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Liquidity provision and stock return predictability

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ABSTRACT

This paper examines the trading behavior of two groups of liquidity providers (specialists and competing market makers) using a six-year panel of NYSE data. Trades of each group are negatively correlated with contemporaneous price changes. To test for return predictability, we sort stocks into quintiles based on each group's past trades and then form long-short portfolios. Stocks most heavily bought have significantly higher returns than stocks most heavily sold over the two weeks following a sort. Cross-sectional analysis shows smaller, more volatile, less actively traded, and less liquid stocks more often appear in the extreme quintiles. Time series analysis shows the long-short portfolio returns are positively correlated with a market-wide measure of liquidity. A double sort using past trades of specialists and competing market makers produces a long-short portfolio that earns 88 basis points per week (act as complements). Finally, we identify a "chain" of liquidity provision. Designated market makers (NYSE specialists) initially trade against order flows and prices changes. Specialists later mean revert their inventories by trading with competing market makers who appear to spread trades over a number of days. Alternatively, specialists may trade with competing market makers who arrive to market with delay.

1. Introduction

Stock returns can have a temporary and predictable short-run component in order to compensate liquidity providers for trading with less patient investors. What is the magnitude of this predictable component? What is its duration? Which types of stocks are most heavily traded by liquidity providers? This paper addresses these questions by employing six years of daily and weekly trading data from the New York Stock Exchange (NYSE). Our data contain records for two types of market makers: designated NYSE market makers (called "specialists") and competing market makers (sometime referred to as "CMMs" in this paper). Our data allow us to examine the specialists' inventory positions and the net trades of competing market makers.[1]

Studying two groups of investors who are linked to liquidity provision allows us to address a rich set of questions: Do the trades of different liquidity providers forecast stock returns in similar or different manners? How long do the designated market makers hold their positions before reverting inventories back to target levels? Do liquidity providers always trade together? Or, is there a "chain of liquidity provision" as initial positions are later transferred between members of these groups?

This paper provides an in-depth study of liquidity provider trading at daily and weekly frequencies.[2] As mentioned above, liquidity providers profit from trading with less patient investors. Such trading requires a liquidity provider to hold a suboptimal portfolio—suboptimal at efficient prices, but not at the transaction prices—until the position can be unwound. The liquidity provider profits from buying a stock below its efficient price and later selling as the price mean-reverts upward. Alternatively, the liquidity provider can sell (short) above the efficient price and later buy shares (to cover the short) as the price mean-reverts downward. Trading profits compensate a liquidity provider for risk, effort, and costs of capital.

From the financial econometrician's perspective, the act of providing liquidity (being compensated for providing a service) is

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[1] Rather than repeatedly refer to the differences in between position levels and changes in positions, we will often say stocks heavily bought or sold by liquidity providers. For competing market makers we exactly measure stocks bought and sold. Unless otherwise noted, for specialists we mean those stocks with the largest (most positive) inventories and smallest (most negative) inventories, respectively.

[2] Campbell et al. (1993), Jegadeesh and Sheridan (1995), Llorente et al. (2002), Pastor and Stambaugh (2003) and Avramov et al. (2006) provide indirect evidence of liquidity providers inducing negative autocorrelation in price changes. Hendershott and Seasholes (2007) provide direct evidence using trading data by liquidity providers.

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linked to predictability in price changes: when prices fall due to demands of sellers, prices will subsequently rise. Similarly, when prices rise due demands of buyers, prices will subsequently fall.[3] This predictability forms a bound around efficient prices and represents an empirical measure of the compensation required by liquidity providers for their services. The bound can also be thought of as a limit to arbitrage—the limit is due to risk-bearing capacity and liquidity provision.

Jagadeesh (1990) and Lehmann (1990) first observed short-horizon return reversals.[4] These reversals have been attributed to both investor overreaction and liquidity provider inventory effects—see Subrahmanyam (2005) for a discussion of this point. If there is no trading, there is no channel for inventory effects. In a market with trading, overreaction and inventory effects can work in concert. If investors trade heavily in one direction and the market for liquidity provision is less than perfectly competitive, then prices can overshoot fundamental values and subsequently reverse. We take no position on whether the source of shocks that our liquidity providers accommodate is rational or not. Instead, we show that the trading of liquidity providers is linked to subsequent price changes. Thus, we establish that liquidity providers and inventory effects play a significant role in short-run price reversion.

For both types of liquidity providers studied in this paper (specialists and competing market makers) we find their trades are negatively correlated with contemporaneous returns. The finding is consistent with liquidity providers temporarily accommodating buying and selling pressure. We sort stocks into quintiles based on each group's trading. Quintile 1 represents stocks most heavily bought and Quintile 5 represents stocks most heavily sold. We then form value-weighted, long-short portfolios using stocks in quintiles one and five (there are two different long-short portfolios based on sorting the trading of both liquidity providers). At a one-day horizon, the long-short portfolios have returns of 20 basis points and 13 basis points when sorting by the trades of specialists and competing market makers respectively.[5] To eliminate bid-ask bounce, all returns are calculated using the midpoint of closing bid-ask quotes. The cumulative weekly returns of the long-short portfolios are 41 basis points and 36 basis points and are statistically significant. The cumulative two week returns are 52 basis points and 40 basis points for specialists and competing market makers. After two weeks, the incremental returns of the long-short portfolios are no longer statistically different from zero consistent with prices having mean-reverted back to near-efficient levels.

