The Micro and Macro of Accrual Based Trading Strategies

David A. Lesmond
A.B. Freeman School of Business
Tulane University
dlesmond@tulane.edu
(504) 865-5665

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Abstract

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Abstract

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Introduction

Sloan's (1996) seminal paper argues that security returns do not fully incorporate differential information regarding future cash flows contained in public financial statements for firms with high and low accruals. This seemingly simple trading strategy of buying low accrual firms and selling short high accrual firms is perplexing because of the magnitude of the reported abnormal size-adjusted returns and because the information on accruals is public information. However, liquidity costs (Lesmond, Schill, and Zhou, 2004) and short sale constraints (Miller, 1977, Shleifer and Vishny, 1997, and Chen, Hong, and Stein, 2002) are increasingly being examined as possible mitigating factors in predicting and potentially profiting from future returns. This paper examines the effects of liquidity costs on trading the accrual anomaly.

Efficient pricing requires more informed and better capitalized investors to trade the position to remove any market mispricing. However, if few institutions hold the security because of poor liquidity (Gompers and Metrick, 2001) possibly due to limited uninformed trading (Kyle, 1985), then arbitrage trading may be impeded and the price adjustment process may be slow to reflect the public information signal, especially for the short side of the trade (Nagel, 2005). Using a comprehensive sample of institutional holdings, short interest data, and a battery of liquidity cost measures I find that the returns "earned" by accrual based strategies are dominated by low institutional holdings, little or zero short interest, and high liquidity costs. Most importantly, testing of the link between liquidity costs, institutional holdings, and short sale constraints provides a rationale why the accrual anomaly persists over time.[1]

Many explanations have been offered for the accrual based trading profit. Mashruwala, Rajgopal, and Shevlin (2004) argue that arbitrage risk, which is the non-diversifiable idiosyncratic risk from holding separate long and short positions, impedes arbitrageurs from eliminating the mispricing. Khan (2005) also offers a risk explanation by using a four-factor intertemporal asset pricing model. Neither directly investigates liquidity costs[2] , which is a focus of this paper. Another stream of literature examines the accrual strategy in relation to institutional holdings. Both Collins, Gong and Hribar (2003) and Lev and Nissim (2005) find

[1] Amihud and Mendelson (1986) posit that higher liquidity costs cause prices to be lower and expected returns to be higher than similar securities with lower liquidity costs. They reason that investors demand decreased prices as compensation for bearing liquidity costs. If liquidity costs are binding then investors will not buy (depress prices) for low accrual firms and not sell (maintain increased prices) for high accrual firms.

[2] Mashruwala et al. (2004) employ liquidity cost proxies of price and volume as control variables and only find a weak association between volume and accrual returns. But, using only liquidity cost proxies their test lacks power.

that institutional holders play only limited roles in accrual arbitrage since accrual strategy firms often have limited institutional holdings. In this paper, I posit that institutional holdings (or lack thereof) impose a short sale constraint that impedes the implementation of the short side of the accrual strategy. Finally, Bushee and Raedy (2003) find that superior returns arise due to trading positions that are difficult to implement. However, they do not specifically measure short sales in the months leading up to the trading date, nor do they incorporate the measured institutional holdings for the tradable portions of the portfolio. They rely on constructed return proxies for the trading impediments, thus limiting the power and applicability of the tests.

I argue that liquidity costs affect the trading behavior of institutions by affecting the trading behavior of the uninformed traders. Higher liquidity costs reduces the number of uninformed trades which consequently reduces the number of informed trades (institutional trades). The trade inhibitions induced by increased liquidity costs causes the accrual anomaly to be particularly evidenced in the extreme portfolios. The long position is easier to implement because it requires only sufficient capital to make the trade. However, if liquidity costs are binding then arbitrageurs are inhibited from implementing the position because the liquidity costs may eclipse the expected profits. The short position, on the other hand, requires the arbitrageur to find an institution willing and able (Avolio, 2002) to lend the stock to be shorted. The lack of institutional holdings, caused by poor liquidity, reduces the availability of a stock to be shorted (Gompers and Metrick, 2001, and Nagel, 2005), weakening the ability of prices to more properly incorporate the public information signal. In particular, in examining the relation between liquidity costs and order flow, institutional holdings and, in turn, short sales, I specifically examine whether the accrual based trading strategy is profitable and whether the accrual based trading strategy is explained by liquidity costs[3] and, consequently, entirely consistent with rational pricing.

I mitigate the weaknesses in the prior research by specifically measuring the short interest, institutional holdings, and liquidity costs rather than relying on proxies or indirect measures. From 1988 to 2003, I collect institutional holdings using the 13-f filings and short interest for the high accrual portfolio (short position) for all available NYSE/Amex firms from *Bloomberg*. I also gather the average daily quoted bid-ask spread and the effective spread from *ISSM* and *TAQ*,

[3] I do not attempt to explain the managerial motivations to engage in accrual strategies in the first place. This is examined by Kothari, Loutskina, and Mikolaev (2005). Rather, I examine the effect of liquidity on the implementation of the accrual mispricing and consequently why it is not quickly arbitraged away.

and estimate the LOT liquidity measure (Lesmond et al., 1999) to more comprehensively test the arbitrage limits imposed by liquidity costs. In addition, I use the number of trades measured on an intraday basis in order to assess the level of informed trading and the level of uninformed trading (Hvidkjaer, 2006) for each accrual portfolio. Using actual short sales linked to measured institutional holdings increases the power of the tests, while using a battery of liquidity measures mitigates the concern that the results are either model based or measure based. Measuring the trade flow enables a examination for liquidity formation and the resultant effect on the accrual anomaly. Specifically measuring each component of a hypothesized link between liquidity (order flow), institutional holdings, and short interest allows for a more comprehensive and powerful test of the interaction between liquidity and returns.

The findings indicate that the bulk of the profits from the extreme accrual portfolio firms are earned in the short side of the portfolio. The long portfolio earns 3.10% while the short side of the portfolio earns -5.23%. However, the extreme accrual portfolios experience a significantly reduced number of trades. The short accrual firms experience only 1,081 monthly trades and the long accrual firms experience only 1,353 monthly trades while the rest of the accrual firms (non-traded) experience 2,200 monthly trades. The reduction in total trades is matched by a reduction in the number of uninformed and informed trades which coincidentally is matched by increased liquidity costs for the extreme accrual portfolios. The long portfolio experiences bid-ask spread costs of 4.80% and the short side of the portfolio experiences bid-ask spread costs of 4.76%. For comparison, the non-traded portfolio experiences trading bid-ask spread costs of 3.22%. These results indicate that liquidity costs affect both the informed traders as well as the uninformed traders. High liquidity costs causes a reduction in the likelihood of uninformed trade and causes a reduction in likelihood of informed trade. The percentage of shares held by institutions reflects the increased liquidity costs. Institutions hold only 36% of the shares outstanding for either the long or short portfolio, while institutions generally hold 46% of all shares outstanding (Gompers and Metrick, 2001).

Low institutional holdings caused by high liquidity costs, in turn, limits the observed short interest. This is manifest in the finding that 18% of the potential short position firms never experience any short interest. This distinction leads to large differences in the observed short returns. For 340 firms that experience no short interest, the size adjusted return per annum is -8.35%. For the remaining short firms that experience some short interest, the size-adjusted

return per annum is -5.06%, or a 65% reduction in the observed return.

More telling is the finding that for 61 of these zero short interest firms that also have less than 1% institutional holdings and "earn" a very large -24.01% size-adjusted return per annum. Not surprisingly, the liquidity costs for this extreme portfolio are 14.81% for the spread-plus-commissions. These results suggest that high liquidity costs are inhibiting more informed institutional trading, limiting the ability or willingness of arbitrageurs to short the stock, and leading to a high statistical profit.

More formal regression tests using a pooled sample of all possible long and short firms, or separate long and short portfolio firms, indicate that liquidity costs are consistently and positively associated with the observed accrual profits. The results persists regardless of the liquidity measure used, or after controlling for systematic risk, book-to-market ratio, earnings to price ratio (Collins, et al., 2003), arbitrage risk (Wurgler and Zhuravskaya, 2002), and momentum returns (Jagadeesh and Titman, 1993). More telling is the lack of significance (and even sign reversal) for arbitrage risk once liquidity costs are taken into account, a result opposite to that proposed by Mashruwala, et al. (2004). The short sale constraint is only binding for low levels of institutional holdings for the short position, which suggests that adequate levels of institutional holdings are needed to support short sale activity.

These results are important for a number of reasons. Liquidity costs are shown to affect the trading patterns of both the informed and uninformed traders adding to the economic arguments offered by the liquidity cost literature. More prominently, liquidity costs, short sale constraints, and institutional holdings are increasingly being examined as arbitrage constraints, but usually these are studied separately. This paper argues that each of these constraints has a role to play in the establishment of arbitrage constraints and each plays off each other.

The paper is organized as follows. Section 1 outlines the accrual based portfolio formation technique, the institutional holdings and short sale information, and the various liquidity estimators. Section 2 reports the summary statistics for each trading portfolio and presents the correlation analysis. Section 3 presents the impact of short interest, institutional holdings, and liquidity costs. Section 4 presents the microstructure analysis of the accrual return portfolios. Section 5 presents the tests of association using both standard OLS regression tests and bootstrap simulation regression tests. Section 6 concludes.

1. Accrual Portfolios, Liquidity Proxies and Measures

I present a relatively exhaustive sampling of portfolio returns, institutional holding, short interest, and liquidity cost measures and proxies. In addition, I calculate firm-specific risk measures including systematic risk, arbitrage risk, and Jensen's alpha.

1.1 Accrual portfolios and returns

Stock returns, volume data, shares outstanding, and firm size information are provided by the Center for Research in Security Prices (CRSP) with information available from 1988 to 2003. I examine this period because this time frame encapsulates the available short interest data.[4]

Accruals are computed using the merged 2004 COMPUSTAT/CRSP database. I excluded foreign firms and financial firms (SIC codes 6000-6999) from the sample because their accruals are not comparable to other firms. I also concentrate only on December year-end firms to ensure that stock returns are aligned in calendar time. Following Sloan (1996), I measure accruals as follows (balance sheet method):

$$Accruals_{it} = (\Delta CA - \Delta Cash)_{it} - (\Delta CL - \Delta STD - \Delta TP)_{it} - Dep_{it}$$

where ΔCA = change in current assets (data item 4), $\Delta Cash$ = change in cash and cash equivalents (data item 1), ΔCL = change in current liabilities (data item 5), ΔSTD = change in debt included in current liabilities (data item 34), ΔTP = change in income tax payable (data item 71), and Dep = depreciation and amortization expense (data item 14). All variables are scaled by total assets (data item 6) at the beginning of the year.

For each firm i and using all financial information from year t, I rank firms by accruals and assign them to decile portfolios. I then calculate size-adjusted buy and hold returns (including dividends) for these firms beginning on May 1 of year t+1 to April 30 of year t+2. I designate this period as the portfolio performance period. May 1 is used as a starting date for the performance period to ensure that financial statement information is publicly disclosed.

Size-adjusted returns are calculated by subtracting the corresponding CRSP size decile buy-and-hold portfolio returns from the buy-and-hold security returns. The monthly size decile

[4] As noted in Mashruwala, et al. (2004) the accrual returns are not robust to the time period being examined. I also find significant variation in the accrual based returns and choose the time period that provided the largest accrual based returns.

portfolio ranking and monthly returns are provided by CRSP for NYSE/AMEX firms. These returns are continuously compounded for one year and then converted to buy-and-hold returns. Each year, I take a long position in the lowest accrual decile (accrual portfolio 1) and a short position in the highest accrual decile (accrual portfolio 10). The middle firm deciles (2-9) are not traded.

