Market Perception of Information Asymmetry: Concentration of Ownership by Different Types of Institutions and Bid-Ask Spread

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Abstract

Total institutional ownership, institutional ownership by type of institution (e.g. banks, insurance companies, mutual funds), and a new measure of ownership concentration (similar to the Herfindahl Index) are used to explain contemporaneous bid-ask spreads for 72 quarters (1983-2000) of NASDAQ-traded stocks. When controlling for a number of commonly-used variables, relative bid-ask spreads are found to be significantly negatively related to the level of institutional ownership and significantly positively related to the concentration of ownership. The results are consistent with expectations of market perception of information asymmetry. The impact of ownership by type of institution and concentration within each type of institution on bid-ask spreads and future returns vary between five major groups of institutional investors. These differences are explained by alternative investment goals and strategies, and by regulatory factors.

Key words: institutional ownership, bid-ask spread, information asymmetry, concentration, NASDAQ.

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Introduction

Institutional investing continues to play an important role in global financial markets. Professional investors and money managers control a significant asset base. Despite an obvious increase in institutional participation in the price development process, the contribution of institutional investors (e.g., mutual funds, pension funds, banks, and insurers) to the liquidity of underlying assets has not received much attention in the financial economics literature. In fact, there are no consensus research findings about the impact of institutional ownership on the liquidity of underlying assets. This study examines the relationship between market microstructure and institutional ownership by analyzing the bid-ask spread on NASDAQ stocks relative to institutional ownership of these securities.

The bid – ask spread is the difference between the best bid and ask prices. "Bid" represents the price that a prospective buyer is willing to pay for a security. "Ask" is the price offered by a prospective seller. Two conflicting forces generated by institutional participation are examined in this study: adverse selection and increased liquidity. The adverse selection hypothesis proposes that high institutional ownership of a security will generate information asymmetry for the security and, therefore increase the security's bid-ask spread. Bid-ask spreads have been shown to widen when market makers face informed traders. Institutions are often considered to be more informed than individuals and generate information asymmetry in the markets. The liquidity hypothesis suggests that increases in institutional ownership will lead to greater liquidity and bid-ask spreads will tend to decrease. Institutional ownership can generate additional liquidity with greater trading volume, an increased number of trades, increased visibility and more analysts following a security. These factors may lead to lower spreads. The magnitude, as well as the net impact, of these two opposite forces, adverse selection and increase liquidity, have not received adequate attention in the financial economics literature.

Previously, institutional investors have been studied as a homogeneous group. Different types of institutional shareholders, however, are likely to have diverse investment goals and strategies and, therefore, alternative trading objectives and patterns. No published research has appeared that addresses the impact of alternative institutional owners upon bid-ask spreads. Separately, analyzing the effects of concentrated ownership may produce valuable contributions to both the market microstructure and ownership literature by identifying differences in magnitudes of the adverse selection and increased liquidity effects generated by various types of institutional owners. This study examines bid-ask spreads in relation to the proportion of total shares held by institutions and in relation to the proportion of total shares held by each of the five major types of institutions: banks, insurance companies, investment companies, independent investment advisors, and "other" (mainly university foundations/endowments).

This paper is organized as follows. First, a discussion of the role of institutional investors is presented. This section is followed by development of testable hypotheses. Then the data analyzed and

methodology are discussed and followed by results. Conclusions are offered in the final section of the paper.

Previous Research

Institutional participation can stimulate investment interest by providing better analysts' coverage and exposure of a security to the investment community, which may lead to increased liquidity and possibly to a narrowed bid-ask spread. Institutions have necessary resources and the ability to select better investment opportunities than do individuals. At the same time, institutions are more efficient in collecting and processing information and may possess an "informational advantage". Such information asymmetry may lead to wider spreads. Consequently, institutional ownership may produce both a positive and a negative effect on the bid-ask spread. However, there is no consensus in the literature about which impact is more significant. Previous research concerning the role of institutional investors is reviewed in this section.

"Smart Money"

Professional investors (institutional investors) are often considered to be more informed than individual investors. That is why institutional investments are often referred to as "smart money". In fact, Sias, Starks and Titman (2001) document price pressure from institutional trades, which creates a positive covariance between changes in institutional ownership and returns. The authors propose that such price pressure results from informational differences.

Institutions prefer to invest their "smart money" in companies with better visibility and transparency of earnings, revenues, and management. Eakins, Stansell, and Wertheim (1998) investigate the relationship between the level of institutional ownership and a number of company characteristics. They provide evidence supporting a hypothesis of institutional concern for the "appearance of their portfolios." Portfolio managers try to avoid extremes in their holdings (i.e., stocks with high or low betas, extreme debt ratios and extreme return on assets). While avoiding extreme risks, institutions select companies with reasonable expected returns.

Healy, Hutton, and Palepu (1999) suggest that increases in disclosure ratings (measured by the amount of disclosed information) are accompanied by increases in stock returns, institutional ownership, the number of analysts following the stock, and liquidity. Furthermore, increases in disclosure provide for better monitoring. Brancato (1990) suggests that institutional investors have become increasingly active since the passage of the Employee Retirement Income Security Act of 1974 (ERISA). This Act fostered a flow of a considerable amount of assets into private pension funds. Being more conservative and strictly governed, pension fund managers are likely to exercise more extensive monitoring to reduce volatility and risk. This Act also made pension fund managers personally liable for violations of fiduciary

standards.

Szewczyk, Tsetsekos, and Varma (1992) examine institutional ownership and equity returns around new equity offering announcements. They argue that information acquisition activities of institutional investors reduce pre-announcement information asymmetries between insiders and capital markets. Therefore, institutional ownership stimulates dissemination of information in the market place.

Institutional participation in ownership and its impact on liquidity and information asymmetry is related to firm size. Large companies may be more attractive to institutions, which are not willing to exercise extensive monitoring. O'Brien and Bhushan (1991) provide evidence of a positive relationship between the number of analysts following the stock, firm beta, and institutional ownership. Smaller companies may be attractive to institutions that engage in monitoring activities. Bennett, Sias, and Starks (2001), for example, show that institutional preferences have shifted towards smaller stocks, where they can achieve more benefits from their informational advantage. Sias, Starks, and Titman (2001) suggest that the investment community infers information from institutional trades, which may explain the price pressure that produces positive returns during quarters with positive changes in institutional ownership. Beard and Sias (1997) provide evidence against the so called "neglected-firm effect'. In other words, stocks with thin analysts' coverage do not provide better returns than those which are widely followed by the investment community. Arbel, et. al. (1983, 1985), however, suggest that holding period returns rise as institutional ownership falls, which is inconsistent with the adverse selection hypothesis and the results of other studies (e.g., Nofsinger and Sias, 1999).

Previous studies provide inconsistent results about the relationship between institutional ownership and stock characteristics. Badrinnath, Gay and Kale (1989) offer evidence that institutional investors are "looking for a safe harbor." They are concerned that their investment behavior be considered "prudent." Del Guercio (1996) finds that banks invest in more "prudent companies" than mutual funds. Badrinnath, Gay and Kale (1989) also find that institutional ownership is "positively related to firm size, negatively related to return volatility, positively related to the firm's beta, positively related to trading liquidity, and positively related to the number of years listed on the exchange" (p. 605).

Benston and Hagerman (1974) report that spreads for NYSE stocks are positively correlated with price, unsystematic risk and institutional ownership; and negatively correlated with the number of shareholders and the number of market makers. It should be noted that absolute spreads rather than relative spreads were used in this study and that spreads tend to be larger for higher-priced stocks.

Bid-Ask Spread

Liquidity, marketability, and trading costs are among the primary attributes of many investment plans and financial instruments. Portfolio managers and investment consultants tailor portfolios to fit their clients' investment horizons and liquidity objectives.

The average of the bid and ask prices is often used to estimate a "fair" market value of the asset at the time of the quote. The quoted ask price includes a premium for immediate buying and the bid price similarly indicates a concession required for immediate sale. That is why the bid-ask spread can be considered a measure of liquidity, which is the sum of a buying premium and selling concession.

Demsetz (1968) was the first to relate the spread to the cost of a transaction. Garbade (1982) and Stoll (1985) showed that the relative bid-ask spread of a stock correlates negatively with its liquidity characteristics, such as trading volume, the number of shareholders and the number of market makers trading the stock. Hasbrouck (1991) suggests that spreads arise solely from the need of dealers to cover the direct costs of transactions. He goes further to claim that dealers set their bid and ask quotes symmetrically around the fair value.

Callahan, Lee, and Yohn (1997) identify three types of costs influencing the spread: order-processing costs, inventory holding costs, and adverse selection (information asymmetry) costs. These types of costs have also been discussed by Stoll (1978), Amihud and Mendelson (1980), and Copeland and Galai (1983). In the same study, Callahan, Lee, and Yohn claim that wider spreads are associated with greater institutional ownership, which is consistent with the hypothesis that the risk of trading with an informed trader is greater for firms with high institutional ownership.

Stoll (1978) uses price per share, trading volume, variability of returns, and other dealer characteristics as predictor variables for the bid-ask spread. The bid-ask spread is determined primarily by dealers' holding costs, competition, and risks. He explains that informed trading and volatility are the main factors influencing dealers' risk. Stoll (1978) finds that relative spreads are negatively related to price and positively related to risk and variance. Decreasing per-share holding and transaction costs and high absolute prices reduce dealers' costs and produce a negative effect on absolute spreads. At the same time, high prices inflate the total value of 100-share lots and, as a result, decrease the average number of shares per trade, increasing the total number of trades. In that respect, high share prices generate a positive impact on bid-ask spreads. Most research provides evidence that high prices lead to lower relative spreads.

It has been shown by some researchers that a price change by itself causes a change in the bid-ask spread. Copeland (1979) and Conroy et al. (1990) suggest that stock splits increase relative bid-ask spreads and return volatility. Ohlson and Penman (1985) provide evidence that the volatility of returns and relative spreads increase after stock splits. Conroy et al. (1990) report that relative spreads increase for NYSE-traded stocks after stock splits. The authors suggest such increases represent a liquidity cost of stock splits and partly explain the volatility of returns after splits.

Previous research documents a consistent positive relationship between return volatility and bid-ask spread (e.i., Benston and Hagerman (1974), Barea and Logue (1975), Stoll (1978), Hamilton (1978), Chiang and Venkatesh (1988), Kini and Mian (1995), Kothare and Laux (1995), Jennings, Schnatterly,

and Seguin (2001)). Substantial price swings may require market makers to keep larger inventory on hand and therefore may increase dealer's holding costs. If price volatility is caused by trades initiated by large institutions, which are often perceived as informed investors, then dealers may face additional information asymmetry risk. In fact, Sias (1996) documented a positive relationship between return volatility and institutional ownership. Hence, a control for the standard deviation of returns would be necessary for a study focusing on bid-ask spread and ownership structure. This study employs the standard deviation of daily returns computed over each quarter as a control variable.

Hasbrouck (1991) notes that the bid-ask spread is one of the most often used measures of liquidity because it can be easily obtained and interpreted. One of the arguments against employing bid-ask spreads to measure liquidity is that the posted prices are relevant only for small orders. Large trades that occur both inside and outside of the posted quotes may not be reflected in the bid-ask spread. Even if the quoted bid and ask depth is rather small, it is indicative of the overall supply and demand around the best-quoted prices. One can argue that with lower spreads, large trades will deviate less from the fair value price (an average of the bid and ask quotes). At the same time, if the best-quoted bid and ask prices are too far apart, then the next best offer will be even further away from the bid and ask average. While the above argument is certainly worth investigating, bid-ask spreads still provide valuable information about the ability of both small and large investors to execute their orders at more favorable prices.

Table 1 summarizes previous literature on the relationship between the bid-ask spread and other, mainly liquidity-related, characteristics.

Volume

One of the important liquidity-related characteristics of securities is trading volume. Most research suggests that higher volume leads to a lower bid-ask spread. This hypothesis is based on the idea that per-share order processing costs and holding costs are lower for high volume stocks. This assumption ignores the fact that higher volume securities are likely to have more market makers. Additionally, lower priced stocks are likely to have higher trading volume. At the same time, low priced stocks have relatively larger bid-ask spreads. Easley, Kiefer, O'Hara, and Paperman (1996) provide empirical evidence for a sample of NYSE-listed stocks that supports the hypothesis that the probability of informed trading is lower for high volume stocks. However, volume should be used with other variables, controlling for average trade size, number of trades, and number of market makers.

Tkac (1999) examines excess turnover versus a benchmark (security specific average trading volume adjusted for market-wide volume measures) and concludes that excess turnover is positively related to institutional ownership and negatively related to firm size.

The research findings on spreads, volume and other liquidity-related characteristics are highly inconsistent. Demsetz (1968), Tinic (1972), Tinic and West (1972), and Hamilton (1978) found that

spreads are positively correlated with price. Branch and Freed (1977) and Stoll (1978) document that spreads are negatively related to price. Demsetz (1968), Tinic (1972), Tinic and West (1972), Branch and Freed (1977), and Stoll (1978) found a negative relationship between bid-ask spreads and trading volume. Tinic (1972), Hamilton (1978), Barnea and Logue (1975), report that spreads are negatively related to institutional ownership. Barnea and Logue (1975) and Stoll (1978) found that spreads are positively related to price variance. Hamilton (1978), however, also found that spreads are positively related to price and volatility, and negatively related to the number of shareholders and institutional ownership. Stoll (1978) reports that spreads are also negatively related to the number of dealers in the security.

What is more important for investors is the fact that they cannot benefit directly from the high volume *per se*. An increase in volume should lead to better execution prices. If it does, then this effect will be reflected in a lower bid-ask spread.

Concentration

Institutional ownership should also be examined in terms of concentration of shares owned by the largest shareholders. Securities with highly-concentrated ownership are likely to exhibit different characteristics than are securities with dispersed ownership. Gompers and Metrick (2001) argue that higher concentration contributes to higher liquidity and "increased frequency of large shareholder activism." Heflin and Shaw (2000), on the other hand, show that firms with a greater percentage of shares owned by blockholders have lower liquidity expressed in larger quoted spreads, larger effective spreads, larger adverse selection components of spreads, and less quote depth.

Bhide (1993) and Roe (1994) suggest that greater liquidity reduces the desire of large shareholders to pursue active monitoring of the company's management and, therefore, reduces large shareholders' desire to accumulate large blocks of stock. Bhide argues that greater liquidity provides for a less costly exit by large shareholders and reduces their incentives to monitor. At the same time, Maug (1998) provides a model in which liquidity is positively related to concentrated ownership. He argues that greater liquidity allows for accumulating large blocks of shares based on private information without revealing this information. Thus there appears to be no consensus in the literature regarding the effects of concentration of ownership on liquidity.

