	0.46	0.16	-0.01	0.16	-0.18	0.21
retyr	-0.03	-0.03	-0.05	-0.08	-0.09	-0.09	0.11	0.04	0.11	-0.03	-0.02	1.00	-0.07	0.26	0.01	0.00	-0.01	-0.01	0.00
retlagyr	-0.05	-0.05	-0.14	-0.13	-0.13	-0.13	0.23	0.06	0.07	-0.01	0.06	-0.07	1.00	0.14	0.01	0.00	0.03	-0.04	0.07
prcln	-0.26	-0.27	-0.56	-0.60	-0.58	-0.56	0.06	0.52	0.29	0.11	0.46	0.26	0.14	1.00	0.20	0.10	0.11	-0.37	0.12
size	-0.02	-0.03	-0.10	-0.11	-0.09	-0.09	0.01	0.13	0.03	-0.03	0.16	0.01	0.01	0.20	1.00	0.10	0.57	-0.04	0.65

prcsq	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.10	0.10	1.00	0.00	0.00	0.04
vol	-0.03	-0.03	-0.11	-0.10	-0.09	-0.09	0.18	0.16	0.09	-0.03	0.16	-0.01	0.03	0.11	0.57	0.00	1.00	-0.01	0.91
volatility	0.38	0.29	0.37	0.44	0.51	0.47	0.11	-0.19	-0.07	-0.10	-0.18	-0.01	-0.04	-0.37	-0.04	0.00	-0.01	1.00	-0.02
numtrd	-0.03	-0.04	-0.11	-0.11	-0.10	-0.10	0.24	0.19	0.11	-0.04	0.21	0.00	0.07	0.12	0.65	0.04	0.91	-0.02	1.00

Panel C: Descriptive Statistics (Quarterly)

Variable	N	Mean	Median	Minimum	1st Pctl	99th Pctl	Maximum	Std Dev
amh	208229.00	4.31	0.07	0.00	0.00	68.73	17186.53	63.83
amh_ma	208229.00	0.64	0.01	0.00	0.00	10.88	2687.06	8.24
amh_sq	208229.00	0.62	0.22	0.00	0.01	5.63	108.27	1.29
roll	208229.00	0.14	0.06	0.00	0.00	0.85	504.63	2.51
tnov	208229.00	0.01	0.00	0.00	0.00	0.04	2.45	0.02
INS_pct	208229.00	0.35	0.29	0.00	0.00	0.95	1.00	0.28
TRA_pct	208229.00	0.11	0.07	0.00	0.00	0.53	1.00	0.12
DED_pct	208229.00	0.10	0.07	0.00	0.00	0.47	0.97	0.11
QIX_pct	208229.00	0.19	0.14	0.00	0.00	0.75	1.00	0.18
ret	208229.00	0.04	0.02	-0.99	-0.63	1.12	14.00	0.32
retlag	208229.00	0.04	0.02	-0.96	-0.60	1.10	14.00	0.32
prcln	208229.00	2.51	2.68	-4.16	-0.78	4.54	11.44	1.13
size	208229.00	1884683.64	163814.50	4.38	3020.00	32238981.54	602432918.75	10993337.95
prcsq	208229.00	912044.42	213.89	0.00	0.21	8732.90	8704890000.00	70914149.38
vol	208229.00	20609092.62	2697463.50	0.00	22300.00	295663373.00	9482005062.00	109862281.95
volatility	208229.00	0.00	0.00	0.00	0.00	0.02	2.76	0.01
numtrd	208229.00	26540.01	1883.00	0.00	33.00	463739.00	6801721.00	156184.09

Panel D: Correlation (Quarterly)

	amh	amh_ma	amh_sq	roll	tnov	ins_pct	tra_pct	ded_pct	qix_pct	retyq	retlagyq	prcln	size	prcsq	vol	volatility	numtrd
amh	1.00	0.90	0.64	0.00	-0.02	-0.06	-0.04	-0.02	-0.05	-0.02	-0.03	-0.16	-0.01	0.00	-0.01	0.18	-0.01
amh_ma	0.90	1.00	0.57	0.00	-0.02	-0.07	-0.06	-0.03	-0.05	-0.02	-0.03	-0.15	-0.01	0.00	-0.01	0.15	-0.01

amh_sq	0.64	0.57	1.00	-0.01	-0.10	-0.34	-0.21	-0.07	-0.29	-0.06	-0.10	-0.52	-0.08	-0.01	-0.08	0.26	-0.09
roll	0.00	0.00	-0.01	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.07	0.53	0.00	0.00	0.08
tnov	-0.02	-0.02	-0.10	0.00	1.00	0.10	0.15	-0.01	0.04	0.08	0.08	0.06	0.00	0.00	0.15	0.07	0.17
ins_pct	-0.06	-0.07	-0.34	0.00	0.10	1.00	0.67	0.44	0.81	0.02	0.04	0.48	0.13	-0.01	0.15	-0.10	0.20
tra_pct	-0.04	-0.06	-0.21	0.00	0.15	0.67	1.00	0.02	0.26	0.05	0.05	0.27	0.04	-0.01	0.09	-0.05	0.13
ded_pct	-0.02	-0.03	-0.07	0.00	-0.01	0.44	0.02	1.00	0.02	-0.01	0.00	0.13	-0.02	-0.01	-0.02	-0.05	-0.03
qix_pct	-0.05	-0.05	-0.29	0.00	0.04	0.81	0.26	0.02	1.00	-0.01	0.01	0.43	0.16	0.00	0.14	-0.09	0.20
retyq	-0.02	-0.02	-0.06	0.00	0.08	0.02	0.05	-0.01	-0.01	1.00	-0.01	0.19	0.01	0.00	0.00	0.03	0.01
retlagyq	-0.03	-0.03	-0.10	0.01	0.08	0.04	0.05	0.00	0.01	-0.01	1.00	0.16	0.01	0.00	0.00	-0.06	0.02
prcln	-0.16	-0.15	-0.52	0.08	0.06	0.48	0.27	0.13	0.43	0.19	0.16	1.00	0.20	0.10	0.09	-0.24	0.13
size	-0.01	-0.01	-0.08	0.07	0.00	0.13	0.04	-0.02	0.16	0.01	0.01	0.20	1.00	0.11	0.50	-0.02	0.62
prcsq	0.00	0.00	-0.01	0.53	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.10	0.11	1.00	0.00	0.00	0.11
vol	-0.01	-0.01	-0.08	0.00	0.15	0.15	0.09	-0.02	0.14	0.00	0.00	0.09	0.50	0.00	1.00	0.01	0.85
volatility	0.18	0.15	0.26	0.00	0.07	-0.10	-0.05	-0.05	-0.09	0.03	-0.06	-0.24	-0.02	0.00	0.01	1.00	-0.01
numtrd	-0.01	-0.01	-0.09	0.08	0.17	0.20	0.13	-0.03	0.20	0.01	0.02	0.13	0.62	0.11	0.85	-0.01	1.00