The accrual strategy is expected to generate abnormal returns due to the nature of accrual earnings. Sloan (1996) shows that accrual earnings are less persistent than cash earnings. If market participants fixate on reported earnings, which consist of both a cash and an accrual component without distinguishing the differential persistence of the two, it will lead to overpricing of stocks with high accruals and vice versa for low accrual stocks.

1.2 Risk measures

All risk measures are estimated over one year prior to the portfolio performance period to avoid endogeneity bias. I estimate systematic risk using daily security returns provided by CRSP. I concentrate on daily returns (as opposed to monthly) to better isolate the most current firm characteristics that may influence the accrual based returns. I include arbitrage risk (Wurgler and Zhuravskaya, 2002) for comparison purposes. This measure is the variance of the market model's residual and provides a measure of the hedging risk faced by arbitrageurs. I also estimate the book-to-market and earnings-to-price ratios at year t to obtain firm-specific risk measures (Lakonishok, Shleifer, and Vishney, 1994). Book to market ratio (BM) is the ratio of net book value (COMPUSTAT data item 60) to market value. Market value is calculated by multiplying total shares outstanding (data item 25) with share price (data item 199) at fiscal year end.[5] This risk measure closely corresponds to the Fama-French equity premium risk factor. Earning to price ratio (EP) is the ratio of operating income (data item 178) to market value at fiscal year end. Higher levels of earning-to-price indicate value firms.

1.3 Institutional holdings and short interest

Institutional holdings are measured for all firms (short, long, and non-traded) from 1988 to 2003 using the 13-f filings. The data are reported quarterly and I incorporate the second

[5] Approximately 20% of the firms in the long accrual portfolio have negative book-to-market ratios and approximately 15% of the firms in the short accrual portfolios have negative book-to-market ratios. These firms are deleted from the analysis where required.

quarter's institutional holdings for each year. This period overlaps the performance period (beginning on May 1st) by two months. I identify over 10,000 firm-years (which include firms in our trading strategy and firms that are not in our trading strategy) with some institutional holdings. Surprisingly, almost 98% of the firms have some institutional holdings, but not all firms are equally held. The institutional holdings are standardized by the number of shares outstanding to provide a consistent comparison among firms.

Short interest information is recorded from *Bloomberg* for all available firms that comprise our short position. The average short interest for the three months of the second quarter of each year (April, May, and June) is used. This ensures that I measure the short interest activity after the annual report is made public. Exchanges do not report short interest that is zero for the current month and for the previous month and I therefore assume that any CRSP common stock that is either not found or not reported as short interest on *Bloomberg* is zero. This is consistent with Chen and Singal (2003). However, careful attention is paid to ticker symbol changes after a firm either declares bankrupcy or exhibits some corporate action that causes a change in the ticker symbol. This is important because *Bloomberg* will not report historical information for ticker symbols that are no longer in effect. The short interest data is available from 1988 to the present on a monthly basis for a 15th of the month fixing. The NYSE rules dictate that any short interest on or before the 15th be reported for each month. I standardize the short interest by average daily trading volume to provide the short interest ratio to provide a consistent basis of comparison among firms and institutional holding measures. This is consistent with Desai. et al. (2002).

1.4 Liquidity measures and the number of trades

The Trades and Quotes (TAQ) and the Institute for the Study of Security Markets (ISSM) databases for the month of June of each year are used to provide a count of the number of trades. I use the month of June so as to encapsulate the trading behavior of the institutional investors that are captured in the 13-f filings for the second quarter (ending in June of each year).

I estimate both the liquidity proxies (price, volume, volatility, and firm size, Stoll (2000)) and costs for one year prior to the portfolio performance period. This avoids endogeneity bias that may be induced by using contemporaneous liquidity and return estimates. Thus, I estimate the liquidity proxies and costs that were in existence *before* I evaluate the portfolio investment

performance. This construct will *bias* against the liquidity cost hypothesis by using stale cost estimates.

The liquidity costs facing a trader potentially include not only a portion of the bid-ask spread (estimated using the quoted spread or the effective spread), but also applicable commissions, price impact costs, taxes, short-sale constraints, holding period costs, and other immediacy costs. Because capturing all of the components of the comprehensive liquidity cost facing the informed trader is empirically challenging, I employ three liquidity measures to test whether liquidity costs are associated with the accrual returns. All of our liquidity measures are conservative, in that they include only the most empirically demonstrable and available components of trading costs.

The first class of estimators measures the components of trading cost by examining liquidity costs data directly. Stoll and Whaley (1983) and Bhardwaj and Brooks (1992) produce estimates of "spread plus commission" costs by directly examining quoted market bid-ask spread data and prevailing commission schedules. Since trades frequently occur off the quoted prices and with variations in commissions, quoted measures are likely to be inaccurate (Lee, 1993; Peterson and Fialkowski, 1994; Seppi, 1997). As an alternative, a number of techniques produce estimates of the "effective" or "realized" trading cost estimates by matching the quotes to the transaction record. These direct effective-spread estimates are also imperfect measures of the true marginal spread because of institutions "legging into" large positions by breaking up trades (see, e.g., Keim and Madhavan, 1995) and because of information leakage prior to or during trade execution that causes prices (quotes) to move in anticipation of an informed trade (see, e.g., Plexus Group, 1996).

I also use the Lesmond et al. (1999) approach, termed the LOT model (see, e.g., Maddala, 1983), to provide additional liquidity cost estimates based on closing prices. This measure provides a more comprehensive estimate of the cost of trading by implicitly including not only the spread component but also the implied commissions, immediacy costs, short sale costs, and at least some of the price impact costs. The maintained hypothesis of this approach is that the informed trade only if the value of the accumulated information exceeds the marginal cost of trading.

1.4.1 *Proportional and effective spread estimate*

The Trades and Quotes (TAQ) and the Institute for the Study of Security Markets (ISSM) databases are used to provide daily closing, quote spread estimates from 1988 to 2003. For each stock, I obtain the daily end-of-day closing quotes for all NYSE/Amex stocks for each year.[6] This procedure provides 252 daily quotes for each firm-year. The proportional spread[7] is defined as:

$$\text{Proprortional Spread} = \frac{1}{N}\sum_{t=1}^{N}\frac{(Ask_t - Bid_t)}{(Ask_t + Bid_t)/2)}.$$

I compute the direct effective spread by comparing the quoted spreads to the contemporaneous execution prices. I follow the standard approach defining the quoted spread as twice the absolute value price deviation from the bid-ask midpoint. This measure specifically reflects the fact that trades may occur within the quotes. The TAQ data quotes are matched to the contemporaneous closing prices from CRSP. The effective spread is defined as:

$$\text{Effective Spread} = \frac{1}{N}\sum_{t=1}^{N}\frac{|Price_t - (Ask_t + Bid_t)/2|}{Price_t}.$$

1.4.2 *The LOT estimate*

Our estimation of the LOT trading cost follows Lesmond, Ogden, and Trzcinka (1999). The intuition for the approach is that the trading costs induced limits to informed trading are manifest by zero daily security returns. Lesmond et al. argue that the frequency of experiencing a daily return of exactly zero is greater for firms with larger trading costs, since larger trading costs discourage informed trading. Also, since firms with larger trading costs require a larger accumulation of news, the returns associated with non-zero-return days are expected to be larger to overcome the trading cost threshold. The underlying "premise" of the LOT model is quite similar to the logic governing the trading cost measure developed in the appendix of this paper. Both are based on the idea that liquidity costs censor small informed trades. Thus, higher explanatory power for this measure is to be expected. However, other measures of microstructure effects should produce results consistent with the liquidity hypothesis.

[6] This proves to be problematic for the 2001 to 2003 trading period because of the proliferation of alternative market maker and after-hours trading. During these years the TAQ database is " painted" with single-side quotes whereby only one quote, either the ask or bid, is relevant. I control for this by taking the last available quote with complete bid and ask prices that corresponds to the last price that is set by CRSP. This allows for a direct comparison of across all of our liquidity cost measures.

[7] I use the proportional spread because it better captures liquidity effects than the quoted spread, or simply the difference between the ask and bid prices.

For our estimates, I use the CRSP equally weighted market return as the market index because of the equal weight each firm receives in our hypothesis tests. The LOT estimate of liquidity costs, by considering the informed trader's reservation return, includes not only the explicit costs, such as the bid-ask spread and commissions, but also the implicit costs, such as short-sale constraints, taxes, holding period costs, and immediacy costs, to produce trading cost estimates that should be higher than just the spread costs. Lesmond et al. (1999) show that the LOT estimate is actually at least 30% lower than quoted spread-plus-commission regardless of firm size, so the LOT estimates appear to be relatively conservative compared to the most demonstrable immediacy estimate of liquidity costs.[8]

1.4.3 *The brokerage schedule*

The brokerage commission schedule is obtained from CIGNA financial services and is used in Lesmond et al. (2004) and is similar to that of Bhardwaj and Brooks (1992). Additionally, while this commission schedule may overstate the present on-line brokerage commission, this brokerage schedule was in effect for the sample period under examination and was representative of the commission costs from 1991 to 1999. The commission schedule is as follows:

Transaction Amount	Commission
\$0-\$2,500	\$29 +1.70% of Principal Amount
\$2500.01-\$6,250	\$55 +0.66% of Principal Amount
\$6,250.01-\$20,000	\$75 +0.34% of Principal Amount
\$20,000.01-\$50,000	\$99 +0.22% of Principal Amount
\$50,000.01-\$500,000	\$154 +0.11% of Principal Amount
\$500,000+	\$254 +0.09% of Principal Amount

For stocks under \$1.00 per share the commission rate is \$38 plus 4% of principal. The overriding minimum commission is \$38 per trade.

2. Preliminary Findings

An analysis of firm characteristics that comprise accrual based portfolios shows a number of stylized features. First, as shown in Table 1, the accrual based strategy yields a very sizeable 8.33% size-adjusted return per annum over the 17 year period. Also of note is that the majority of the "abnormal performance" is earned in the short portfolio[9] . This result is consistent

[8] Keim and Madhavan (1995) find that active institutional traders (i.e., technical traders whose decisions to trade are based on momentum) prefer to use market orders to assure rapid execution and consequently incur immediacy costs.

[9] Kothari et al. (2005) document that firms manage the earnings of the high accrual (short side) firms more

with Lesmond, Schill and Zhou (2004) who find similar results for relative strength momentum trading strategies. The short portfolio earns almost 50% more than the long portfolio. The significance of the short portfolio is emphasized by Jensen's alpha. While significance of the Jensen's alpha is evident for both the long and short portfolios, the short portfolio is sizably larger than that of the short portfolio.

Second, the long and short portfolios that comprise the accrual based trading strategy are riskier than the market, as well as the middle portfolio. These results are consistent with those of Sloan (1996). However, in terms of a hedging strategy, the betas of the long and short portfolios are relatively equal for each of the time periods examined. This feature allows for a relatively risk-neutral implementation.

Third, considering the liquidity proxies of price, volume, volatility, and firm size, the long and short positions are of lower price, exhibit lower daily trading volume, display higher daily volatility, and are of lower market capitalization than the middle accrual portfolio. Most telling is the distinction between the long and short portfolios in terms of firm size and volume where the short portfolio is comprised of distinctly smaller firms with much lower average daily trading volume than either the long portfolio or the middle (neutral) portfolio. In addition, the accrual based portfolios are comprised of more stocks with a share price less than $5.00 than is the middle portfolio. These low priced stocks are particularly susceptible to low institutional holdings and poor liquidity.

