

Liquidity, Expectations and Ownership: Motivations and Explanations for Short Sales on the Nasdaq

J. Edward Graham
Department of Economics and Finance
Cameron School of Business
University of North Carolina at Wilmington
Wilmington, NC 28403
edgraham@uncwil.edu

J. Christopher Hughen
Department of Finance
Bowling Green State University
Bowling Green, OH 43403
E-mail: chughen@cba.bgsu.edu

Cynthia G. McDonald
Finance Department
College of Business and Public Administration
University of Missouri-Columbia
214 Middlebush Hall
Columbia, MO 65211
McDonaldCy@Missouri.edu

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ABSTRACT

We examine transaction costs and the factors impacting both stock liquidity and short interests. We think that variations in short interest ratios reflect variations in transaction costs, for which we provide controls. Testing our premises, we examine short selling activity among the 200 largest Nasdaq stocks between 1991 and 1998. Our findings confirm our expectations. First, the more liquid stock with a greater number of market makers is more likely to be shorted; second, shorting is greater among stocks with higher forecasted growth and for which there is less agreement among analysts; third, short and long horizon returns are lowest for stocks reporting unexpected increases in short interests; fourth, short interest ratios are higher for firms with both high (over 25%) and low (under 5%) inside ownership; finally, we provide evidence that short-sellers may anticipate overall market direction, and not only negative share price movements in individual stocks. Supporting our findings and affirming earlier work, we find falling short sales with larger bid/ask spreads and lower trading volumes, with larger firm market values, with dividends and with prior positive returns on the stock. We discover increasing short sales with available options, with higher P/E and market to book measures, and with larger long term growth forecasts and deviations of analysts' growth forecasts. Short sales tell an invaluable story about the prospects for a given stock; in fact, the unanticipated change in a stock's short interest is the single most important factor, in our examinations, for describing subsequent returns. .

Liquidity, Expectations and Ownership: Motivations and Explanations for Short Sales on the Nasdaq

A number of recent studies reveal that short and long term stock returns can be characterized by the degree of short-selling in heavily shorted firms. Asquith and Meulbroek (1996), DeChow, Hutton, Meulbroek and Sloan (2001) and Desai, Thiagarajan, Ramesh and Balachandran (2002) provide evidence of negative long-run underperformance for NYSE, AMEX and Nasdaq stocks experiencing high short interest.¹ The studies hold that high short interest levels often contain negative information.

We believe the information content of short sales is largely a function of the costliness of the constraints on short selling. These short sales constraints, further, impact both stock liquidity and pricing. However, any presumptions that these constraints provide some absolute limit to a stock's short interest are misguided. Our proxy for the idea that the constraints are not binding is the explanatory power of unexpected changes in short interest levels. We don't, however, simply examine short sales: We develop and adopt a set of new variables that motivate and explain short sales on the Nasdaq. We discover new relationships between short selling, the firms sold short, returns behavior and overall market performance. We extend earlier studies with controls for such factors as market value ratios, analyst opinions, unexpected levels of reported short-selling and firm ownership structures.

The costliness of short-selling is a matter of degree. We believe, for example, that the costliness of short-selling illiquid stocks underscores the significance of the information delivery with

¹ Alternatively, Vu (1987) Brent, Morse and Stice (1990) and Woolridge and Dickenson (1994) find no significant relation between short-interest measures and abnormal returns. Woolridge and Dickenson hold that short-sellers do not earn significant returns at the expense of less-informed traders. In an earlier study, Hanna (1976) discovers a positive relation between increasing short interest and stock prices, and he concludes short-interest ratios are actually bullish indicators. Conversely, Figlewski (1981) finds significantly lower risk-adjusted returns for firms with high short interests. More recently Aiken, et al (1998) find short sales data quickly incorporated into Australian stocks. Further, Kadiyala and Vetsuypens (2002) propose that changing short interest is a "new metric" of the signaling power of a corporate announcement, in their

a short sale, but we expect higher short sales among more liquid stocks that are less costly to short – those with smaller bid/ask spreads and more market makers and higher trading volumes. The ability of a short-seller to disguise his trading and spread sales among a larger number of market makers is, we expect, especially important. Further, we expect stocks with greater divergences between analysts’ opinions to be attractive candidates for short sellers. We also believe there is confusion about the use of short sales data; we address this with our treatment of the unexpected component of reported short selling. These unexpected reported short interest levels are not measured in earlier studies as in ours. Finally, prior work on short selling overlooks the potential explanatory power of ownership structure in describing short sales. We control for institutional and inside ownership in our examinations.

We build a model in this study that employs these factors associated with short-selling and that can be used to more fully describe short-selling activity in the 200 largest Nasdaq stocks between 1991 and 1998. We control for transaction costs and do not believe there is a meaningful limit to the short sales of our sample stocks. Test results support our expectations. The more liquid stock with a greater number of market makers is more likely to be shorted. We discover that shorting is greater among stocks with less analyst consensus. We find that subsequent returns are lowest for stocks reporting unexpected increases in short interests. As well, short interest ratios are higher for firms with both high (over 25%) and low (under 5%) inside ownership. Finally, we provide evidence that short-sellers seem to anticipate overall market direction, and not only price declines in individual stocks; unanticipated increases in short interest ratios are significantly associated with declinations in both short and long run returns, and seem often to portend declinations in the overall market, during a period of unprecedented market advances.

Extending earlier work and supporting our findings, we observe falling short sales with larger bid/ask spreads and lower trading volumes, with larger firm market values, with institutional ownership, with dividends and with prior positive returns on the stock. Increasing short sales are seen with available options, with higher P/E and market to book measures, and with larger long term growth forecasts and deviations of analysts' growth forecasts. Unexpected changes in short interest help to explain negative long run and short run subsequent stock returns. Underscoring the idea that well-informed short-sellers may anticipate overall market direction, we find that an *unexpected increase* in the short interest ratio is more significant than the short interest ratio itself in describing later returns.