Most researchers examining concentration of ownership in equity studies use the percentage of shares held by the five largest shareholders as the measure of concentration. This study employs a different measure as a proxy for concentration – the Herfindahl Index. This index provides researchers with a tool to account for each institutional holding individually (e.g., each pension fund) and the size of each holding. The Herfindahl Index can provide a better picture of the true levels of concentration in institutional ownership of a particular company. Consider two companies. At Company A, 75% of all shares outstanding are held by institution X, the rest of the shares (25%) are dispersed between small

institutional and individual investors. At Company B, the top five owners each own 15% of the shares, the rest of the shares (25%) are dispersed between small institutional and individual investors. If "percent of holdings owned by the top five shareholders" is used as a proxy for concentration, then the ownership structure of Company A and Company B will be misrepresented. Both companies have almost the same percentage of shares held by the top five shareholders (Company A has a slightly higher percentage of shares held by top five shareholders, than company B). Company A, however, has 75% of its shares controlled by a single owner. The Herfindahl Index accounts for every institutional owner and distinguishes between companies with different concentrations of ownership.

The Herfindahl Index, which is often referred to in the financial literature as "Focus," has been employed to measure the level of focus of firms' businesses. For example, Comment and Jarrell (1995) used the Herfindahl Index to measure the relationship between a firm's focus, or specialization, and stock returns. Woerheide and Persson (1993) evaluated different measures of diversification of securities portfolios. They conclude that the Herfindahl Index was the best of the five measures of diversification considered, as it provided the highest explanatory power.

Performance, Preferences and Herding

Having access to alternative sources and different types of information, institutional investors can identify and choose securities that meet their preferences and goals. Falkenstein (1996) shows that mutual funds have a significant preference toward stocks with high visibility of earnings and low transaction costs. Falkenstein's results show a positive relationship between the standard deviation of returns and ownership by mutual funds, but a negative relationship between mutual fund ownership and variance of security returns. Falkenstein's findings suggest that mutual fund managers either prefer volatile stocks to achieve better returns relative to major market indices, or they believe in their ability to select "better stocks" which can provide abnormal returns with low systematic risk.

Bogle and Twardowski (1980) found that mutual funds have consistently earned higher returns than other types of institutional investors except for the period of a major bear market in 1970-1974, when their performance was almost identical to that of the other three categories of institutional investors. The authors also showed that pension funds failed to yield returns higher than mutual funds for any time frame during the period of study. In the same vein, Lakonishok, Shleifer and Vishny (1992) and Del Guercio (1996) suggest that bank and pension fund managers' preference toward "glamour stocks" may explain the difference of their portfolio performance relative to that of mutual funds.

According to Falkenstein (1996), Morningstar Investment Survey shows that in December 1992, 37.5 percent of mutual funds stated "growth" as their investment objective. Additionally, 28.7 percent of the funds were growth-income funds and 2.5 percent were aggressive growth funds. Aggressive growth, growth, and growth-income funds represent 68.5 percent of all mutual funds. Only 4.9 percent of the

funds reported their objective as equity-income and 3.3 percent called themselves balanced funds. These data suggests that most mutual funds are rather aggressive in their investment strategies.

Mutual funds and independent investment advisors are likely to differ from other three types of institutions in their trading patterns and investment styles. Their ownership may, therefore, result in different perception of information asymmetry and various impacts on liquidity. Del Guercio (1996) shows that unlike mutual funds, both bank trusts and bank managed pension funds prefer that their investments be considered by courts to be "prudent." She proposes that these differences may explain relative underperformance by bank trusts and bank pension funds. Lakonishok, Shleifer and Vishny (1992) provide evidence in support of the hypothesis that pension fund managers do not pursue potentially destabilizing herding and positive-feedback trading practices. Mutual fund managers may be pressured by their incentives (i.e., Sirri and Tufano, 1993) and may be less bound by fiduciary limitations on their investment portfolios, and therefore might tend to undertake riskier and/or momentum investment strategies to improve relative performance. It has been shown by Grinblatt, Titman, and Wermers (1995) that mutual funds tend to purchase stocks based on their past returns. In fact, the authors report that 77 percent of mutual funds have been found to be momentum traders. If mutual fund managers rely mostly on widely available public information and are less likely to exercise additional thorough monitoring than other types of institutional investors (e.g., index fund managers), their contribution to information asymmetry may be the least significant.

Mutual fund managers' preferences towards higher volatility stocks (Falkenstein, 1996) may suggest that they are more likely to trade out of their positions during down markets and reacquire their investments when the market turns - it is easy to outperform a down market by being less than fully invested, but managers may be punished for missing a major upturn. If market participants believe that some trading by mutual funds is not based on information asymmetry, but is rather caused by the positive feedback trading, herding, market timing or asset allocation, then such trading may generate additional liquidity without creating a perception of information asymmetry. If most of the market makers do not consider such institutions as informed investors, then they are not likely to increase their spreads even if an institution is in fact an informed investor. Thus, mutual fund participation may increase market liquidity without additional risk for the market maker, thereby decreasing spreads.

Chevalier and Ellison (1997) show that the riskiness of mutual fund individual holdings depends on the performance incentives for managers and on the fund's year-to-date returns. The authors provide evidence that supports a hypothesis that mutual fund managers alter the riskiness of their portfolios at the end of the year and these portfolio changes can be explained by performance incentives and year-to-date performance. Performance pressure may encourage mutual funds to follow trends in the market. Market timing could force mutual fund managers to reduce or eliminate long positions during periods of negative returns and to increase their overall holdings in a bull market. Consequently, mutual fund managers are

likely to be less involved in monitoring their long-term investments than other types of large blockholders. In fact, Falkenstein (1996) shows that equity mutual fund managers prefer stocks with more public information as measured by the number of newspaper articles mentioning the companies.

Unclassified institutional investors, which are grouped together with endowments in the CDA Spectrum database, differ from all other types of institutional owners. According to Bhide (2000) nonfinancial corporations acquire large positions in other companies mainly for the purposes of business alliances, joint ventures, and takeovers. Obviously, nonfinancial corporations and other institutional owners will have different effects on liquidity. They are more likely to possess an information advantage and to trade less frequently than other institutions, especially mutual funds.

Herding behavior or trend following by institutions has been examined in a number of studies (i.e., Lakonishok, Shleifer, and Vishny (1991, 1992), Grinblatt, Titman, and Wermers (1995), Nofsinger and Sias (1999)). Herding refers to any mass buying or selling of a particular asset. Trend following is a specific form of herding, when a particular asset, which has recently risen in price, is "chased" or bid-up by institutions. Lakonishok, Shleifer, and Vishny (1992) suggest that pension fund managers do not strongly pursue these "potentially destabilizing practices."

It should be noted that a high level of institutional trading might be associated with greater volatility (e.g., Seely, 1985). Potter (1992) argues that there is positive correlation between price volatility and institutional ownership around earnings announcements. If institutional ownership has an impact on volatility, then such a relationship would be particularly evident during periods of herding. Sias (1996) documents a positive relationship between institutional ownership and volatility of returns. He presents results that support a hypothesis that an increase in institutional holdings results in greater volatility.

Herding is likely to increase the liquidity and volatility of underlying assets. Schulman (1992) shows that a "dramatic reduction in institutional commission costs" has led to substantial growth in both the number and size of institutional trades. The impact of institutional trading can lead to higher or lower liquidity and may result in wider or narrower spreads.

Because various types of institutions have alternative reasons for being in the market, diverse trading and investment strategies, and a range of preferences toward their portfolios and the individual securities comprising them, they have different impacts on information asymmetry, returns, and liquidity. It is important to separate institutional owners by type of institutions in order to identify these impacts for each type of institutions. Such differences, which have been largely overlooked in financial literature, may present valuable information for academia and investors.

Fiduciary Responsibilities, Regulations and Prudence

Del Guercio also shows that both bank trusts and bank managed pension funds tilt their portfolios

towards high quality or "prudent" stocks. Additionally, Lakonishok, Shleifer and Vishny (1992) show that pension fund managers do not strongly pursue potentially destabilizing practices of herding or positive feedback trading. This is another evidence that all institutions are not the same.

All institutional investors are responsible for their investment decisions. Endowment managers generally are not rewarded for good returns, but are penalized for bad performance. Mutual funds are the most diverse of all types of institutions and, at the same time, appear to be the least restricted group of institutional investors. All mutual funds (growth, value, balanced, international, sector) are governed by the SEC in accordance with the Investment Company Act of 1940, which makes no reference to "prudent investments." Longstreth (1986) shows that 63 percent of bank investment managers reported that law precluded investment opportunities that they would have otherwise pursued. The American Bankers Association's "Model Prudent Man Investment Act" and the American Law Institute's "Restatement of Trusts," preclude investment in "speculative shares of stock," "new and untried enterprises," "unseasoned securities," and margin trading (Scott, 1959).

In addition to the general "prudent man" rules, each group of institutional investors is governed by additional rules pertaining to that particular type of institution. Insurance companies, for example, are regulated by state legislatures, state insurance commissioners and state insurance departments. Private pension plans are governed by the Employee Retirement Security Act (ERISA) and subsequent pension legislation. Passed in 1974, ERISA is believed to be one of the primary causes for the growth of private pension fund investments.

According to ERISA, private pension plan managers are personally liable for breaches of fiduciary responsibility. Krikorian (1989) states that public pension plan managers are liable to the same degree as bank trust managers, they are also legally constrained in their investment strategies and trading patterns. Lakonishok, Shleifer, Thaler, and Vishny (1991) show that pension funds invest mostly in large capitalization stocks: the bottom 50 percent of stocks in terms of size represent only 1.4 percent of pension funds' equity holdings. Monitoring large companies is much easier and less costly than monitoring small companies. Being constrained to "prudent investments" and being liable for their decisions; banks, pension funds and insurance companies exercise more caution and are more motivated to monitor their investments. Such monitoring may lead to information asymmetry between "constrained managers" and other market participants.

While several researches have tried to examine the relationship between bid-ask spreads and institutional ownership (i.e., Kini and Mian (1995), and Jennings, Schnatterly, and Seguin (2001)), none of the studies have employed a sample of cross-sectional and/or time-series observations as broad as the sample used for this study. Furthermore, no institutional ownership study has used the Herfindahl index to measure the level of institutional concentration of ownership. This study provides a comprehensive investigation of institutional ownership, its structure, returns, and bid-ask spreads on NASDAQ stocks,

while controlling for other liquidity-related variables, such as number of market makers, trading volume, price, number of trades, and number of shares outstanding.

Hypotheses Development

There are arguments and evidence for both a positive and a negative relationship between institutional ownership and the magnitude of the bid-ask spread. If institutional ownership generates information asymmetry, then spreads become wider and improve the dealers' risk-reward ratio. If institutional presence improves information dissemination and generates additional interest in a security, then spreads should be lower. Sias and Starks (1997) provide evidence that institutional trading is based on information and stimulates the speed of adjustment to that information.

This study suggests that with control for concentration of ownership, additional liquidity provided by dispersed institutional owners has stronger effects on lowering spreads than the effects of information asymmetry has on widening spreads. The net impact of institutional participation on liquidity depends on the extent to which institutions are informed. Concentrated ownership allows for more information asymmetry. Therefore, the effects of concentrated ownership on spreads will be negatively correlated with the effects of overall institutional ownership. Concentrated ownership is likely to widen spreads, while high institutional and dispersed ownership will provide more liquidity and thereby will lower the corresponding spreads.

The above arguments motivate the first hypothesis to be tested in this study:

Hypothesis #1: The percentage of shares of NASDAQ-traded common stocks held by institutional owners is negatively related to the relative bid-ask spread of these stocks. (The coefficients of the proportion of total institutional ownership (TIO) in regressions of spread on different predictor variables will be negative.

This hypothesis is based on the argument that institutional participation stimulates information dissemination and increases interest in the underlying security. Additional interest in the stock is likely to generate extra trading volume, attract additional investors and may eventually lead to an increase in the number of market makers. In order to differentiate between impacts of institutional and individual trades and to account for a per-share component of market makers' costs, the number of trades and trading volume measures are used as separate predictor variables (i.e., Jones, Kaul, and Lipson (1993)). The research question addressed by the first hypothesis was approached in some of the existing literature, however, it has not been investigated while controlling for the level of concentration of ownership.

It can be expected that alternative types of institutional owners may have different impacts on liquidity. Pension funds, endowments and bank trust managers, for example, are likely to exercise more

monitoring of the "prudence" of their investments which they own for longer periods and trade less often. Mutual fund managers, on the contrary, tend to trade more often, trying to improve their relative returns. Bennett, Sias, and Starks (2001) document that average correlation between turnover (monthly trading volume to number of shares outstanding) and ownership by banks is almost five times smaller than the correlation between turnover and shares held by independent investment advisors, three and a half times smaller than the correlation between turnover and mutual fund ownership and 50 percent less than correlation with insurance companies and other institutional investors.

The fifth category of institutional investors is unclassified "others" and comprised mostly of university and foundation endowments. As discussed above, endowments pursue less risky investment strategies than mutual funds.

Brown (1999) provides evidence that university endowments exhibit considerably less variance of returns than major market indices. While Brown documents considerable variation in performance and holdings across the range of university endowment funds, he shows that most endowments are similar in that they undertake considerably lower amounts of risk. The high risk aversion of endowment managers can be explained by agency costs, and the nature of university obligations. Universities have lower tolerance for variations in performance and university trustees are not financially motivated to improve endowment returns. Poor performance of an endowment portfolio, on the other hand, may lead to significant problems for endowment managers, which comprise the majority of the fifth category of the institutional investors. Participation of these types of investors is likely to have a negative impact on liquidity due to information asymmetry. To separate the effects of different types of owners, we should analyze ownership by type of institution.

As discussed above, mutual funds and independent investment advisors are likely to trade more often and exercise less monitoring. As a consequence, they might provide greater liquidity and less information asymmetry than banks, insurance companies, and other institutions. These arguments provide the foundation for the test of the following hypothesis:

Hypothesis #2: The effect of the percentage of ownership by investment companies and independent investment advisors (categories 3 and 4 of institutional investors) on bid-ask spreads of NASDAQ-traded stocks will be negative and more significant than the effect produced by banks, insurance companies, and other types of owners (categories 1, 2, and 5 of institutional owners).

Monitoring by larger institutional shareholders may stimulate accumulation of asymmetric information, which may translate into wider spreads. Institutions with smaller holdings, however, may rely more on public information and, therefore, their trading may not lead to wider spreads, but may

increase liquidity of the underlying asset. Falkenstein (1996) argues that institutions behave "less like insiders and more like general public" in their trading patterns. Mutual funds rely mostly on publicly available information and represent less information asymmetry risk for market-makers. Pension funds, on the other hand, are likely to monitor more closely, participate in corporate governance and intervene. The degree of their shareholder activism can be explained by alternative investment strategies (i.e., Del Guercio and Hawkins (1999)). Separating different types of institutional investors in regression models and measuring the level of their concentration may provide a better explanation of bid-ask spreads.