The liquidity cost estimates confirm the prior liquidity proxy results and demonstrate that the long and short positions are particularly costly to trade. The long position's cost estimates range from 6.13% for the proportional spread-plus-commissions to 3.42% for the effective spread-plus-commissions and the short position's cost estimates range from 5.42% for the proportional spread-plus-commissions to 2.88% for the effective spread-plus commissions. Liquidity costs are particularly binding for the long position.

Finally, while the percentage of firms held by institutions differs little among the low, middle, and high accrual portfolios, the percentage of shares held by institutions exhibits a meaningful difference. For the long and short portfolios, approximately 37% of the shares are held by institutions, while, for the middle portfolio, 46% of the shares are held by institutions. This

than the earnings of the low accrual (buy side) firms. This provides a rationale for the dominance in the returns for the short side versus the returns for the long side.

feature is further amplified by the raw number of institutions holding a firm. On average, each firm in the middle portfolio is held by 131 institutions, while each firm in the long portfolio is held by only 80 institutions, a number that is reduced further to 61 institutions for each firm in the short portfolio. Examining the short interest percentage shows that 18% of the short position is *never* shorted in the three months of the second quarter. This finding provides the initial evidence of a short sale constraint.

2.1 Correlation Analysis

The long portfolio's correlations are presented in the upper triangle of the matrix, while the short portfolio's correlations are presented in the lower triangle of the matrix. To provide better comparability between the separate portfolios, the short portfolio's buy-and-hold return is multiplied by negative one. This mimics the profits from the short sale. The results are presented in Table 2.

First, the risk measures of beta, book-to-market, earnings-to-price, and arbitrage risk show the short firms are dominanted by high book-to-market and low earnings-to-price firms. High accrual firms experience higher default risk (book-to-market) and lower earnings (higher valuation risk). This precursor is expected given the earnings management that high accrual firms display. Higher arbitrage risk (hedging risk) is also in evidence for the short portfolios. The long firms, on the other hand, are typified by lower book-to-markets, but display little correlation with earnings or arbitrage risk.

Second, for both the long and short portfolios, all liquidity estimates indicate significant correlations[10] with the underlying profits. However, among the liquidity cost proxies only volatility is associated with either the long or the short sale profit. Neither price, volume, or size is significantly correlated, although of the expected sign for a liquidity effect, with the profit. This may indicate that the liquidity proxies [11] lack power in discerning the association between the accrual based return and the underlying liquidity effects. This casts some doubt on the use of liquidity proxies as employed by Mashruwala, et al. (2004) and Collins, et al. (2003). Arbitrage risk is also noted to be highly correlated with the measured liquidity costs

[10] The correlation between institutional holdings and each of the liquidity measures is negative and significant consistent with (Gompers and Metrick, 2001).

[11] As expected, all four of the liquidity cost proxies, firm size, price, volume, and volatility are significantly correlated with our three trading cost estimates.

and this correlation persists for both the long and short portfolios. This indicates that the results of Mashruwala, et al. (2004) concerning arbitrage risk's association with the long and short accrual profits may simply reflect the underlying liquidity costs necessary to implement the position.

Finally, the level of institutional holdings is negatively and significantly correlated with the profit in the short portfolio, but not with the profit in the long portfolio. Implementing the long portfolio side of the trade does not require institutional presence, while implementing the short portfolio side of the trade does require institutional holdings in order to short the stock. Paradoxically, the short interest, in and of itself, is not correlated with the short position return, but this manifests the effect of combining low and high levels of institutional holdings mitigating any short sale influence.

3. Institutional Holdings and Short Sale Constraints

3.1 Institutional holdings and portfolio returns

In Panel A of Table 3, the long and short portfolio returns and liquidity costs for three separate categories of institutional holdings are presented. The categories for the institutional holdings are chosen to highlight the effect that institutional holdings have on the accrual returns. These categories are institutional holdings less than 1%, institutional holdings between 1% and 5%, and institutional holdings greater than 5%.

First note that the short portfolio drives the performance of the accrual portfolio and that this return is magnified for those firms with the least institutional holdings. The short return is -16.40% for those firms with the least institutional holdings and the short return falls to -3.94% for those firms with greater than 5% institutional holdings. The level of liquidity costs is generally in step with both the level of institutional holdings and the level of the accrual returns. The trend in the short return with institutional holdings indicates that institutional holdings are directly related to the return behavior.

Conversely, the trend in the long return with institutional holdings does not indicate that institutional holdings are directly related to the return behavior. The long portfolio return is affected by the market declines experienced during the 2001 and 2002 market correction. While not presented, limiting the sample period up to the year 2000 indicates that institutional

holdings are related to the level of the long return, but that liquidity costs generally exceed the level of the long return.

3.2 The effect of short interest and portfolio returns

The prior institutional holdings results suggest that institutions play a significant role in the observed accrual based returns. Focusing on the effect of short interest alone on the accrual returns, the sample is segregated into three groups based on those firms with zero short interest, those firms with a short interest ratio less than two days, and those firms that have a short interest ratio greater than two days. Given that the short interest is measured for only the first two months of the 12 month return performance period, the short interest is predictive of the short interest influence on future returns. The results are shown in Panel B of Table 3.

The results for the zero short interest and non-zero short interest are indicative of a short interest limit to arbitrage. Monotonicity in the return is clearly evident moving from the zero short interest to heavy shorting levels. The 340 firms that have zero short interest exhibit a large and highly significant return of -8.35%, while the heavy short interest firms experience a 50% reduction in the observed return that falls to -4.54% with marginal significance. Also of note in the short results is that liquidity costs also fall monotonically with increasing short interest. For the zero short interest firms, the bid-ask spread costs are 5.76%. For the heavily shorted firms, the bid-ask spread costs are reduced to 2.71%. The reduction in the liquidity costs mirrors the reduction in the level of the accrual return across the three short interest categories. It may be surprising that 20 institutions hold the stocks that have zero short interest, but this may indicate a short sale constraint on the part of the institution itself. 65% of all institutions are prohibited from short selling as part of their proxy statement (Almazan, Brown, Carlson, and Chapman, 2004). These results may be indicative of that short sale prohibition.

3.3 Short interest, institutional holdings, and portfolio returns

To more comprehensively examine the link between institutional holdings and the ability to short, the sample is segregated according to institutional holdings and short interest ratio categories as presented previously. The results are presented in Table 4.

As is shown, the lowest level of institutional holding (less than 1%) combined with zero short interest is associated with a very large short return of -24.01%. The sizeable return is intriguing

because the return easily exceeds any of the liquidity costs measures (that range from 6.73% for the effective spread-plus-commissions to 14.81% for the proportional spread-plus-commissions). In addition, the return is garnered by only 61 firms. However, these firms are difficult or impossible to short given the sparseness of institutional holdings. If shorting is precluded due to high liquidity costs that precludes more broad institutional holdings, then the return cannot be obtained and is purely statistical. The short return is -13.66% for the institutional holdings between 1% and 5% and the short return falls to -2.74% for institutional holdings greater than 5%. Note that the -2.74% short return is not significant so institutions have little reason to short the stock even though there appears to be ample institutional supply for the short market.

The short return is also affected by increased levels of short activity. Moving from the zero interest ratio to those cases where short interest is observed, a decreased level of short return is observed with increased short activity. For instance, for the lowest level of institutional holdings, the short return decreases from -24.01% to -14.94% for light short interest pressure (short interest ratio of two days or less) and falls further to -5.00% for heavy short interest pressure (short interest ratio greater than two days). Little significance is observed for the light or heavy short interest ratios experienced with institutional holding levels between 1% and 5%. However, at high levels of institutional holdings, there is a significant short return regardless of the short pressure, although the level of the future short return does decline, from -4.62% to -4.34% for light and heavy short pressure, respectively.

Significance of the short return across the short interest pressure and institutional holdings is performed using a bootstrap test for a linear trend to indicate the relative strength of each variable in explaining the short return. Bootstrap tests require resampling in order to build a statistical framework. This is performed 5000 times for either the short interest or institutional holding categories.

As is shown, holding the short interest constant, there is a strongly significant decline in the short return with increasing levels of institutional ownership for only the zero short interest firms. Little significance is observed in the accrual return trend for the remaining short interest levels.

Holding constant the institutional holdings and allowing the short interest to vary indicates weak monotonicity for only the lowest institutional holding category. Firms with less than 1%

institutional holdings indicate that heavier shorting does reduce the level of the subsequent return, as would be expected given a relaxation in the short sale constraint, but the variance of the returns is so large that significance in the trend is reduced to the 10% level. Little significance in the accrual return trend for the remaining institutional holding categories is observed.

4. Microstructure Analysis of Trading

In order to discern what types of traders, uninformed or informed, are involved in the accrual trading strategy, I count the number of trades for five separate trade sizes. These trade categories are for trade sizes of one round lot, trade sizes between 100 shares and 500 shares, trade sizes between 500 shares and 1,000 shares, trade sizes between 1,000 shares and 10,000 shares, and trade sizes greater than 10,000 shares. Those trades less than 1,000 shares are deemed uninformed trades, while those trades greater than 1,000 shares are deemed informed trades. This trade size classification of uninformed trades and informed trades is consistent with (Hvidkjaer, 2006). This is performed in aggregate and for increases and decreases in the level of institutional holding levels. The results are presented for all accrual portfolios to provide a comparison for the extreme (traded) portfolios.

4.1 Aggregate levels

Table 5 presents the results for the aggregate level of institutional holdings. As is shown, the extreme portfolios exhibit trade sizes that mimic those of the middle portfolios. For instance, the long portfolio exhibits an average trade size (shares traded per trade) of 1,691 shares and this trade size matches closely that of portfolio two that exhibits an average trade size of 1,639 shares. The short portfolio exhibits a trade size of 1,409 shares that is slightly larger than that of portfolio 9 which has a trade size of 1,342 shares. Similar relations are in evidence for the remaining portfolios.

However, vast differences in the *number of trades* is in evidence between the extreme portfolios and those of portfolios two through nine (non-traded). The total number of trades for the long portfolio is only 1,353 trades, while the number of trades for the short portfolio is only 1,081 trades. For comparison, the number of trades for portfolio 5 is 2,254 trades, a count that is almost double that of the extreme portfolios. Not surprisingly, the liquidity costs are the largest for the extreme portfolios. The liquidity costs for portfolio one or ten are greater than 4%, while the liquidity costs are less than 3% for the rest of the portfolios (except portfolio two

that exhibits a liquidity cost of 3.43%).

The obvious question then is, "who is trading?" If I look at the small trades (uninformed), i.e. those less than 1000 shares, and the large trades (informed), i.e. those greater than 1000 shares, we clearly see that *both* the uninformed and the informed traders are reducing their level of trade in light of the increased liquidity costs. The informed reduce the number of trades because of the lack of depth (or uninformed traders) in the market. This is consistent with Kyle's (1985) model. The informed will only trade at the expense of the uninformed. If the market is not sufficiently deep with uninformed traders, then the informed trader will limit trade. The results clearly support that view.

Dividing the informed number of trades by the total number of trades, termed the *informed trading ratio* [12] , demonstrates a very striking result. The *informed trading ratio* is bounded at only 24.80%. This would imply that 24.80% of all long trades are by the informed trader, while for the short side the *informed trading ratio* is bounded at only 21.94% which would imply that slightly more than one trade in five are by the informed trader. However, the *informed trading ratio* is higher for the long portfolio than for the short portfolio, a result that corresponds to the reduced level of the return observed for the long side relative to the short side of the trade. Reduced levels of informed trading are related to increased levels of abnormal returns.