The organization of this paper is as follows. First, we review the evidence on short interest and stock prices, as well as alternative motivations for short-selling. We summarize elements of an evolving literature that suggests that market anomalies, such as the predictability of returns for heavily shorted stocks, can be more fully explained with a coupling of financial theory and investor behavior. Section II provides a description of the sample used to test our initial premises, the 200 largest Nasdaq firms. We conduct an empirical analysis of the cross-sectional characteristics of short interest in our sample in Section III. A summary of the empirical results is given in Section IV, along with some concluding remarks.

I. The Short-Selling Background

Allen and Gale (1991) note that short-selling is normally accomplished in the pursuit of three primary objectives: (1) to profit from a stock price decline, (2) to postpone the taxation of and lock in a gain in the stock shorted (known as shorting against the box) and (3) to reduce portfolio exposure or variance through hedging or arbitrage activities.² In circumstances where short sales are prompted

² Shorting against the box, considered by Tucker and Watson (1999), is a practice virtually eliminated by the Taxpayer

by uninformed strategies, as with objectives (2) and (3), high short interest is less likely to be followed by the underperformance occurring with “informed” short-selling.

Short-selling is associated with costly constraints not assumed by traders taking a long position. These costly constraints include restricted access to short-sales proceeds, dividend payments on the shorted stock, the uptick rule (not a concern for Nasdaq trades prior to June of 1994), short “squeezes,” and insider prohibitions against short-selling.³ Brown, Carlson and Chapman (1999) note also that the majority of mutual funds explicitly exclude short sales as a trading strategy. Further, Kosti and Pontiff (1999) find that almost 80% of “equity mutual funds make no use of derivatives whatsoever,” implying that short positions are likely not constructed “synthetically” within the funds.

Miller (1977), in a seminal modeling of the theoretical impact of restricted short sales, shows that a “badly informed minority” of optimistic investors can bid up a stock price to an inefficient level if a better informed group of investors are prevented from delivering their averse opinion to the market due to short selling preclusions. Diamond and Verrecchia (1987) likewise illustrate the effects of short-sale constraints on risky asset prices and information flows. Under their assumption that rational investors incorporate short-sale constraints into their expectations, asset prices themselves are not biased upward. However, “the constraints imply an information asymmetry,” and the *speed* of asset price adjustment is reduced when there are restrictions on short sales. Duffie (2002) counters, in his recent theoretical study, that greater upward bias in prices can be attributed to costly shorting restrictions where some shorting is allowed than where “shorting is disallowed” altogether. Hong and Stein (2002) constrain short sales altogether in their current theoretical discourse, and propose that

Relief Act of 1997. Short-selling activity is frequently associated, as well, with merger activity. Geczy, Musto and Reed (2002) report the increased costliness of this strategy where the acquirer’s stock is not widely available to borrowers. Jindra and Walkling (2001) comment on market mispricing during mergers and allude to the short-selling strategy sometimes suggested by merger announcements.

³ These costs are discussed in Janvey (1992). D’Avolio (2002) provides a broad examination of “the market for borrowing stock,” where the short seller is required to “borrow” the stock that is later sold short.

information excluded from security prices is more likely to be “flushed out through the trading process” in a falling, versus stable or rising, market. 4

If, as alluded to by Jones and Lamont (2002) and Fama (1991), prices are influenced by costly frictions, and prices are within a “band” of plus or minus this cost, then an “efficient” price may be a significant distance from the price that would exist in a market absent these costly additional frictions.

The key finding of recent studies suggest, however, that a profitable strategy exists even with investors suffering these extra costs, especially for the heavily shorted stock.

Mitchell, Pulvino and Stafford (2001) note the need for an investor to post additional collateral with an appreciating shorted stock; this is analogous to receiving margin calls on depreciating stocks held long and bought on margin. Jones and Lamont (2002) hold, further, in their study of the costs of short-selling in US markets between 1926 and 1933, that the “stock lender may charge a fee to the stock seller.” Since a short sale is the sale of a security that the seller does not own or chooses not to deliver, the short-seller must borrow the shares sold. This additional costly friction may discourage the delivery to the market of valuable adverse opinions about a stock. Yet, despite these costs, Jones and Lamont find that stocks newly shorted or that are the most costly to short have “low subsequent returns,” suggesting that even the stocks most costly to short later underperform.⁵

4 Baker and Stein (2002) and Hong and Stein (2002) suggest that lower average returns attach to the more heavily traded stock. This negative skewness among the returns of more liquid stocks is supported earlier in Chen, Hong and Stein (2002), who hold that the breadth of stock ownership is a better proxy for firm prospects than short interest levels. Chen, Hong and Stein suggest further that variations in short interest levels reflect costs of going short, not necessarily variations in the degree of negative information.

5 Although the recent studies (Asquith and Meulbroek, 1996, and DeChow, Hutton, Meulbroek and Sloan, 2001) provide evidence that high short interest is frequently followed by negative returns in the shorted stock, the popular press suggests that only a small fraction of short sales is related to bearish sentiment. One author suggests, “[t]he vast majority—perhaps 98% by one informed estimate—are merely efforts to hedge stock holdings or take advantage of arbitrage opportunities with other forms of investment.”(See “The Secret World of Short-Sellers,” by Gary Weiss, *Business Week*, August 5, 1996, p. 62). Similarly, Michael Minikes, treasurer at Bear Stearns Cos., remarks that short interest often “has nothing to do with people’s opinions about a particular stock.” (See “What Short-Sellers Are Really Thinking,” by Greg Ip, *Wall Street Journal*, March 6, 1997, pp. C1, C19).

