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International Evidence on Institutional Trading Behavior and Price Impact

CHIRAPHOL N. CHIYACHANTANA, PANKAJ K. JAIN, CHRISTINE JIANG, and ROBERT A. WOOD*

ABSTRACT

This study characterizes institutional trading in international stocks from 37 countries during 1997 to 1998 and 2001. We find that the underlying market condition is a major determinant of the price impact and, more importantly, of the asymmetry between price impacts of institutional buy and sell orders. In bullish markets, institutional purchases have a bigger price impact than sells; however, in the bearish markets, sells have a higher price impact. This differs from previous findings on price impact asymmetry. Our study further suggests that price impact varies depending on order characteristics, firm-specific factors, and cross-country differences.

CROSS-BORDER INVESTMENT has increased dramatically during the past 20 years and has become a crucial element in modern portfolios of investors worldwide. While individual investors typically diversify their portfolios through mutual funds and American Depository Receipts, large institutional investors such as mutual funds and pension funds often transact directly in international markets for their portfolio needs. Investing directly in international stocks involves unique risks, challenges, and costs.[1] Whereas the tradeoffs between these unique risks and returns from international investments have been widely studied, the transaction costs, particularly price impact costs, can potentially be another critical component of a successful international portfolio strategy. This is especially important for active institutional investors who frequently transact in foreign stocks. Understanding the determinants of price impact can be helpful in designing trading strategies that lower transaction costs and maximize net returns from an institutional portfolio.

Despite the significant impact of transaction costs on portfolio performance and successful international diversification, only a few studies have examined the trading costs across different countries. The notable papers are Perold

*Chiyachantana is from the College of Business Administration, California State University at San Marcos; Jain, Jiang, and Wood are from the Fogelman College of Business and Economics, University of Memphis. We are grateful to Wayne Wagner and Vinod Pakianathan of the Plexus Group for providing us with the data and for related discussions. We thank Bob Jennings, Cynthia McDonald, Richard Green (the editor), and an anonymous referee for comments and suggestions. Any errors are our own.

[1] International investments pose some problems that are not encountered in domestic markets. These include exchange rate risks, political risks, restrictions on capital flows across national boundaries, differences in accounting practices, and language barriers.

and Sirri (1998), Domowitz, Glen, and Madhavan (2001, 2002), and Jain (2002). These studies report significant differences in trading costs across regions and countries. Relationships between trading costs, volatility, trading turnover, and exchange design are examined in these papers. A much richer set of empirical findings is reported for institutional trading within the United States. For instance, Keim and Madhavan (1995, 1996, 1997), Chan and Lakonishok (1995, 1997), and Conrad, Johnson, and Wahal (2001) analyze institutional trading behavior, investment styles, trade motivations, price impact of trades, and asymmetry of price impact. The empirical evidence on the determinants and the magnitude of institutional trading costs in foreign markets is very limited primarily because of lack of data. In this paper, we examine the price impact of institutional trades in bullish and bearish markets and shed light on the determinants of price impact in an international setting.

Our paper makes several contributions to the literature on institutional trading behavior and price impact. First, we conduct an out-of-sample test of the results reported in previous studies on the U.S. markets. This is the first paper that uses proprietary data provided by the Plexus Group to examine institutional trading in international stocks from 36 countries, in addition to the United States. The Plexus data set is unique because it contains information on direction of trade (purchase or sell decision), date of release of orders, and details about actual trades that materialized. This structure facilitates analysis of transaction costs associated with an indicated desire to trade, which cannot be accomplished with transaction level data.[2] Moreover, as institutions account for a lion's share of trading both in terms of share volume and market value, this study of institutional trading costs in international stocks can be used by the regulators in various countries to design policies that effectively attract foreign portfolio investments. Second, by studying two separate periods that are 4 years apart, we are able to test whether institutional trading and price impact of their trades vary significantly in bullish and bearish markets. This is especially important in understanding the asymmetry between the price impacts of institutional buy and sell orders. Almost all previous studies in this area were conducted using data primarily from bullish markets. Studying the intricacies of transaction costs in a bearish market phase is also valuable because cost-cutting measures are particularly important in down markets. Third, by including data on local market indices from Datastream, we are able to adjust for market-wide price movements and get a cleaner measure of price impact of institutional trading on individual stocks. Most prior studies in this area, particularly the international ones, did not adjust for market-wide price movements. Finally, we are able to empirically investigate