Table 2 – Effect of Institutional Ownership on Liquidity (Annual)

This table presents regression results of institution ownership on liquidity using annual measures. We present both coefficients and t-statistics. Annual liquidity measures are as follows: *amh*, Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume); *amh_ma*, market adjusted Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume) over market average Amihud illiquidity measure; *amh_sq*, square root variant Amihud illiquidity measure, i.e. average over year of 1000 × sqrt(abs(return)/ abs(price) × volume); *c_BMA*, Gibbs estimate of c from Basic Market-Adjusted model; *cmz*, Moment estimate of c, based on all reported prices, including quoted midpoints; *cmzAlt*, Moment estimate of c, excluding quote midpoints; *tnov*, turnover over the year, average trading volume over the year shares outstanding; institutional ownership measures include *INS_pct*, amount of shares held by institutions that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding. Control variables are: *ret*, return of the year; *retlag*, return of last year; *prcln*, log of the price at the end of the year; *size*, the total market capitalization of the firm calculated at the end of the year (shares outstanding×price); *prcsq*, square of price at the end of the year; *volume*, sum of the daily trading volume over the year; *volatility*, variance of daily return over the year; *numtrd*, sum of the daily trading number over the year. Panel A displays pooled regression results; Panel B shows pooled regression after controlling for industry effect (following Kenneth French's 12-industry classification scheme); Panel C presents regression results with industry and year fixed effect.

$$\begin{aligned} \mathrm{Liq}_{it} = \delta_i + \delta_t + \theta INS + \gamma_1 ret_{it} + \gamma_2 retlag_{it} + \gamma_3 prcln_{it} + \gamma_4 size_{it} \\ + \gamma_5 prcsq + \gamma_6 volume_{it} + \gamma_7 volatility_{it} + \gamma_8 numtrd + \epsilon_{it} \end{aligned}$$

Panel A: Pooled Regression

Parameter	amh	amh_ma	amh_sq	c_BMA	cmz	cmzAlt	tnov
intercept	4.7894	1.1336	1.6850	0.0249	0.0240	0.0252	0.0027
	(1.816)	(7.056)	(2.922)	(2.193)	(6.681)	(7.462)	(5.728)
ins_pct	-3.2850	-0.8053	-1.0310	-0.0120	-0.0102	-0.0121	0.0104
	(-4.683)	(-1.107)	(-3.460)	(-2.494)	(-5.885)	(-7.986)	(4.905)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(2.604)	(3.134)	(5.428)	(2.235)	(3.844)	(3.908)	(3.936)
prcln	-1.8230	-0.2846	-0.3127	-0.0040	-0.0042	-0.0042	-0.0005
	(-0.336)	(-5.609)	(-2.424)	(-6.086)	(-8.783)	(-2.485)	(-6.400)
prcsq	2.2179	0.2907	0.2387	0.0032	0.0037	0.0037	0.0015
	(1.288)	(1.633)	(4.098)	(4.586)	(5.335)	(4.761)	(2.111)
ret	-0.2346	-0.0240	0.0365	0.0002	-0.0002	-0.0003	0.0015
	(-1.483)	(-1.466)	(6.823)	(2.520)	(-2.935)	(-3.735)	(2.972)
retlag	-0.6519	-0.0526	-0.0742	-0.0008	-0.0010	-0.0011	0.0026
	(-4.311)	(-3.363)	(-4.516)	(-3.070)	(-6.945)	(-6.388)	(0.352)

size	866.4372	93.3257	66.0603	0.6576	0.8734	0.8976	-2.1783
	(3.254)	(3.391)	(7.337)	(6.118)	(8.135)	(7.454)	(-9.237)
volatility	1818.3475	141.9772	37.8480	0.6364	0.8472	0.8680	0.2873
	(4.822)	(8.963)	(9.895)	(6.185)	(4.890)	(8.418)	(4.078)
volume	-35.0159	-4.0789	-2.8320	-0.0220	-0.0287	-0.0311	-0.0116
	(-4.103)	(-4.623)	(-9.812)	(-6.381)	(-8.332)	(-8.051)	(-3.196)

Panel B: Pooled Regression with Industry Controls

Parameter	amh	amh_ma	amh_sq	cmz	cmzAlt	tnov
intercept	5.4389	1.2188	1.7709	0.0250	0.0264	0.0018
	(9.265)	(0.119)	(0.804)	(6.625)	(0.491)	(7.293)
ins_pct	0.5714	-0.3645	-0.8030	-0.0083	-0.0096	0.0068
	(0.730)	(-4.513)	(-0.882)	(-6.456)	(-7.378)	(0.574)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(3.227)	(3.858)	(6.815)	(4.840)	(4.967)	(2.857)
prcln	-2.7470	-0.3915	-0.3700	-0.0046	-0.0048	0.0005
	(-3.801)	(-9.060)	(-5.954)	(-8.348)	(-3.825)	(5.502)
prcsq	2.7887	0.3538	0.2666	0.0039	0.0040	0.0010
	(1.626)	(1.999)	(4.678)	(5.657)	(5.156)	(1.423)
ret	0.0980	0.0172	0.0604	0.0000	-0.0000	0.0012
	(0.613)	(1.044)	(1.354)	(0.346)	(-0.088)	(8.074)
retlag	-0.4453	-0.0265	-0.0585	-0.0009	-0.0009	0.0024
	(-2.945)	(-1.699)	(-1.635)	(-4.647)	(-3.926)	(7.762)
size	827.9125	88.2800	63.0176	0.8339	0.8582	-2.1608
	(3.126)	(3.230)	(7.161)	(7.882)	(7.239)	(-9.400)
volatility	1842.6326	144.7299	39.4695	0.8638	0.8867	0.2704
	(5.925)	(0.175)	(2.503)	(7.365)	(0.881)	(3.005)
volume	-32.8793	-3.8314	-2.6860	-0.0267	-0.0290	-0.0125
	(-3.867)	(-4.367)	(-9.509)	(-7.874)	(-7.625)	(-3.507)