Consistent with short-sellers having superior information, Asquith and Meulbroek (1996), DeChow, Hutton, Meulbroek and Sloan (2001) and Figlewski and Webb (1993) find long-run underperformance for NYSE and AMEX stocks experiencing high short interest.⁶ Figlewski and Webb suggest “investors do not make full use of published short-selling information and that confusion over the use of short-interest data may explain the seemingly inefficient impoundment of short-interest data in stock prices.”⁷ Figlewski and Webb find also that increased short-selling is common for optionable stocks. This is affirmed by Danielson and Sorescu (2001), who model and empirically test the idea that security prices should decrease and short levels increase with reduced short sale constraints; these constraints are reduced with the introduction of options. Their premise holds for much of their sample, but evidence prior to 1981 suggests both short levels and stock prices increase with option introduction. Danielson and Sorescu suggest this pattern was ameliorated in 1982, with the advent of index options to “complete” the market. Similarly, Senchack and Starkes (1993) find negative, albeit small, market responses to “unexpected” increases in stock short levels, but the market response is tempered if the stock has tradable options.⁸

Other factors are expected to influence the amount of short interest in a stock. DeChow, Hutton, Meulbroek and Sloan (2001) examine monthly short interests of exchange-listed stocks (using Asquith and Meulbroek’s, 1996, database) and note that “fundamental analysis” is linked to the shorting of stocks that are identified as “overpriced.” They consider factors such as analysts’ growth forecasts, earnings-to-price measures and market-to-book ratios, associated in a broad literature with the cross-section of stock returns, and discover that these and other variables are “actively exploited

⁶ Similar findings for Nasdaq stocks are given in Desai, Thiagarajan, Ramesh and Balachandran (2002).

⁷ Figlewski and Webb’s results, however, are not robust to a partitioning of their data; high short interests characterize subsequent returns for their sample from 1973 through 1979, but not for the later period from 1979 to 1983.

⁸ Senchak and Starkes (1993) consider a short level announcement “unexpected” if a firm’s level of shares sold short doubles from the previous month’s report in the *Wall Street Journal*. Their naïve expectations hypothesis holds that the “expected” level of shorting is the same as the prior month’s report, and that a doubling is “unexpected.”

by sophisticated investors who specialize” in the shorting of “overpriced stocks.”⁹ DeChow, et al further reveal increased short-selling among fundamentally overvalued stocks whose transaction costs are “relatively low” and whose fundamentals are not *temporarily* skewed to suggest over-valuation. They support a temporary mispricing hypothesis forwarded by Lakonishok, Shleifer and Vishny (1994).

The sentiment of investors likely also influences short-selling willingness, and measures of sentiment can be expected to be associated with short-selling activity. For example, bid-ask spreads, proxying for investor sentiment, should widen if investors observe heavy short sales in a stock and use those sales as a proxy for increased riskiness in the stock. Likewise, if the bid-ask spreads for heavily shorted stocks widen, then investors may be using short interest information in their trading decisions.

The costliness of short-selling also increases with widening spreads and may discourage additional short sales.¹⁰ This impact of widening spreads is framed in a recent working paper by Baker and Stein (2002). They construct a model that predicts lower returns for firms with *narrower* spreads and lower trading costs. Adopting “market liquidity as a sentiment indicator,” Baker and Stein’s model constrains short sales, keeping investors out of the market when their sentiment is negative, and shows how the more liquid stock with a lower bid/ask spread is more likely, *ceteris paribus*, to be overvalued. Thus, we expect increasing short-selling activity and lower subsequent returns for this security that is less costly to short and that is more likely to be overpriced.

⁹ The findings of DeChow, et al (2001) contrast with DeChow and Sloan (1997). In that earlier article, the two authors find that a contrarian strategy is suggested for investors, but the strategy is one framed by betting against over-optimistic *analysts*, and not one – as implied by Lakonishok, Shleifer and Vishny (1994) – where the short-seller simply bets against stocks with over-optimistic *fundamentals*. In this latter strategy, explaining the short sales in the more recent DeChow, et al study, a naïve expectations hypothesis dominates; investors naively extrapolate current earnings and sales growth rates into the future and bid a stock up to a price attractive to short-sellers.

¹⁰ Closed-end fund (CEF) discounts are examined in a similar light, by Brown (1999). He finds greater discounts on the selling prices of CEF’s with increased CEF price volatility; his work extends a decade-long debate on the importance of investor sentiment in describing pricing and volume behavior in the securities markets. The CEF “puzzle” is examined earlier by Lee, Shleifer and Thaler (1991), who find that discounts on CEF’s narrow when buyers perceive less risk in the CEF purchase. Elton, Gruber and Busse (1998) do not support Lee, Shleifer and Thaler. However, Neal and Wheatley

Since short-sellers must borrow the shares, the availability of shares will influence the amount of short interest. Two primary sources of stock loans are institutions and brokerage accounts. Institutions lend shares for a fee. Brokers are permitted to lend shares from their own accounts and from customers' margin accounts.¹¹ Hence, there should be a positive relationship between the amount of institutional ownership and short interest. Similarly, ownership concentration may be related to short sales activity depending upon how short sellers use market-value measures in their shorting decisions. Morck, Shleifer and Vishny (1988) find that insider ownership of less than 5% or more than 25% of the firm is associated with increases in firm value, as measured using Tobin's Q. Assuming similar patterns exist within our sample of Nasdaq stocks, and that short sellers use surrogates for Tobin's Q in selecting short candidates, then we expect the firms with high or low inside ownership to exhibit increasing levels of short-selling; we expect these higher levels, ceteris paribus, just as we expect higher shorting among firms with higher P/E ratios.

There should likewise be a positive correlation between the marginability of a stock and its adjacent level of short-selling. Non-marginable stocks are likely to have a much lower relative level of short interest, given their frequent unavailability to the short-seller. Asquith and Meulbroek (1996) note that large short-sellers attempt to avoid potential short squeezes by discovering the lender's identity; the premise is that there should be a positive relation between the presence of institutional investors with long expected holding periods (such as an index fund) and short-selling activity.