[2] The traditional measures of transaction cost (e.g., bid-ask spread) using transaction level data such as TAQ cannot fully account for all the costs embedded in extensive trading activities, which span over a period of time by a single investor. It is also difficult to compare price impact of buying with price impact of selling using TAQ data because it does not have any information about order submissions.

the characteristics of institutional decisions, orders, and trades, and consequently provide a better understanding of the determinants of their transaction costs in foreign markets.

Our sample of institutional trading data consists of orders and trades in international stocks of 36 countries from January 1997 to March 1998 and from January 2001 to September 2001. We also use Plexus data for U.S. stocks, which has been made available to us for 1997 and the first quarter of 2001. In the first period, stock markets in most countries were rising and in the second period, they were falling. For each period, we calculate components of transaction costs such as price impact and commissions. Thereafter, we proceed to identify specific factors that explain the cross-sectional difference in price impact of institutional orders.

The key finding of this paper concerns the asymmetric price impact for institutional purchases versus sells. Consistent with prior research, the price impact is much higher for institutional purchases in 1997 to 1998, when the market condition was bullish. However, this phenomenon is reversed in 2001, when the market condition around the world was bearish. In 2001, institutional sell orders had a bigger price impact than the institutional buy orders. Our results are inconsistent with the notion that institutional purchases are more informed than institutional sells, as contended in previous research papers with the exception of Saar (2001). Instead, our results seem to suggest that due to large trade sizes the institutional trades tend to be affected by market conditions and pay a higher premium for liquidity when they trade on the same side of the market. This finding suggests that the liquidity available to buy (sell) orders is higher in bearish (bullish) markets. This explanation of the asymmetry in price impact is very intuitive and, yet, was not explored in the previous studies because they were all conducted when the market was in a bullish phase. Our results hold whether we look at price impact costs alone or total costs that include price impact, commissions, and opportunity cost of nonexecution. Additional robustness checks such as a month-by-month analysis, a country-by-country analysis, market-adjusted price impact, and other variations yield the same results as the basic pooled analysis.

We also find that price impact varies substantially across international stocks based on firm-specific factors, country-specific factors, and order submission strategies. In particular, price impact is negatively correlated with a stock's market capitalization and price level, and positively correlated with the volatility, and order complexity. Price impact is considerably higher for orders that are executed over multiple days or use more than one broker. More importantly, this difference persists even after controlling for order-difficulty. Trading costs also differ across geographic regions. Furthermore, they are higher in emerging markets, nonliberalized markets, and markets with poor shareholder rights.

The remainder of this study is organized in four sections. Section I reviews the existing literature and develops the empirical hypotheses about institutional trading behavior and price impact of institutional trades. Section II describes the data and sample characteristics. Section III discusses the empirical

methodologies and results, and Section IV contains concluding remarks and some directions for future research.