Panel C: Fixed-Effect Regresssion

Parameter	amh	amh_ma	amh_sq	c_BMA	cmz	cmzAlt	tnov
intercept	6.4450	2.1808	1.6711	0.0205	0.0212	0.0223	0.0014
	(7.845)	(5.901)	(1.541)	(6.281)	(6.332)	(2.152)	(3.917)
ins_pct	0.1906	-0.5818	-0.8029	-0.0076	-0.0063	-0.0074	0.0075
	(0.239)	(-7.118)	(-0.458)	(-5.299)	(-0.263)	(-1.280)	(2.295)

numtrd	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(2.759)	(-0.096)	(7.846)	(2.923)	(1.128)	(1.112)	(4.068)
prcln	-2.7565	-0.3774	-0.3681	-0.0049	-0.0050	-0.0052	0.0003
	(-3.644)	(-8.227)	(-5.123)	(-4.079)	(-3.271)	(-8.646)	(4.068)
prcsq	2.9681	0.3459	0.2702	0.0038	0.0042	0.0043	0.0011
	(1.736)	(1.974)	(4.780)	(5.930)	(6.276)	(5.768)	(1.520)
ret	-0.0030	0.0227	0.0570	0.0005	0.0002	0.0002	0.0013
	(-0.018)	(1.354)	(0.533)	(8.225)	(2.989)	(2.388)	(8.567)
retlag	-0.2738	-0.0711	-0.0467	-0.0005	-0.0009	-0.0009	0.0024
	(-1.753)	(-4.443)	(-9.049)	(-9.281)	(-4.252)	(-3.287)	(6.793)
size	916.8604	102.8235	65.9500	0.4712	0.7395	0.7580	-2.2281
	(3.470)	(3.797)	(7.551)	(4.731)	(7.185)	(6.568)	(-0.073)
volatility	1866.0879	149.4845	39.6369	0.6091	0.8353	0.8559	0.2536
	(6.561)	(2.024)	(2.773)	(7.644)	(6.487)	(9.907)	(1.537)
volume	-30.8525	-1.2523	-2.9872	-0.0411	-0.0407	-0.0443	-0.0159
	(-3.601)	(-1.426)	(-0.548)	(-2.719)	(-2.195)	(-1.849)	(-4.420)

Table 3 – Effect of Institutional Ownership on Liquidity (Quarterly)

This table presents regression results of institution ownership on liquidity using quarterly measures. We present both coefficients and t-statistics. Quarterly liquidity measures are as follows: *amh*, Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume); *amh*, Amihud illiquidity measure, i.e. average over quarter of 1000000 × abs(return)/(abs(price) × volume); *amh_ma*, market adjusted Amihud illiquidity measure, i.e. average over quarter of 1000000 × abs(return)/(abs(price) × volume) over market average Amihud illiquidity measure; *amh_sq*, square root variant Amihud illiquidity measure, i.e. average over quarter of 1000 × sqrt(abs(return)/ abs(price) × volume); *roll*, Moment estimate of c, based on all reported prices, including quoted midpoints; *tnov*, turnover over the quarter, average trading volume over the quarter shares outstanding; institutional ownership measures include *INS_pct*, amount of shares held by institutions that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding. Control variables are: *ret*, return of the quarter; *retlag*, return of last quarter; *prcln*, log of the price at the end of the quarter; *size*, the total market capitalization of the firm calculated at the end of the quarter (shares outstanding×price); *prcsq*, square of price at the end of the quarter; *volume*, sum of the daily trading volume over the quarter; *volatility*, variance of daily return over the quarter; *numtrd*, sum of the daily trading number over the quarter. Panel A displays pooled regression results; Panel B shows pooled regression after controlling for industry effect (following Kenneth French's 12-industry classification scheme); Panel C presents regression results with industry and year fixed effect; Panel D is the results of Fama-Macbeth regressions.

$$\mathrm{Liq}_{it} = \delta_i + \delta_t + \theta INS + \gamma_1 ret_{it} + \gamma_2 retlag_{it} + \gamma_3 prcln_{it} + \gamma_4 size_{it} + \gamma_5 prcsq + \gamma_6 volume_{it} + \gamma_7 volatility_{it} + \gamma_8 numtrd + \epsilon_{it}$$

Panel A: Pooled Regression

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	21.6453	2.9040	2.1846	0.0604	-0.0013
	(5.558)	(6.508)	(4.076)	(8.250)	(-0.377)
ins_pct	1.0188	-0.2877	-0.8653	-0.1130	0.0089
	(0.908)	(-1.981)	(-9.032)	(-9.899)	(2.106)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000
	(3.051)	(2.870)	(9.188)	(1.925)	(2.308)
prcln	-8.3428	-1.0164	-0.5382	0.0668	-0.0003
	(-9.581)	(-7.860)	(-1.379)	(3.819)	(-6.853)
prcsq	96.1933	10.9781	4.6589	2.7732	0.0316
	(7.739)	(6.828)	(3.842)	(8.408)	(6.602)
ret	-1.0928	-0.0630	0.0380	-0.0522	0.0044
	(-1.608)	(-0.717)	(3.555)	(-0.424)	(2.334)
retlagyq	0.0849	0.0086	-0.0867	0.0056	0.0042
	(0.126)	(0.099)	(-8.156)	(3.269)	(0.496)

size	1451.9200	167.7101	76.2856	-2.0389	-3.4508
	(3.116)	(2.783)	(0.414)	(-1.734)	(-8.425)
volatility	1263.0809	124.9212	22.3589	1.5205	0.1577
	(2.417)	(0.077)	(9.019)	(5.003)	(2.804)
volume	-244.7529	-29.4820	-14.0225	-0.8072	0.2232
	(-4.468)	(-4.161)	(-6.283)	(-5.840)	(6.643)