Another factor likely to influence the amount of short interest is the presence of convertible securities. A 1997 *Wall Street Journal* article quotes Anand Iyer, director of global convertible-

(1998) find that spreads on CEF's are important sentiment measures; these discounts predict later fund returns.

¹¹ Geczy, Musto and Reed (2002) examine the costliness to short-sellers of borrowing in the "equity lending market in general" and in three specific areas that the authors suggest are particularly vulnerable to costly constraints on short sales: IPO's, merging stocks and growth stocks..

product analysis at Salomon Brothers, as estimating that “hedge funds now hold between 30% and 35% of convertible securities.” Hedge funds can sell short the underlying stock, thereby neutralizing the impact on the convertible of movements in the stock, and acquire a “rich income stream from the convertible’s coupon or dividend.” The same article notes that hedging models often require additional short-selling when the convertible securities are closer to being “in the money.” Howe, Lin, and Singh (1998) document profitable cross-security arbitrage opportunities (buying the convertible preferred and simultaneously selling the underlying common) for market makers at the time of and subsequent to the announcement of conversion-forcing calls of convertible preferred stocks.¹²

As exhaustively reviewed by Hirshleifer (2001), the study of asset pricing is in “vibrant flux,” and current financial theory and purely rational explanations do not adequately describe security prices. His remarks broadly encourage the linking of investor psychology with financial models used to portray such market anomalies as the predictability of returns for heavily shorted stocks. As in Barber and Odean (2001), individual investor overconfidence in their own information may lead to the sort of overpricing that attracts short-sellers. We consider whether or not short sales might be a noisy proxy for, or a costly signal of, the degree of overpricing in these stocks. If psychological biases exist in the pricing of these securities, those biases should manifest themselves in the factors encouraging short sales. Likewise, if the larger and better covered Nasdaq stocks are more often shorted, then there is less uncertainty and less room, all else constant, for psychological biases.

On the way towards discovering the sources of risk underlying short sales, we seek to add to the explanation of the factors that influence short-selling. It is difficult, though, to explain the continued ownership of heavily shorted stocks by investors holding long positions, given recent

¹² An inadequate number of conversions (30), only four times more than one per month, exist within our sample to draw

discoveries of adverse performance for heavily shorted stocks. Perhaps the unfamiliarity of short sales data, its “costly processing” or its infrequent reporting may contribute to this conundrum. Or, investors may have formed a habit of ignoring short sales data; a self-deception theory, reviewed by Hirshleifer (2001), holds that people simply do not want to hear evidence about others whose opinions are likely the reverse of their own, as is the case in those owning long versus going short a selected stock. Short sales, being unfamiliar, seem more risky. To understand this risk, rational learning includes increasing our knowledge and the use of short sales data in security selection. We are being remiss in overlooking factors that encourage short sales. Heavily shorted stock returns do not appear to be “vagaries of chance.”

II. Sample Selection Procedure and Summary Information

We begin our study with a sample drawn from a comprehensive report of all monthly short-selling activity on the Nasdaq.¹³ The relative short interest ratio is defined as a firm’s reported short interest divided by its shares outstanding. We use this ratio and examine the short-selling activity of the largest 200 firms on the Nasdaq, as determined using market value of equity at the end of each year. We select the 200 largest firms given the greater data available for these companies. We partition the sample with CRSP-reported market values beginning in July of 1991 and ending in December of 1998. The sample “rolls” each year to the 200 largest market-valued firms at the end of the previous year. Securities that are delisted (due to acquisition, for example) are dropped from our analysis when they removed from the Nasdaq. Securities continuing to be listed after acquisition activity are retained. We exclude from our analysis securities that are never listed in any one of the IBES, CRSP or *Compustat* data sets. The sample is restricted also to the common stock of Nasdaq

any meaningful statistical conclusions.

¹³ The report is prepared by the Historical Research Department at the NASD. This data avoids the potential sample selection bias of short-sale studies using information published in the financial press.

firms with available CRSP, *Compustat*, IBES, *Standard and Poors* and *Compaq Disclosure* data.

Table 1 illustrates the increase over time in short-selling activity for our sample. The table provides average monthly median and mean short interest ratios for these 200 largest Nasdaq firms. Mean (median) short interests for the sample increase from around 2% (.68%) to over 4% (3%). The median short interest level more than quadruples between 1991 and 1998; the mean level of short-selling increases for every year during our sample period except 1998. We report also in Table 1 the median short interest ratios for the first and third quartiles of short-selling activity. We find that short selling is concentrated among the most heavily shorted of these 200 largest Nasdaq firms. The median short interest ratio for the third quartile, in column five of Table 1, is over 5.5% in 1998. The median quintile for the least heavily shorted quartile is less than 1% until 1996.

[TABLE 1 ABOUT HERE]

Median levels of short interest for the sample firms are portrayed in Figure 1; there, increasing short interest levels between 1991 and 1998 for the sample are contrasted with the decreasing relative bid/ask spreads (the bid/ask spread divided by a stock's price) for those firms over the same period. Among the costly constraints to short-selling is the bid/ask spread; increasing short-selling over the observed period of declining transaction costs makes intuitive sense. As stock trading and overall market activity expanded during the 90's, the importance of short sales increased in both an absolute, and relative, context.

[FIGURE 1 ABOUT HERE]

The characteristics of the 200 largest Nasdaq securities over the period from 1991 through 1998 are provided in Table 2. Using information provided by Nasdaq, the mean (median) short interest ratio for our sample is 3.55% (1.93%). The mean (median) share price is \$33.48 (\$29.84). Price and volume data provided by CRSP reveals average mean (median) trading volumes of over 780,000 (321,000). The mean (median) market value of these firms' shares outstanding is \$2.64 billion (\$1.06 billion). Bid/ask spread data in Table 2 illustrates absolute spreads that average around \$.37 or 1.3% of the typical firm's stock price. Extending earlier research, we anticipate larger and more costly spreads to constrain short-selling activity. The number of market makers averages over 24 in our sample, with a slightly lower median. Unexamined in the currently circulating short sales studies, we expect more short sales with more market makers, as "sophisticated" investors are able to spread short sales among more parties, and are able also to reduce transaction costs in a more competitive trading environment.

