THE PRICE IMPACT RESPONSE OF INSTITUTIONAL TRADES: BULL AND BEAR MARKET ANALYSIS

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Abstract

Institutional traders face significant transaction costs when they have large orders to fill on behalf of their clients. A driving force behind the price impact of these orders is the available market liquidity at the time of the trade. Institutional traders with buyer-initiated (seller-initiated) trade packages during rising (falling) markets will face steeper and steeper price impacts as market liquidity is exhausted at current prices. As a result, the price impact response to market level returns or firm level excess returns is positive (negative) for buyer-initiated (seller-initiated) trade packages.

INTRODUCTION

Institutional traders often have extremely large orders to fill on behalf of their clients, and market liquidity is a driving factor behind the transaction costs associated with the execution of these orders[i]. As a result, they must be mindful of the costs associated with the execution of those orders when liquidity is scarce. When buying in a crowd of buyers or selling in a crowd of sellers, institutional traders face significant price impact costs on their trades. This study adds to the existing body of literature on institutional trading and price impacts in several ways. First, this study focuses on the price impacts during bullish and bearish market environments, which are nice representations of extreme market conditions, or tail risk. Second, the data are examined at the trade package level, rather than the individual transaction level. Institutional traders often split their larger orders into several individual trades, so this is a superior approach to capturing their motives. Third, our price impact response model is able to show that not only are buys (sells) more costly than sells (buys) during bull (bear) markets, but that these buy (sell) orders become increasingly more costly to fill as the market continues to move up (down).

When examined at both the market level and firm level, our results show that as prices rise (fall) more dramatically, institutional traders looking to fill buy (sell) orders face ever increasing price impact costs. Using a regression framework, the price impact response for buyer-initiated trade packages (seller-initiated trade packages) is positive (negative) when the price impact of the trade package is regressed on the market return at the market level or the excess return in the stock at the firm level. Specifically, the price impact response for buyer-initiated trade packages during the bull markets of 1999 and 2003 was 39.7 basis points and 69.7 basis points, respectively. The price impact response for seller-initiated trade packages during the bear market of 2000 was -80.8 basis points. At the firm level, the price impact response for buyer-initiated trade packages in NYSE (Nasdaq) stocks with excess returns in the first quartile was 70 basis points (73 basis points). The price impact response for seller-initiated trade packages in NYSE (Nasdaq) stocks with excess returns in the fourth quartile was -87 basis points (-80 basis points).

The rest of this paper is organized as follows: literature review, data description, methodology, hypotheses development, results, and concluding remarks.

LITERATURE REVIEW

Chiyachantana et al. (2004) examine price impacts in an international framework during different underlying market conditions. Whereas prior literature (Chan and Lakonishok, 1993, 1995, and 1997; Holthausen, Leftwich, and Mayers, 1987 and 1990) suggests that buy price impacts are consistently larger than sell price impacts, these authors demonstrate that the underlying market condition largely determines the size and disparity between buy and sell price impacts.

Keim and Madhavan (1997) examine the magnitude and determinants of institutional trader transaction costs across varying investment styles. The authors argue that differences in investment style can alter the overall transaction costs associated with a trade substantially. Using data provided by the Plexus Group, the study focuses on the equity transactions for 21 institutions covering the period 1991 to 1993. Keim and Madhavan show that both explicit and implicit trading costs increase as trades become more difficult to execute. Furthermore, buys are generally more costly than sells, which is a similar finding to that of Chan and Lakonishok (1995).

An important strand of literature pertaining to price impacts is the work on block transactions. Scholes (1972) examines both the *price-pressure hypothesis* and the *substitution hypothesis* to determine how block transactions impact share prices. The entire sample period contained all NYSE firms from January 1947 to December 1965, with the majority of the analysis focused on the time period July 1961 to December 1965. This study found consistent support for the *substitution hypothesis*, which suggests that most trades can be executed at the prevailing market price due to many close substitutes being available to the investor. Dann, Mayers, and Raab (1977) look at the intra-day price behavior of block transactions, and the authors find most of the price adjustment associated with these trades occurs within the first 15 minutes. Kraus and Stoll (1972) study the impacts of institutional block transactions on the efficiency of prices. The authors find a temporary price impact of 0.70% for sold block transactions and no price impact for bought block transactions.