I. Determinants of Price Impact

A. Market Condition, Order Direction, and Price Impact

The proprietary nature of institutional trading data has restricted the proliferation of empirical literature in this area even for the domestic trades. None of the existing studies directly explores the relation between market condition and price impact. The unequivocal result, so far, is that buyer-initiated trades have a stronger price impact than seller-initiated trades. This asymmetry has been attributed to higher informed trading in purchases than in sells. Kraus and Stoll (1972) investigate whether the price effects accompanying block trades on NYSE can be ascribed to a change in the underlying value of the stock (information effect) or to a temporary deviation of price (distribution effect). They report that information effect exists for block purchases but not for block sells. Keim and Madhavan (1996) suggest that the reason for asymmetric price response is that purchases, which create new long positions, are more likely to be based on private information. By contrast, when an institution already has a long position in the stock, market participants can estimate when that particular stock has met the institution's target return requirement or is included in its sell list for other liquidity based reasons. Chan and Lakonishok (1993) give a similar argument. Since an institutional investor typically has limited alternatives among its current portfolio to sell an issue, such a decision does not necessarily convey negative information. In contrast, the choice of one specific issue to buy, out of virtually all the stocks trading in the market, is more likely to convey positive firm-specific news. Alternatively, they suggest that brokers are willing to facilitate institutional sells and accumulate long inventory position for smaller price concessions but not so willing to facilitate institutional purchases because they have to undertake short selling.

Saar (2001) provides an excellent review of the literature on asymmetric price response of buys and sells and develops an intertemporal theoretical model to explain this asymmetry. The expected permanent price impact of a block trade in the model corresponds to a change in the market's expectation of the true value of a stock resulting from the block transaction. The model relates this effect to the underlying economic environment and demonstrates that a stock's history of price performance influences the asymmetry. The model even predicts negative price asymmetry, that is, sells have greater price impact than buys following a long period of price run-ups.

Along these lines, we propose an alternative explanation to the asymmetric price impact finding. Instead of historical price run-ups, we relate contemporaneous market condition to the asymmetric price impact of buys and sells. To elaborate on this relation, institutional buy orders demand that liquidity in a given stock be supplied by other participants, that is, institutions are looking for sellers willing to accept the prevailing market price in exchange for their

shares. On the other hand, institutional sell orders demand that suppliers of liquidity absorb the shares at the prevailing prices. In a bullish market, suppliers of liquidity are wary of buy orders and run up the prices in the face of a strong buying interest. Buy orders are likely to be a confirmation of a shift to a higher expected equilibrium price. Suppliers of liquidity are not so cautious about the institutional sell orders in a bullish environment and do not push down the prices as much when they face a selling interest.

When market conditions are bearish, the situation is exactly the opposite. Many traders are willing to sell shares at the prevailing prices and fewer traders are willing to buy. During such times, institutions can buy shares without paying a huge liquidity premium. On the other hand, if they want to sell, they will be forced to offer bigger price discounts to find buyers to take the opposite side. In bearish market conditions, institutional sellers are more willing to accept a bigger price impact because they are more worried about further price declines than about the relatively smaller price impact.

Our study differs from Saar (2001) in the sense that past performance need not predict future price impact. Our hypothesis is that the contemporaneous market condition is a key determinant of price impact and its asymmetry between buys and sells. In bullish (bearish) markets, buys (sells) have a bigger price impact. We are able to test our proposed hypothesis against the current explanations given in other empirical papers that mostly used data from rising markets. This is made possible in our paper by examining two distinct calendar periods, 1997 to 1998 (the bullish phase) and 2001 (the bearish phase). We expect that in the falling markets of 2001, the price impact of sells will be greater than the price impact of buys.

B. Other Determinants of Price Impact

Apart from market condition and the direction of trade (buys versus sells), there are several other factors that impact transaction costs. Chan and Lakonishok (1995) and Keim and Madhavan (1997) find that institutional trading costs for domestic stocks are negatively correlated with market capitalization, and positively correlated with relative decision size, and demand for immediacy of trades.[3] We analyze the role of these variables in our analysis of price impact of institutional trades for international stocks. Another firm-specific variable that we add in our regression analysis is stock price volatility. We expect that more volatile stocks will have higher trading costs (see Domowitz et al. (2001)).

Jones and Lipson (2001) suggest that trading costs are different for worked versus nonworked orders. Worked orders are defined as orders that have duration longer than one trading day or use multiple brokers. On one hand, such orders are expected to be more difficult to transact and are likely to be associated with a higher price impact. On the other hand, this strategy of spreading

[3] Chan and Lakonishok (1997) also compare institutional trading costs across the NYSE and Nasdaq and find that trading costs on NYSE (Nasdaq) are lower for large (small) firms.

the order across brokers and across days also signifies patience on the part of the traders and therefore might result in a lower price impact compared to the orders that are executed quickly using one broker on a single day. We investigate which of these effects dominates.