Analyst data used in our examinations is provided by IBES. The number of analysts averages just under 11 for our sample firms, with a median of nine. Estimates of the growth that these analysts expect is given in Table 2, as well. We believe that with greater estimates of long term growth, short sales will increase. We extend the current research with our consideration of this factor and a "Standard Deviation of Analyst Estimates" of growth in Table 2. We predict that more positive estimates of growth and greater standard deviations of these estimates will be associated with higher short selling activity. The "Price / Book" and "Price / Earnings" measures in Table 2 are constructed using CRSP data and accounting information from *Compustat*. We expect increasing short sales with higher measures of these market value ratios. Likewise, we believe we will find decreasing short sales for dividend paying stocks, though data in Table 2 suggests that only modest dividends are paid by our sample firms.

[TABLE 2 ABOUT HERE]

Ownership data in Table 2 is provided by *Compaq Disclosure*. Ownership is another factor we believe influences short selling activity and subsequent returns, and it has received little attention in the short sales literature. Institutional ownership of the 200 largest Nasdaq firms averages just under 52%, with the median close to the mean. The mean of inside ownership is skewed, however, with insider ownership averaging 19.3% versus a median of 11.6%. Substantial inside ownership of select firms in our sample causes this disparity. We extend the extant short sales literature with our expectation of increasing short sales for firms with substantial institutional ownership; we believe the institutional ownership is a likely proxy for the availability of the stock for short selling, either through institutional lending directly to short sellers or through brokerage house margin accounts.

We also extend the short sales research with our inclusion of an inside ownership variable. This factor, though likely framing the motivations of a number of short-sellers, is not included in any circulating short sales study. As noted above, increasing measures of firm value are often associated with management ownership of less than 5% or more than 25% of the outstanding shares; given investors' patterns of using similar proxies for firm value in their shorting decisions, we anticipate increasing levels of short-selling for firms with high or low inside ownership; we expect greater short-selling of these firms, *ceteris paribus*, just as we expect higher shorting among firms with high market value ratios. Data in Table 2 reveal that just under a third of the firms in our sample exhibit inside ownership of more than 25 % or less than 5%, with a third control group occupying the middle ground.

Finally, option data in Table 2 is gathered from *Standard and Poors Stock Guides*. We expect

to affirm the findings of earlier studies that optionability leads to greater short sales, through arbitrage strategies and with the greater liquidity of optionable stocks. As portrayed in Table 2, a majority of the firms in our sample have available options during the period examined. Conversion data is the last item in Table 2; as earlier disclosed, very few conversions took place for the sample firms over the period examined.

III. Empirical Analysis

Practitioners sometimes hold that short sales are good news, representing subsequent pent up demand, yet academics counter in recent work. One of our objectives is to consider this popular contrast between academics and practitioners. Towards that end, we study the relationship between short-interest levels and firm characteristics. Our interest is with the impact of short sales constraints on both stock liquidity *and* short-selling, and to determine the relative importance of transactions costs and short interests in describing stock price behavior. Our controls for transactions costs are designed to separate the associations of these costs and short levels with stock returns.

Studies considered above reveal that highly shorted firms on the two major exchanges and the Nasdaq underperform selected benchmarks in the near and long term; however, no earlier study considers, in our framework, the factors that may contribute to substantial short positions in a particular stock. While recent work contributes to the task of identifying factors associated with short-selling, the specific motivations of the short-sellers are not completely clear.

We examine cross-sectional variations in short-selling behavior. We control for market conditions with our month-by-month analysis, reporting mean and median coefficient estimates for each month. We allow for the factors in earlier work found significant in describing short sales. Variables such as the stock's liquidity, earnings-to-price ratios, analysts' growth forecasts, book-to-market ratios, dividends, ownership, number of market makers, and divergences of analysts opinions

are examined.

Employing the factors above, a correlation analysis is given in Table 3 and cross-sectional results are provided in Tables 4 and 5. A cross-sectional analysis of returns subsequent to the reporting of short sales data is given in Table 6. Measures of the importance of unanticipated levels of short sales in explaining subsequent stock price behavior are provided in that final table.

Table 3 reports the results of a univariate analysis of the relation between spreads and short-interest levels with the security characteristics hypothesized to influence short-selling activity. Perhaps most importantly, an inverse relationship is observed between short selling and relative spreads. Data in Table 3 affirm that relationships, largely consistent with our expectations, exist between all but two of the factors (number of analysts and bond conversions with percent short interest), the spread and the short ratio. Mean coefficients for all but those two factors are statistically different than zero, as the table illustrates.

[TABLE 3 ABOUT HERE]

A cross-sectional analysis of the relative short interest ratio is reported in Table 4, with mean coefficient and p-values for each of the 90 months of our study given for each factor. Results of a seemingly unrelated regression analysis of the bid/ask spread are given in Table 5. We estimate a regression among all the stocks for each month. This is key. Inasmuch as bid-ask spreads are narrowing and short interest levels are increasing over virtually the entire study period, we would expect to find misleading relationships between the explanatory factors and the dependent variables without this control for time.

Model 1 in Tables 4 and 5 includes analyst data, and a smaller sample than Model 2. That

second model accomplishes the same tests as Model 1, but with a larger sample unrestricted to firms with available analyst data.

The influence of our included factors upon the relative short interest ratio is given in Table 4. Results are broadly in line with our expectations. Greater spreads, higher market values, dividend payments and positive prior returns are associated with reduced short selling activity. That the prior returns are significant in describing short selling activity is curious. On the one hand, we expect the highest priced stocks to offer the greatest potential gain to the short-seller, but the firms that have outperformed the market (presumably on the way to a price more attractive to a short-seller) in the preceding months are associated with declines in short-selling activity.