The second part of our analysis investigates the characteristics of stocks most likely to be in the liquidity providers' highest or lowest trading quintiles. The more frequently a stock appears in Quintile 1 or Quintile 5, the more often the stock contributes to the long-short portfolio returns discussed above. We calculate the frequency with which each stock appears in the two extreme portfolios and then rank stocks by this frequency. In general, smaller, more volatile, less actively traded, and less liquid stocks appear more often in the extreme portfolios. Consistent with results in Amihud and Mendelson (1986), we find that stocks' average daily returns increase with the frequency they appear in the extreme portfolios. In other words, less liquid stocks appear to have higher returns.

Time series regressions show the returns of the long-short portfolios are related to a time series measure of effective bid-ask spreads in the market. This finding complements the cross-sectional evidence that less liquidity stocks are more often in an extreme portfolio. Taken together, the sort results, cross-sectional analysis, and time series regressions provide strong evidence that short-run return predictability is related to liquidity provision.

We employ Fama–MacBeth style regressions to show trades from one group do not drive out the predictability of trades from other groups. Trades also predict future returns above and beyond the predictability contained in only past returns. We also sort stocks into market capitalization terciles before repeating the regressions. Our results show that trades by competing market makers have the best ability to predict the returns of small stocks after controlling for specialists' inventories and past returns. Specialist inventories have the best ability to predict the returns of large stocks. The size/predictability results suggest the two groups of traders do not normally provide liquidity in the same stocks at the same time. We hypothesize that observing two groups contemporaneously providing liquidity for the same stock indicates a time of exceptionally high liquidity demand. To test this hypothesis, we double-sort stocks based on the trades of specialists and competing market makers and form a long-short portfolio. The return of the long-short portfolio is 88 basis points (on average) over the week following the double sort.

Our data allow us to better understand the inventory control behavior specialists and competing market makers. Both types of liquidity providers lean against the wind—they trade in the opposite direct as contemporaneous returns—a characteristic of both contrarian investing and liquidity provision. Both contrarian investing and liquidity provision involve buying temporarily underpriced securities and selling temporarily overpriced securities. Models of market making, however, predict that liquidity providers hold their positions for brief periods of time. Brief holding periods help manage inventory and control risk. Thus, trades of liquidity providers' should be negatively autocorrelated as in Madhavan and Smidt (1993).

We find evidence of inventory control behavior for the NYSE specialists only. They buy stocks with falling prices (sell stocks with rising prices) and revert their positions over the next few days. The half-life of the average specialist position is about 1.8 days which is far shorter than the 7.3 days reported by Madhavan and Smidt (1993) using data from fifteen years earlier. Furthermore, the negative autocorrelation is stronger (mean-reversion is faster) the larger the specialist's inventory position. We do not find evidence of competing market makers managing their inventory over short horizons as the autocorrelations of their net trades are positive for at least 10 daily lags. The positive autocorrelations may result from competing market makers having longer holding periods than specialists. Or, the positive autocorrelations may result from data that are aggregated across many different types of competing market makers. If some competing market makers provide liquidity over short horizons and others continue trading in the direction of original price movements, then detecting mean reversion in aggregate trading data becomes difficult.

It is possible the autocorrelated CMM trades result from limitations of our data and point to avenues for future research. For example, we do not currently have access to the competing market makers' portfolios (as we do for the NYSE specialists.) It is possible that the CMMs trade on the NYSE to hedge positions built up from trading on other venues. Hedging their positions may entail trading over a number of days, thus leading to positively autocorrelated

[3] Reversals can occur at intraday horizons due to market makers buying at the bid and selling at the ask. For examples, see Stoll (1978), Amihud and Mendelson (1980), Ho and Stoll (1981), and Roll (1984). Over longer horizons, liquidity providers who take on positions have assumed risk which can lead to reversals—see Grossman and Miller (1988). These longer-term, inventory-induced reversals are empirically similar to, but on a larger and market-wide scale, than reversals following block trades—see Kraus and Stoll (1972).

[4] Conrad et al. (1994), Ball et al. (1995), Cooper (1999), Avramov et al. (2006), and others also study short-run reversal strategies and their profitability.

[5] The price reversals are also consistent with inventory models where a liquidity provider offers attractive prices to induce order flow on one side of the market to reduce his inventory position. For example, if other investors have been buying from the specialist, prices have been rising, and the specialist has built up a short position. The specialist then raises his quotes to the point where investors begin to sell and this selling leads to prices subsequently falling.

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