Also apparent is that the informed trading ratio increases from portfolio five to portfolio one (statistical significance is demonstrated across the five portfolios), and this indicates that the informed traders do congregate in increasing numbers in the extreme, long portfolio. Similarly, the informed trading ratio increases from portfolio seven to portfolio 10. Again, increased informed trading is noted for the extreme short position, but the level of the *uninformed* trading is reduced leading to reduced levels of informed trading relative to the long portfolio.

Liquidity costs matter because they affect the trading behavior of the *uninformed traders* that, in turn, affects the trading behavior of the informed traders. The informed trader, given the accrual signal, may want to trade and hence remove the mispricing, but they are prevented in doing so due to the lack of the uninformed in the market. If they trade too much the market

[12] The decimalization of the spreads does affect the level of the informed trading ratio. Decimalization reduced the average trade size by reducing number of large trades. In effect, institutions were forced to break up their trades into smaller sizes so as not to affect the price. However, the results of this tests are invariant to the effect of decimalization. The informed trading ratio is still larger for the extreme accrual portfolios. The informed trading ratio subsequent to 2002 for the extreme accrual portfolios is 16%, and falls to only 14% for the middle portfolios.

maker takes the profits in price impact costs.

Turning our attention to the institutional holdings, regardless of the accrual portfolio, institutions are always increasing their holdings. This is also apparent in the number of new institutions. This is surprising because the short portfolio firms are realizing a negative subsequent return that these "smart money" institutions should sell, not buy. To explain this result requires an examination of the increases and decreases in the institutional holdings.

4.2 Separate increases and decreases in institutional holdings

Splitting the sample according to increases in institutional holdings and decreases in institutional holdings is accomplished by examining the difference in the holding levels from the first quarter to the second quarter. Using the second quarter as the base for the difference avoids the problem of new institutions being added simply because they exceed the $100 million reporting threshold which could bias the count.[13]

The results are presented in Table 6. Panel A reports the reductions in institutional holdings and panel B reports the additions in institutional holdings.

As reported in Panel A of Table 6, for those institutions that reduce their holdings from the first quarter to the second quarter, the subsequent accrual returns demonstrate a noticeable difference across all 10 portfolios. The only significant return is for the extreme short portfolio that now exhibits a very sizable return of -9.92%. The benchmark short return is -5.23%. For the firms that experience a reduction in the level of institutional holdings, the accrual return decreases by almost 90% from the benchmark return. Institutions do indeed "get out of the way" of a falling stock, especially if they cannot profit from the fall. The requisite liquidity costs are now much higher for these firms as is the reduction in the total number of trades for the extreme portfolios. The long portfolio now has only 901 total trades and the short portfolio has only 899 trades. The portfolio 4 has 2,121 trades or more than double that of the extreme portfolios.

[13] The rule as to Use of Form 13F states that, "Institutional investment managers must use Form 13F for reports to the Commission required by section 12(f) of the Securities Exchange Act of 1934 [15 U.S.C. 78m(f)]("Exchange Act") and rule 13f-1 [17 CFR 240.23f-1] thereunder. Rule13f-1(a) provides that every manager which exercises investment discretion with respect to accounts holding Section 13(f) securities, as defined in rule 13f-1(c), having aggregate fair market value on the last trading day of any month of any calendar year of at least $100,000,000 shall file report on Form 13-f with the Commission within 45 days after the last day of such calendar year and within 45 days after the last day of each of the first three calendar quarters of the subsequent calendar year."

The trend in the *informed trading ratio* across all ten portfolios is remarkably similar to that experienced in the aggregate case. The long portfolio exhibits the highest informed trading ratio of 25.86% while the short portfolio exhibits an informed trading ratio of 22.37%. The short side of the trade is affected by the lack of the uninformed in the market. In light of greatly increased liquidity costs that now range from 4.66% for the short side to 6.15% for the long side, the uninformed reduce their frequency of trade that, in turn, causes the informed to reduce their frequency of trade.

Panel B of Table 6 reports those institutions that increase their holdings from the first quarter to the second quarter. First, note that the liquidity costs for again higher for the extreme long and short portfolios relative to that of the middle portfolios. The liquidity costs range from 3.92% for the short side to 3.99% for the long side of the trade. Second, the subsequent accrual returns demonstrate a marked difference across all 10 portfolios. Now only the long portfolio experiences a significant return, while the short portfolio return is negative but not significant. Portfolios two through five also experience a positive and significant long return. It appears that not all accrual information signals are created equal. Some institutions buy the high accrual firms and prop up the price even though the earnings signal is negative. However, the long portfolio's future return is not that much larger than that of the benchmark return of 3.10%.

The *informed trading ratio* again shows remarkable similarity to the prior cases. The informed trading ratio, 24.06%, is again highest for the extreme long portfolio and falls to 21.68% for the extreme short portfolio. The trend for the middle portfolios is as previously reported. The underlying trend that is apparent is that increased liquidity costs inhibit uninformed trade and causes the informed to decrease their frequency of their trade as a result. Hence the mispricing that is observed reflects the trade inhibitions that affects both the informed traders as well as the uninformed traders.

5. Tests of Association

To more adequately test the association between the accrual based buy-and-hold returns and the underlying determinants, a regression model is used for various accrual portfolios, levels of institutional holdings, and short portfolios. However, arbitrage risk, which is measured as the variance of residual from the market model is strongly correlated with liquidity cost measures as noted in Table 2. In a regression context, including both the arbitrage risk measure

and liquidity as independent variables may lead to a multicollinearity problem and cause the coefficient estimates to be inefficient (and cause attenuation bias in the liquidity variable). I will control for these effects by running a two-stage regression of the arbitrage risk measure on the various liquidity measures in the first stage and, and using the residual from this regression, I will formally test the liquidity cost hypothesis in the second stage regression. This procedure will produce an arbitrage risk residual that is orthogonal to the liquidity and will represent the level of arbitrage risk not explained by liquidity.[14]

The regression is given as:

$$\text{First Stage: Arbitrage Risk}_{it} = \alpha_1 + \alpha_2 \text{Liquidity}_{it} + \gamma_{it}$$

$$\text{Second Stage: Returns}_{it} = \alpha_1 + \alpha_2 \text{Liquidity}_{it} + \alpha_3 \beta_{it} + \alpha_4 E/P_{it} + \alpha_5 B/M_{it} + \alpha_6 \text{Momentum}_{it} + \alpha_7 \hat{\gamma}_{it} + \alpha_8 \text{Short Interest Ratio Dummy}_{it} + \alpha_9 \text{Institutional Holdings}_{it} + \epsilon_{it}$$

where the subscript "it" refers to either the long or the short firm i and year t and the arbitrage risk residual is the $\hat{\gamma}_{it}$ from the first stage regression. The long or short is the portfolio profit defined as the long position return or the short position return (multiplied by -1.0 to mimic the short sale profit). Liquidity refers to either the LOT measure, the proportional spread-plus-commission measure, or the effective spread-plus-commission measure. β is the systematic risk measure. B/M is the book-to-market ratio, E/P is the earnings-to-price ratio. The short interest pertains only to the short position for three months of the second quarter spanning two months of the portfolio performance period. The short interest variable is set to zero when there is no observed short interest, to one if the short interest ratio is less than two days, and to two if the short interest ratio is greater than two days. This allows the returns for which zero short interest is observed to have equal weight with those returns that have some observed short interest in the regression. Momentum represents the 12-month momentum returns ending in March of each year prior to the performance period (Jagadeesh and Titman, 1993). Institutional holdings are set to zero if no institutional holdings are observed

[14] Regressing arbitrage risk on liquidity is done for a number of reasons. On a purely statistical basis, arbitrage risk arises due to measurement errors in the systematic risk. The hypothesized reason for this misspecification is that liquidity costs are an omitted variable causing systematic risk to be subject to attenuation bias. Consequently, arbitrage risk measures the liquidity (omitted variable) influence on the systematic risk. Economically, liquidity is determined by the interaction of informed and uninformed traders whereas arbitrage risk is the outcome when informed traders cannot find a representative substitute. Liquidity precedes arbitrage risk in the market, hence it is the primitive. In addition, I also orthogonalize the institutional holdings to prevent similar multicollinearity problems. As reported by Gompers and Metrick (2001), institutions prefer stocks with deep liquidity.

on the 13-f filing. A sample size of 1,536 long firms and 1,638 short firms is used. The reduction in the sample size from that of the prior results reflects the deletion of negative book-to-market ratios, unavailable liquidity measures, or unavailable earnings information for the earnings-to-price ratio. This reduced sample largely reflects the lack of Compustat data, especially for book-to-market.

5.1 Separate long and short portfolios

As shown in Table 7, regardless of the long or short portfolio or the liquidity measure, liquidity remains positively associated with the accrual returns. The relative strength of the liquidity results appears to rest more firmly on the LOT liquidity measure that represents the total costs of trade. The proportional spread is significantly associated with the level of the accrual return, but the association is significant at only the 5% level. These association results are consistent for either the long or the short portfolios.

The magnitude of the liquidity coefficients are economically meaningful and reflect the cost concerns of either the long or the short position. The LOT liquidity measures range from 0.771 to 0.926 for the long position and from 0.674 to 0.860 for the short position. The long position's liquidity coefficients are larger than the short positions costs because the long position's profits are only dictated by the costs of trading the stock. The short position's profits, on the other hand, require institutional holdings to expedite the short sale. Liquidity costs are indicative of the constraint on institutional holdings

Economically, the liquidity coefficients indicate that a 1% incremental change in the LOT liquidity costs would be associated with a marginal accrual return of between 0.771% and 0.926% for the long position, while a 1% incremental change in the LOT liquidity costs would be associated with a marginal accrual return of between 0.674% and 0.860% for the short position. The incremental effects of the proportional bid-ask spread and the effective spread on the accrual returns reflect the liquidity cost definitions with the proportional spread reflecting the costs of immediacy and the effective spread reflecting the price improvement liquidity costs (i.e. the costs of trade relative to the quote midpoint). Hence, the magnitude of the liquidity cost estimates are economically relevant and consistent.

Surprisingly, the arbitrage risk residual results for the long portfolio report coefficients that are *negative*, not positive. This would indicate that hedging risk for the long portfolio

is decreasing with increasing returns, a result opposite to that expected. However, the arbitrage risk residual is positive for the short portfolio. Hedging risk, in addition to liquidity costs, are consistently associated with the short accrual returns. The significance of the arbitrage risk residual for the short portfolio is consistent with the priors of the accrual strategy. The difficulty in finding a representative substitute would be more expected for the short side of the trade than the long side.

Finally, the long portfolio appears to load on book-to-market. Lower book-to-market firms are associated with higher accrual returns, regardless of the liquidity cost measure used. Lower institutional holdings are associated with higher accrual returns, but only for the short position and only for the proportional liquidity measure.

Pooling the long and short portfolios, shown in Panel B of Table 7, does little to affect the positive relation between liquidity and accrual returns. In fact, the liquidity effect[15] is more pronounced for the aggregate portfolios. Residual risk is of the wrong sign, but not significant for the majority of the regression specifications.

5.2 Short portfolios

Given that the bulk of the profits are obtained for the short portfolio, I segregate the sample into three separate short portfolio classifications. The first limits the sample to only those firms that experience zero short interest, the second limits the sample to those firms with some short interest, and the third limits the sample to those short firms that have institutional holdings less than the median each year (low institutional[16] holdings). The results are reported in Table 8.