Inasmuch as we expect inordinate short-selling in certain industries, we control for four SIC codes in Table 4: SIC 35 demarks “Electronic Equipment,” SIC 36 denotes “Semiconductors and Communication Equipment,” SIC 48 controls for “Communication Services” and SIC 73 includes “Services.” With the rapid advance in the market values of “high-tech” firms especially, we find that firms in the semiconductor (SIC36) and communications (SIC48) industries are more likely shorted. Four of the factors in Table 4, high inside ownership, price-to-book ratios (likely displaced by other measures for which we control) and SIC codes 35 and 73 are not significant in model 1; all of the coefficients in Model 2 in Table 4 are significant. Among our findings are that options, low or high inside ownership, larger numbers of market makers, higher price/earnings and price/book measures, and optimistic estimates of firm growth (or disparity among the estimates of growth made by analysts) are all associated with increased levels of short selling, when controls are not provided for analysts or industry.¹⁴

¹⁴ The price/earnings and price/book measures are Winsorized to eliminate the influence of extreme measures of these

[TABLE 4 ABOUT HERE]

Overall, results reported in Table 4 affirm that the most liquid stock, with the greatest number of market makers and highest trading volumes is more likely to be sold short; as well, a stock with higher institutional ownership, and presumed greater marginability and availability, is *less* likely to be shorted. It is probable that greater institutional ownership exists among “older” and more stable and dividend-paying stocks – those less actively shorted – thus influencing those results. Also in Table 4, we see that confirmation of our expectations vis a vis inside ownership, with short-selling positively correlated with high and low inside ownership.

In Table 5, riskier stocks, with greater standard deviations of returns, are associated with greater bid/ask spreads. In general, higher priced stocks of firms with greater market values (within our sample), more market makers and options available have lower spreads. The signs and significance of the coefficients in Table 5 are consistent with our expectations. With smaller (larger) bid/ask spreads, we anticipate more (less) short selling activity in a given stock.

[TABLE 5 ABOUT HERE]

Our final set of results is given in Table 6. There, we employ the residuals from the models in Table 4 to perform regressions on the ability of short interest, unanticipated changes in short interests (the residual from the models in Table 4) and a CRSP index to describe stock returns subsequent to the reporting of the short interest data. The results in Table 6 are telling; whereas recent research focuses upon the ability of reported short interest levels to describe subsequent stock returns, the

factors.

ability of the “surprising” portion of these short sales reports to describe returns is overlooked. Yet, in all of the models reported in the two panels of Table 6, we find the unanticipated short interest factor displaces the simple short interest ratio in describing subsequent security returns. Where both factors are included in Models 1c and 2c of Panels A and B, the unanticipated factor dominates and displaces the significance of the short interest ratio. The data in Table 6 suggests also that short-sellers may anticipate market returns.

[TABLE 6 ABOUT HERE]

IV. Summary and Concluding Remarks

We examine the relation between firm characteristics and short-interest levels and between short interest levels and subsequent returns. We control for the costly constraints to short-selling and are able to explain, in a new fashion, the motivations for short selling among the largest 200 Nasdaq stocks between 1991 and 1998. Since the institutional framework of a short sale is costly relative to a purchase, we believe that the characteristics of highly shorted and non-highly shorted stocks on the Nasdaq differ significantly. Our findings broadly support our expectations. We show short selling is discouraged for securities with larger bid/ask spreads, with larger firm market values, with dividends and with prior positive returns on the stock. We find higher short sales for securities with available options, with certain levels of inside ownership, with larger numbers of market makers, with higher “market multiples,” and with larger long term growth forecasts and deviations of analysts’ growth forecasts. Higher short interest ratios are discouraged for firms with high institutional ownership, given our controls, and for firms with higher returns over the previous six months. We show also that short sales, during the period examined, are higher in certain industries.

We find also that unanticipated changes in short interest levels are significant in explaining subsequent stock returns. The explanatory power of raw short interest levels in describing these returns is largely displaced when this “unanticipated changes” factor is included alongside the “raw levels.” We hold that the market’s response to these unexpected changes in relative short interest ratios is a proxy for a belief among investors that although short sales constraints may well be costly, they do not necessarily suggest some absolute limit to the potential level of short-selling in a given stock. Although many stocks are not shorted at all, and some institutional limit to the amount of short sales in some stocks may exist, the costly constraints do not appear to be binding for our sample firms.

We wish to better understand investor behavior as it manifests itself in short-selling activity and as it describes the seemingly inefficient and “unorderly” predictable returns associated in recent studies with heavily shorted stocks. The efficient markets hypothesis suggests that liquid asset markets are reasonably orderly, yet the ability of such “softer” measures as investor sentiment to frame market returns, as portrayed by Brown and Cliff (2001), is evidence of the importance of investor psychology and investor behavior in describing market movements. Investor behavior with respect to short-selling is still not completely clear, but we provide additional evidence in this study of the factors associated with short sales. If short sales are able to characterize long term stock price behavior, the markets may not be as orderly as the efficient markets proponents suggest. We examine new issues related to short sales in this study, such that a broader appreciation of short sales can be developed, and additional study encouraged.

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Table 1

Relative Short-Interest (SI) Ratio

Year	Mean SI	Q1 Median SI	Median SI	Q3 Median SI
1991	0.0206	0.0018	0.0068	0.0233
1992	0.0306	0.0034	0.0118	0.0362
1993	0.0322	0.0040	0.0129	0.0384
1994	0.0322	0.0050	0.0154	0.0417
1995	0.0350	0.0076	0.0185	0.0422
1996	0.0367	0.0102	0.0232	0.0445
1997	0.0456	0.0156	0.0310	0.0579
1998	0.0431	0.0145	0.0305	0.0555

The relative short-interest ratio is the number of shorted shares divided by the number of shares outstanding, as reported by the NASD. The sample of the 200 largest Nasdaq securities consists of the 200 securities with the largest market value of shares outstanding at the end of the prior year, where market value is provided by CRSP. Data is examined for the period from July of 1991 through December of 1998 for securities with available data.