Bennett, Sias, and Starks (2001) suggest that over time, institutional investors have changed their preferences toward smaller and more risky securities, where they can receive more benefits from their informational advantage. Therefore, institutional trading in large companies with extensive analyst coverage contains less information asymmetry. In fact, the small-firm effect may actually be an asymmetric-information effect if small stock prices contain discounts for the information asymmetry risk and relatively lower liquidity.

Considerations discussed above suggest that it is necessary to control for concentration of institutional ownership when examining bid-ask spreads. While high institutional ownership with holdings widely dispersed may decrease the bid-ask spread, concentrated ownership tends to widen the bid-ask spread. Concentrated institutions have more incentives and resources to use in monitoring activities.

While institutions are believed to prefer companies with better visibility and fundamentals, some investment managers are more conservative than others. Pension fund managers, for example, may prefer long-term investment horizons and may invest prudently to avoid violating provisions of ERISA. Mutual fund managers may tend to capitalize on short-term trading profits. Institutions with concentrated positions (blockholders or parent companies) are limited in their ability to liquidate their positions in a timely manner and are more likely to monitor and to intervene into company management if necessary. Such concentrated owners may possess an information advantage and will contribute to information asymmetry in the marketplace. Information asymmetry may force market makers to hedge their risks by widening the spread between bid and ask prices.

The above arguments support the introduction of a measure of concentration (the Herfindahl Index) in the study and are the basis for the third testable hypothesis:

Hypothesis #3: The level of concentration of institutional ownership in NASDAQ-traded common stocks is positively related to the relative bid-ask spread of these stocks. (The coefficients of HST (the Herfindahl Index) in regressions of spread on different predictor variables will be positive.

The third hypothesis is based on the argument that owners with larger positions may be more informed and therefore, information asymmetry may be present in the market for the underlying security. In fact, Chiang and Venkatesh (1988) conclude that dealers do not consider institutions to be informed traders. According to Bhide (1993) active stockholders reduce agency costs by providing internal monitoring, but at the same time, reduce stock liquidity by stimulating information asymmetry. Bhide goes further to argue that higher liquidity "discourages internal monitoring by reducing the costs of "exit" of unhappy stockholders." These arguments suggest that stocks with concentrated positions will have more information asymmetry and less liquidity.

As discussed earlier, concentration of ownership by different types of institutions is likely to have various impacts on bid-ask spreads.

Hypothesis #4: The effect of the concentration of ownership by investment companies and independent investment advisors (categories 3 and 4 of institutional investors) on bid-ask spreads of NASDAQ-traded stocks will be positive and more significant than the effect produced by banks, insurance companies, and other types of owners (categories 1, 2, and 5 of institutional owners).

The second and fourth hypotheses are based on the arguments that mutual fund managers trade more often, chasing better relative returns, while exercising less monitoring of the quality of their investments than other participants. Being restricted by their investment guidelines, goals and regulations; banks, insurance companies, endowment and pension fund managers will exercise more monitoring and trade less actively. Therefore, their positive impact on liquidity will be less pronounced due to less frequent trading and is likely to be offset by the negative impact of information asymmetry.

A restricted institutional investor (e.g., bank trust, pension fund, insurance company or foundation) has to rely on publicly available information to "justify the prudence" of their investments. An accumulation of a large position by an unrestricted investor (e.g., mutual fund or independent investment advisor) on the other hand, may signal that an institution possesses some information advantage. Mutual fund investments are less likely to be made for prudence considerations only, but would rather be based on the institutional belief that a security is underpriced. With less oversight from regulators and clientele, mutual funds and independent investment advisors do not have to reveal the sources of their information and therefore may capitalize on an information advantage. Therefore, concentration of ownership by mutual funds and independent investment advisors is a more robust signal of information asymmetry, than that of banks, insurance companies and foundations.

Trades of informed investors should contribute to information asymmetry and therefore may widen spreads. Trades of uninformed investors should contribute to liquidity without additional

information asymmetry. Separating volume generated by owners with large positions from volume generated by minor institutional owners and volume generated by individual investors may yield additional information about information asymmetry.

Institutional owners are first sorted in two groups. A group of "large" owners consists of institutions with positions of at least one percent of the shares outstanding. A group of "small" institutional owners is comprised of the rest of the institutions. Using one percent instead of the usual five percent allows for inclusion of those institutions which may be avoiding costly reporting requirements and do not want to be identified as blockholders.

Net change in shares owned is calculated for each institution and the absolute value of the change in shares held is added for each of the institutional groups. The difference between total volume for the quarter and volume of large institutional owners, Vol_{large}, and smaller institutional owners, Vol_{small}, is used as a proxy for the trading volume generated by individuals, Vol_{ind}. Individual volume, Vol_{ind}, also captures volume which is offset by buying and selling by the reporting institution within the reported quarter. This separation is possible because NASDAQ volume was double counted until 2001.

Three volume variables will be included in regressions instead of an average volume variable. The total trading volume is included in separate regression estimates.

Hypothesis #5: Trading volume generated by institutions with small positions (less than one percent of shares outstanding), and individual trading volume are negatively related to the relative bid-ask spread of NASDAQ-traded stocks, when controlled for institutional ownership. (Coefficients of Vol_{Small}, Vol_{Ind} in regressions of spread on different predictor variables will be negative.)

Hypothesis #6: The more trading by institutions with large positions (>1%) the wider the spread of NASDAQ-traded stocks, when controlled for institutional ownership. (Coefficients of Vol_{Large} in regressions of spread on different predictor variables will be positive.)

Data and Methodology

Data

The CDA Spectrum database of 13F filings was obtained from Thomson Financial (previously CDA Investment Technologies), a part of Thomson Corporation. 13F Reports are filed quarterly by institutions with a discretional control of at least $100MM for positions of more than $200,000 or 10,000 shares in each security. The number of shares held by each institution is reported for each security. Institution type is identified as: (1) banks; (2) insurance companies; (3) investment companies and their

managers; (4) independent investment advisors; and (5) others (which consists primarily of universities and foundations endowments).

During the period covered in this study (1983 to 2000), the total number of institutional entities increased by more than 150%. In 1983, 638 institutions reported their holdings. By the end of 1997, 1,598 entities filed Form 13F. 2,057 institutional investors reported their holdings in the fourth quarter of 2000. Almost all of the groups of institutions experienced growth during the period, with the exception of banks. The number of banks represented in the sample decreased from 236 to 192 between 1983 and 1997. This decline can be explained by mergers and consolidation in the banking industry. Banks' equity investments can be expected to grow in light of the legislation enacted in 1999 easing regulation of bank investment activities. The number of institutional managers classified as independent investment advisors skyrocketed during the same period. In 1997, there were almost six times more independent investment advisors than there were in 1983 (1,128 vs. 195). Because institutions are likely to avoid holding more than 5% of the total shares outstanding due to costly reporting requirements, institutional ownership of small capitalization stocks may be under - reported in the CDA Spectrum database of 13F filings.

The CRSP tapes provide closing bid-ask spreads for NASDAQ traded stocks. Average spread provides a more accurate representation of real spreads during the quarter. The average spread is a simple arithmetic average of all daily closing spreads during the quarter.

Closing spreads on NASDAQ stocks can serve as good proxies for average intraday spreads. The behavior of NASDAQ spreads is different from NYSE spreads that have been shown to behave in a U-shaped intraday pattern (e.g., Wei (1992), Chung, Van Neese, Van Neese (1999)). Chan, Christie, and Schultz (1995) found that NASDAQ spreads, unlike NYSE spreads, do not widen near the close of the market. On the contrary, they are rather stable throughout the day and narrow at the close. McInish and Wood (1992) provide evidence that NASDAQ spreads behave in a reverse J-shape pattern: spreads are wide at the beginning of the day, gradually narrowing through the day and slightly widening at the close. In either case, all of the above authors document that closing spreads for NASDAQ stocks are not significantly different from the average intraday spreads.

Seventy-two quarters of recorded ownership data were employed in the study starting with March 1983 and ending in December 2000. The first quarter of 1983 contains information for 4,639 securities. A total of 2,344 (50%) of these securities are NASDAQ stocks. The last quarter of 1997 contains data for 10,720 securities, with 7,124 of these being NASDAQ stocks (66.5%).

The number of shares outstanding is provided both in the CDA-Spectrum and CRSP database. Price is identified as the average of the bid and ask prices. Average trading volume, number of market makers, and number of trades are provided by CRSP as well.

Market microstructure literature identifies four major components of the bid-ask spread: order processing costs, dealers' holding costs, information asymmetry risk premium, and level of dealers'

competition (i.e., Stoll (1978), Amihud and Mendelson (1980), Copeland and Galai (1983)). The order processing component of the bid-ask spread can be captured by number of trades, trading volume, and share price. Number of market makers is a direct measure of the degree of dealer's competition. The Herfindahl Index, a measure of concentration of ownership, represents a proxy for information asymmetry risk along with trading volume and number of trades.

Methodology

Closing daily bid and ask prices are obtained from the CRSP database. The daily relative spread is computed for each asset. The daily spread, S, for security j is defined as:

$$S_{jq} = 2^* \text{ (Ask Price – Bid Price) / (Ask Price + Bid Price)} \quad (1)$$

To obtain a better estimate of the relative spread, an average spread is computed for each asset for each quarter.

$$S_{jq} = \frac{\sum_{d=1}^{d=n} S_{jd}}{n} \quad (2)$$

where:

n is the number of observations (days with a recorded price) in a quarter, q.

The number of shares outstanding, volume, number of market makers, and number of trades are obtained from the CRSP tapes.

Daily price is an average of the daily bid and ask prices for each security.

$$P_{jd} = \frac{\text{closing ask} + \text{closing bid}}{2} \quad (3)$$

An average quarterly price is computed by averaging daily prices.

$$P_{jq} = \frac{\sum_{d=1}^{d=n} P_{jd}}{n} \quad (4),$$

where:

n is the number of recorded closing prices in a quarter, q.

Daily number of trades (NumTrades) is obtained from the CRSP database and averaged through the quarter. Total quarterly trading volume is also obtained from CRSP. Kothare and Laux (1995) used average trade size to measure the impact of large trades on spreads. McInish and Wood (1992) found that number of trades and number of shares per trade are significantly negatively related to relative spreads.

Number of trades and volume provide better explanatory power than average trade size. In this study we employ number of trades along with control for volume to separate the effects of overall volume from different sizes of trades. Stoll (1978) used the ratio of volume to the total number of shares outstanding to estimate the effect of informed trading. This approach, however, will not provide a proxy for a per share component of dealer costs. Also, with quarterly data volume spikes will be diluted by other trading days during the quarter. Used along with volume, number of trades will serve to clarify the effect of the trades placed by large shareholders.

Total trading volume is decomposed into three variables. VolLarge – volume generated by institutions with large positions (one percent or more of shares outstanding), is calculated by adding the absolute values of quarterly change in holdings of each institutional owner with positions of one percent of shares outstanding or greater. VolSmall – volume generated by institutions with relatively small positions (less than one percent of shares outstanding) - is calculated by adding the absolute values of quarterly change in holdings of each institutional owner with positions of less than one percent of shares outstanding. VolInd – is the difference between total quarterly trading volume in security and VolLarge and VolSmall. VolInd captures volume generated by individuals and institutions which do not pass the reporting benchmarks and offsetting institutional trades. Volume variables are more volatile than turnover (or relative volume), but they are employed in the estimations of spread to capture a per share component of dealers' costs and risk[2].

The proportion of total institutional ownership (TIO_{jt}) can be calculated by dividing the total institutional ownership of shares by the total number of shares outstanding for each stock j, and each quarter t.

$$TIO_{jq} = \frac{\sum_{m=1}^{m=k} IO_{jmq}}{\#Shares_{jq}} \qquad (5),$$

where:

IO_{jmq} is the number of shares of company j held by institution m at the end of quarter q,

k is the total number of institutional owners of asset j, and

$\#Shares_{jq}$ is the number of shares outstanding of security j at the end of quarter q.

Institutional ownership by type of institution is the proportion of shares held be each of the five institutional owners.

[2] Consider two securities with identical turnover variables and prices. Security A has 1,000,000 shares outstanding, security B has 1,000 share outstanding. Using only a turnover variable will mask the market makers' per share

The percentage of the company owned by banks, the first institutional group, $Banks_{jq}$, is:

$$Banks_{jq} = \frac{\sum_{m=1}^{m=k_1} IO_{banksjmq}}{\#Shares_{jq}} \quad (6),$$

where k_1 is the number of banks with positions in security j.

The percentage of the company owned by insurance companies, Ins_{jq}, is:

$$Ins_{jq} = \frac{\sum_{m=1}^{m=k_2} IO_{insjmq}}{\#Shares_{jq}} \quad (7),$$

where k_2 is the number of insurance companies with positions in security j.

The percentage of the company owned by investment companies, Inv_{jq}, is:

$$Inv_{jq} = \frac{\sum_{m=1}^{m=k_3} IO_{invjmq}}{\#Shares_{jq}} \quad (8),$$

where k_3 is the number of investment companies with positions in security j.

The percentage of the company owned by independent investment advisors, $Indj_q$, is:

$$Ind_{jq} = \frac{\sum_{m=1}^{m=k_4} IO_{indjmq}}{\#Shares_{jq}} \quad (9),$$

where k_4 is the number of independent investment advisors with positions in security j.

The percentage of the company owned by other institutional owners (e.g., university and foundation endowments), $Other_{jq}$, is:

$$Other_{jq} = \frac{\sum_{m=1}^{m=k_5} IO_{otherjmq}}{\#Shares_{jq}} \quad (10),$$

where k_5 is the number of other institutional owners (primarily university endowments) with positions in security j.

The Herfindahl Index based on the number of institutional owners and their respective holdings,

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costs. In case of security A, per share trading costs are spread over 1,000 times more shares – a clear economy of scale for the market maker.

$HST_{jq,}$ is calculated across five types of owners for the j's security as the sum of the squares of each owner i's number of shares as a proportion of total shares outstanding:

$$HST_{jq} = \sum_{i=1}^{n} (S_{ijq} /\#shares)^2 , \tag{11}$$

where S_{ij} represents the number of shares of security j owned by institutional investor i.