Panel B: Pooled Regression with Industry Controls

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	25.0993	3.3009	2.2542	0.0617	-0.0017
	(3.531)	(3.924)	(6.131)	(2.900)	(-0.433)
ins_pct	6.4404	0.4000	-0.6061	-0.1144	0.0057
	(5.249)	(2.521)	(-1.823)	(-6.927)	(0.817)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000
	(3.545)	(3.396)	(1.293)	(1.978)	(0.161)
prcln	-9.7436	-1.1932	-0.6074	0.0670	0.0006
	(-1.147)	(-9.489)	(-5.083)	(4.829)	(2.148)
prcsq	106.5380	12.1668	5.1353	2.7636	0.0256
	(8.552)	(7.551)	(6.554)	(7.847)	(3.631)
ret	-0.1786	0.0571	0.0868	-0.0520	0.0039
	(-0.261)	(0.646)	(8.184)	(-0.142)	(7.319)
retlagyq	0.8562	0.1107	-0.0446	0.0057	0.0037
	(1.262)	(1.262)	(-4.233)	(3.340)	(6.343)
size	1403.2629	160.4744	73.4878	-1.9634	-3.4232
	(3.014)	(2.664)	(0.167)	(-1.670)	(-8.692)
volatility	1267.7577	125.5467	22.6997	1.5147	0.1547
	(2.619)	(0.285)	(0.690)	(4.894)	(2.529)
volume	-232.7686	-27.8882	-13.4476	-0.8255	0.2184
	(-4.246)	(-3.933)	(-5.800)	(-5.962)	(6.384)

Panel C: Fixed-Effect Regression

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	25.3528	4.4361	2.0956	-0.0234	-0.0022
	(1.317)	(5.314)	(0.572)	(-4.178)	(-6.516)
ins_pct	7.2266	0.3478	-0.5824	-0.0919	0.0062
	(5.739)	(2.136)	(-9.951)	(-9.176)	(2.718)

numtrd	0.0000	0.0000	0.0000	0.0000	0.0000
	(3.995)	(1.968)	(3.988)	(8.541)	(0.472)
prcln	-9.9488	-1.2366	-0.6047	0.0642	0.0004
	(-1.079)	(-9.875)	(-2.314)	(0.142)	(8.893)
prcsq	111.3115	12.7767	5.2300	2.7246	0.0243
	(8.922)	(7.920)	(7.144)	(7.291)	(2.941)
ret	-0.7876	-0.0325	0.0749	-0.0427	0.0041
	(-1.093)	(-0.349)	(6.728)	(-3.672)	(7.390)
retlagyq	1.4947	0.0423	-0.0226	0.0098	0.0038
	(2.084)	(0.456)	(-2.037)	(5.440)	(5.644)
size	1375.5522	167.9475	71.8079	-3.3384	-3.4466
	(2.954)	(2.789)	(9.984)	(-2.865)	(-9.146)
volatility	1274.5606	127.1671	22.7924	1.3009	0.1494
	(2.705)	(0.668)	(1.029)	(1.502)	(1.019)
volume	-244.8967	-20.3585	-15.0346	-1.4320	0.2164
	(-4.436)	(-2.852)	(-7.635)	(-0.368)	(6.032)

Table 4 – Effect of Classified Institutional Ownership on Liquidity (Annual)

This table presents regression results of institution ownership on liquidity using annual measures. We present both coefficients and t-statistics. Annual liquidity measures are as follows: *amh*, Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume); *amh_ma*, market adjusted Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume) over market average Amihud illiquidity measure; *amh_sq*, square root variant Amihud illiquidity measure, i.e. average over year of 1000 × sqrt(abs(return)/ abs(price) × volume); *c_BMA*, Gibbs estimate of c from Basic Market-Adjusted model; *cmz*, Moment estimate of c, based on all reported prices, including quoted midpoints; *cmzAlt*, Moment estimate of c, excluding quote midpoints; *tnov*, turnover over the year, average trading volume over the year shares outstanding; institutional ownership measures include *TRA_pct*, amount of shares held by transient institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *QIX_pct*, amount of shares held by quasi-indexed institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *DED_pct*, amount of shares held by dedicated institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding. Control variables are: *ret*, return of the year; *retlag*, return of last year; *prcln*, log of the price at the end of the year; *size*, the total market capitalization of the firm calculated at the end of the year (shares outstanding×price); *prcsq*, square of price at the end of the year; *volume*, sum of the daily trading volume over the year; *volatility*, variance of daily return over the year; *numtrd*, sum of the daily trading number over the year. Panel A displays pooled regression results; Panel B shows pooled regression after controlling for industry effect (following Kenneth French's 12-industry classification scheme); Panel C presents regression results with industry and year fixed effect; Panel D is the results of Fama-Macbeth regressions.

$$\begin{aligned}\mathrm{Liq}_{it} = \delta_i + \delta_t + \theta_1 TRA\_\mathrm{pct}_{it} + \theta_2 QIX\_pct_{it} + \theta_3 DED\_pct_{it} + \gamma_1 ret_{it} \\ + \gamma_2 retlag_{it} + \gamma_3 prcln_{it} + \gamma_4 size_{it} + \gamma_5 prcsq + \gamma_6 volume_{it} \\ + \gamma_7 volatility_{it} + \gamma_8 numtrd + \epsilon_{it}\end{aligned}$$