Table 2**Sample Characteristics for the
Two Hundred Largest Nasdaq Firms
1991-1998**

	Mean	Median
Short interest (percent of shares outstanding)	3.55%	1.93%
Price	\$33.48	\$29.84
Average number of trades per day	556.65	188.60
Average daily volume	780,967	321,063
Market value of stock (in thousands)	\$2,643,496	\$1,059,010
End-of-Day Spread	0.37	0.30
Relative Spread	1.30%	1.08%
Number of Market Makers	24.59	21.80
Number of Analysts	10.82	9.00
Median Estimate of Long-Term Earnings Growth	22.41	20.40
Standard Deviation of Analyst Estimates	5.08	3.60
Price / Book	7.42	4.49
Price / Earnings	29.78	16.43
Dividend / Price	0.04%	0.00%
Percent Institutional Ownership	51.63%	53.11%
Percent Insider Ownership	19.33%	11.56%
Insider Ownership <= 5%	32.75%	
Insider Ownership > 25%	29.89%	
Percent of Months with Listed Options	81%	
Percent of Months with Convertible Bond Conversion	0.04%	

Table 3
Correlation Analysis
(cyndi adding a prior return factor)

	Relative Spread	Percent Short Interest
Percent Short Interest	-0.1665***	
Relative Spread		-0.1665***
Share Price	-0.3522***	0.0356***
Market Value	-0.2842***	-0.0877***
Volume	-0.3735***	0.1197***
Number of Analysts	-0.4520***	0.0049
Median Analysts' Forecast of Long-Term Growth	-0.0958***	0.3525***
Standard Deviation of Analysts' Forecasts	-0.0504***	0.1982***
Dividend-to-Price Ratio	0.0761***	-0.1351***
Price Earnings Ratio	-0.0625***	0.2139***
Price-to-Book Ratio	-0.1024***	0.1304***
Traded Option	-0.0693***	0.0922***
Number of Market Makers	-0.4203***	0.1791***
Percent Institutional Ownership	-0.3075***	0.0507***
Percent Insider Ownership	0.1790***	-0.0194***
Low Insider Ownership	-0.0612***	0.0084*
High Insider Ownership	0.1551***	0.0179**
Convertible Bond Conversion	-0.0389***	0.0313

Pearson correlation coefficients between the bid-ask spread, relative short interest, and other variables associated with the level of short interest are estimated each month. The table reports mean correlations for 90 monthly estimates (22 estimates for convertible bond conversion). Mean coefficient is statistically different from zero at the 1% (5%, 10%) level for a t-test where the factor is marked with a *** (**, *).

Table 4
Cross-Sectional Analysis of the
Relative Short Interest Ratio

	Model 1		Model 2	
	Mean Coefficient	P-value	Mean Coefficient	P-value
Relative Short Interest Ratio				
Intercept	-3.645	<.0001	-0.760	0.0001
Spread	-0.434	<.0001	-0.401	<.0001
Market Value	-0.331	<.0001	-0.343	<.0001
Options	0.116	<.0001	0.088	<.0001
Market makers	0.448	<.0001	0.500	<.0001
Turnover (Volume)	0.451	<.0001	0.610	<.0001
Institutional Ownership	-0.086	0.0117	-0.090	0.0095
High Inst. Ownership	-0.120	0.0004	-0.096	0.0093
Percent Insider-owned	0.005	0.0085	0.003	0.0195
Low Inside Ownership	0.218	<.0001	0.143	<.0001
High Inside Ownership	0.016	0.8047	0.107	0.0322
Dividend/Price	-32.193	0.0007	-56.320	<.0001
Prior Return	-0.279	<.0001	-0.405	<.0001
Price/Earnings	0.135	<.0001	0.396	<.0001
Price/Book	0.022	0.2672	0.112	<.0001
L-T Growth	0.872	<.0001		
Std Dev of Growth	0.112	<.0001		
SIC35	0.048	0.1722		
SIC36	-0.199	<.0001		
SIC48	-0.346	<.0001		
SIC73	-0.042	0.1372		

Seemingly unrelated regression analysis of the relative short interest for a sample of the 200 largest market-valued Nasdaq firms from July 1991-to the end of 1998. Each model is estimated for each month in the 90-month sample period. Mean coefficient estimates and p-values for the null hypothesis that the mean coefficient estimate is different than zero are reported. Some firms are not in the sample for the full period due to exchange changes and merger activity. In Model 2, the number of observations is further limited to firms with I/B/E/S data and firms with multiple analysts (the standard deviation of the analysts' forecasted growth rates can not be calculated when only one analyst provides an estimate for a particular firm).

Table 5
Cross-Sectional Analysis of the
Relative Bid-Ask Spread

	Model 1		Model 2	
	Mean Coefficient	P-value	Mean Coefficient	P-value
Spread				
Intercept	2.411	<.0001	2.456	<.0001
Std dev of Return	0.260	<.0001	0.271	<.0001
Price	-0.624	<.0001	-0.607	<.0001
Market Value	-0.026	0.0002	-0.0251	0.0007
Volume	-0.197	<.0001	-0.206	<.0001
Options	-0.008	0.3395	-0.017	0.0453
Market Makers	-0.346	<.0001	-0.333	<.0001

Seemingly unrelated regression analysis of the bid-ask spread for a sample of the 200 largest market-valued Nasdaq firms from July 1991-to the end of 1998. Each model is estimated for each month in the 90-month sample period. Mean coefficient estimates and p-values for the null hypothesis that the mean coefficient estimate is different than zero are reported. Some firms are not in the sample for the full period due to exchange changes and merger activity. In Model 2, the number of observations is further limited to firms with I/B/E/S data and firms with multiple analysts (the standard deviation of the analysts' forecasted growth rates can not be calculated when only one analyst provides an estimate for a particular firm).