The Herfindahl Index based on the number of shares held by each type of institution:

$$HS_{banksjq} = \sum_{i=1}^{n} (S_{ibanksjq} /\#shares)^2 \tag{12}$$

$$HS_{Insjq} = \sum_{i=1}^{n} (S_{iInsjq} /\#shares)^2 \tag{13}$$

$$HS_{Invjq} = \sum_{i=1}^{n} (S_{iInvjq} /\#shares)^2 \tag{14}$$

$$HS_{Indjq} = \sum_{i=1}^{n} (S_{iIndjq} /\#shares)^2 \tag{15}$$

$$HS_{Othersjq} = \sum_{i=1}^{n} (S_{iOthersjq} /\#shares)^2 \tag{16}$$

Finance literature proposes OLS regression as the most appropriate format for this study.[3] Most of the studies of the components of bid-ask spreads and the determinants of institutional ownership employed cross-sectional regressions with different predictor variables. Gompers and Metrick (2001), for

[3] A potential simultaneity problem may arise from employing OLS to investigate the relationship between the bid-ask spread, institutional ownership, and concentration. If spread affects concentration of ownership while concentration influences the bid-ask spread, then both variables may be considered as endogenous. In that case, OLS may not be able to consistently estimate the simultaneous system of equations. Two stage least squares (2SLS), an instrumental variables approach, can be used to estimate a system of potentially simultaneous equations (Whidbee, David A., 1997). In the first stage of the 2SLS, a potentially endogenous independent variable is estimated using additional exogenous variables. Its estimated values are then used in the second stage of the 2SLS. The analysis was performed using both OLS and 2SLS methodologies. The results indicated that endogeniety was not a problem, and that OLS estimates were preferred.

example, used 68 cross-sectional regressions with quarterly data and summarized the determinants of the institutional ownership by calculating the average value of coefficients and reporting the number of significant positive and negative coefficients. Similarly, Jennings, Schnatterly, and Seguin (2001) investigate the relationship between institutional ownership and bid-ask spreads using OLS regressions for each quarter. They report observation-weighted mean parameter estimates. Jennings, Schnatterly, and Seguin (2001) use Fama-MacBeth test statistics: $\mu\sqrt{n}/\sigma$, where μ is the estimated weighted mean value of the parameters, n is the number of quarters used, and σ is the estimated weighted standard deviation of the series. Results of this study are presented in a manner similar to Gompers and Metrick and/or Jennings, Schnatterly, and Seguin.

Results

Table 2 summarizes the data for all variables for the time period analyzed (72 quarters). Observations with missing bid or ask prices were deleted from all datasets, which resulted in a maximum number of 250,663 observations. Some variables were calculated over a period of the previous twenty quarters (standard deviation and variance of the return on equity), some variables were calculated over past quarter and preceding three quarters (momentums of past returns) and some over the future one, four, and twelve quarters (returns). By the nature of their construction, such variables produce fewer observations without missing values.

Descriptive Statistics: Bid-Ask Spread

The number of valid quarterly observations ranges from 189 in the first quarter (March 1983) to 5,454 (December 1996) with an average of 3,481 per quarter. The average quarterly closing bid-ask spread for the 72-quarter period is 5.95% of the price with a minimum and maximum of 0% and 142.86%[4]. The standard deviation of the time series of 72 quarterly observations is 7.22%.

The smallest average spread is observed in the first quarter (March 1983), 1.18%, which may be partially attributed to the smallest number of securities with institutional ownership reported in the first quarter of the 13F database. Holdings reported in that quarter represent larger and, therefore, possibly more widely followed and more liquid companies. Figure 1 shows average bid-ask spreads over the period of analysis. One can clearly see a pattern of spreads steadily rising from the first quarter (March 1983) until the 38th quarter (June 1992) and then declining, with the smallest average spread for the last decade reported in the first quarter of 2000 (January-March). In the middle of the last month of that quarter (March 13th, 2000) major market indices reached all time highs. This so-called "bubble" was

[4] From 250,663 valid observations, two have a spread of 0% and 55 have a spread greater than 100%. A pilot study was performed to check for possible impacts of outliers. No significant differences were observed.

particularly pronounced on NASDAQ stocks – the subject of this research. The lowest spreads, not surprisingly, correspond with the highest trading volume, the largest number of trades, and coincide or follow rising markets: September 1989, March 1992, June 1998, March 2000.

Local maximums, high levels of spreads, can be observed as spikes in Figure 1. Local maximums correspond to the times of lower trading volume following major market declines. The market crash of 1987 occurred in the beginning of quarter # 20 (December 1987) and was followed by sluggish trading volume and a slow market recovery. The next spike in spreads, in quarter #32 (December 1990), followed the major market decline of the second half of 1990. Another visible local high for spreads was in quarter #58 (June 1997), which was a rather volatile period for the market. The last spike occurred in the last quarter of 1998, which included a significant decline in November of that year. Spreads were also steadily rising during 2000 – a major bear market with declining trading volume.

The only increase in spreads which did not coincide or follow a major market decline occurred in quarter # 38 (June 1992) and was followed by the high level of spreads in the next quarter (#39). Bid-ask spreads at that time were the highest for the period of this study (11.55% and 11.50%). The high spreads coincided with low and rapidly declining trading volume and a major decline in total institutional ownership. Institutional ownership dropped from almost 25% in the first quarter of 1992 to slightly above 18% in the second quarter of the same year and below 18% in the following quarter (see Figure 2). While this pattern supports the main hypotheses suggested in this research, it must be noted that valid sample increased from 2,674 to 4,002 during the second quarter of 1992. Hence, the changes may be caused by the addition of most-likely more volatile small capitalization stocks.

Market sentiment in the second quarter of 1992 resembled that of early 2002. The economy had come out of the recession, but uncertainty still prevailed in the market place. Investors were hesitant to make long-term investments and were worried about future economic prospects and corporate earnings. Uncertainty creates a perception of information asymmetry, which is expressed in wider spreads.

Descriptive Statistics: Institutional Ownership

The overall average for institutional ownership is 21.11% with a high of almost 100% of the total number of shares outstanding. The long-term trend shows a steady increase in total institutional ownership (Figure 2). The only major decline in total institutional ownership (except for a low observation sample in the first three quarters) happened in quarter # 38 (June 1992) followed by a smaller decline in the following quarter. The decline in institutional ownership was accompanied by low and falling trading volume and a jump in bid-ask spreads. While the relationship may directly support the proposition developed earlier in this study that high levels of total institutional ownership increase liquidity, reduce information asymmetry and lead to lower spreads, the relationship may be explained by

the substantial increase in sample size during the second quarter of 1992. A jump in valid observations may have been caused by the addition of smaller, riskier stocks to CRSP files.[5]

The percent of shares owned by banks has been declining during the period of study. The overall average is 3.57%, which declined from about 4.5% to 5.5% in the 1980s to about 2.6 to 4.6% in the 1990s. During the last two years (1999-2000), the percent of shares owned by banks decreased to about 2.6%. Insurance companies owned about the same fraction of shares over the period of study with an average of 1.3%.

In contrast to insurance companies and banks, investment companies (mutual funds) increased their fractional ownership from an average of 1.4% of shares outstanding in 1980s to about 5.7% in late 1990s. A noticeable jump occurred in the second half of 1995 (quarters # 51 and 52). The highest average ownership by mutual funds was documented in the first quarter of 2000 (NASDAQ's all time high) at 6.17%, which coincided with the lowest spread since June of 1984. A local minimum in the ownership by investment companies happened in June and September 1992, along with the widest spreads.

Independent investment advisors increased their proportional ownership from about 7.2% in 1985 to almost 13.3% in 2000. One can observe a steady growth in the proportional ownership over the entire period of study with a considerable drop in the second quarter of 1992 from almost 15% to 10.5%. As the largest group of institutional investors, independent investment advisors own the largest share of all stocks.

The last group of unclassified institutional investors – "other" – owns the smallest proportion of shares of all the five major groups of institutions. This group is comprised of foundations and endowments. One can observe a growth trend in the last three years of the sample period: the average ownership increased from 0.9% in the first quarter of 1997 to almost 3% in the last quarter of 2000. The growth can be explained by an increase in the number and size of foundations and endowments.

Descriptive Statistics: Concentration of Ownership

The time-series patterns of concentration of ownership resemble that of the total fractional ownership by the institutional group. Concentration of total institutional ownership, measured by the Herfindahl Index, increased from about 0.008 in September of 1984 to 0.017 in March of 2000. In other words, in March of 2000 the average reporting institution owned 1.7% of shares of a NASDAQ traded stock. As in the case of fractional ownership by institutions, the concentration of ownership declined in the second quarter of 1992 by almost 20% (from 1.4187 percent to 1.1427 percent).

[5] Average market capitalization, number of shares outstanding, and price declined from, respectively, $197,300,000, 9,864, and $15.52 in the first quarter of 1992 to $130,228,000, 9,597, and $11.05 in the second quarter of 1992.

Examination of the concentration of ownership by groups of institutional investors shows similar patterns. The chart for concentration of ownership for all institutional owners (Figure 3) is very similar to the charts of ownership by type of institution. The concentration of banks' ownership declined during 1990s. However, one can clearly see an increase in concentration for banks during 1980 with a high of 0.4116 percent in the second quarter of 1991. These results are also true for the concentration of ownership by insurance companies. On average, insurance companies take much less concentrated positions in equities. The average Herfindahl Index for the whole sample is 0.2560 percent for banks and 0.0965 percent for insurance companies. Interestingly, banks contributed a smaller and declining fraction of their portfolios to each security during the same time period. The average value of the Herfindahl Index for banks fell from 0.0017791 in December of 1990 to 0.0012614 in March of 2000.

Investment companies, on average, increased concentration of their ownership over time from 0.0663 percent in the end of 1993 to a high of 0.4247 percent (5.4 times) in the first quarter of 2000, which coincides with the all-time high for the NASDAQ market. It appears that banks and investment companies exhibit almost the opposite behavior in the concentration of their positions.

Independent Investment Advisors control the largest institutional proportion of the NASDAQ equity market and they have the most concentrated positions in their stocks. The concentration of ownership has been increasing during the period of study from 0.3362 percent in the second quarter of 1984 to 0.8988 percent in the third quarter of 2000. The value of the concentration measure increased by 167.3%, while the square root of the Herfindahl Index increased by 63.5%. At the same time, the fraction of shares owned by independent investment advisors rose by 85.6%.

The fifth category of institutions – "other" - increased their ownership of shares and their positions in each security over time. The highest level of the Herfindahl Index was recorded in the last month of the period of study – December 2000 - with a value of 0.2162%. The lowest level (0.0205%) was recorded during the third quarter of 1986.

Simultaneity Tests (Two-Stage Least Squares Regressions)

Finance literature does not address the question of institutional owners being attracted to lower spread stocks. While the inverse relationship has been addressed in some studies, there is no evidence refuting the hypothesis that spread influences institutional ownership and concentration. To address this issue, two-stage least squares regression estimates of bid-ask spreads were performed for 70 quarters of standardized data sets. The results are compared to results using ordinary least squares (OLS) regressions. Hausman specification tests were performed for each of the 70 quarters to compare 2SLS with the more efficient OLS estimate. The results are summarized in Tables 3 and 4.

It should be noted that in the absence of a bias or inconsistency of estimators, an OLS estimation is clearly preferred to an instrumental variables approach, because it is less sensitive to specification

errors. In the first stage of the 2SLS, estimated values of the predictor variables are calculated, and then used to replace actual values in the second stage. This process allows for construction of a model without a problem of potential correlation between explanatory variables and error terms. For the sake of consistency between two different estimations, observations with missing instrumental variables values were excluded from both samples. Because return on equity values were not available for the last two quarters of 2000, the tests are performed using 70 quarters of data.

As discussed in previous sections, a measure of total concentration of institutional ownership – the Herfindahl Index or HST – is estimated with the following instrumental variables: market capitalization, variance and standard deviation of the daily returns and quarterly returns on equity, and three industry dummy variables for financial, media, and regulated utility companies. The estimated values of HST are used as one of the predictor variables in 70 cross-sectional regressions of the spread on total institutional ownership, concentration of the total ownership, price, standard deviation of daily returns, number of trades, number of shares outstanding, number of market makers, and three volume variables.

The average of 70 estimates is calculated for each of the parameters. The resulting time-series is treated in a Fama-French manner as a sample from an unknown distribution with mean, standard deviation, and corresponding p-values for both OLS and 2SLS reported in Table 3. Most of the parameter estimates are very close for OLS or 2SLS. Total institutional ownership, price, number of shares outstanding, volume of institutions with small positions, and individual trading volume differ by the size of their average values. Volume generated by institutions with large positions, and the measure of concentration of ownership – HST – have different signs on their respective means in OLS and 2SLS. However, estimates of both are not significant under the 2SLS (p-value for HST and VolLarge is 60% and 61% respectively). An OLS estimate of HST on the other hand is significant at the 10% level with p-value of 6.4%. It is reasonable to expect slightly different values for a variable, which is replaced with its estimated value.

Table 4 summarizes results of Hausman specification tests.[6] The first number in each column reports the fraction of 70 Hausman specification tests in which the 2SLS method is preferred to OLS. The second number in each column shows the fraction of tests that failed to show that preference. Overall, 35% of cross-sectional regressions are better specified with an instrumental variable approach. From all quarters, 65% of tests failed to show preference of 2SLS over more powerful OLS regression.

[6] The test statistics, m, is calculated as $q' (V_1 - V_0)^{-1} q$ where $V_1$and V_0 represent consistent estimates of the asymptotic covariance matrices of β_1 and β_0, and $q = \beta_1 - \beta_0$. Under the null hypothesis both β_1 and β_0 are consistent, but only β_0 is asymptotically efficient. Under the alternative hypothesis, only β_1 is consistent. The statistic is distributed as a Chi-square with k degrees of freedom, where k represents the rank of the matrix $(V_1 - V_0)$.

Even though the results do not provide sufficient proof that size of the spreads influences level and concentration of ownership, this question deserves further attention and should be a subject of future research. All other estimations in this study are based on a more powerful, and less sensitive to specification errors, OLS approach.

Relationship between Bid-Ask Spreads and the Structure of Institutional Ownership

The main subject of the following analysis is the impact of different institutional owners and their concentration on the bid-ask spread. From the discussion presented earlier in the study, one can expect that high levels of institutional ownership inject additional liquidity in underlying securities, and therefore decrease the bid-ask spread. This proposition is tested along with the hypothesis that different types of institutional owners will produce impacts of alternative magnitudes. To test the latter proposition, differences between parameter estimates from standardized regressions are examined in this section.

It was expected that concentration of ownership would have a widening impact on spreads. Again, the size of the impact was expected to differ between various types of institutions. Seventy-two cross sectional regressions were estimated for each model. For each quarter, all variables were standardized to have a mean of zero and a standard deviation of one to allow for comparison between different types of institutions.

Total Institutional Ownership (Test of Hypothesis # 1)

Total institutional ownership was defined earlier in the study as the fraction of shares outstanding owned by all institutional investors reporting their holdings in quarterly form 13F. This measure of institutional participation in ownership is the one that has been addressed in the literature and is often mislabeled as concentration of ownership. Though there is no consensus about the direction of its impact on the bid-ask spread, it was expected in this study that percentage of total institutional ownership will be negatively correlated with the bid-ask spread (see Hypothesis #1).