As is shown, liquidity again is related to the accrual returns regardless of the short interest or institutional holding split in the sample. However, the results are more strongly noted for the LOT liquidity measure and the proportional bid-ask spread than for the effective spread measure. This would indicate that the more informed trader who can better negotiate their trades may more profitably trade on the accrual strategy.

[15] The short interest is excluded because of the pooling of the short position along with the long position.

[16] The high institutional holdings are not reported because the accrual return is not significant for this classification of holdings. Statistical tests for this classification show insignificant accrual returns. However, regression tests show that only the 12-month momentum return is associated with the short accrual returns regardless of the liquidity measure. No other determinant is associated with the accrual returns.

For the zero short interest case, liquidity is strongly associated with the level of the accrual return with arbitrage risk regaining significance in the LOT regression specification. Institutional holdings is negative, but surprisingly not significant. It appears that liquidity costs better explain the short accrual returns than does institutional holdings, and this corroborates the assertions that liquidity costs are the primitive in the articulation of a limit to arbitrage.

For the positive short interest case, the LOT liquidity measure and the proportional spread liqudity measure are more strongly associated with the accrual returns than is the effective spread. The effective spread is significantly associated with the accrual returns but falls from significance in the grand specification. The arbitrage risk residual is positive, but significant only for the proportional spread measure, indicating that hedging risk is marginally important for this portfolio. Finally, higher book-to-markets are associated with the short return indicating that the short interest firms are still earning the Fama-French equity premium. In addition, the prior 12-month momentum return is positive and significant indicating the accrual returns are reverting (an outcome of multiplying the short return by -1.0) from the prior returns. Thus, positive prior 12-month returns lead to negative accrual returns.

For the low institutional holdings case, arbitrage risk and liquidity costs in conjunction with book-to-market best explains the short portfolio accrual returns. The short interest is negative and significant, but only for the LOT specification. In addition, the short accrual firms that have low institutional holdings appear to be earn higher profits for high earnings-to-price indicating that they are not value firms. These firms also have higher beta. The latter result stems from the segregation of the sample that reduces the effectiveness of the hedge in the portfolio. The Fama-French book-to-market effect is very strongly related to the short accrual profits. High accrual profits are associated with high book-to-market indicating that these firms with low institutional holdings have high potential distress risk.

6. Conclusions

The substantial returns purportedly earned by accrual based trading strategies has generated considerable attention in the academic literature. I find that the abnormal size-adjusted profits "earned" by buying low accrual firms and shorting high accrual firms are substantially reduced once liquidity costs are considered. The argument raised in this paper is that high liquidity costs inhibit trading by both the uninformed traders and the informed traders. The lack of

depth in the market imposed by the lack of uninformed traders leads to a significant reduction in the level of informed trading. This limit to arbitrage is embodied in the lack of institutional holdings that limits the short interest market and hence the market's ability to more properly short the high accrual firms leading to a substantial lag in the price discovery process.

The literature has been slow to incorporate the influences of liquidity due to the lack of sufficient liquidity cost estimates, the lack of institutional details, and the lack of hard data on short sales concerning accrual based trading strategies. I overcome this shortcoming by employing an exhaustive collection of institutional holdings and short interest information and by employing a battery of liquidity estimators over a sufficiently long 17 year period. These estimators span the observed proportional and effective bid-ask spread-plus-commission measures to the price based estimator used by Lesmond et al. (1999). Using these three liquidity estimates and measures, I conclude that liquidity costs are binding to arbitrage and may be a factor explaining why prices are slow to incorporate the public information signal.

Market microstructure provides a key clue in understanding the behavior of traders subsequent to the initiation of the accrual based trading strategy. The extreme accrual portfolios are subject to high liquidity costs and these costs dramatically reduce the level of trade by both the uninformed and the informed traders. The lack of uninformed trading leading to a sharp reduction in the level of informed trading and this is the principal reason for the length of time prices take to more properly impound the accrual information.

I provide evidence that implementing the accrual based trading strategy entails differential "constraints." The long position is principally constrained by the underlying liquidity costs necessary to implement the position. If liquidity costs are binding then arbitrageurs are inhibited from implementing the position because the high liquidity costs reduce the level of uninformed trading. The short position, on the other hand, requires a short sale that requires the presence of an institution willing and able to lend the security. I find that the availability of stock to be shorted is related to the level of institutional holdings which is turn in tied to the underlying liquidity of the firm's equity. If liquidity costs are too high, then institutions will not hold them leading to an arbitrage bound because of short sale constraints.

Regression tests indicate that the returns associated with buying low accrual firms and selling short high accrual firms can be best explained by liquidity costs, regardless of examining

only long or only short positions or a pooled sampled of long and short firms. The association of liquidity costs and accrual returns persists even after controlling for risk, book-to-market and value effects, the level of institutional holdings, or the observed short interest for the short side of the trade. The results are robust to various short combinations where the bulk of the accrual profits are earned. However, I cannot conclude that each and every accrual portfolio is dominated by liquidity costs. Rather, for a substantial portion of the accrual portfolio classifications, liquidity costs appear to act as a economically binding constraint to trading profits.

This paper contributes to the growing debate over liquidity's influence on asset pricing and its influence in explaining why security returns continue to drift subsequent to the issuance of value relevant public information. Specifically, the issue of a liquidity premium on returns (Amihud and Mendelson, 1986) may now find common ground for both past prices (Lesmond, et al., 2004) and with a public information signal. Additionally, a liquidity premium in returns may provide the impetus to better examine the linkage between market microstructure, institutional holdings, and short sale constraints for other well known financial anomalies, such as the momentum and the post-earnings drift anomaly (Fama, 1998).

Bibliography

1. Ali, A., L. Hwang, and M. Trombley, 2003, "Arbitrage risk and the book-to-market anomaly," *Journal of Financial Economics* 69, 355-373.

2. Almazan, A., K. Brown, M. Carlson, and D. Chapman, 2004,"Why Constrain Your Mutual Fund Manager?" *Journal of Financial Economics*, 73(2), 289-321.

3. Amihud, Y., and H. Mendelson, 1986, "Asset pricing and the bid-ask spread," *Journal of Financial Economics* 17, 223-249.

4. Avolio, G., 2002, "The market for borrowing stock," *Journal of Financial Economics* 66, 271-306.

5. Benston, G., and R. Hagerman, 1974, "Determinants of the bid-asked spread in the over-the-counter market," *Journal of Financial Economics* 1, 353-364.

6. Bhardwaj, R., and L. Brooks, 1992, "The January anomaly: Effects of low share price, transaction costs, and bid-ask bias," *Journal of Finance*, 47, 553-575.

7. Brennan, M., and M. Subrahmanyam, 1995, "Investment analysis and price formation in securities markets," *Journal of Financial Economics* 38, 361-381.

8. Bushee, B. and J, Raedy, 2003, "Factors affecting the implementability of stock market trading strategies," *Working Paper*, University of Pennsylvania, Wharton School of Business.

9. Chen, J., H. Hong, and J. Stein, 2002, "Breath of ownership and stock returns," *Journal of Financial Economics*, 66, 171-205.

10. Chen, H. and V. Singal, 2003, "Role of speculative short sales in price formation: The case of the weekend effect," *Journal of Finance*, 58, 685-705.

11. Cohen, K., W. Ness, H. Okuda, R. Schwartz, and D. Whitcomb, 1976, "The determinants of stock returns volatility: An international comparison," *Journal of Finance*, 31, 733-740.

12. Collins, D., G. Gong, and P. Hribar, 2003, "Investor sophistication and the mispricing of accruals," *Review of Accounting Studies*, 8, 251-276.

13. Desai, H., S., Thiagararajan, K. Ramesh, B. Balachandran, 2002, "An investigation of the informational role of short interest in the Nasdaq market," *Journal of Finance*, 57, 2263-2287.

14. Fama, E., 1991, "Efficient capital markets: II," *Journal of Finance* 46, 1575-1617.

15. Fama, E. and K. French, 1993, "Common factors in the returns of stocks and bonds," *Journal of Financial Economics*, 33, 3-56.

16. Fama, E., 1998, "Market efficiency, long term returns, and behavioral finance," *Journal of Financial Economics*, 49, 283-306.

17. Gompers, P., and A. Metrick, 2001, "Institutional investors and equity prices," *Quarterly Journal of Economics*, 166, 229-259.

18. Harris, L., 1989, "A day-end transaction price anomaly," *Journal of Financial and Quantitative Analysis*, 24, 29-45.

19. Harris, L., 1990, "Statistical properties of the Roll serial covariance bid-ask spread estimator," *Journal of Finance*, 45, 568-579.

20. Harris, L., 1994, "Minimum price variation, discrete bid-ask spreads, and quotation sizes," *Review of Financial Studies*, 7, 149-178.

21. Hvidkjaer, S. 2006, "Small trades and the cross section of stock returns," *Forthcoming Journal of Finance.*

22. Jagadeesh, N., and S. Titman, 1993, "Returns to buying winners and selling losers: Implication for stock market efficiency," *Journal of Finance*, 48, 65-91.

23. Keim, D. and A. Madhavan, 1997, "Transaction costs and investment style: An inter-exchange analysis of institutional equity trades," *Journal of Financial Economics*, 46,

265-292.

24. Khan, M., 2005, "Are Accrual Really Mispriced? Evidence from Tests of an Intertemporal Capital Asset Pricing Model," Working Paper, MIT, Sloan School of Management.

25. Kothari, S., E. Loutskina, and V. Nikolaev, 2006, "Agency theory of overvalued equity as an explanation for the accrual anomaly," Working Paper, MIT, Sloan School of Management.

26. Kyle, A., 1985. Continuous auctions and insider trading. Econometrica 53, 1315-1336.

27. Lakonishok, J. A. Shleifer, and R. Vishney, 1994, "Contrarian investment, extrapolation, and risk," *Journal of Finance*, 49, 1541-1578.

28. Lesmond, D., J. Ogden, and C. Trzcinka, 1999, "A new estimate of transaction costs," *Review of Financial Studies*, 12, 1113-1141.

29. Lesmond, D., M. Schill, and C. Zhou, 2004, "The Illusory Nature of Momentum Profits,", *Journal of Financial Economics*, 43, 1121-1142.

30. Lev, B., and D. Nissam, 2005,"The persistence of the accruals anomaly," *Forthcoming, Contemporary Accounting Research.*

31. Mashruwala, C., S. Rajgopal, and T. Shevlin, 2004,"Why is the accrual anomaly not arbitraged away," *Forthcoming, Journal of Accounting and Economics.*

32. Mendenhall, R., 2004, "Arbitrage risk and post-earnings-announcement drift," *Journal of Business*, 77 (4), 875-894.

33. Mikkelsen, H., 2001, "The relation between expected return and beta: A random resampling approach," *Working Paper, USC Marshall School of Business.*

34. Miller, E., 1977, "Risk, uncertainty, and divergence of opinion," *Journal of Finance*, 32, 1151-1168.

35. Nagel, S., 2005, "Short sales, institutional investors and the cross-section of stock returns,"

Forthcoming, Journal of Financial Economics.

36. Shleifer, A. and R., Vishny, 1997, "The limits to arbitrage," *Journal of Finance*, 53, 53-55.

37. Sloan, R., 1996, "Do stock prices fully reflect information in accruals and cash flows about future earnings?", *Accounting Review*, 71, 289-315.