Holthausen, Leftwich, and Mayers (1987) study the price effects of large block transactions. Using all transactions of at least 5000 shares for 1982, the authors find that buyers receive temporary price discounts relative to the block size on large seller-initiated transactions. Any evidence of a permanent price impact on these trades is weak. Conversely, any buyers who are initiating a block transaction offer the opposing seller a premium for their shares. Not only do sellers receive a premium for these shares, but this price increase is also shown to be permanent. In their later study, Holthausen, Leftwich, and Mayers (1990) continue to focus on large block transactions in an effort to learn how quickly the market is able to reach equilibrium following a large block trade along with the size of any price adjustment that is made. The authors note an asymmetry between buyer-initiated and seller-initiated trades. Specifically, prices fully recover within one trade following a buyer-initiated trade. The speed of adjustment for seller-initiated trades is slower in that equilibrium is found in no more than three trades following the block transaction, with the bulk of the price adjustment occurring in the first post-block trade. Furthermore, the speed of adjustment is shown to be inversely related with block size.

DATA

For the period 1999-2005, Abel Noser (AN) has provided us with institutional trade data. Within the data, we are able to see the stock traded, the date of the transaction, whether the transaction was a buy or a sell, the client identifier code, the execution price of the trade, the execution volume for the trade, the total volume for the block, and the first record number of the block. The analysis of these variables in combination with one another allows us to better understand the motives of institutional traders. Our sample begins with all publicly traded NYSE and Nasdaq securities. We only focus on the stocks that the institutions with AN traded between 1999-2005, and any stock that trades under $10 per share is eliminated to avoid the problems associated with thinly traded securities. A more detailed description of our sample is provided in table 1.

Trade Packages

A trade package is classified as any grouping of transactions that meet the following criteria: the same security, the same client identifier code, the same total volume of shares for the block, and the same record number of the block. Chiyachantana et al., (2004)use a similar approach with the Plexus data to measure institutional price impacts at the decision level. Along these same lines, we believe our work better captures the true intent of institutional traders by centering on an entire trade package, which is often split into several transactions, rather than each individual transaction itself. To account for data inconsistencies, we discard any institutional trade package price impacts above 50% or below -50%. [ii]

Bull/Bear Market Classification
Our bull and bear markets were chosen to align with the market tops/bottoms as closely as possible, given the time constraints of our data. The 1999 bull market is 1999-March, 2000, the 2000 bear market is July, 2000-June, 2002, and the 2003 bull market is 2003-2005. To remain consistent with both academia and the business world at large, we use the S&P 500 as our benchmark to represent the entire stock market. The returns in the S&P 500 during these time segments were 22.02%, -51.35%, and 31.23%, respectively.

METHODOLOGY

Using standard event study methodology (Brown and Warner, 1985), we focus on two distinct elements:

Price Impact
In a manner consistent with prior literature, we measure the price impact resulting from a trade in the following manner[iii]:

$P_{TP,C} = [VWTP_{TP}/P_{T-1}) - 1]$ for buys (negative of this expression for sells)(1)

where $P_{TP,C}$ is the price impact of the trade package with the previous day's closing price in the stock used as the benchmark, $VWTP_{TP}$ is the volume-weighted trade price of the trade package, and P_{T-1} is the previous day's closing price. Our using the prior day's closing price as our benchmark price to compare with the $VWTP_{TP}$ of the trade package is consistent with the price impact literature[iv].

Excess Return
Fama and Macbeth (1973) empirically test the two-parameter market model and demonstrate a positive relationship between risk and average return. In this study, the authors estimate a firm's β for several years prior to the event window in determining whether or not the market is accurately priced. In the spirit of their model, we estimate β for two years prior to the year being analyzed in the following manner:

$$RET_{D,I} = \delta + \beta MKT_D + \varepsilon \qquad (2)$$

where $RET_{D,I}$ is the return for day $_D$ on security $_I$ and MKT_D is the return of the overall stock market for day $_D$. Once the β is estimated, we utilize the following method to capture the risk-adjusted excess return, or alpha, for security $_I$ on day

$_D$: $\alpha_{D,I} = RET_{D,I} - \beta MKT_D$ (3)

Thus, $\alpha_{D,I}$ represents the excess return in security $_I$ for day.