Finally, we incorporate country-specific variables into our regression analysis. We have variables that control for developed and emerging nations; liberalized and nonliberalized countries; differences in shareholder rights; enforcement of insider trading laws; and different geographic regions. These factors have been shown to affect trading costs and asset prices in international markets in various studies such as La Porta et al. (1998), Bekaert and Harvey (2000), Domowitz et al. (2001), Jain (2002), and Bhattacharya and Daouk (2002). We also account for the possibility that these variables may not capture all country-specific differences by estimating the pooled regression with fixed-country effects and by running separate country-by-country regressions.

II. Data and Sample Characteristics

A. Data

We obtain a sample of institutional trading data across 39 foreign countries for the four quarters of 1997 and the first quarter of 1998. We refer to this period as the 1997 to 1998 sample throughout this paper. We filter out three countries that have less than 100 institutional trades to ensure that our sample is representative of institutional trading in respective countries and free of any outliers.[4] In addition, we obtain domestic data on institutional trading in U.S. stock for 1997. Thus, in our final sample, we have 37 countries, which are listed in our country-by-country results. Throughout the paper, we report the U.S. results separately from the remaining 36 countries. This makes it possible to make direct comparisons with prior literature on the United States and also ensures that our inferences about international markets are not swamped by the huge amount of U.S. data. The second part of our sample consists of the first three quarters of 2001 for 36 foreign countries and the first quarter of 2001 for the United States. We refer to this period as the 2001 sample. Although there are 46 countries in the 2001 sample, we limit our analysis to the same 37 countries for which we have 1997 data. Both samples are from the Plexus Group (Plexus, hereafter), an independent consulting firm for institutional clients. In 2000, Plexus provided consulting services to 180 domestic clients who collectively managed assets valued at nearly $4.5 trillion. Plexus also has 38 clients that trade extensively in foreign stocks. Of these, 21 clients are domiciled in the United States and the remaining 17 in other foreign countries. Data on domestic transactions from Plexus have been used in studies of institutional trading behaviors and transaction costs (Keim and Madhavan (1995, 1997), Jones and Lipson (2001), Chakravarty, Panchapagesan, and Wood (2002), and

[4] These countries are Chile, Turkey, and Venezuela with 1, 5, and 40 decisions, respectively, in 1997 to 1998 compared to a per-country average of 3,880 decisions. Inclusion of these countries does not alter the statistical or economic significance of our results.

Conrad et al. (2001, 2002)). To the best of our knowledge, the current study is the first one using Plexus data to study transaction costs in international trading. The data are provided to us by the Plexus Group under the condition that the names of the managers involved are removed from the data released by Plexus.

The institutional trading data on international securities are quite similar in their format and contents to Plexus data on domestic stocks, except that institutional style classifications are not included. The international data have information on institutional decisions about what stocks to trade, direction of trade (buy or sell), quantity of shares desired, value-weighted average stock prices on and before decision date, dates of release of orders from institutional clients to trading desks, price at the time of release, number of shares released, code number of broker(s) used to fill the order, transaction price, quantity of shares traded, execution date, commissions charged (2001 only), and the market capitalization of the stock.

To maintain the integrity of the data and filter out possible errors, we eliminate observations with missing prices or order quantities. In addition, following the approach of Keim and Madhavan (1995, 1997), we exclude orders or transactions of less than 100 shares, orders for stocks trading under $1.00, and orders that took longer than 21 calendar days to complete.

Finally, we use Datastream International stock market indices for the 37 countries from which the stocks in the sample originate. These indices help us to control for market-wide returns. For instance, if the market index in Canada rose significantly on a given day, then all purchases, whether institutional or retail, will have more positive price impact for purchases and perhaps negative price impact for sells. By conducting additional analysis that controls for market-wide movements, we are able to look at transaction costs with and without considering market-timing costs.