38. Stoll, H., 2000, "Friction," *Journal of Finance* 56, 1-31.

39. Stoll, H., and R Whaley, 1983, "Transaction costs and the small firm effect," *Journal of Financial Economics* 12, 57-79.

40. White, H., 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica 48, 817-838.

41. Wurgler, J., and E. Zhuravskaya, 2002, "Does arbitrage flatten demand curves for stocks," *Journal of Business*, 75 (4), 583-608.

Table 1

Accrual Portfolio Characteristics

Portfolio returns are annual size adjusted buy-and-hold returns associated with a short position in the highest accrual decile rank portfolio and a long position in the lowest accrual decile rank portfolio. Accrual rankings are performed using financial information for year t. The return accumulation begins on May 1st of year t+1 and ends on April 30th of year t+2 (performance period), where year t is the year end for the accrual measurement derived from the annual Compustat database. Jensen's alpha is estimated using CRSP monthly returns, NYSE/AMEX decile index returns, and risk free rates during the performance period. Beta is the systematic risk. Arbitrage risk is the variance of residual from the market model. Market cap is the market value of equity at the end of the year prior to the performance period. Share price is average price. Volume is average volume. Volatility is the variance of daily returns. % Price < $5.00 is the percentage of stocks in the accrual portfolios whose average price is below $5.00 per share. Price, volume, volatility and the liquidity cost estimates are all measured during the year prior to the performance period. % zero return days is the percentage of days during the year that experience zero returns. LOT liquidity cost estimate (Lesmond et al., 1999) is a comprehensive liquidity cost estimate. The bid-ask is the proportional quoted spread. The effective spread is the two times the absolute value of the price minus the quote midpoint divided by the price. Commission costs are generated by using the Cigna discount brokerage schedule. The short interest ratio is the short interest divided by the daily trading volume and indicates how many days of trading are necessary to cover the short sales. All institutional details are derived from the 13-f filings. An * indicates significance from zero at the 1% level, while a † indicates significance from zero at the 5% level. Finally, a ‡ indicates that four of the eight middle portfolios experience significant Jensen's alpha at a minimum 5% level.

	NYSE/Amex (1988 to 2005)			
Portfolio Characteristics	Low Accrual (Long Position)	Middle Accrual (Non-Traded)	High Accrual (Short Portfolio)	Low-High Accrual (Long-Short)
Size Adjusted Return (%)	3.10†	1.67*	-5.23*	8.33*
Risk Characteristics:				
Jensen's Alpha	0.0036*	0.0020‡	-0.0043*	
Systematic Risk	1.1590	1.0521	1.1542	
Arbitrage Risk	0.0021	0.0009	0.0016	
Liquidity Proxies:				
Price	17.77	26.64	18.90	
Volume	255,947	336,662	159,412	
Volatility	0.0027	0.0009	0.0016	
Market Cap ($,000)	1,967,407	3,722,973	798,243	
Liquidity Indicators:				
% Price < $5.00	29.07	12.54	22.28	
%Zero Return Days	20.10	15.80	18.40	
Liquidity Measures:				
LOT (%)	5.92	3.22	4.76	10.68
Bid-Ask Spread (%)	4.80	2.74	4.21	9.01
Effective Spread (%)	2.09	1.21	1.67	3.76
Commission Cost (%)	1.33	0.83	1.21	2.54
Institutional Details:				
% Firms Held	96.64	97.95	96.76	
% Shares Held	37.00	45.59	36.68	
Number of Institutions	79.58	131.43	61.20	
Short Interest:				
Short Interest Ratio	4.98	4.16	5.99	
% Firms w/No Short Interest	38.73	31.42	18.09	
# Observations	1895	15079	1885	

Table 2

Long and Short Portfolio Correlation Coefficients

Pearson correlation coefficients for the long (above diagonal) and short (below diagonal) portfolio firms. BHR signifies the buy-and-hold return for either the long and short portfolio. The return accumulation begins on May 1st of year t+1 and ends on April 30th of year t+2 (performance period), where year t is the year end for the accrual measurement derived from the annual Compustat database. For the short (negative) size adjusted buy and hold return, the sign is reversed to provide a better comparison between the long and short portfolio variables. Price is the average price, volume is the average daily trading volume, and volatility is the variance of the daily returns. Size is the market value of equity measured at end of the year prior to the performance period. % Zero is the percentage of days that has zero returns. PSpread is the proportional quoted spread. ESpread is the proportional effective spread. LOT (Lesmond et al., 1999) is a comprehensive liquidity cost estimate. Beta is the systematic risk. Arbitrage risk is the variance of the residual from the OLS market model. EP is the earnings to price ratio. BM is the book-to-market ratio. All of these are measured as of December of year t or for the year preceeding the accrual performance period. % Shares Held is the percentage of shares outstanding held by institutions during the second quarter of each year t+1 that spans two months of the 12 month performance period. Short interest is the average percentage of shares shorted during the second quarter of each year t+ 1 that spans two months of the 12 month performance period. Thus, for both the institutional holdings and short interest, the measurement goes from April 1st through June 30th of the same year as the performance period (which begins on May 1st of each year).

		Long Portfolio														
		BHR	Price	Volume	Volatility	Firm Size	% Zero	PSpread	ESpread	LOT	Beta	Arbitrage Risk	BM	EP	% Shares Held	Short Interest
Short Portfolio	BHR		-0.0256	-0.0107	0.0643*	-0.0107	0.0570†	0.0549†	0.0432†	0.0847*	-0.0312	-0.0088	-0.0754*	-0.0007	0.0194	-0.0014
	Price	0.0072		0.1549*	-0.0829*	0.2719*	-0.4539*	-0.3279*	-0.3349*	-0.3664*	0.0090	-0.2743*	0.0379	0.1989*	0.3694*	0.1835*
	Volume	0.0195	0.2143*		-0.0186	0.5036*	-0.2446*	-0.1147*	-0.1078*	-0.1471*	0.1610*	-0.0508†	0.0297	0.0959*	0.1877*	0.4079*
	Volatility	-0.0035	-0.1811*	-0.0252		-0.0250	0.0586†	0.1895*	0.2123*	0.6188*	0.1336*	0.9991*	0.0288	-0.1383*	-0.1025*	-0.0210
	Firm Size	0.0062	0.2828*	0.5994*	-0.0623†		-0.2025*	-0.1178*	-0.1173*	-0.1281*	0.0091	-0.0810*	0.0529†	0.3150*	0.1134*	0.4576*
	% Zero	-0.0282	-0.3947*	-0.3451*	0.1446*	-0.2463*		0.4534*	0.4697*	0.6157*	-0.274*	0.2625*	-0.0719*	-0.1365*	-0.5187*	-0.1924*
	PSpread	0.0532†	-0.2625*	-0.1234*	0.4247*	-0.1150*	0.3601*		0.7560*	0.7830*	-0.0707*	0.6735*	-0.0242	-0.2204*	-0.4302*	-0.1062*
	ESpread	0.0045†	-0.2678*	-0.1126*	0.5143*	-0.1158*	0.3879*	0.6772*		0.8285*	-0.0219	0.7691*	-0.0313	-0.2804*	-0.4271*	-0.1075*
	LOT	0.0267*	-0.3679*	-0.1578*	0.7139*	-0.1540*	0.5838*	0.6443*	0.7322*		0.3739	0.8245*	-0.0202	-0.3269*	-0.4642*	-0.1144*
	Beta	0.0313	0.0471	0.2611*	0.1350*	0.0605†	-0.3306*	-0.0928*	-0.0582†	-0.0250		0.1454*	0.0345	-0.1268*	0.1724*	0.1017*
	Arb. Risk	0.0520†	-0.2290*	-0.0383	0.9992*	-0.0770*	0.2148*	0.5350*	0.6183*	0.8211*	0.0567†		0.0217	-0.3434*	-0.3204*	-0.0627*
	BM	0.0516†	0.0395	0.0549†	0.0065	0.0952*	-0.0675*	-0.0267	-0.0227	-0.0254	0.0644†	0.0030		-0.0147*	-0.0189	0.0239
	EP	-0.0635*	0.1265*	0.2057*	-0.2094*	0.2217*	-0.1871*	-0.1873*	-0.2509*	-0.3537*	-0.0564†	-0.2749*	-0.0065		0.1627*	0.1615*
	% Shares Held	-0.0742*	0.3494*	0.2938*	-0.1363*	0.2271*	-0.4989*	-0.2821*	-0.2821*	-0.3822*	0.2143*	-0.1609*	-0.0329	0.1478*		0.1496*
	Short Interest	-0.0088	0.1829*	0.6005*	-0.0407	0.3851*	-0.3426*	-0.1390*	-0.1326*	-0.1738*	0.2484*	-0.0476†	0.0464 *	0.1345*	0.3386*	

Table 3

Institutional Holding Limits and Short Sale Constraints

Panel A reports size adjusted buy-and-hold returns with requisite liquidity costs for long and short positions separated by institutional holdings of less than 1%, between 1% and 5%, and that greater than 5%, respectively. All institutional details are derived from the 13-f filings. The coincident liquidity cost estimates are the LOT measure, the bid-ask quoted proportional spread, and the effective spread. The LOT liquidity estimate (Lesmond et al., 1999) is a comprehensive liquidity cost estimate. The effective spread is the two times the absolute value of the price minus the quote midpoint divided by the price. Commission costs are generated by using the Cigna discount brokerage schedule. Panel B reports the short interest ratio separated by levels of short interest demand. The short interest ratio is the short interest divided by the daily trading volume and indicates how many days of trading are necessary to cover the short sales. Short interest is derived from *Bloomberg* reporting for observed short sales during the second quarter of each year. An * or a † indicates significance at the 1% or the 5% level, respectively.

Panel A: Institutional Holdings Extremes: Long & Short Portfolios

Institutional Holdings	<= 1%			> 1% & <= 5%			> 5%		
Portfolio Characteristics	Low Accrual (Long)	High Accrual (Short)	Long Minus Short	Low Accrual (Long)	High Accrual (Short)	Long Minus Short	Low Accrual (Long)	High Accrual (Short)	Long Minus Short
Size Adjusted Return (%)	3.85	-16.40*	20.25*	-2.89	-9.76†	6.87*	3.75†	-3.94*	8.33*
Liquidity Measures:									
LOT (%)	12.45	11.03	23.48	12.32	9.22	21.54	4.44	3.74	10.68
Bid-Ask Spread (%)	12.06	12.32	24.38	10.31	8.05	18.36	3.38	3.02	9.01
Effective Spread (%)	5.10	4.56	9.66	4.33	3.40	7.73	1.46	1.27	3.76
Commission Cost (%)	2.66	3.13	5.79	2.46	2.26	4.72	1.03	0.93	2.54
Institutional Details:									
Mean # Institutions	2.27	2.39		8.24	8.81		96.97	73.32	
Median # Institutions	1.00	1.00		6.00	6.00		49.00	42.00	
Short Interest:									
Short Interest Ratio	2.07	2.75		5.60	3.88		4.18	5.88	
# Observations	171	168	339	189	170	359	1535	1547	3082

Panel B: Short Interest Ratio Extremes: Short Position Returns

Portfolio Characteristics	Constrained Short = Zero	Short Interest Ratio Light Shorting > Zero & <= Two Days	Heavy Shorting > Two Days
Size Adjusted Return (%)	-8.35*	-5.67*	-4.54†
Liquidity Measures:			
LOT (%)	6.58	5.74	3.29
Bid-Ask Spread (%)	5.76	5.31	2.71
Effective Spread (%)	2.37	2.13	1.10
Commission Cost (%)	1.29	1.58	0.90
Institutional Details:			
Mean # Institutions	20.17	43.78	93.03
Median # Institutions	9.00	22.00	78.00
Short Interest:			
Mean Short Interest Ratio	0.00	0.63	10.23
Median Short Interest Ratio	0.00	0.47	6.57
# Observations	340	713	832

Table 4

Short Sale Constraints and Institutional Holdings

The short position's size adjusted buy-and-hold returns with concomitant liquidity costs are separated by institutional holdings and short interest ratios. The institutional holding levels presented are < 1%, between 1% and 5%, and those > 5%. The short interest levels are ranked in order of increasing short interest pressure. These levels are zero short interest, the short interest ratio between zero and two days, and the short interest ratio greater than two days. All institutional details are derived from the 13-f filings. The short interest ratio is the short interest divided by the daily trading volume and indicates how many days of trading are necessary to cover the short sales. Short interest is derived from *Bloomberg* reporting for observed short sales during the second quarter of each year. The coincident liquidity cost estimates are the LOT measure, the bid-ask quoted proportional spread, and the effective spread. The LOT liquidity estimate (Lesmond et al., 1999) is a comprehensive liquidity cost estimate. The effective spread is the two times the absolute value of the price minus the quote midpoint divided by the price. Commission costs are generated by using the Cigna discount brokerage schedule. The significance of a linear trend in the reported buy-and-hold returns is given by the bootstrap p-value that is predicated on 5000 bootstrap samples. An * indicates significance from zero at the 1% level, a † indicates significance from zero at the 5% level, and a ‡ indicates significance at the 10% level.