Seventy-two cross-sectional standardized and raw regressions were performed for each of the estimation models. Tables 6 and 7 display averages of each parameter calculated over 72 quarters, the standard deviation of the resulting time-series of estimates, the fraction of positive and negative parameter estimates, and the fractions of positive and negative parameter estimates significant at the 1%, 5%, and 10% level.

Table 6 provides summaries of standardized regressions for the same model. The intercept in the raw regression is positive (0.03952) and significant at the 1% level for all 72 regressions. The variable is negatively related to bid-ask spread for all but one quarter, with an average of – 0.02374. Almost all of the quarterly parameter estimates are significant at the 1% level. Both raw and standardized regressions

have exceptionally high R-squares of 67.82% and adjusted R-squares of 67.66%. The average number of observations in each of the 72 quarters is 3,462.86.

The average coefficient of total institutional ownership in the standardized regressions is –0.08899. Again, 93% of parameter estimates are negative and significant at the 1% level, 1% are negative and significant at the 5% level, and 3% are negative and significant at the 10% level. This estimate is the third largest negative average coefficient with only the number of market makers (-0.32066) and the number of trades (-0.09635) larger. This variable is more important in lowering spreads than price (-0.07310).

Table 7 provide results of the estimation of the third model. Here, instead of the aggregate concentration of ownership, five concentration measures – one for each type of institution - are employed. The resulting R-squares and adjusted R-squares are even higher than in previous model (67.89% for R-square and 67.66% for the adjusted R-square), which is consistent with the hypothesis that the type of institution does matter in explaining bid-ask spreads. Adding five concentration measures resulted in a more powerful estimation despite the fact that all five Herfindahl Indexes are highly correlated with each other. Total institutional ownership here, as in the previous model, has a significant negative impact on spreads with an average value of the coefficient estimates of –0.08970 for standardized regression and –0.02371 for the raw regression. Almost all of the estimates are significant at 1% level.

All of the results are consistent with expectations of this study and support Hypothesis #1. High levels of total institutional ownership clearly generate additional liquidity, measured by the bid-ask spread, and provide for better execution prices for all market participants, other than market makers.

Institutional Ownership by Type of Institution (Tests of Hypothesis # 2)

The following estimations are similar to the models discussed in the previous section, but total institutional ownership is replaced with the fraction of shares owned by each of the five groups of institutions: banks, insurance companies, investment companies, independent investment advisors, and other. The results are similar to that of the total institutional ownership. Hypothesis #2 stated that the percent of shares owned by investment companies and independent investment advisors would be negatively related to bid-ask spreads and that the magnitudes of the effects produced by these two institutional groups would be stronger than that of banks, insurance companies and unclassified institutions.

Table 8 provides results for standardized regressions. Average R-square (67.98%) and adjusted R-square (67.74%) are both slightly higher than the model with only one variable for the percentage of institutional ownership (Tables 6). The results support the proposition that various institutions affect spreads differently and that separating types of institutions in different groups adds value and explanatory power to the model.

All of the five parameters of institutional ownership have negative average values and most of the 72 estimates are highly significant. Ownership by independent investment advisors has the largest negative impact on the spread with an average value of –0.07314 with 96% of estimates being negative and significant at the 10% level or better. The average value of the parameters for the remaining four groups of institutions is –0.01253 for banks, -0.01358 for insurance companies, -0.01546 for investment companies, and –0.01050 for other institutions.

To further examine the impact of different institutions upon the bid-ask spread, pairwise differences of the parameters were computed for each of the 72 quarters. The results are treated in a Fama – French manner, as samples from unknown distributions with means, standard deviations, and p-values reported in Table 9. Even though all of the variables have a negative impact on spreads, as discussed above, some of them are significantly more powerful than others. Independent investment advisors, for example, contribute significantly more to lowering spreads, than do banks. The average value of all 72 differences between banks and independent investment advisors is 0.0606 with a T-value of 11.52. This finding indicates that independent investment advisors, on average, are more powerful creators of liquidity, than banks are. While the ownership by independent investment advisors is strongly related to future quarterly and yearly returns, market makers apparently do not perceive them as informed investors presenting information asymmetry or illiquidity risks. Independent investment advisors also generate about eight times more trading volume and turnover positions approximately 2.5 times more often than banks. Greater volume and more frequent trading decreases market makers order processing and holding costs and reduces a per share amount of the information asymmetry risk premium.

Table 10 (line 3) summarizes the test of the differences between coefficients of various institutions. From pairwise tests (Table 9) one can see that independent investment advisors have a much more powerful narrowing effect on spreads than the other four groups. Differences between coefficients for independent investment advisors and all other groups of institutions are significant at the 1% level. Pairwise tests between the remaining four types of institutions do not produce statistically significant evidence of one being more powerful than the other. Therefore, independent investment advisors – the largest group of all institutions – can be singled out from all institutional investors. As discussed earlier, one might expect independent investment advisors to exercise less monitoring and act on publicly-available information. Independent investment advisors may be less concerned with prudence of their investments (being less bound by regulations, than, say, bank trust departments and pension funds) and may be induced to invest mostly for short-term performance.

Investment companies have the second largest negative impact on spreads, but results of the pairwise tests are not as powerful as those for independent investment advisors. All institutions can be ranked in the following order based on their contribution to narrowing spreads: (1) independent investment advisors; (2) investment companies; (3) insurance companies; (4) banks; and (5) "other."

Concentration of Total Institutional Ownership (Tests of Hypothesis # 3)

The impact of the concentration of total institutional ownership on bid-ask spread was examined with the first and third regression model. Hypotheses # 3 proposed that concentration of total institutional ownership is positively related to bid-ask spreads. The test results are summarized in Tables 6 and 8. As in the case with percentage of institutional ownership, both R-squares and adjusted R-squares are very high for the models described in this section.

Both estimates of the coefficients of the Herfindahl Indices are positive and significant at the 10% level or better for 71% of regressions for models with overall measure of institutional ownership, TotalIO, and for 65% of regressions for models with the five different types of institutions. The average value of the coefficients of HST is 0.03744 in the standardized regressions with five measures of ownership and 0.02929 in standardized regressions with total institutional ownership.

Separating the different types of institutions provides more information for estimations. A naive approach with only one measure of institutional ownership and without any concentration measures may produce misleading results and incorrect conclusions. Unfortunately, existing literature fails to measure concentration of ownership and often employs measures of total ownership as a proxy for concentration.

The results provide significant evidence in support of the Hypothesis # 3. Institutional owners with concentrated positions are perceived as informed traders and stimulate increases in bid-ask spreads.

Concentration of Ownership by Type of Institution (Tests of Hypotheses # 4)

To further investigate the effects of different types of institutions on spreads, a concentration measure is divided into five Herfindahl Indices, one for each type of institutional owner. Hypothesis # 4 proposes that concentration of ownership by investment companies and independent investment advisors are positively and more significantly related to bid-ask spreads, than concentration of ownership by banks, insurance companies and unclassified institutions. As in the case with total institutional ownership, resulting R-squares and adjusted R-squares are slightly higher (67.89% and 66.66% respectively) than for the models with one measure of concentration, HST.

As expected, all coefficients have positive averages, but there is a significant variance in their size. Fifty one percent of HSBanks estimates are significant at the 10% level or better, 31% of HSInv estimates are significant at the same level, 26% of HSIndep are significant at the 10% level, and only 8% of HSOther and 7% of HSIns are significant at the same level.

By taking differences for all pairs of coefficients from 72 standardized regressions, one can further determine the relative importance of each variable. Table 35 summarizes results of pairwise comparisons. Most of the average differences are significant, except for HSInv - HSIndep and HSIns-HSOther, which were expected to produce a similar impact on the bid-ask spread. The largest differences are between HSBanks and HSOther and between HSBanks and HSIns.

Table 10 (line 1) summarizes results of the pairwise tests. It is clear that concentration of ownership by banks has a significantly stronger impact on widening spreads than that of other institutions. Independent investment advisors and investment companies have the next greatest impact on spreads, contributing less to widening spreads than banks, but more than other institutions and insurance companies. Apparently, insurance companies with concentrated positions contribute the least to the widening of spreads. This result confirms the statement made earlier in the study that insurance companies have very different investment goals, strategies, and trading patterns than investment companies and independent investment advisors. If investment companies or independent investment advisors obtain a highly concentrated position in each security, then they must possess additional information about the underlying asset. However, it was not expected that banks with concentrated positions would make the strongest contribution to widening of spreads. This surprising result may, possibly, be explained by prudence of bank's investments (i.e., Del Guercio, 1999) or by concentration in a parent firm. If banks obtain a significant holding in one security, they must be sure that this position is a safe and prudent investment.

The results of the empirical analysis provide significant evidence in support of Hypothesis # 4, with the only exception being banks, which surprisingly have the largest positive impact on spreads when there are high levels of concentrated ownership.

Trading Volume (Tests of Hypotheses # 5 and # 6)

This section summarizes results of the tests of the impact of different volume variables on bid-ask spreads. Hypotheses #5 suggests that volume generated by institutions with small positions and individuals is negatively related to the bid-ask spread. Hypothesis #6 proposes that trading volume of institutions with large positions is positively related to spreads. The three volume variables used in all regressions of spreads include: VolLarge – volume generated by institutions with relatively large positions (1% or more of shares outstanding), VolSmall – volume generated by institutions with positions less than 1% of shares outstanding, and VolInd – volume attributable to individual trading, trading of institutions that do not report trades, and offsetting trades by institutions with no net change in shares outstanding during a reporting quarter.

Tables 6-9 provide summaries of the volume variables. Surprisingly, all coefficients are positive, with the volume of small institutions and individuals having a significantly stronger widening impact on bid-ask spreads in all regression models. Only volume generated by large institutions was expected to have a widening impact on spreads. Table 10 (line 2 and 4) summarizes the impact of volume on bid-ask spreads. In all models, volume of small institutions has a slightly stronger effect on spreads than does individual trading volume. The differences, however, are not significant, but they are stronger than the influence of volume of large institutions.

Empirical analysis does not support Hypothesis # 5. Indeed, the results are contrary to the hypothesized relationship. Hypothesis # 6 is supported with results of the analysis.

Summary and Conclusion

Market perception of information asymmetry is examined by analyzing spreads in relation to ownership and concentration variables for NASDAQ stocks. All of the hypotheses, except #5, were supported by empirical results. Total institutional ownership was found to be inversely related to the bid-ask spread (Hypotheses #1). Concentration of ownership, measured by the Herfindahl Index, is positively related to spreads (Hypothesis #3). Percentages of institutional ownership by each group of institutions are negatively related to spreads, with independent investment advisors contributing the most to lowering spreads (Hypothesis #2). No evidence was found to support a hypothesis that percentage of shares owned by investment companies had a higher impact on lowering spreads than percentage ownership by banks, insurance companies and other institutions. The findings support the idea that higher levels of dispersed institutional ownership stimulate distribution of information among market participants by increasing exposure of the underlying security, widening analysts' coverage, and providing additional liquidity.

Concentration of ownership by all types of institutions was found to be positively related to spreads, as hypothesized. Investment companies and independent investment advisors with concentrated positions have a significantly stronger impact on widening spreads than do insurance companies and "other" institutions. Concentration by banks, however, unexpectedly exhibited the largest positive impact on widening spreads compared to all other groups of institutions, which provides support to most, but not all of the implications of Hypothesis #4.

Volume of small institutions and individuals was unexpectedly positively related to widening of the spreads with a significantly larger impact than that of the volume generated by institutions with large positions. The results are contrary to the expectations of Hypothesis #5. One explanation may be the fact that it is easier to monitor the largest blockholder, than a large number of smaller, widely-dispersed shareholders. As expected in Hypothesis # 6, volume generated by institutions with large positions (greater than 1% of shares outstanding) is positively related to spread, but as discussed above, the impact is much less significant than that of other two volume variables.

References

Amihud, Yakov and Haim Mendelson, 1980, Dealership market: Market making with inventory, *Journal of Financial Economics*, 8, 1, 31.

Amihud, Yakov and Mendelson, Haim, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics*, 17, 223-249.

Amihud, Yakov and Mendelson, Haim, 1986, Liquidity and stock returns, *Financial Analysts Journal*, May-June, 42, 3, 43-48.

Arbel, 1983, Pay Attention to neglected firms, *Journal of Portfolio Management*, 9, 2, 37-42.

Arbel, A., and P. Strebel, 1982, The neglected and small firm effects, *The Financial Review*, 201-218.

Bardiniath, S. G., Gerald, D., Kale Jayant R., 1989, Patterns of institutional investment, prudence, and managerial "safety net" hypothesis, *Journal of Risk and Insurance*, 56, 4, 605-630.

Bardiniath, S. G., Kale Jayant R., Tyan, Harley E. Jr., 1996, Characteristics of common stock holdings of insurance companies, *Journal of Risk and Insurance*, 63, 1, 49-77.

Beard, Craig and Richard Sias, 1997, Is there a neglected-firm effect?, *Financial Analysts Journal*, September/October, 19-23.

Bennet, James A., R.W. Sias, and L.T. Starks, 2002, Greener pastures and dynamic institutional preferences, working paper, *Journal of Financial Econimics*, forthcoming.

Benston and Hagerman, 1978, Risk, volume, and spread, *Financial Analyst Journal*, 34, 1, 46.

Bessembinder, Hendrik, 1999, Trade execution costs on NASDAQ and the NYSE: A post-reform comparison, *Journal of Financial and Quantitative Analysis*, 34, 3, 387-407.

Bhide, Amar, 1993, The hidden costs of stock market liquidity, *Journal of Financial Economics*, 34, 1, 31-52.

Bogle, John and Jan Twardowski, 1980, Institutional investment performance: Banks, investment counselors, insurance companies and mutual funds, *Financial Analyst Journal*, 33-41.

Brancato, Carolyn Kay, 1990; Who owns corporate America: The momentum of the big investor, *Directors and Boards*, Philadelphia; 14, 2; 38-41.

Brown, K. and Brooke, 1993, Institutional demand and security price pressure: The case of corporate spinoffs, *Financial Analysts Journal*, 49, 5, 53-62.

Brown, W. Jr., 1999, University endowments: Investment strategies and performance, *Financial Practice and Education*, 9, 2, 61-69.

Callahan, Lee, and Yohn, Accounting Information and Bid-Ask Spreads, *Accounting Horizons*, December 1997, v. 11, n. 4, pp. 50-61.

Chan, K. C., William G. Christie, and Paul H. Schultz, 1995, Market structure and the intraday pattern of bid-ask spreads for NASDAQ securities, *Journal of Business*, 68, 1, 35-60.