Table 6
 Cross-Sectional Analysis of Returns
 Subsequent to Short Interest Announcement

Panel A: Short-Run Returns

Coefficient Estimates and (P-values)

	Model 1a	Model 1b	Model 1c	Model 2a	Model 2b	Model 2c
Intercept	-0.032 ($<.0001$)	-0.024 ($<.0001$)	-0.026 ($<.0001$)	-0.031 ($<.0001$)	-0.025 ($<.0001$)	-0.024 ($<.0001$)
Short Interest	-0.002 (.0379)		0.001 (.6595)	-0.001 (.0533)		0.000 (.9428)
Unanticipated Short Interest		-0.004 (.0066)	-0.003 (.0715)		-0.004 (.0031)	-0.004 (.0253)
Return on CRSP Equal-Weighted Index	1.149 ($<.0001$)	1.150 ($<.0001$)	1.150 ($<.0001$)	1.164 ($<.0001$)	1.166 ($<.0001$)	1.166 ($<.0001$)
Adjusted R-square	0.144	0.145	0.145	0.146	0.147	0.147

Panel B: Long-Run Returns

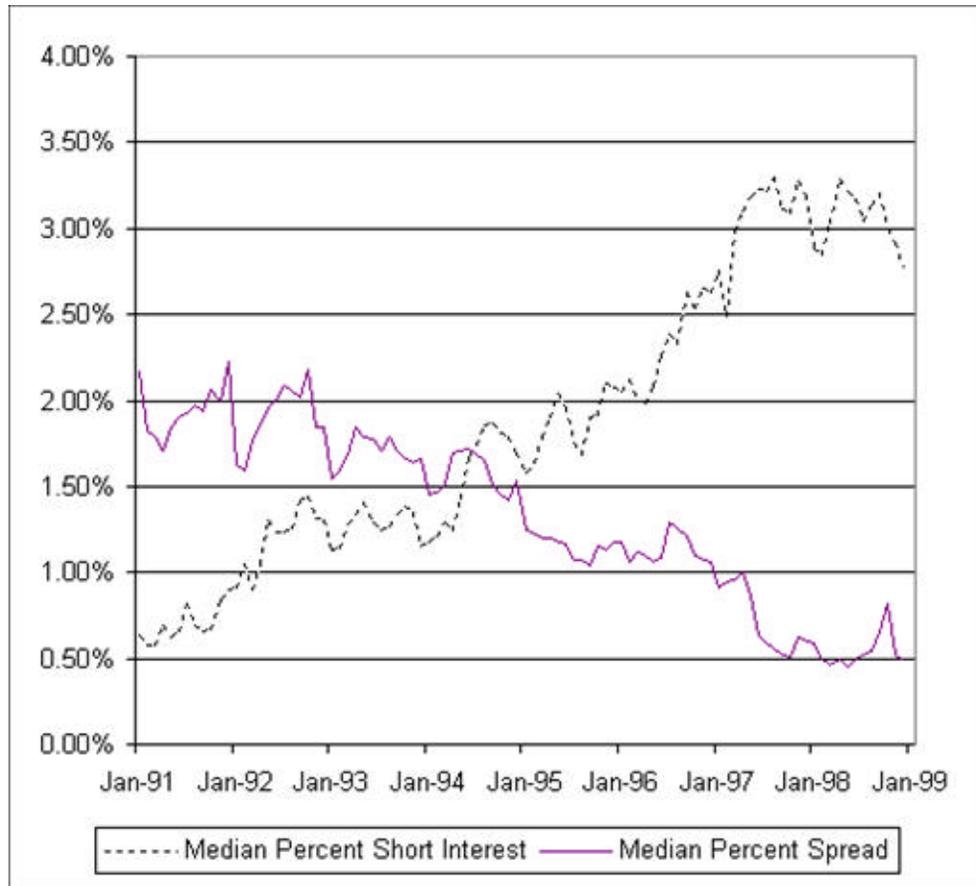
Coefficient Estimates and (P-values)

	Model 1a	Model 1b	Model 1c	Model 2a	Model 2b	Model 2c
Intercept	-0.119 ($<.0001$)	-0.063 ($<.0001$)	-.090 ($<.0001$)	-0.127 ($<.0001$)	-0.073 ($<.0001$)	-0.104 ($<.0001$)
Short Interest	-0.015 ($<.0001$)		-.007 (0.0592)	-0.014 ($<.0001$)		-0.008 (.0255)
Unanticipated Short Interest		-0.026 ($<.0001$)	-.019 (0.001)		-0.021 ($<.0001$)	-0.013 (.0124)
Return on CRSP Equal-Weighted Index	0.489 ($<.0001$)	0.502 ($<.0001$)	0.496 ($<.0001$)	0.509 ($<.0001$)	0.524 ($<.0001$)	0.515 ($<.0001$)
Adjusted R-square	.0246	.0253	.0255	.0264	.0265	.0268

OLS Regression of the Returns on the 200 Largest Nasdaq Firms for the 20-day and 180-day periods subsequent to the short-interest report date. For Models 1a-1c, unanticipated short interest is the residual from Model 1, Table 4. For Models 2a-2c, unanticipated short interest is the residual from Model 2, Table 4. The sample size is 11,730 firm-month observations.

Figure 1

Median levels of short interest and relative spreads for the 200 largest Nasdaq firms from January of 1991 through December of 1998*



*Percent short interest is the number of total shares short in a given month divided by the total shares outstanding. Percent spread is the absolute spread divided by the midpoint between the bid and ask on a stock.