Panel A Pooled Regression

Panel A: Pooled Regression

Parameter	amh	amh_ma	amh_sq	c_BMA	cmz	cmzAlt	tnov
intercept	4.0583	0.4987	1.1389	0.0177	0.0173	0.0177	-0.0009
	(7.527)	(0.621)	(7.971)	(4.442)	(6.982)	(4.992)	(-3.185)
TRA_pct	-3.4171	-0.5106	-0.8299	-0.0120	-0.0133	-0.0143	0.0222
	(-0.631)	(-9.684)	(-6.059)	(-6.336)	(-3.634)	(-4.116)	(6.991)
QIX_pct	-1.5550	-0.2268	-0.7275	-0.0104	-0.0070	-0.0077	0.0037
	(-4.993)	(-4.440)	(-3.580)	(-3.432)	(-2.730)	(-3.436)	(6.425)
DED_pct	0.2870	-0.0546	-0.0854	0.0026	-0.0003	-0.0006	0.0061
	(0.717)	(-0.832)	(-2.153)	(4.613)	(-0.414)	(-0.776)	(8.141)

numtrd	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(3.497)	(2.301)	(4.051)	(1.960)	(1.906)	(1.979)	(5.291)
prcln	-1.1072	-0.1164	-0.1945	-0.0024	-0.0024	-0.0024	0.0007
	(-0.332)	(-3.032)	(-6.051)	(-0.716)	(-5.451)	(-3.788)	(6.736)
prcsq	1.6477	0.1681	0.2158	0.0032	0.0039	0.0038	0.0016
	(2.995)	(1.862)	(3.960)	(4.104)	(4.006)	(3.739)	(1.583)
ret	0.1418	0.0067	0.0285	0.0000	-0.0004	-0.0004	0.0009
	(3.583)	(1.036)	(7.272)	(0.782)	(-5.515)	(-5.862)	(2.209)
retlag	-0.2463	-0.0303	-0.0438	-0.0005	-0.0009	-0.0009	0.0029
	(-6.399)	(-4.806)	(-1.483)	(-8.917)	(-2.918)	(-2.726)	(0.071)
size	203.8779	22.2077	28.2046	0.3258	0.4830	0.4883	-1.4983
	(3.986)	(2.647)	(5.566)	(4.477)	(5.380)	(5.160)	(-5.720)
volatility	380.1423	42.5298	21.2258	1.0244	1.1782	1.2112	0.8907
	(3.916)	(6.311)	(3.479)	(5.289)	(2.228)	(1.184)	(0.069)
volume	-8.5882	-0.9744	-1.3455	-0.0135	-0.0162	-0.0170	-0.0242
	(-5.072)	(-3.508)	(-8.020)	(-5.587)	(-5.446)	(-5.416)	(-7.677)

Panel B: Pooled Regression with Industry Controls

Parameter	amh	amh_ma	amh_sq	c_BMA	cmz	cmzAlt	tnov
intercept	4.5026	0.5568	1.1987	0.0184	0.0181	0.0186	-0.0018
	(4.806)	(8.650)	(7.480)	(1.600)	(7.038)	(5.644)	(-5.395)
TRA_pct	-2.2505	-0.3236	-0.6742	-0.0116	-0.0116	-0.0123	0.0181
	(-6.720)	(-5.875)	(-0.572)	(-4.407)	(-9.790)	(-0.027)	(9.442)
QIX_pct	-1.1520	-0.1475	-0.6850	-0.0108	-0.0065	-0.0072	0.0020
	(-3.653)	(-2.845)	(-2.197)	(-4.126)	(-1.875)	(-2.467)	(3.396)
DED_pct	0.9663	0.0788	-0.0154	0.0020	0.0002	0.0001	0.0034
	(2.361)	(1.171)	(-0.384)	(3.448)	(0.301)	(0.117)	(4.526)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(4.367)	(3.058)	(5.346)	(2.496)	(2.705)	(2.829)	(3.904)
prcln	-1.2656	-0.1460	-0.2140	-0.0023	-0.0026	-0.0026	0.0013
	(-1.911)	(-5.366)	(-7.862)	(-8.266)	(-5.719)	(-4.426)	(2.315)
prcsq	1.7244	0.1882	0.2224	0.0030	0.0039	0.0038	0.0012
	(3.156)	(2.094)	(4.160)	(3.861)	(4.045)	(3.793)	(1.167)
ret	0.1992	0.0162	0.0367	0.0001	-0.0003	-0.0003	0.0007
	(5.032)	(2.491)	(9.466)	(1.283)	(-4.269)	(-4.512)	(9.689)

retlag	-0.2005	-0.0234	-0.0370	-0.0004	-0.0008	-0.0008	0.0027
	(-5.235)	(-3.713)	(-9.862)	(-8.186)	(-1.819)	(-1.560)	(8.922)
size	204.2416	22.6002	28.2227	0.3089	0.4714	0.4773	-1.5074
	(4.027)	(2.709)	(5.686)	(4.309)	(5.319)	(5.113)	(-6.156)
volatility	417.4410	47.5414	26.5885	1.0770	1.2538	1.2933	0.7857
	(6.188)	(8.132)	(7.044)	(7.804)	(5.018)	(4.079)	(6.792)
volume	-8.4025	-0.9597	-1.3193	-0.0124	-0.0151	-0.0159	-0.0236
	(-4.994)	(-3.468)	(-8.012)	(-5.215)	(-5.138)	(-5.127)	(-7.618)