Chevalier, Judith, and Glenn Ellison, 1997, Risk taking by mutual funds as a response to incentives, *Journal of Political Economy*, 105, 6, 1167-1200, Chicago, IL.

Chiang, David and P. C. Venkatesh, 1988, Insider holdings and perceptions of information asymmetry, *Journal of Finance*, 43, 4, 1041-1049.

Comment, R. and G. A. Jarrel, 1995, Corporate focus and stock returns, *Journal of Financial Economics*, 37, 67-87.

Conroy, R.; R. Harris; and B. Benet, 1990, The effects of stock splits on bid-ask spreads, *Journal of Finance*, 45, 1285-1295.

Copeland, T., 1979, Liquidity changes following stock splits, *Journal of Finance*, 34, 115-141.

Copeland and Galai, 1983, Information effects on the bid-ask spread, *Journal of Finance*, December, 38, 5, 1457-1470.

Chung, Kee H., Bonnie F. Van Ness, and Robert A. Van Ness, 1999, Limit orders and the bid-ask spread, *Journal of Financial Economics*, 53, 255-287.

Del Guercio, Diane, 1996, The distorting effect of the prudent-man laws on institutional equity investments, *Journal of Financial Economics*, 40, 1, 31-63.
Del Guercio, Diane and Jennifer Hawkins, 1999, The motivation and impact of pension fund activism, *Journal of Financial Economics*, 52, 293-340.
Demsetz, Harold, The cost of transacting, 1968, *Quarterly Journal of Economics*, 82, 33-53.
Demsetz, Harold, and Kenneth Lehn, 1985, The structure of corporate ownership: causes and consequences, *The Journal of Political Economy*, 93, 6, pp. 1155-1177.
Eakins, Stanley, R Stansell and James F. Buck, 1998, Analyzing the nature of institutional demand for common stock, *Quarterly Journal of Business and Economics*, 37, 2, 33-48.
Eakins, Stanley, R. Stansell, and Wertheim, 1998, Institutional portfolio composition: An explanation of the prudent investment hypothesis, Q*uarterly Review of Economics and Finance*, 38, 1, 93-109.
Easley, David, Kiefer, Nicholas M., O Hara, Maureen, Paperman, Joseph B., 1996, Liquidity, information. and infrequently traded stocks, *Journal of Finance*, 51, 4, 1405-1436.
Fabozzi, Frank, 1979, Bid-Ask Spreads for Over-the-Counter Stocks, *Journal of Economics and Business*, 32, 1, 56.
Falkenstein, E., 1996, Preferences for stock characteristics as revealed by mutual fund portfolio holdings, *Journal of Finance*, 51, 1, 111-136.
Fama, E. F., and J. D. MacBeth, 1973, Risk, return and equilibrium: Empirical tests, *Journal of Political Economy*, 81, 607-636.
Fortin, Richard D., R. Corwin Grube, and O. Maurice Joy, 1990, Bid-ask spreads for OTC NASDAQ firms, *Financial Analysts Journal*, 46, 3, 76-79.
Gompers, Paul and A. Metrick, 2001, Institutional investors and equity prices, *Quarterly Journal of Economics*, 116, 1, 229-259.
Garbade, Kenneth, 1982, Securities Markets, McGraw-Hill, New York.
Grinblatt, Mark, Sheridan Titman, and Russ Wermers, 1995, Momentum investment strategies, portfolio performance and herding: A study of mutual fund behavior, *The American Economic Review*, 85, 5, 1088-1104.
Hamilton, J., 1978, Marketplace organization and marketability: NASDAQ, the stock exchange, and the national market system, *Journal of Finance*, 33, 2, 487-503.
Hasbrouck, Joel, 1991, Measuring the information content of stock trades, *The Journal of Finance*, 46, 1, 179-208.
Hasbrouck, Joel, 1991, Security markets, information and liquidity, *Financial Practice and Education*, fall/winter, 7-16.
Healy, Hutton, and Palepu, 1999, Stock performance and intermediation changes surrounding sustained increases in disclosure, *Contemporary Accounting Research*; Mississauga; 16, 3, 485-520.
Heflin, Frank, and Kenneth Shaw, 2000, Blockholder ownership and market liquidity, *Journal of Financial and Quantitative Analysis*, 35, 4, 621-633.
Jennings, William, Schnatterly, Karen, and Paul Seguin, 2001, Institutional ownership, information and liquidity, Working Paper.
Jones, C.M., G. Kaul, and M.L. Lipson, 1994, Transactions, volume, and volatility, *Journal of Financial Studies*, 7, 4, 631-651.
Kahn, Charles and A. Winton, 1998, Ownership structure, speculation, and shareholder intervention, *Journal of Finance*, 1, 99-129.
Kini, Omesh and S. Mian, 1995, Bid-ask spread and ownership structure, *Journal of Finance*, 18, 4, 401-414.
Kothare, Meeta and Paul A. Laux, 1995, Trading costs and the trading systems for NASDAQ stocks, *Financial Analysts Journal*, 51, 2, 42-53.
Lakonishok, Josef, A. Shleifer, R. Thaler, and Robert Vishny, 1991, Window dressing by pension fund managers, *The American Economic Review*, 81, 2, 227-232.
Lakonishok, Josef, Andrei Shleifer, Robert Vishny, 1992, The impact of institutional trading on stock prices, *Journal of Financial Economics*, 32, 23-43.

Laux, P., 1993, Trade sizes and theories of the bid-ask spread, *Journal of Financial Research*, 16, 237-249.
Longstreth, Bevis, 1986, Modern investment management and the prudent man rule, Oxford University Press, New York, NY.
Maug, Ernst, 1998, Large shareholders as monitors: Is there a trade-off between liquidity and control? *Journal of Finance*, 53, 1, 65-98.
McInish, Thomas H. and Robert A. Wood, 1992, An analysis of intraday patterns in bid-ask spread for NYSE stocks, *Journal of Finance*, 47, 2, 753-764.
Morck, R., A. Shleifer, and R. W. Vishny, 1988, Management ownership and market valuation: An empirical analysis, *Journal of Financial Economics*, 20**,** 293-315.
Nofsinger, John and Richard Sias, 1999, Herding and feedback trading by institutional and individual investors, *Journal of Finance*, 6, 2263-2295.
O'Brien, Patricia and Ravi Bhushan, 1990, Analyst following and institutional ownership, *Journal of Accounting Research*, 28, 55-76.
Ohlson, James and Stephen Penman, 1985; Volatility increases subsequent to stock splits: An empirical aberration, *Journal of Financial Economics*, 14, 2; 251-267.
Potter,G., 1992, Accounting earnings announcements, institutional investor concentration, and common stock returns, *Journal of Accounting Research*, 30, 1, 146-155.
Roe, Mark J., 1994, German "populism" and the large public corporation, *International Review of Law and Economics*, 14, 2, 187-203.
Scott, Austin Wakeman, 1959, Restatement (second), of trusts, Section 174, Little, Brown, Boston, MA.
Seely, Michael, 1985, In praise of institutional investors, *Fortune*, 111, 8, 167-168.
Senteney, David L., 1991, Characteristics of earnings news and operational efficiency in the NASDAQ securities market, *Review of Financial Economics*; New Orleans; 1, 1, 49-62.
Shulman, E., 1992, Shackled liquidity: An institutional manifesto, *The Journal of Portfolio Management*, 18, 4, 42-46.
Sias, Richard and L. Starks, 1997, Institutions and individuals at the turn of the year, *Journal of Finance*, 4, 1543-1562.
Sias, Richard and L. Starks, 1997, Return autocorrelation and institutional investors, *Journal of Financial Economics*, 46, 1, 103-131.
Sias, Richard W., L.T. Starks, and S. Titman, 2001, The price impact of institutional trading, working paper.
Stoll, Hans, 1985, Alternative views of market making, in Y. Amihud, T. Ho and R Schartz, eds., Market Making and the Changing Structure of Securities Industry, Lexington Health, Lexington, MA, 67-92.
Stoll, Hans, 1978, The Pricing of security dealer services: an empirical study of NASDAQ stocks, *Journal of Finance*, 33, 4, 1153-1172.
Stoll, Hans, 1989, Inferring the components of the bid-ask spread: theory and empirical tests, *Journal of Finance*, 44, 1, 115-134.
Szewczyk, Samuel H.; Tsetsekos, George P.; Varma, Raj, 1992; Institutional ownership and the liquidity of common stock offerings, *The Financial Review*, 27, 2; 211-226.
Tinic, S., 1972, The economics of liquidity services, *Quarterly Journal of Economics*, February 1972, 86, 79-93.
Tinic, S. and R. West, 1972, Competition and pricing of dealer service in the over-the-counter market, *Journal of Financial and Quantitative Analysis*, 7, 3, 1707-1727.
Tkac, Paula, 1999, A trading volume benchmark: Theory and evidence, *Journal of Financial and Quantitative Analysis*; 34, 1, 89-114.
Venkatesh, P.C. and Chiang, R., 1986, Information asymmetry and the dealer's Bid-ask spread: A case study of earnings and dividend announcements, *The Journal of Finance*, 41, 5, 1089-1103.
Wei, Pei-Hwang, 1992, Intraday variations in trading activity, price variability, and the bid-ask spread, *Journal of Financial Research*, 15, 3, 265.

Weston, James, 2000, Competition on the NASDAQ and the impact of recent market reforms, *Journal of Finance*, 55, 6, 2565-2598.
Whidbee, David A., 1997, Board composition and control of shareholder voting rights in the banking industry, *Financial Management*, 26, 4, 27-41.
Woerheide, Walt and Don Persson, 1993, An index of portfolio diversification," *Financial Services Review*, 2, 2, 73-85.
Wu, D., Alternative tests of independence between stochastic regressors and disturbances, *Econometrica*, 41, 1973, 733-750.

Table 1

Review of Earlier Studies of the Determinants of the Bid-Ask Spread

Study	Direction of the variable's impact on the bid-ask spread						
	Price	Volume	Institutional ownership	Variance	Block ownership	Number of Market Makers	Number of Shareholders
Demsetz (1968)	Positive	Negative					
Tinic (1972)	Positive	Negative	Negative				
Tinic and West (1972)	Positive	Negative					
Benston and Hagerman (1974) (absolute spreads)	Positive		Positive			Negative	Negative
Barnea and Logue (1975)		Negative		Positive			
Branch and Freed (1977)	Negative	Negative					
Stoll (1978-2)	Negative	Negative		Positive		Negative	
Hamilton (1978)	Positive		Negative	Positive			Negative
Fabozzi (1979)	Negative		No Relationship			Negative	
Garbade (1982)		Negative				Negative	Negative
Stoll (1985)		Negative				Negative	Negative
Chiang and Venkatesh (1988)		Negative	No Relationship	Positive			
Kini and Mian (1995)		Negative	Negative	Positive	No Relationship		
Kothare and Laux (1995)	Negative	Negative	Positive	Positive		Negative	
Callahan, Lee and Yohn (1997)			Positive				
Heflin and Shaw (2000)	Negative	Negative		Positive	Positive		
Jennings, Schnatterly, and Seguin (2001)	Negative	Positive	Negative	No Relationship	Positive	Negative	

Table 2

Summary Statistics for the Total Sample of 72 Quarters of All Variables

Variable	Mean	Std. Dev.	Min	Max	No. of Obs.
Spread	0.059517	0.072227	0.00000	1.42857143	250,663
InvSpreadSqr	10003.8	405,864.2	0.49000	117,213,707	250,661
InvSpread	43.2182	90.19987	0.70000	10,826.5279	250,661
TotalIO	0.211123	0.215141	0.00000	0.9999355	250,663
Banks	0.035745	0.059013	0.00000	0.99950556	250,663
Ins	0.013004	0.033496	0.00000	0.984375	250,663
Inv	0.036456	0.067838	0.00000	0.9974115	250,663
Indep	0.11785	0.12988	0.00000	0.99949341	250,663
Other	0.012192	0.030839	0.00000	0.99153567	250,663
HST	0.013486	0.037513	0.00000	0.99907471	250,663
HSBanks	0.00256	0.019563	0.00000	0.98868722	250,663
HSIns	0.000965	0.012568	0.00000	0.96899414	250,663
HSInv	0.002319	0.012893	0.00000	0.92301558	250,663
HSIndep	0.006931	0.022677	0.00000	0.93331938	250,663
HSOther	0.000797	0.010621	0.00000	0.98314299	250,663
ChangeTIO	0.001802	0.079196	-0.99887	0.9999355	235,983
ChangeBanks	-0.000074	0.024352	-0.98119	0.99431397	235,976
ChangeIns	-0.000042	0.01586	-0.96661	0.984375	235,978
ChangeInv	0.000478	0.027014	-0.96577	0.87108615	235,977
ChangeIndep	0.000601	0.047295	-0.9985	0.94573643	235,945
ChangeOther	0.000463	0.015164	-0.98005	0.98004575	235,982
ChangeHST	0.0000539	0.021991	-0.99907	0.99907471	235,983
ChangeHSBanks	-0.000015	0.010411	-0.84162	0.98866027	235,975
ChangeHSIns	-0.00003	0.007987	-0.96157	0.96899414	235,979
ChangeHSInv	0.0000116	0.008206	-0.90703	0.86286433	235,980
ChangeHSIndep	-0.000053	0.013964	-0.99638	0.92628107	235,964
ChangeHSOther	0.0000256	0.008095	-0.96485	0.96048967	235,982
Price	14.13095	29.61385	0.03125	4,772.5	250,663
ShrOut (000)	13,133.91	61,255.65	0.00000	7,148,199.97	250,663
MrktCap (000)	311,216.8	4,364,701	0.00000	526,293,980	250,663
NumMktMkrs	11.58935	7.842479	0.00000	105.111111	250,663
NumTrades (daily)	103.8922	872.6716	0.00000	79,524.0317	250,663
Turnover (daily)	0.0062	0.024108	0.00000	6.49247847	250,633
Media	0.04763	0.212982	0.00000	1	250,663
Util	0.016153	0.126065	0.00000	1	250,663
Fin	0.239345	0.426685	0.00000	1	250,663
StdROE (quarterly)	2.33038	63.34192	0.00000	7,551.7725	186,856
VarROE(quarterly)	4,017.608	295,317	0.00000	57,029,267.8	186,856
VarDailyRet	0.00397	0.018722	0.00000	3.8175223	250,118
StdDailyRet	0.048327	0.040432	0.00000	1.95384807	250,118