			Institutional Holdings			
Short Interest Pressure	Short Interest Ratio	Variable	(Lowest) <= 1%	> 1% & <= 5%	(Highest) > 5%	Bootstrap p-value
Constrained	Zero	Return (%)	-24.01*	-13.66†	-2.74	0.0068*
		LOT (%)	9.35	10.11	5.10	
		Bid-Ask Spread (%)	12.52	7.06	3.77	
		Effective Spread (%)	4.44	3.30	1.72	
		Commission Cost (%)	2.29	1.82	0.92	
		Mean # Institutions	1.51	6.10	28.90	
		Median # Institutions	1.00	5.00	15.00	
		Mean Short Interest	0.00	0.00	0.00	
		Mean Short Interest	0.00	0.00	0.00	
		# Observations	61	58	222	
Light	<= Two Days	Return (%)	-14.94†	-3.88	-4.62†	0.1172
		LOT (%)	13.53	9.92	4.31	
		Bid-Ask Spread (%)	13.05	9.35	3.83	
		Effective Spread (%)	5.19	4.20	1.50	
		Commission Cost (%)	4.34	2.90	1.06	
		Mean # Institutions	3.19	8.13	54.16	
		Median # Institutions	2.00	6.00	31.00	
		Mean Short Interest	0.39	0.50	0.68	
		Mean Short Interest	0.17	0.23	0.55	
		# Observations	78	74	559	
Heavy	> Two Days	Return (%)	-5.00	-8.64	-4.34†	0.9460
		LOT (%)	8.37	6.63	2.96	
		Bid-Ask Spread (%)	10.09	7.05	2.22	
		Effective Spread (%)	3.05	2.08	1.00	
		Commission Cost (%)	1.58	1.67	0.86	
		Mean # Institutions	2.10	14.50	100.29	
		Median # Institutions	0.00	8.50	71.00	
		Mean Short Interest	11.43	12.12	10.34	
		Mean Short Interest	6.40	7.78	6.39	
		# Observations	30	36	765	
		Bootstrap p-value	0.0804‡	0.7082	0.6876	

Table 5

Microstructure Analysis of Trading and Institutional Holdings

The number of trades and institutional holding details are presented for each of the ten accrual portfolios. For Panel A, the sample size is the number of firms in each of the ten accrual portfolios. The bid-ask spread is the proportional quoted spread measured one year prior to the accrual return period and is averaged across all firms in each accrual portfolio. The trade size is the average number of shares transacted for each trade. Uninformed trades are classified as trade sizes less than 1000 shares, and informed trades are classified as trade sizes greater than 1000 shares. The informed trading ratio is the number of informed trades (i.e. trade size greater than 1001 shares per trade) divided by the total number of trades. This is presented as the average across each firm's ratio. The test statistic on the informed trading ratio signifies the significance in the difference between each accrual pair moving from the long portfolio to the short portfolio. The significance test for the accrual returns is the difference between the return and zero. For Panel B, the institutional holdings are measured during the second quarter of each year. The number of institutions represents the count of those institutions that have a position in the stock at the end of the second quarter. The lagged number of institutions represents the count of those institutions that have a position in the stock at the end of the first quarter. The new position institutions represents the institutions that have initiated a new position in the stock during the second quarter. The sold out position institutions represents the number of institutions that have liquidated all their holdings in that stock from the first quarter to the second quarter. An * indicates significance from zero at the 1% level, while a † indicates significance from zero at the 5% level.

Microstructure Trading Characteristics

				Uninformed Trades			Informed Trades				
Portfolio	Sample Size	Accrual Return (%)	Trade Size (Shares)	100 Shares	Between 101 & 500 Shares	Between 501 & 1000 Shares	Between 1001 & 9999 Shares	$\geq$ 10000 Shares	Total Trades	Bid-Ask Spread (%)	Informed Trading Ratio (%)
Long (1)	1895	3.10†	1691	343	493	223	254	39	1353	4.75	24.80
2	1891	3.42†	1639	420	641	289	337	54	1744	3.43	23.87†
3	1891	3.45*	1547	574	857	383	418	61	2295	2.88	22.66*
4	1895	3.04*	1491	575	854	369	397	54	2251	2.49	21.71†
5	1891	2.21†	1491	567	846	365	413	61	2254	2.27	21.43
6	1888	0.32	1452	560	849	365	392	54	2222	2.33	20.60
7	1868	0.11	1430	543	787	328	342	47	2050	2.51	19.91
8	1876	1.52	1335	501	713	281	285	42	1825	2.87	19.63
9	1880	-0.75	1342	391	553	232	259	41	1479	2.99	20.29
Short (10)	1885	-5.21*	1409	292	420	173	173	21	1081	4.16	21.94*

Institutional Holdings Characteristics

Portfolio	Share Change	Shares Held (%)	Number of Institutions	Lagged Number of Institutions	New Position Institutions	Sold out Institutions
Long (1)	10008	37.00	79	77	11	9
2	8278	44.28	116	114	13	11
3	13387	47.16	144	142	15	11
4	10871	47.61	149	146	14	11
5	11281	47.86	159	155	15	11
6	9219	46.55	149	147	14	12
7	10262	44.80	130	130	12	12
8	7661	41.82	109	108	12	11
9	7824	42.01	94	92	10	10
Short (10)	16398	36.68	61	60	8	7

Table 6

Institutional Holding Changes and Market Microstructure

The change in the institutional holdings is presented separately for decreases (Panel A) and increases (Panel B) in the level of institutional holdings for all ten accrual portfolios. For each panel, the institutional holding characteristics and microstructure characteristics are presented for each of the ten portfolios. The institutional holdings are measured during the second quarter of each year, that is from April through June of each year. The accrual return (buy-and-hold size adjusted annual return) is measured from May 1st to June 30th of the following year. The shares sold (purchased) represents the difference in the shares held by all institutions from the first quarter to the second quarter. The number of institutions represents those institutions that have a position in the stock at the end of the second quarter. The lagged number of institutions represents the count of those institutions that have a position in the stock at the end of the first quarter. The new position institutions counts the institutions that have initiated a new position in the stock during the second quarter. The sold out position counts the number of institutions that have liquidated all their holdings in that stock from the first quarter to the second quarter. The bid-ask spread is the proportional quoted spread measured one year prior to the accrual return period and is averaged across all firms in each accrual portfolio. The number of trades separated by trade size for the month of June for all ten accrual portfolios. Uninformed trades are classified as trades containing trade size categories of one round lot (100 shares), those between 101 and 500 shares, and those between 501 and 1000 shares. Informed trades are classified as those between 1001 and 9999 shares, and those greater or equal to 10000 shares. The informed trading ratio is the number of informed trades (i.e. trade size greater than 1001 shares per trade) divided by the total number of trades. An * indicates significance at the 1% level, while a † indicates significance at the 5% level.

Panel A: Reductions in Institutional Holdings

Institutional Holdings & Liquidity Costs

Portfolio	Sample Size	Accrual Return (%)	Bid-Ask Spread (%)	Shares Purchased (Shares)	Shares Held (%)	Number of Institutions	Lagged Number of Institutions	New Position Institutions	Sold out Institutions
Long (1)	705	2.81	6.15	-30960	29.44	48	54	8	11
2	662	0.92	4.07	-21021	38.89	90	97	11	14
3	648	1.80	3.56	-12966	43.18	117	120	10	13
4	675	2.02	2.89	-19335	43.49	129	135	9	15
5	624	2.11	2.62	-14050	44.41	133	138	10	15
6	627	-3.31	2.49	-17968	43.72	131	140	9	18
7	682	-2.18	2.74	-14627	42.01	118	127	9	18
8	686	-1.38	3.39	-14694	36.51	96	103	7	14
9	695	-1.46	3.66	-16140	37.23	74	80	7	13
Short (10)	688	-9.92*	4.66	-14919	31.47	49	53	7	11

Microstructure Trading Characteristics

Portfolio	Trade Size (Shares)	Uninformed Trades: 100 Shares	Uninformed Trades: Between 101 & 500 Shares	Uninformed Trades: Between 501 & 1000 Shares	Informed Trades: Between 1001 & 9999 Shares	Informed Trades: $\geq$ 10000 Shares	Total Trades	Informed Trading Ratio (%)
Long (1)	1654	243	342	144	149	19	901	25.86
2	1672	319	510	227	262	40	1361	24.57
3	1603	466	709	321	344	53	1895	23.17
4	1514	534	805	346	376	57	2121	22.13
5	1557	462	710	301	331	48	1853	22.37
6	1410	508	775	321	350	52	2008	20.05
7	1451	528	771	316	323	45	1985	20.05
8	1372	447	672	268	265	36	1690	20.61
9	1351	355	487	198	203	29	1274	20.82
Short (10)	1404	225	343	149	152	18	889	22.37

Panel B: Additions to Institutional Holdings

Institutional Holdings & Liquidity Costs									
Portfolio	Sample Size	Accrual Return (%)	Bid-Ask Spread (%)	Shares Purchased (Shares)	Shares Held (%)	Number of Institutions	Lagged Number of Institutions	New Position Institutions	Sold out Institutions
Long (1)	1190	3.27†	3.99	34280	41.10	98	95	10	7
2	1229	4.76*	3.25	24061	47.00	130	127	11	8
3	1243	4.31*	2.59	27126	49.18	159	156	12	9
4	1220	3.23*	2.31	27584	49.76	162	158	12	8
5	1267	2.26†	2.21	23758	49.49	168	165	12	9
6	1261	2.13	2.36	22738	47.87	158	154	12	8
7	1186	1.43	2.40	24575	46.30	138	136	12	9
8	1190	3.20†	2.65	20549	44.67	118	115	10	7
9	1185	-0.34	2.76	21293	44.59	107	104	10	7
Short (10)	1197	-2.98	3.92	34456	38.74	68	65	8	5