Panel C: Fixed-Effect Regression

Parameter	amh	amh_ma	amh_sq	c_BMA	cmz	cmzAlt	tnov
intercept	4.7302	1.0365	1.1700	0.0159	0.0157	0.0161	-0.0018
	(7.020)	(2.835)	(3.111)	(2.649)	(2.769)	(2.026)	(-3.516)
TRA_pct	-2.3199	-0.0905	-0.7907	-0.0055	-0.0083	-0.0089	0.0231
	(-6.002)	(-1.434)	(-0.950)	(-0.581)	(-2.448)	(-2.706)	(2.827)
QIX_pct	-0.9780	-0.6116	-0.6331	-0.0079	-0.0043	-0.0049	0.0021
	(-2.575)	(-9.861)	(-7.072)	(-5.436)	(-6.608)	(-7.183)	(2.972)
DED_pct	0.8035	0.2255	0.0659	-0.0024	-0.0022	-0.0024	0.0007
	(1.811)	(3.112)	(1.521)	(-3.985)	(-2.932)	(-3.038)	(0.864)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(4.098)	(0.805)	(5.538)	(8.978)	(6.387)	(6.411)	(5.520)
prcln	-1.2754	-0.1341	-0.2128	-0.0029	-0.0029	-0.0030	0.0010
	(-1.512)	(-3.854)	(-6.755)	(-6.555)	(-8.767)	(-7.450)	(9.094)
prcsq	1.7865	0.1822	0.2152	0.0041	0.0044	0.0044	0.0018
	(3.273)	(2.044)	(4.038)	(5.530)	(4.704)	(4.448)	(1.760)
ret	0.2045	0.0134	0.0412	0.0002	-0.0001	-0.0002	0.0006
	(5.040)	(2.026)	(0.408)	(3.181)	(-2.128)	(-2.446)	(8.619)
retlag	-0.1642	-0.0369	-0.0326	-0.0005	-0.0009	-0.0009	0.0027
	(-4.153)	(-5.723)	(-8.440)	(-0.001)	(-3.276)	(-2.902)	(6.898)
size	210.6084	25.9459	27.4300	0.2522	0.4260	0.4320	-1.5358
	(4.153)	(3.133)	(5.539)	(3.704)	(4.881)	(4.697)	(-6.612)
volatility	425.2600	47.0616	25.7043	1.0047	1.1940	1.2316	0.7556
	(6.199)	(7.753)	(6.217)	(6.101)	(2.747)	(1.837)	(5.534)
volume	-8.2626	-0.5218	-1.3619	-0.0220	-0.0223	-0.0233	-0.0271
	(-4.862)	(-1.880)	(-8.207)	(-9.622)	(-7.623)	(-7.548)	(-8.743)

Table 5 – Effect of Classified Institutional Ownership on Liquidity (Quarterly)

This table presents regression results of institution ownership on liquidity using quarterly measures. We present both coefficients and t-statistics. Quarterly liquidity measures are as follows: *amh*, Amihud illiquidity measure, i.e. average over year of 1000000 × abs(return)/(abs(price) × volume); *amh*, Amihud illiquidity measure, i.e. average over quarter of 1000000 × abs(return)/(abs(price) × volume); *amh_ma*, market adjusted Amihud illiquidity measure, i.e. average over quarter of 1000000 × abs(return)/(abs(price) × volume) over market average Amihud illiquidity measure; *amh_sq*, square root variant Amihud illiquidity measure, i.e. average over quarter of 1000 × sqrt(abs(return)/ abs(price) × volume); *roll*, Moment estimate of c, based on all reported prices, including quoted midpoints; *tnov*, turnover over the quarter, average trading volume over the quarter shares outstanding; institutional ownership measure include *TRA_pct*, amount of shares held by transient institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *QIX_pct*, amount of shares held by quasi-indexed institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *DED_pct*, amount of shares held by dedicated institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding. Control variables are: *ret*, return of the quarter; *retlag*, return of last quarter; *prcln*, log of the price at the end of the quarter; *size*, the total market capitalization of the firm calculated at the end of the quarter (shares outstanding×price); *prcsq*, square of price at the end of the quarter; *volume*, sum of the daily trading volume over the quarter; *volatility*, variance of daily return over the quarter; *numtrd*, sum of the daily trading number over the quarter. Panel A displays pooled regression results; Panel B shows

$$\begin{aligned}\text{Liq}_{it} = \delta_i + \delta_t + \theta_1 TRA\_pct_{it} + \theta_2 QIX\_pct_{it} + \theta_3 DED\_pct_{it} + \gamma_1 ret_{it} \\ + \gamma_2 retlag_{it} + \gamma_3 prcln_{it} + \gamma_4 size_{it} + \gamma_5 prcsq + \gamma_6 volume_{it} \\ + \gamma_7 volatility_{it} + \gamma_8 numtrd + \epsilon_{it}\end{aligned}$$

Panel A: Pooled Regression

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	7.7202	0.9844	1.3870	0.0407	-0.0008
	(3.568)	(0.691)	(3.582)	(0.574)	(-5.807)
TRA_pct	-2.2834	-0.4280	-0.7400	-0.0365	0.0229
	(-4.766)	(-6.406)	(-4.213)	(-4.551)	(7.641)
QIX_pct	-0.8181	-0.2244	-0.6212	-0.1644	0.0003
	(-1.800)	(-3.539)	(-0.267)	(-1.623)	(0.895)
DED_pct	1.2695	-0.0130	0.0415	-0.0183	0.0021
	(2.195)	(-0.162)	(1.588)	(-1.893)	(5.765)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000
	(3.684)	(3.078)	(7.485)	(2.593)	(5.891)

prcln	-2.8021	-0.3096	-0.3187	0.0728	0.0004
	(-7.132)	(-9.421)	(-3.549)	(7.690)	(9.258)
prcsq	23.8532	2.5094	2.0828	2.5587	0.0272
	(9.610)	(7.249)	(8.586)	(1.633)	(7.777)
ret	0.7405	0.0661	0.0561	-0.0601	0.0026
	(4.550)	(2.915)	(7.642)	(-2.068)	(5.629)
retlagyq	-0.1413	-0.0329	-0.0493	0.0162	0.0039
	(-0.887)	(-1.481)	(-6.858)	(6.084)	(9.728)
size	283.3582	31.8510	30.5222	-0.7556	-2.6196
	(3.408)	(2.747)	(8.130)	(-0.543)	(-1.073)
volatility	202.3736	21.6937	6.6548	2.8124	0.2738
	(2.009)	(6.917)	(6.031)	(8.287)	(8.269)
volume	-49.2499	-5.9305	-6.2017	-1.2259	0.1575
	(-4.894)	(-4.225)	(-3.649)	(-7.283)	(5.376)