VolLarge(quarterly)	840,780.5	5,413,718	0.00000	938,765,717	250,663
VolSmall(quarterly)	841,340.5	12,467,378	0.00000	2,406,055,965	250,663
VolInd(quarterly)	4,879,840	31,553,684	0.00000	3,842,881,712	250,663
Mom1	0.030592	0.364038	-0.98941	16.6249603	250,510
Mom41	0.105638	0.723503	-0.99966	33.8334075	208,777
Ret1	0.031903	0.367369	-0.98941	16.6249603	236,333
Ret4	0.155303	0.899669	-0.99988	37.7037596	195,970
Ret12	0.600507	2.359136	-0.99988	155.789952	115,464

Figure 1

Time-Series of the Average Bid-Ask Spread (1983-2000)

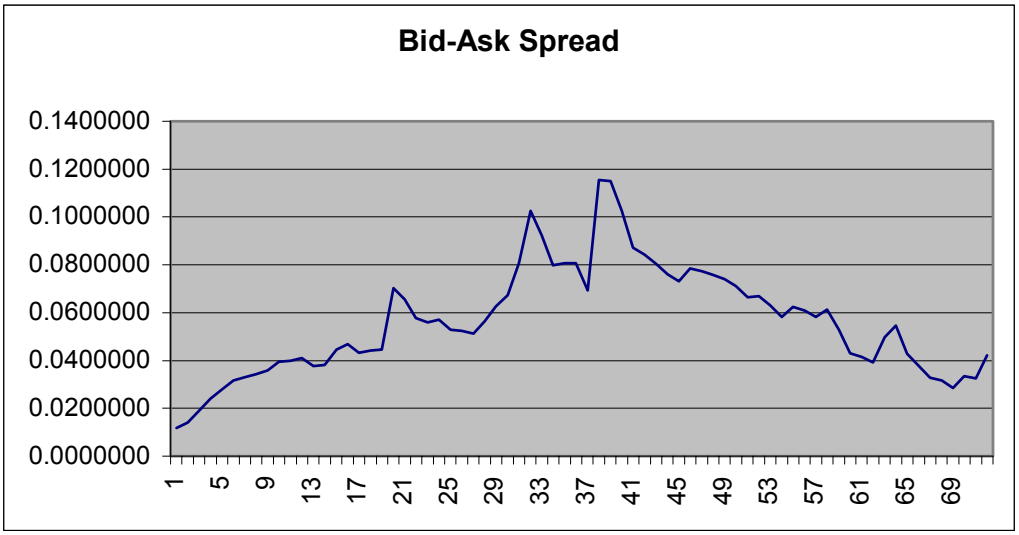

Figure 2

Time-Series of the Total Institutional Ownership (1983-2000)

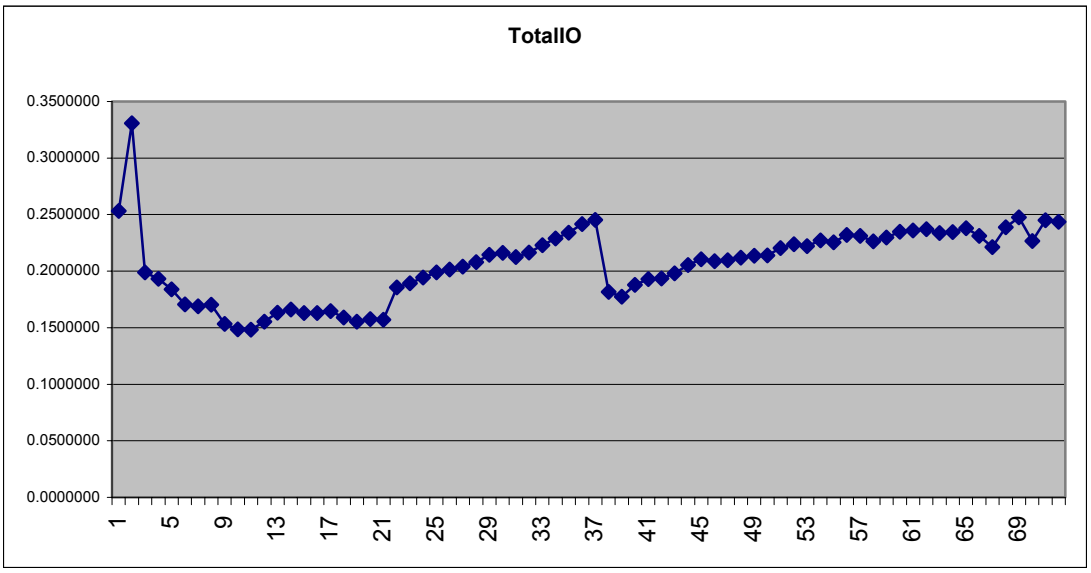

Figure 3

Time-Series of the Total Concentration of Institutional Ownership, Measured by the Herfindahl Index (1983-2000)

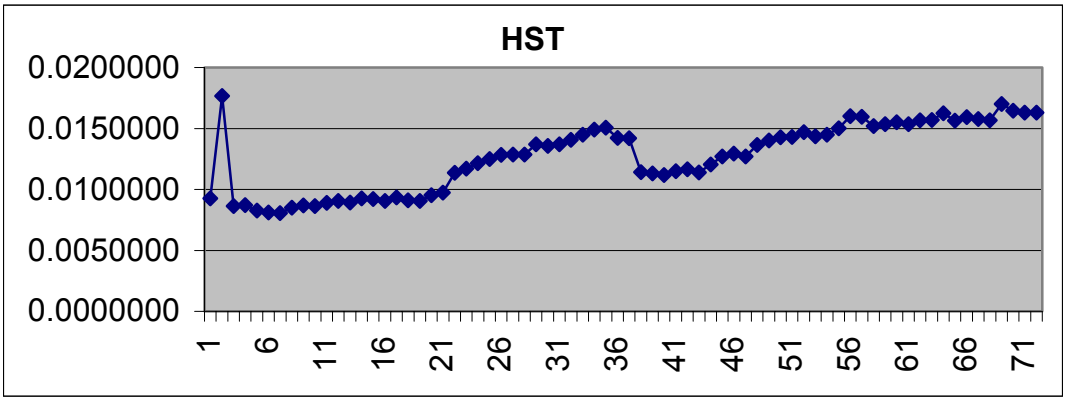

Table 3

Simultaneity Test: OLS vs. Two Stage Least Squares (2SLS)
Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

Bid-ask spreads and predictor variables for all NASDAQ-traded stocks are averaged throughout the quarter for each of the 72 quarters (March 1983 and December 2000). Quarterly averages are used in 70 cross-sectional regressions of the spreads on the institutional ownership, concentration, and other predictor variables. Mean is the time-series average coefficient from the 70 quarterly regressions. St. Dev. is the standard deviation of the time series of parameter estimates. The results are reported for OLS and 2SLS. In 2SLS a concentration measure, HST, is treated as an endogenous variable. In the first stage, values of HST are estimated with the following instrumental variables: Market Capitalization, Variance and Standard Deviation of the Daily Returns and Quarterly Returns on Equity, and dummy variables for companies in Media Financial and regulated Utilities industries. The estimated HST values are used in a second stage – estimation the bid –ask spreads.

Variable*	2SLS			OLS		
	Mean	St. Dev	T-Value	Mean	St. Dev	T-Value
TotalIO	-0.05580	0.04009	-11.65	-0.08900	0.04124	-18.06
HST	-0.17613	0.71066	-2.07	0.02929	0.01925	12.73
Price	-0.14276	0.13267	-9.00	-0.07311	0.08526	-7.17
StdDailyRet	0.65916	0.18110	30.45	0.67393	0.13079	43.11
NumTrades	-0.09007	0.13220	-5.70	-0.09635	0.13783	-5.85
ShrOut	0.02432	0.06688	3.04	0.01399	0.06249	1.87
NumMktMkrs	-0.30324	0.08010	-31.67	-0.32066	0.07714	-34.78
VolLarge	-0.01350	0.04831	-2.34	0.00545	0.03813	1.20
VolSmall	0.18433	0.16752	9.21	0.07916	0.06748	9.81
VolInd	0.04615	0.10885	3.55	0.07225	0.10305	5.87

* TotalIO is a fraction of shares owned by all institutional investors. HST is the Herfindahl Index – a measure of the concentration of the institutional ownership. Price is the average price during each quarter. StdDailyRet is the standard deviation of daily returns. NumTrades is the average daily number of trades during each quarter. ShrsOut is the average number of shares outstanding during each quarter. NumMktMkrs is the average number of market makers during each quarter. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.

Table 4

Summary of the Hausman Specification Tests Comparing 70 OLS and Two Stage Least Squares (2SLS) Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

Bid-ask spreads and predictor variables for all NASDAQ-traded stocks are averaged throughout the quarter for each of the 72 quarters (March 1983 and December 2000). Quarterly averages are used in 70 cross-sectional regressions of the spreads on the institutional ownership, concentration, and other predictor variables. In 2SLS approach a concentration measure, HST, is treated as an endogenous variable. In the first stage, values of HST are estimated with the following instrumental variables: Market Capitalization, Variance and Standard Deviation of the Daily Returns and Quarterly Returns on Equity, and dummy variables for companies in Media Financial and regulated Utilities industries. The estimated HST values are used in a second stage – estimation of the bid –ask spreads. The Hausman specification test compares OLS to 2SLS in terms of a bias or inconsistency of an estimator. The test statistics is distributed as Chi-square with k degrees of freedom.

Comparing	TO	Fraction of the Hausman Specification Tests, which Indicate that 2SLS is Preferred to OLS*			
		At 1% level	At 5% level	At 10% level	Total at least at 10% level
OLS	2SLS	0.13 / 0.87	0.11 / 0.89	0.11 / 0.89	0.35 / 0.65

* The first number shows the fraction of the 70 Hausman Specification tests, which indicate that the 2SLS is preferred to OLS; the second number shows the remaining fractions of the tests, which failed to show that 2SLS is preferred to OLS.

Table 5

Summary of the Relationship Between Predictor Variables and Bid-Ask Spread

After obtaining time-series of the parameter estimates from the 72 cross-sectional standardized regressions of the spreads, differences between selected pairs of the parameters were computed. These differences were treated as samples from unknown distributions. Estimated means, standard deviations, t-statistics and corresponding p-values are reported in Tables 49-50. The summaries of the positive and negative relationships are reported below.

Variables	Direction of the variable's impact on the bid-ask spread		
	Model 1	Model 2	Model 3
TIO	Negative	Negative	
HST	Positive		Positive
Price	Negative	Negative	Negative
StdDailyReturns	Positive	Positive	Positive
#Trades	Negative	Negative	Negative
#Shares	Positive	Positive	Positive
#MarketMakers	Negative	Negative	Negative
VolLarge	Positive_{ns}*	Positive_{ns}*	Positive
VolSmall	Positive	Positive	Positive
VolInd	Positive	Positive	Positive
Banks			Negative
Ins			Negative
Inv			Negative
Indep			Negative
Other			Negative
HSBanks		Positive	
HSIns		Positive	
HSInv		Positive	
HSIndep		Positive	
HSOther		Positive	

* Positive_{ns} and Negative_{ns} indicate that relationship is positive or negative, but not significant. Positive and negative without a subscript indicate a significant relationship.

Table 6

Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

Bid-ask spreads and predictor variables for all NASDAQ-traded stocks are averaged throughout the quarter for each of the 72 quarters (March 1983 and December 2000). Quarterly averages are used in 72 cross-sectional regressions of the spreads on the institutional ownership, concentration, and other predictor variables. All variables are standardized each quarter, i.e., re-scaled to have a mean of zero and a standard deviation of one. Mean is the time-series average coefficient from the 72 quarterly regressions. St. Dev. is the standard deviation of the time series of parameter estimates. The first number in a Pos/Neg column reports the fraction of the 72 regressions with positive parameter estimates followed by the fraction of negative parameter estimates. The first number in the Pos/Neg 10% column contains fractions of the 72 parameter estimates, which are positive and significant at 10% significance level or better followed by the fraction of the negative parameter estimates, which are significant at 10% level or better. Pos. 1/5/10% column contains fractions of the positive parameter estimates, which are significant at 1/5/10% level, respectively. Neg. 1/5/10% column contains fractions of the negative parameter estimates, which are significant at 1/5/10% level, respectively. R^2 is average R^2 from 72 regressions; R^2-adj is average adjusted R^2 from 72 regressions; number of observations is average number of individual securities in 72 quarterly regressions.

Variable*	Mean	St. Dev	Pos/Neg	Pos/Neg 10%	Pos. 1/5/10 %	Neg. 1/5/10 %
TotalIO	-0.08899	0.04124	0.01 / 0.99	0.00 / 0.97	0.00 / 0.00 / 0.00	0.93 / 0.01 / 0.03
HST	0.02929	0.01925	0.97 / 0.03	0.71 / 0.00	0.39 / 0.24 / 0.08	0.00 / 0.00 / 0.00
Price	-0.07310	0.08526	0.01 / 0.99	0.01 / 0.79	0.01 / 0.00 / 0.00	0.72 / 0.03 / 0.04
StdDailyRet	0.67393	0.13078	1.00 / 0.00	1.00 / 0.00	1.00 / 0.00 / 0.00	0.00 / 0.00 / 0.00
NumTrades	-0.09635	0.13783	0.21 / 0.79	0.10 / 0.56	0.06 / 0.04 / 0.00	0.46 / 0.07 / 0.03
ShrOut	0.01398	0.06248	0.67 / 0.33	0.40 / 0.15	0.25 / 0.11 / 0.04	0.08 / 0.06 / 0.01
NumMktMkrs	-0.32066	0.07713	0.00 / 1.00	0.00 / 1.00	0.00 / 0.00 / 0.00	0.99 / 0.01 / 0.00
VolLarge	0.00541	0.03813	0.63 / 0.38	0.17 / 0.15	0.11 / 0.03 / 0.03	0.06 / 0.03 / 0.07
VolSmall	0.07916	0.06748	0.92 / 0.08	0.79 / 0.01	0.64 / 0.14 / 0.01	0.01 / 0.00 / 0.00
VolInd	0.07225	0.10305	0.79 / 0.21	0.60 / 0.07	0.40 / 0.13 / 0.07	0.06 / 0.01 / 0.00
R^2	0.6782					
R^2-adj	0.6766					
Number of qtrs	72					
Number of obs	3,463.86					

* TotalIO is a fraction of shares owned by all institutional investors. HST is the Herfindahl Index – a measure of the concentration of the institutional ownership. Price is the average price during each quarter. StdDailyRet is the standard deviation of daily returns. NumTrades is the average daily number of trades during each quarter. ShrsOut is the average number of shares outstanding during each quarter. NumMktMkrs is the average number of market makers during each quarter. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.