HYPOTHESES DEVELOPMENT

Traders looking to buy shares in a rising market will likely face a steep price impact as they exhaust the available liquidity on the ask side of the limit order book and are forced to walk through the book. Furthermore, as the market begins to rise higher and higher, buyers will find it increasingly difficult to obtain shares without incurring substantial market impact costs. This is especially true in regards to institutional traders who typically fill extremely large orders on a regular basis. Sellers in a rising market understand the value of their shares and thus attach an ever increasing premium to the sale of those shares as the market moves upward. As this contagion begins to set in and liquidity becomes more and more scarce, buyers are forced to absorb significant market impact costs as they purchase shares in a rising market. Similarly, sellers looking to unload shares in a falling market will be faced with significant market impact costs as those traders establishing bid prices in the limit order book will command deeper and deeper discounts as the market drop becomes more and more severe. As a result, the price impact response to the market return is expected to be positive (negative) for institutional traders looking to fill buyer-initiated (seller-initiated) trade packages.

Hypothesis I: The price impact response to the market return is expected to be positive (negative) for institutional traders with buyer-initiated (seller-initiated) trade packages.

Similarly at the firm level, a security that is exhibiting a high/positive (low/negative) excess return will correspond with higher price impacts for institutional traders interested in buying (selling) that security. A security will a high/positive (low/negative) excess return is clearly one in which a great deal of buying (selling) interest has already been established in that security. As a result, an institutional trader looking to fill a buyer-initiated (seller-initiated) trade package in that security will face steeper and steeper price impacts as the excess return increases (decreases). The price impact response to the excess return in a stock is expected to be positive (negative) for institutional traders looking to buy (sell) shares in that stock.

Hypothesis II: The price impact response to the excess return in a stock is expected to be positive (negative) for institutional traders looking to fill buyer-initiated (seller-initiated) trade packages in that stock.

RESULTS

Table 1 gives some descriptive statistics of our sample. Panel A begins with the total number of NYSE and Nasdaq securities in our sample for the given year. Next, the total number of institutions submitting trades in our sample stocks is presented. Panel B gives some statistics that relate directly to the trade packages of all the securities in our sample. First, the statistics are divided into buyer-initiated trade packages and seller-initiated trade packages. Then, for each category, the number of trade packages and the average number of shares per trade package is displayed. Our sample period covers 1999-2005.

Figure 1A and figure 1B plot average daily price impact response to the market return using the following model:

$$BUYIMP_D = \beta_0 + \beta_1 MKT_D + \varepsilon \text{ for buys} \quad (4a)$$
$$SELLIMP_D = \beta_0 + \beta_1 MKT_D + \varepsilon \text{ for sells} \quad (4b)$$

where $BUYIMP_D$ ($SELLIMP_D$) is the price impact for all buyer-initiated (seller-initiated) trade packages in the AN database on day $_D$, MKT_D is the S&P 500 return on day $_D$ and $\beta_1$represents the price impact response to the market return.

The price impact response to the market return from this model is 0.57 (-0.55) for all the buyer-initiated (seller-initiated) trade packages from our institutional traders. This result begins to confirm our hypothesis that market liquidity determines price impact and extends the work of Chiyachantana et al (2004). Those authors showed that during bull (bear) periods, buy (sell) price impacts exceeded sell (buy) price impacts. However, their methodology implicitly treated a market that had risen (fallen) 1% the same as a market that had risen (fallen) 20%. By focusing on the price impact response to the market return, we are able to directly measure the amount of stress applied to the market as institutional traders look for quick fills and fair prices, while liquidity evaporates.

Table 1 – Panel A begins with the total number of NYSE and Nasdaq securities in our sample for the given year. Next, the total number of institutions submitting trades in our sample stocks is presented. Panel B gives some statistics that relate directly to the trade packages of all the securities in our sample. First, the statistics are divided into buyer-initiated trade packages and seller-initiated trade packages. Then, for each category, the number of trade packages and the average number of shares per trade package is displayed. Our sample period covers 1999-2005.

Figure 1A shows the daily price impacts for all institutional trade packages that were buys in the AN database during the period 1999-2005 plotted against daily market return as measured by the S&P 500. The model used to estimate this line is:

$BUYIMP_D = \beta_0 + \beta_1 MKT_D + \varepsilon$

where $BUYIMP_D$ is the price impact for all buy-initiated trade packages in the AN database on day $_D$, MKT_D is the return on the S&P 500 for day $_D$, and β_1 represents the response coefficient (0.57).

The price impact of the given institutional trade package using the prior day's closing price as the pre-execution is calculated as follows:

$P_{TP,C} = [VWTP_{TP}/P_{T-1}) – 1]$ for buys and the negative of this expression for sells

where $VWTP_{TP}$ is the volume-weighted trade price of the trade package and P_{T-1} is the previous day's closing price for the traded security.