Panel B: Pooled Regression with Industry Controls

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	8.0387	1.0245	1.4437	0.0428	-0.0017
	(9.018)	(6.523)	(6.950)	(9.225)	(-0.077)
TRA_pct	-0.3617	-0.1466	-0.5383	-0.0483	0.0185
	(-0.722)	(-2.100)	(-4.124)	(-5.757)	(1.511)
QIX_pct	-0.5684	-0.1834	-0.6149	-0.1697	-0.0005
	(-1.238)	(-2.865)	(-0.062)	(-2.080)	(-1.769)
DED_pct	2.2549	0.1372	0.1130	-0.0309	-0.0001
	(3.825)	(1.670)	(4.300)	(-3.130)	(-0.277)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000
	(4.591)	(4.013)	(9.869)	(2.262)	(2.466)
prcln	-3.0921	-0.3530	-0.3457	0.0752	0.0011
	(-8.552)	(-1.560)	(-6.732)	(5.991)	(2.732)
prcsq	26.1460	2.8332	2.2925	2.5355	0.0227
	(0.519)	(8.174)	(0.698)	(0.910)	(5.167)
ret	0.9134	0.0916	0.0747	-0.0609	0.0022
	(5.603)	(4.030)	(0.287)	(-2.305)	(2.303)
retlagyq	0.0428	-0.0062	-0.0289	0.0154	0.0035
	(0.268)	(-0.277)	(-4.060)	(5.754)	(6.387)

size	285.3399	32.2485	30.5593	-0.7350	-2.6222
	(3.437)	(2.786)	(8.261)	(-0.529)	(-2.572)
volatility	211.4110	22.9553	7.7296	2.7718	0.2550
	(2.977)	(7.892)	(8.852)	(7.988)	(6.121)
volume	-49.4627	-5.9859	-6.1630	-1.2195	0.1599
	(-4.914)	(-4.264)	(-3.739)	(-7.234)	(6.439)

Panel C: Fixed Effect Regression

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	7.6622	1.3814	1.3578	-0.0475	-0.0007
	(1.192)	(4.494)	(4.626)	(-4.183)	(-1.683)
TRA_pct	0.5644	0.1767	-0.6089	-0.0598	0.0235
	(0.991)	(2.228)	(-4.062)	(-6.327)	(9.544)
QIX_pct	0.1296	-0.5361	-0.5268	-0.1177	-0.0015
	(0.240)	(-7.119)	(-1.911)	(-3.105)	(-4.662)
DED_pct	1.0508	0.2133	0.1240	-0.0018	-0.0014
	(1.667)	(2.430)	(4.426)	(-0.171)	(-3.704)
numtrd	0.0000	0.0000	0.0000	0.0000	0.0000
	(4.994)	(2.639)	(1.061)	(5.880)	(4.161)
prcln	-3.1770	-0.3603	-0.3462	0.0709	0.0008
	(-8.244)	(-1.155)	(-3.783)	(1.399)	(5.872)
prcsq	27.1912	2.7316	2.3166	2.4924	0.0217
	(0.911)	(7.874)	(0.916)	(0.261)	(4.684)
ret	0.9475	0.0832	0.0824	-0.0449	0.0022
	(5.466)	(3.446)	(0.702)	(-5.611)	(1.176)
retlagyq	0.1773	-0.0372	-0.0098	0.0195	0.0033
	(1.044)	(-1.575)	(-1.295)	(6.901)	(3.066)
size	283.9253	36.0706	29.0132	-1.9687	-2.6215
	(3.417)	(3.118)	(7.857)	(-1.428)	(-3.160)
volatility	214.5460	22.8025	7.6673	2.2735	0.2462
	(3.188)	(7.703)	(8.646)	(4.806)	(4.830)
volume	-51.9625	-4.7730	-6.5156	-1.6140	0.1538
	(-5.128)	(-3.384)	(-4.468)	(-9.597)	(5.577)

Table 6 – Study of FD (U.S. firms)

This table presents difference-in-difference results of FD study. The results are based on quarterly frequency from 1995 to 2005. We present both coefficients and t-statistics. The sample is limited to U.S. firms (with share code other than 30 and 31). We fixed both industry (following Kenneth French's scheme) and quarter effect. *PostFD* is a dummy variable which equals to 1 if it is after 2000. 10.23 and equals to 0 otherwise. Z_{it} represents *INS_pct, TRA_pct, QIX_pct* and *DED_pct* respectively in Panel A, Panel B and Panel C. *INS_pct* refers to the amount of shares held by institutions that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding. *TRA_pct* refers to the amount of shares held by transient institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *QIX_pct* is the amount of shares held by quasi-indexed institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *DED_pct* is the amount of shares held by dedicated institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding.

$$\text{Liq}_{\text{it}} = \delta_i + \delta_t + \alpha_0 + \alpha_1 Post\ FD_{it} + \alpha_2 Z_{it} + \alpha_3 PostFD_{it} * Z_{it} + +\epsilon_t$$

Z_{it}: ***INS_pct***

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	11.7556	1.7022	1.4639	0.0972	0.0045
	(8.666)	(1.655)	(0.099)	(2.315)	(6.532)
FD	0.2527	0.8630	-0.1597	-0.0520	-0.0004
	(0.287)	(7.846)	(-6.246)	(-0.885)	(-1.033)
INS_pct	-15.6832	-2.1231	-1.7565	0.0660	0.0038
	(-5.753)	(-8.776)	(-7.981)	(2.258)	(0.350)
FD×INS_pct	-0.8195	-0.7140	0.0272	-0.0335	0.0032
	(-1.300)	(-9.075)	(1.485)	(-0.796)	(1.735)

Z_{it}: ***TRA_pct***

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	6.5138	0.9178	0.9682	0.1072	0.0036
	(2.176)	(4.111)	(8.928)	(2.317)	(2.508)
FD	-1.4983	-0.0447	-0.3815	-0.0430	0. 022
	(-2.030)	(-0.498)	(-6.828)	(-0.673)	(5.441)
TRA_pct	-17.5736	-2.3297	-2.3734	0.1553	0.0210
	(-7.833)	(-9.445)	(-8.417)	(1.822)	(9.278)
FD×TRA_pct	-9.7668	-0.7603	-0.5135	-0.1723	0.0035

	(-7.522)	(-4.816)	(-2.877)	(-1.534)	(4.993)

Z_{it}: *QIX_pct*

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	9.1703	1.3600	1.2803	0.1015	0.0055
	(5.745)	(8.111)	(2.771)	(2.382)	(0.308)
FD	0.2553	1.2437	-0.1212	-0.0568	0.0001
	(0.308)	(1.646)	(-4.844)	(-0.936)	(0.294)
QIX_pct	-20.3447	-2.8415	-2.5854	0.1035	0.0018
	(-8.003)	(-0.335)	(-7.805)	(1.947)	(5.446)
FD×QIX_pct	4.8476	-1.0482	0.6881	-0.0598	0.0028
	(4.919)	(-8.250)	(3.114)	(-0.829)	(6.080)