Table 7

Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

Bid-ask spreads and predictor variables for all NASDAQ-traded stocks are averaged throughout the quarter for each of the 72 quarters (March 1983 and December 2000). Quarterly averages are used in 72 cross-sectional regressions of the spreads on the institutional ownership, concentration, and other predictor variables. All variables are standardized each quarter, i.e., re-scaled to have a mean of zero and a standard deviation of one. Mean is the time-series average coefficient from the 72 quarterly regressions. St. Dev. is the standard deviation of the time series of parameter estimates. The first number in a Pos/Neg column reports the fraction of the 72 regressions with positive parameter estimates followed by the fraction of negative parameter estimates. The first number in the Pos/Neg 10% column contains fractions of the 72 parameter estimates, which are positive and significant at 10% significance level or better followed by the fraction of the negative parameter estimates, which are significant at 10% level or better. Pos. 1/5/10% column contains fractions of the positive parameter estimates, which are significant at 1/5/10% level, respectively. Neg. 1/5/10% column contains fractions of the negative parameter estimates, which are significant at 1/5/10% level, respectively. R^2 is average R^2 from 72 regressions; R^2-adj is average adjusted R^2 from 72 regressions; number of observations is average number of individual securities in 72 quarterly regressions.

Variable*	Mean	St. Dev	Pos/Neg	Pos/Neg 10%	Pos. 1/5/10 %	Neg. 1/5/10 %
TotalIO	-0.08970	0.04209	0.01 / 0.99	0.00 / 0.97	0.00 / 0.00 / 0.00	0.92 / 0.04 / 0.01
HSBanks	0.02184	0.01951	0.96 / 0.04	0.51 / 0.00	0.17 / 0.22 / 0.13	0.00 / 0.00 / 0.00
HSIns	0.00512	0.01204	0.67 / 0.33	0.07 / 0.04	0.03 / 0.03 / 0.01	0.00 / 0.03 / 0.01
HSInv	0.01482	0.01410	0.88 / 0.13	0.31 / 0.00	0.19 / 0.07 / 0.04	0.00 / 0.00 / 0.00
HSIndep	0.01425	0.01432	0.93 / 0.07	0.26 / 0.01	0.13 / 0.11 / 0.03	0.00 / 0.00 / 0.01
HSOther	0.00555	0.00840	0.76 / 0.24	0.08 / 0.00	0.01 / 0.03 / 0.04	0.00 / 0.00 / 0.00
Price	-0.07374	0.08501	0.01 / 0.99	0.01 / 0.79	0.01 / 0.00 / 0.00	0.72 / 0.03 / 0.04
StdDailyRet	0.67379	0.13053	1.00 / 0.00	1.00 / 0.00	1.00 / 0.00 / 0.00	0.00 / 0.00 / 0.00
NumTrades	-0.09575	0.13694	0.21 / 0.79	0.10 / 0.56	0.06 / 0.04 / 0.00	0.46 / 0.06 / 0.04
ShrOut	0.01475	0.06166	0.67 / 0.33	0.40 / 0.15	0.24 / 0.14 / 0.03	0.08 / 0.06 / 0.01
NumMktMkrs	-0.32054	0.07665	0.00 / 1.00	0.00 / 1.00	0.00 / 0.00 / 0.00	0.99 / 0.01 / 0.00
VolLarge	0.00602	0.03758	0.64 / 0.36	0.17 / 0.14	0.11 / 0.03 / 0.03	0.06 / 0.03 / 0.06
VolSmall	0.07839	0.06670	0.90 / 0.10	0.79 / 0.01	0.63 / 0.15 / 0.01	0.01 / 0.00 / 0.00
VolInd	0.07157	0.10233	0.79 / 0.21	0.58 / 0.07	0.40 / 0.13 / 0.06	0.06 / 0.01 / 0.00
R^2	0.6789					
R^2-adj	0.6766					
Number of qtrs	72					
Number of obs	3,459.86					

* TotalIO is a fraction of shares owned by all institutional investors. HSBanks, HSIns, HSInv, HSIndep, HSOther are measures of the concentration (Herfindahl Indices) of the ownership by Banks, Insurance Companies, Investment Companies, Independent Investment Advisors, and Other institutional investors. Price is the average price during each quarter. StdDailyRet is the standard deviation of daily returns. NumTrades is the average daily number of trades during each quarter. ShrsOut is the average number of shares outstanding during each quarter. NumMktMkrs is the average number of market makers during each quarter. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.

Table 8

Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

Bid-ask spreads and predictor variables for all NASDAQ-traded stocks are averaged throughout the quarter for each of the 72 quarters (March 1983 and December 2000). Quarterly averages are used in 72 cross-sectional regressions of the spreads on the institutional ownership, concentration, and other predictor variables. All variables are standardized each quarter, i.e., re-scaled to have a mean of zero and a standard deviation of one. Mean is the time-series average coefficient from the 72 quarterly regressions. St. Dev. is the standard deviation of the time series of parameter estimates. The first number in a Pos/Neg column reports the fraction of the 72 regressions with positive parameter estimates followed by the fraction of negative parameter estimates. The first number in the Pos/Neg 10% column contains fractions of the 72 parameter estimates, which are positive and significant at 10% significance level or better followed by the fraction of the negative parameter estimates, which are significant at 10% level or better. Pos. 1/5/10% column contains fractions of the positive parameter estimates, which are significant at 1/5/10% level, respectively. Neg. 1/5/10% column contains fractions of the negative parameter estimates, which are significant at 1/5/10% level, respectively. R^2 is average R^2 from 72 regressions; R^2-adj is average adjusted R^2 from 72 regressions; number of observations is average number of individual securities in 72 quarterly regressions.

Variable*	Mean	St. Dev	Pos/Neg	Pos/Neg 10%	Pos. 1/5/10 %	Neg. 1/5/10 %
Banks	-0.01253	0.02335	0.32 / 0.68	0.03 / 0.28	0.01 / 0.01 / 0.00	0.18 / 0.08 / 0.01
Ins	-0.01358	0.01234	0.11 / 0.89	0.00 / 0.26	0.00 / 0.00 / 0.00	0.13 / 0.08 / 0.06
Inv	-0.01546	0.02385	0.26 / 0.74	0.06 / 0.46	0.03 / 0.03 / 0.00	0.24 / 0.11 / 0.11
Indep	-0.07314	0.03458	0.00 / 1.00	0.00 / 0.96	0.00 / 0.00 / 0.00	0.86 / 0.07 / 0.03
Other	-0.01050	0.02146	0.28 / 0.72	0.03 / 0.18	0.00 / 0.01 / 0.01	0.10 / 0.03 / 0.06
HST	0.03744	0.02871	0.96 / 0.04	0.65 / 0.00	0.46 / 0.08 / 0.11	0.00 / 0.00 / 0.00
Price	-0.07413	0.08355	0.01 /0.99	0.01 / 0.78	0.01 / 0.00 / 0.00	0.72 / 0.04 / 0.01
StdDailyRet	0.67402	0.12988	1.00 / 0.00	1.00 / 0.00	1.00 / 0.00 / 0.00	0.00 / 0.00 / 0.00
NumTrades	-0.09606	0.13948	0.21 / 0.79	0.10 / 0.56	0.06 / 0.04 / 0.00	0.46 / 0.07 / 0.03
ShrOut	0.01092	0.05948	0.65 / 0.35	0.39 / 0.15	0.22 / 0.10 / 0.07	0.10 / 0.06 / 0.00
NumMktMkrs	-0.32113	0.07780	0.00 / 1.00	0.00 / 1.00	0.00 / 0.00 / 0.00	0.99 / 0.01 / 0.00
VolLarge	0.01086	0.03730	0.65 / 0.35	0.22 / 0.11	0.13 / 0.03 / 0.07	0.06 / 0.00 / 0.06
VolSmall	0.07603	0.06476	0.92 / 0.08	0.78 / 0.01	0.63 / 0.13 / 0.03	0.01 / 0.00 / 0.00
VolInd	0.07415	0.10247	0.79 / 0.21	0.58 / 0.07	0.43 / 0.13 / 0.03	0.06 / 0.00 / 0.01
R^2	0.6798					
R^2-adj	0.6774					
Number of qtrs	72					
Number of obs	3,459.86					

* Banks, Ins, Inv, Indep, Other are fraction of shares outstanding owned by Banks, Insurance Companies, Investment Companies, Independent Investment Advisors, and Other institutional investors. HST is the Herfindahl Index – a measure of the concentration of the institutional ownership. Price is the average price during each quarter. StdDailyRet is the standard deviation of daily returns. NumTrades is the average daily number of trades during each quarter. ShrsOut is the average number of shares outstanding during each quarter. NumMktMkrs is the average number of market makers during each quarter. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.

Table 9

Pair-wise Comparison of the Parameter Estimates from the Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

A difference between a pairs of parameter estimates is calculated for each of the 72 quarterly standardized cross-sectional regressions. The resulting time series of 72 differences is treated as sample from an unknown distribution. The estimated mean and standard deviation of the 72 pairwise differences are reported below along with the minimum, maximum, and median values, T-statistics and a corresponding p-value.

Difference	Mean	Std.Dev	T-value	Pr>|t|	Min	Max	Median
Banks-Inv	0.0029210	0.0325120	00.76	0.4484	-0.0678288	0.0595106	0.0111542
Banks-Indep	0.0606089	0.0446504	11.52	<.0001	-0.0239479	0.1798948	0.0627758
Banks-Other	-0.0020297	0.0301868	-00.57	0.5701	-0.0839645	0.1076279	-0.0049771
Banks-Ins	0.0010444	0.0203737	00.43	0.6649	-0.0579085	0.0492708	0.0024941
Inv-Ins	-0.0018765	0.0207313	-00.77	0.4450	-0.0371128	0.0436075	-0.0061385
Inv-Other	-0.0049506	0.0317006	-01.33	0.1894	-0.0594757	0.0812173	-0.0121751
Inv-Indep	0.0576879	0.0351307	13.93	<.0001	0.0110844	0.1861401	0.0475256
Indep-Ins	-0.0595645	0.0348561	-14.50	<.0001	-0.1618044	0.0025390	-0.0577760
Indep-Other	-0.0626386	0.0292111	-18.20	<.0001	-0.1385395	0.0145662	-0.0644544
Ins-Other	-0.0030741	0.0218074	-01.20	0.2356	-0.0321137	0.0794688	-0.0069508
VolLarge-VolSmall	-0.0651718	0.0786441	-07.03	<.0001	-0.2816571	0.1438799	-0.0629674
VolLarge-VolInd	-0.0632863	0.0991034	-05.42	<.0001	-0.3669919	0.2038327	-0.0524021
VolSmall-VolInd	0.0018855	0.1156583	00.14	0.8904	-0.3257472	0.3401607	0.0063197

* Banks, Ins, Inv, Indep, Other are fraction of shares outstanding owned by Banks, Insurance Companies, Investment Companies, Independent Investment Advisors, and Other institutional investors. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.

Table 10

Summary of the Relative Impact of Selected Variables on the Bid-Ask Spread.

After obtaining time-series of the parameter estimates from the 72 cross-sectional standardized regressions of the spreads, differences between selected pairs of the parameters were computed. These differences were treated as samples from unknown distributions. Estimated means, standard deviations, t-statistics and corresponding p-values are reported in Tables 49-50. The summaries of the relative contributions to the widening of the spread are reported below. X>Y means that same values of X produce larger contribution to widening of the spreads, than identical values of Y. {Z, W} means that tests did not provide significant inference about relative impact of the variables Z and W on widening bid-ask spreads, and therefore their relative ranking is not reported.

Model	Relative Contribution to Widening Spreads*
Spread 2 (Eq. 19)	HS Banks > {HS Indep, HS Inv} > HS Other > HS Ins {VolSmall, VolInd} > VolLarge
Spread 3 (Eq. 20)	{Banks, Inv, Ins, Other} > Indep {VolSmall, VolInd} > VolLarge

* Banks, Ins, Inv, Indep, Other are fraction of shares outstanding owned by Banks, Insurance Companies, Investment Companies, Independent Investment Advisors, and Other institutional investors. HSBanks, HSIns, HSInv, HSIndep, HSOther are measures of the concentration (Herfindahl Indices) of the ownership by Banks, Insurance Companies, Investment Companies, Independent Investment Advisors, and Other institutional investors. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.

Table 11

Pair-wise Comparison of the Parameter Estimates from the Standardized Regressions of the Bid-Ask Spread on the Ownership, Concentration and Other Predictor Variables

A difference between a pairs of parameter estimates is calculated for each of the 72 quarterly standardized cross-sectional regressions. The resulting time series of 72 differences is treated as sample from an unknown distribution. The estimated mean and standard deviation of the 72 pairwise differences are reported below along with the minimum, maximum, and median values, T-statistics and a corresponding p-value.

Difference	Mean	Std.Dev	T-value	Pr>|t|	Min	Max	Median
HSBanks-HsInv*	0.0070166	0.0200606	2.97	0.0041	-0.0475308	0.0741565	0.0098564
HSBanks-HSIndep	0.0075843	0.0171133	3.76	0.0003	-0.0391525	0.0583037	0.0071761
HSBanks-HSOther	0.0162826	0.0222490	6.21	<.0001	-0.0128831	0.1051327	0.0100255
HSBanks-Hsins	0.0167166	0.0180353	7.86	<.0001	-0.0102276	0.0999034	0.0122708
Hsinv-HSIns	0.0097000	0.0163766	5.03	<.0001	-0.0215055	0.0447760	0.0107773
Hsinv-HSOther	0.0092660	0.0162251	4.85	<.0001	-0.0192688	0.0452344	0.0050432
Hsinv-HSIndep	0.0005676	0.0163798	0.29	0.7696	-0.0433520	0.0376522	-0.0002320
HSIndep-Hsins	0.0091323	0.0175890	4.41	<.0001	-0.0469636	0.0580882	0.0070419
HSIndep-HSOther	0.0086983	0.0164858	4.48	<.0001	-0.0190884	0.0533185	0.0053305
HSIns-HSOther	-0.0004339	0.0144968	-0.25	0.8002	-0.0208445	0.0539590	-0.0027570
VolLarge-VolSmall	-0.0723694	0.0813334	-7.55	<.0001	-0.2776551	0.1428384	-0.0669469
VolLarge-VolInd	-0.0655458	0.0990649	-5.61	<.0001	-0.3651654	0.2012608	-0.0527445
VolSmall-VolInd	0.0068236	0.1168443	0.50	0.6218	-0.3119998	0.3482506	0.0117822

* HSBanks, HSIns, HSInv, HSIndep, HSOther are measures of the concentration (Herfindahl Indices) of the ownership by Banks, Insurance Companies, Investment Companies, Independent Investment Advisors, and Other institutional investors. VolLarge is the quarterly volume generated by institutional investors with large positions (greater, than 1% of shares outstanding). VolSmall is the quarterly volume generated by institutional investors with small positions (smaller, than 1% of shares outstanding). VolInd is the quarterly volume generated by individual investors, institutions with positions that do not pass reporting thresholds, and other institutional trades, which are offset within a quarter.