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FIGURE 1A: Buy Price Impact and Market Return

Figure 1B shows the daily price impacts for all institutional trade packages that were sells in the AN database during the period 1999-2005 plotted against daily market return as measured by the S&P 500. The model to estimate the resultant line is:

$SELLIMP_D = \beta_0 + \beta_1 MKT_D + \varepsilon$

where $SELLIMP_D$ is the price impact for all sell-initiated trade packages in the AN database on day $_D$, MKT_D is the return on the S&P 500 for day $_D$, and β_1 represents the response coefficient (-0.55).

The price impact of the given institutional trade package using the prior day's closing price as the pre-execution is calculated as follows:

$P_{TP,C}$ = [$VWTP_{TP}/P_{T-1}$) – 1] for buys and the negative of this expression for sells

where $VWTP_{TP}$ is the volume-weighted trade price of the trade package and P_{T-1} is the previous day's closing price for the traded security.

FIGURE 1B: Sell Price Impact and Market Return

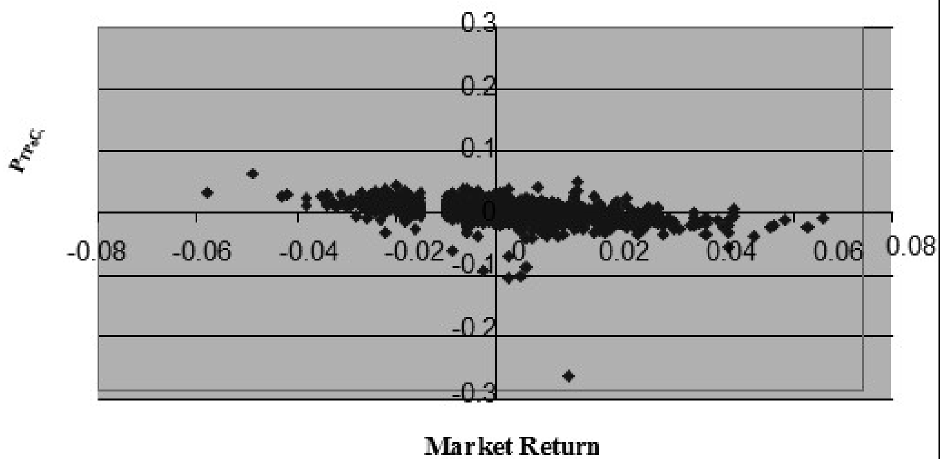

Table 2 presents more detailed results from the following model:

$P_{TP,C} = \beta_0 + \beta_1 MRET_{M,D} + TRNS_{TP} + PRCE_{I,D} + ORDR_{TP} + MKCP_{I,D} + \varepsilon$
(5)

where $P_{TP,C}$ is the price impact of the trade package based on the previous day's closing price, $MRET_{M,D}$ is the return on the S&P 500 for day $_D$, $TRNS_{TP}$ is the number of transactions in the trade package, $PRCE_{I,D}$ is the inverse of the stock price for stock $_I$ on day $_D$, $ORDR_{TP}$ is the natural logarithm of the order complexity of the trade package, and $MKCP_{I,D}$ is the natural logarithm of the market capitalization in stock $_I$ on day $_D$,.

Even after the inclusion of the control variables, the results support our first hypothesis: institutional traders looking to fill a buyer-initiated (seller-initiated) trade package in a bullish (bearish) market environment will face increasing price impacts as the market continues to move up (down). Specifically, the 1999 and 2003 bull markets cost institutional traders an additional 39.7 basis points and 69.7 basis points, respectively, for every 1% move higher in the market. The

2000 bear market cost institutional traders an additional 80.8 basis points for every 1% move lower in the market. Regardless of direction, when the magnitude of the market move was greater, the price impacts to institutional traders looking to trade with the market movement increased. These results support our hypothesis that institutional traders looking to fill orders on the same side of the overriding market direction will pay steeper and steeper costs as the market moves become more significant.

Table 3 adds some robustness to our market level results by analyzing excess returns at the firm level with the following model:

$$P_{TP,D,I} = \rho_0 + \rho_1\alpha_{D,I} + \varepsilon \text{ for buys} \quad (6)$$

where $P_{TP,D,I}$ is the price impact for all buyer-initiated or seller-initiated trade packages in stock $_I$ on day $_D$, $\alpha_{D,I}$ is the excess return in stock $_I$ on day $_{D,}$ andρ_1 represents the price impact response to the excess return in stock $_I$ on day $_D$.