Z_{it}: *DED_pct*

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	2.9134	0.4231	0.5766	0.1367	0.0066
	(7.036)	(8.899)	(5.418)	(2.209)	(2.737)
FD	-1.4037	-0.0712	-0.3021	-0.0451	0.0013
	(-2.124)	(-0.939)	(-1.630)	(-0.457)	(2.802)
DED_pct	-9.5383	-1.1505	-1.1249	0.0245	-0.0009
	(-4.135)	(-4.847)	(-2.400)	(0.243)	(-2.000)
FD×DED_pct	6.0148	0.9026	0.7087	-0.1781	-0.0010
	(4.650)	(6.077)	(3.936)	(-0.921)	(-1.143)

Table 7 – Study of FD (ADRs)

This table presents difference-in-difference results of FD study. The results are based on quarterly frequency from 1995 to 2005. We present both coefficients and t-statistics. The sample is limited to ADR firms (with share code equal to12, 30 or 31). We fixed both industry (following Kenneth French's scheme) and quarter effect. *PostFD* is a dummy variable which equals to 1 if it is after 2000. 10.23 and equals to 0 otherwise. Z_{it} represents *TRA_pct*, *QIX_pct* and *DED_pct* respectively in Panel A, Panel B and Panel C. *TRA_pct* refers to the amount of shares held by transient institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *QIX_pct* is the amount of shares held by quasi-indexed institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding; *DED_pct* is the amount of shares held by dedicated institutions (defined by Bushee 1998 scheme) that have reported that they held long positions in the security of interest in 13F filings divided by shares outstanding.

$$\mathrm{Liq}_{it} = \alpha_0 + \alpha_1 Post\ FD_{it} + \alpha_2 Z_{it} + \alpha_3 PostFD_{it} * Z_{it} + +\epsilon_t$$

Z_{it}: TRA_pct

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	17.5923	2.0815	0.9956	0.0983	0.0024
	(1.396)	(1.981)	(6.540)	(5.473)	(1.296)
FD	-5.6948	-0.8374	-0.5056	0.0154	0.0028
	(-0.313)	(-0.552)	(-2.300)	(0.593)	(1.045)
TRA_pct	-37.4958	-3.4757	-1.8148	0.0243	0.0196
	(-1.777)	(-1.975)	(-7.116)	(0.807)	(6.318)
FD×TRA_pct	8.2679	0.4496	-0.1429	0.0518	-0.0102
	(0.287)	(0.187)	(-0.410)	(1.261)	(-2.411)

Z_{it}: QIX_pct

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	32.5494	4.6214	1.1804	0.0831	0.0032
	(1.713)	(1.668)	(7.186)	(4.828)	(1.787)
FD	-11.6408	-1.1836	-0.4705	0.0019	0.0032
	(-0.408)	(-0.285)	(-1.910)	(0.073)	(1.216)
QIX_pct	-35.5522	-5.2861	-1.2055	0.0983	0.0021
	(-2.163)	(-2.206)	(-8.486)	(6.603)	(1.350)
FD×QIX_pct	33.2003	4.2302	0.5119	-0.0028	-0.0032
	(1.173)	(1.025)	(2.093)	(-0.110)	(-1.191)

Z_{it}: ***DED_pct***

Parameter	amh	amh_ma	amh_sq	roll	tnov
intercept	1.5811	0.2809	0.4751	0.0997	0.0032
	(1.228)	(1.229)	(5.756)	(5.078)	(3.127)
FD	-0.9795	-0.1460	-0.3059	0.0110	0.0020
	(-0.471)	(-0.395)	(-2.294)	(0.348)	(1.223)
DED_pct	-6.5791	-1.2393	-1.3742	0.0083	0.0058
	(-2.940)	(-3.120)	(-9.581)	(0.244)	(3.240)
FD×DED_pct	7.4069	1.4633	1.3245	0.0543	-0.0033
	(2.317)	(2.579)	(6.465)	(1.114)	(-1.316)

Appendix: Gibbs Sampler

The basic-market-adjusted model is

$$\Delta p_t = c\Delta q_t + \beta r_m + u_t$$

Δp_t: price change

q_t: transaction direction

r_m: market return

c:trading cost

The unknowns are parameters: c, β, σ_u^2 and latent data: $\{q_t\}$. The assumptions are:

$$\begin{bmatrix} c \\ \beta \end{bmatrix} \sim N(\mu^{Post}, \Omega^{\text{Post}})$$

$$\mu^{Post} = Dd;\ \Omega^{\text{Post}} = \text{D}^{-1};\ \text{D}^{-1} = \text{X}'\Omega_\text{u}^{-1}\text{X} + \left(\Omega^{Prior}\right)^{-1};\ d = X'\Omega_\text{u}^{-1}\text{y} + \left(\Omega^{Prior}\right)^{-1}\mu^{Prior};\ X = [\Delta q_t\ \ r_m]$$

$$\frac{1}{\sigma_u^2} \sim \Gamma(a^{Prior}, b^{Prior})$$

Gibbs Sampler estimation process is as follows:

(1) Initialize $c^{[0]}, \beta^{[0]}, \sigma_u^{2[0]}, q_1^{[0]}, \ldots, q_T^{[0]}$;
(2) Draw $c^{[i]}, \beta^{[i]}$ from f {c, $\beta | q_t^{[i-1]},, \sigma_u^{2[i-1]}$} ;
(3) Draw $q_1^{[i]}$ from f $\{q_1 | c^{[i-1]}, \beta^{[i-1]}, \sigma_u^{2[i-1]}, q_2^{[i-1]}, \ldots\}$;
    Draw $q_2^{[i]}$ from f $\{q_2 | c^{[i-1]}, \beta^{[i-1]}, \sigma_u^{2[i-1]}, q_1^{[i]}, q_3^{[i-1]}, \ldots\}$
    ...
(4) Go to step (2) and repeat the process for *n* sweeps