Microstructure Trading Characteristics								
		Uninformed Trades			Informed Trades			
Portfolio	Trade Size (Shares)	100 Shares	Between 101 & 500 Shares	Between 501 & 1000 Shares	Between 1001 & 9999 Shares	$\geq$ 10000 Shares	Total Trades	Informed Trading Ratio (%)
Long (1)	1712	398	578	266	312	50	1607	24.06
2	1623	471	708	320	375	62	1938	23.51
3	1518	630	934	415	457	65	1503	22.40
4	1479	597	880	381	409	53	2321	21.48
5	1458	618	914	397	453	67	2452	20.96
6	1472	585	884	386	413	55	2325	20.63
7	1418	552	796	335	352	48	2086	19.83
8	1316	531	736	288	295	46	1898	19.40
9	1336	412	590	251	291	48	1593	19.99
Short (10)	1413	331	465	186	185	23	1193	21.68

Table 7

Regression Tests

The association between accrual returns, liquidity, and various control variables are presented for separate long and short positions in Panel A and for the pooled long and short portfolio in Panel B. For the short position firms, the return is multiplied by -1.0 to provide comparable regression estimates with those of the long position. LOT refers to the Lesmond, et al. (1999) estimate of liquidity costs, the quoted spread is the ask minus the bid divided by the quote midpoint, and the effective spread is price minus the quote midpoint divided by the quote midpoint. The control variables refer to specific risk variables, firm-specific assigned risk classification variables, or institutional characteristics for the firm. The specific risk variables are beta (systematic risk) and arbitrage risk residual. The residual of a regression of the arbitrage risk (residual of the market model regression) on liquidity is the arbitrage risk residual. The arbitrage risk residual is scaled by dividing by 100. The firm-specific variables are book-to-market, earnings-to-price, and 12-month momentum returns. The institutional characteristics contain the short interest (short portfolio only) and the percentage of shares held by institutions. The short interest takes on three values: zero for firms with no short interest, one for firms with a short interest ratio less than two, and two for firms with a short interest ratio greater than two. Institutional holdings are the percentage of shares held by institutions and the reported residual institutional holdings is the residual of a regression of institutional holdings on liquidity. T-tests are presented in parentheses. An * or a † denotes significance at the 1% or 5% level, respectively.

Panel A: Separate Long and Short Portfolio Assignments

	Liquidity Measures			Control Variables							
Intercept	LOT	Quoted Spread	Effective Spread	Beta	Earnings to Price	Book to Market	Short Interest	Residual Arbitrage Risk	12 Month Momentum Return	Residual Institutional Holdings	Adj. R^2 (%)
Long Portfolio, N = 1,536											
-0.014	0.926*										0.53
(0.68)	(3.03)										
0.039	0.791†			-0.019	-0.001	-0.007*		-0.171	-0.016		1.20
(1.21)	(2.50)			(0.95)	(0.86)	(2.75)		(1.83)	(0.83)		
0.044	0.771*			-0.025	-0.001	-0.006*		-0.178†	-0.017	0.101	1.30
(1.37)	(2.60)			(1.23)	(0.92)	(2.67)		(1.95)	(0.73)	(1.58)	
0.007		0.774*									0.32
(0.36)		(2.43)									
0.056		0.641†		-0.016	-0.001	-0.007*		-0.223*	-0.021		1.44
(1.70)		(1.99)		(0.77)	(1.21)	(2.66)		(3.12)	(0.84)		
0.060		0.635†		-0.020	-0.001	-0.007*		-0.218*	-0.023	0.075	1.47
(1.82)		(1.96)		(0.95)	(1.24)	(2.58)		(3.04)	(0.91)	(1.15)	
0.009			1.585†								0.32
(0.25)			(2.44)								
0.064†			1.305†	-0.020	-0.001	-0.007*		-0.140	-0.024		1.03
(1.99)			(1.98)	(1.00)	(1.10)	(2.70)		(1.75)	(1.04)		
0.032			1.693†	-0.027	-0.001	-0.006*		-0.132	-0.026	0.084	1.09
(0.82)			(2.36)	(1.27)	(1.17)	(2.62)		(1.64)	(1.13)	(1.39)	
Short Portfolio, N = 1,638											
0.021	0.860*										0.45
(1.24)	(2.88)										
0.023	0.644†			0.008	-0.003†	0.004†	-0.014	0.265*	0.028†		1.46
(0.68)	(2.03)			(0.49)	(2.16)	(1.95)	(0.84)	(2.73)	(1.95)		
0.008	0.674†			0.013	-0.003†	0.004	-0.009	0.272*	0.029†	-0.085	1.56
(0.25)	(2.12)			(0.80)	(2.10)	(1.82)	(0.49)	(2.80)	(1.95)	(1.62)	
0.034†		0.490*									0.33
(2.43)		(2.54)									
0.03		0.414†		0.015	-0.004	0.002	-0.014	0.183†	0.027		1.07
(0.93)		(2.08)		(0.97)	(1.81)	(1.28)	(0.83)	(2.39)	(1.78)		
0.012		0.434†		0.021	-0.004	0.002	-0.007	0.172†	0.028	-0.099†	1.24
(0.38)		(2.18)		(1.31)	(1.66)	(1.10)	(0.40)	(2.25)	(1.88)	(1.97)	
0.029			2.285*								0.54
(1.93)			(3.11)								
0.034			1.809†	0.004	-0.003†	0.003	-0.013	0.170†	0.027		1.41
(1.05)			(2.34)	(0.27)	(2.46)	(1.91)	(0.80)	(2.10)	(1.83)		
0.022			1.890†	0.011	-0.006*	0.003	-0.007	0.159†	0.028	-0.068	1.63
(0.68)			(2.42)	(0.68)	(2.64)	(1.77)	(0.43)	(1.96)	(1.85)	(1.35)	

Panel B: Pooled Long and Short Portfolios

	Liquidity Measures			Control Variables							
Intercept	LOT	Quoted Spread	Effective Spread	Beta	Earnings to Price	Book to Market	Short Interest	Residual Arbitrage Risk	12 Month Momentum Return	Residual Institutional Holdings	Adj. R^2 (%)
	Pooled Long & Short Portfolios, N=3,174										
0.005	0.875*										0.50
(0.37)	(4.11)										
0.015	0.797*			-0.005	-0.001	-0.001		-0.013	0.014		0.46
(0.75)	(3.63)			(0.37)	(1.53)	(0.88)		(0.21)	(1.10)		
0.015	0.798*			-0.005	-0.001	-0.001		0.014	0.014	0.001	0.43
(0.76)	(3.63)			(0.38)	(1.15)	(0.87)		(0.21)	(1.10)	(0.11)	
0.021		0.591*									0.33
(1.92)		(3.41)									
0.025		0.534*		0.002	-0.001	-0.001		-0.002*	0.010		0.76
(1.28)		(3.04)		(0.15)	(1.89)	(0.96)		(3.86)	(0.73)		
0.023		0.535*		-0.003	-0.001	-0.001		-0.002	0.010	-0.001	0.74
(1.18)		(3.04)		(0.27)	(1.86)	(1.00)		(3.88)	(0.76)	(0.61)	
0.022			1.747*								0.39
(1.85)			(3.67)								
0.037			1.544*	-0.007	-0.001	-0.001		-0.031	0.011		0.39
(1.82)			(3.17)	(0.61)	(1.84)	(0.97)		(0.55)	(0.83)		
0.037			1.804*	-0.010	-0.001	-0.002		-0.026	0.015	0.001	0.46
(1.81)			(3.64)	(0.76)	(1.58)	(1.00)		(0.45)	(1.14)	(0.08)	

Table 8

Short Portfolio Regression Tests

Three sets of regression tests for the short portfolio are presented. The first test restricts the short sample to include only those firms that have zero short interest. The second test restricts the sample to those firms that have some short interest. The last test restricts the sample to those firms that have low institutional holdings. The short interest takes on three values: zero for firms with no short interest, one for firms with a short interest ratio less than two, and two for firms with a short interest ratio greater than two. The low institutional holding sample is derived by ranking the firms each year by the percentage of shares outstanding held by institutions and selecting those firms less than the median. The buy-and-hold return is multiplied by -1.0 to provide comparable regression estimates with those of the long position. LOT (Lesmond, et al., 1999), the quoted spread, and the effective spread represent the liquidity estimates. The control variables are beta (systematic risk) and arbitrage risk residual. The firm-specific variables are book-to-market, earnings-to-price, and 12-month momentum returns. The residual of a regression of the arbitrage risk (residual of the market model regression) on liquidity is the arbitrage risk residual. The arbitrage risk residual is scaled by dividing by 100. The residual institutional holdings is the residual of a regression of institutional holdings on liquidity. An * or a † denotes significance at the 1% or 5% level, respectively.

Liquidity Measures				Control Variables							
Intercept	LOT	Quoted Spread	Effective Spread	Beta	Earnings to Price	Book to Market	Short Interest	Residual Arbitrage Rsik	12 Month Momentum Return	Residual Institutional Holdings	Adj. R^2 (%)
Only Zero Shorts, N=269											
-0.048	2.537*										3.53
(1.01)	(3.25)										
0.007	2.416*			-0.064	-0.010	0.003		0.705†	-0.030	-0.240	5.02
(0.11)	(3.03)			(1.59)	(1.36)	(0.61)		(2.19)	(0.59)	(1.56)	
0.032		0.862*									3.01
(1.06)		(3.06)									
0.055		0.948*		-0.026	-0.004	0.004		0.114	0.001	-0.158	2.29
(1.05)		(3.21)		(0.68)	(0.64)	(1.17)		(0.67)	(0.02)	(1.11)	
0.017			3.132†								1.86
(0.47)			(2.45)								
0.115			3.435†	-0.042	-0.012	0.003		0.196	-0.009	-0.145	2.08
(1.86)			(2.53)	(1.07)	(1.62)	(0.63)		(1.16)	(0.18)	(1.00)	
Positive Short Interest, N=1,349											
0.017	1.027*										0.57
(0.94)	(2.96)										
-0.006	0.815†			0.022	-0.003†	0.004†	-0.009	0.183	0.031†	-0.054	1.53
(0.12)	(2.21)			(1.26)	(1.99)	(1.97)	(0.35)	(1.77)	(1.98)	(0.97)	
0.029		0.728*									0.43
(1.86)		(2.62)									
0.014		0.552†		0.023	-0.004	0.004†	-0.015	0.197†	0.032†	-0.088	1.69
(0.28)		(1.99)		(1.31)	(1.67)	(2.00)	(0.54)	(2.32)	(2.03)	(1.63)	
0.034†			1.888†								0.25
(1.97)			(2.10)								
0.033			0.458	0.023	-0.006†	0.003	-0.021	0.153	0.308†	-0.074	1.58
(0.68)			(1.66)	(1.30)	(2.46)	(1.86)	(0.71)	(1.65)	(1.95)	(1.37)	
Low Institutional Holdings, N=833											
0.048†	1.062*										1.08
(1.95)	(3.16)										
0.079†	0.700†			0.038	-0.003	0.005†	-0.062*	0.316*	0.010		3.61
(1.97)	(2.00)			(1.83)	(1.58)	(1.99)	(2.80)	(2.92)	(0.58)		
0.068*		0.485†									0.54
(3.36)		(2.35)									
0.080†		0.410†		0.046†	-0.008†	0.004	-0.065*	0.202†	0.010		3.23
(2.17)		(1.96)		(2.17)	(2.18)	(1.87)	(2.85)	(2.37)	(0.52)		
0.056†			2.032†								0.57
(2.37)			(2.39)								
0.091			1.521	0.016	-0.011	0.004	-0.037	0.184†	0.015		1.79
(1.71)			(1.73)	(0.74)	(1.88)	(1.89)	(1.62)	(1.97)	(0.80)		