Panel A displays results for our NYSE securities and panel B displays results for our Nasdaq securities. Given our hypotheses, our primary focus is on the first and second quartiles for the buyer-initiated trade packages and the third and fourth quartiles for the seller-initiated trade packages. In the first and second quartiles of excess returns, the price impact response to the excess return of the stock for institutional traders submitting buyer-initiated trade packages on NYSE (Nasdaq) securities was 70 (73) basis points and 60 (62) basis points, respectively. In the third and fourth quartiles of excess returns, the price impact response to the excess return of the stock for institutional traders submitting seller-initiated trade packages on NYSE (Nasdaq) securities was -56 (-67) basis points and -87 (-80) basis points, respectively. In other words, an institutional trader looking to fill a buyer-initiated trade package on an NYSE security in the first quartile of excess returns incurred an average additional price impact of 70 basis points for every additional 1% in excess return of the stock. An institutional trader looking to fill a seller-initiated trade

Table 2 displays the results from the following model:

$$P_{TP,C} = \beta_0 + \beta_1 MRET_{M,D} + TRNS_{TP} + PRCE_{I,D} + ORDR_{TP} + MKCP_{I,D} + \varepsilon$$

where $P_{TP,C}$ is the price impact of the trade package based on the previous day's closing price, $MRET_{M,D}$ is the return on the S&P 500 for day $_D$, $TRNS_{TP}$ is the number of transactions in the trade package, $PRCE_{I,D}$ is the inverse of the stock price for stock $_I$ on day $_D$, $ORDR_{TP}$ is the natural logarithm of the order complexity of the trade package, and $MKCP_{I,D}$ is the natural logarithm of the market capitalization in stock $_I$ on day $_{D}$,. The 1999 bull market, 2000 bear market, and 2003 bull market are clearly segmented. The parameter estimates are given along with their corresponding p-values in parentheses.

The following model is estimated to measure the price impact response to the excess return of a given stock on a given day:

$$P_{TP,T,I} = \rho_0 + \rho_1\alpha_{I,D} + \varepsilon$$

where $P_{TP,T,I}$ is the price impact associated with the trade package in stock $_I$ at time $_T$, $\alpha_{I,D}$ is the excess return for stock $_I$ on day $_D$, and ρ_1 is the price impact response. The excess returns are broken into quartiles with the 1st (4th) quartile representing the most positive (negative) excess returns. Panel A is for all NYSE stocks in our sample, while Panel B is for all Nasdaq stocks in our sample. Price impact responses are presented in basis points.

TABLE 3
Price Impact Response to Excess Return

Panel A: NYSE Stocks			
	Quartile Range	**Buyer-Initiated**	**Seller-Initiated**
1st Quartile	Above 1.8%	70 (0.000)	-31 (0.011)
2nd Quartile	0.1% to 1.8%	60 (0.001)	-40 (0.029)
3rd Quartile	-1.6% to 0.1%	43 (0.005)	-56 (0.001)
4th Quartile	Below -1.6%	34 (0.023)	-87 (0.000)
Panel B: Nasdaq Stocks			
	Quartile Range	**Buyer-Initiated**	**Seller-Initiated**
1st Quartile	Above 1.1%	73 (0.001)	-33 (0.030)
2nd Quartile	0.3% to 1.1%	62 (0.021)	-51 (0.008)
3rd Quartile	-0.9% to 0.3%	55 (0.010)	-67 (0.002)
4th Quartile	Below -0.9%	41 (0.007)	-80 (0.001)

package on a Nasdaq security in the fourth quartile of excess returns incurred an average additional price impact of 80 basis points for every 1% reduction in excess return of the stock.

CONCLUSION

Institutional traders face significant costs when trying to fill orders on the same side of the underlying market movement. If the market is rising (falling), then buyer-initiated (seller-initiated) trade packages incur ever increasing price impacts. These results are consistent at both the market level and firm level. Future research could look more closely at the similarities and differences of buyer-initiated price impacts and seller-initiated price impacts during these periods of extreme stress on the market.

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[i] Chiyachantana et al (2004) show that market liquidity determines price impact in the sense that buyers (sellers) in a bull (bear) market will face steeper price impacts than sellers (buyers) as liquidity quickly dries up for buyers (sellers) as prices rise (fall).

[ii] See Conrad, Johnson, and Wahal (2001)
[iii] See Chiyachantana et al., (2004), Chan and Lakonishok (1995), and Keim and Madhavan (1996 and 1997)
[iv] See Gang Hu (2008) for a thorough discussion of benchmark selection