B. Sample Characteristics for International Data

One of the main tasks of this paper is to provide descriptive statistics of characteristics of institutional trading in international stocks. We report statistics on institutions' decisions to trade in Panel A of Table I. Panel B shows how these decisions are reflected in their actual orders, and Panel C shows how these orders are finally executed.

Our data include trades across 4,892 foreign securities on 36 international exchanges in five continents for 1997. There are 6,275 foreign securities from those 36 exchanges in the 2001 data. The average market capitalization of these firms has grown from $908 million in 1997 to 1998 to $1,903 million in 2001. The median volume-weighted average trade price at the decision level is $11.52 in 1997 to 1998 and $11.33 in 2001. These are relatively low compared to an average price of $36.50 reported by Chan and Lakonishok (1993) and $31.36 reported by Keim and Madhavan (1995) for institutional trading in U.S. stocks.

The key difference between our two sample periods is the market condition. The average buy and hold return for the 36 countries in 1997 to 1998 is +17.60

Table I

Institutional Decisions, Orders, and Transactions in International Stocks

This table contains sample characteristics of institutional trading in 36 countries. The second column shows four quarters of 1997 and the first quarter of 1998. The last column is for the first three quarters of 2001. Panel A provides overall statistics of the sample. Panels B and C categorize the sample characteristics at the decision, and order/transaction level, respectively. The last two panels also include the characteristics of buy and sell orders separately in addition to the combined statistics for all decisions.

Panel A: Sample Characteristics

	1997	2001
Number of countries	36	36
Number of securities	4,892	6,275
Average market cap (million $)	908	1,903
Volume-weighted trade price	$11.52	$11.34
Average buy and hold returns (%)	+17.60	−24.22

Panel B: Decision Characteristics

	1997–1998			2001		
	All Orders	Buys	Sells	All Orders	Buys	Sells
Total number of decisions	139,680	75,585	64,100	372,753	204,330	168,423
Number of decisions per quarter	27,936	15,117	12,820	124,251	68,110	56,141
Quarterly dollar volume (million $)	35,410	18,031	17,379	138,814	69,490	69,324
Percentage of total volume (%)	100	50.92	49.08	100	50.06	49.94
Number of shares per decision	150,486	136,088	167,464	136,552	124,692	150,941
Dollar volume per decision ($)	1,369,346	1,288,516	1,464,659	1,186,886	1,089,118	1,305,499
Number of transactions per decision	2.26	2.24	2.30	2.22	2.22	2.21
Average duration (days)	2.88	2.82	2.95	2.19	2.20	2.19
Number of brokers per decision	1.33	1.33	1.33	1.29	1.31	1.26

Panel C: Order and Transaction Characteristics

	All Orders	Buys	Sells	All Orders	Buys	Sells
Total number of transactions	316,376	168,981	147,395	824,053	454,486	387,567
Number of shares per order	89,964	83,726	97,321	54,211	49,101	60,411
Dollar volume per order	846,865	812,914	886,900	472,639	427,865	526,959
Order complexity (%)	39.10	33.38	45.84	32.65	31.09	34.54
Average order completion (%)	97.38	97.41	97.35	99.12	99.05	99.20
Fill rate (% of orders for which at least 80% of quantity desired is filled)	95.55	95.62	95.47	98.58	98.47	98.71

percent. These countries have an average buy and hold return of −24.2 percent for 2001. Of the 36 countries, 24 have positive returns and 12 have negative returns in 1997 to 1998. In contrast, all but one country have negative returns in 2001. Thus, it is clear that the market condition was bullish in 1997 to 1998 and bearish in 2001. This is also true for our U.S. sample where buy and hold returns are +33.48 percent in 1997 and −10.37 percent in the first quarter of 2001.

A comparison of the buy and hold returns in our study with those in other studies highlights an important contribution of our paper. Almost all previous studies are based on data from bullish market conditions. For instance, the CRSP equal weighted buy and hold returns including dividends for the respective sample periods are 31.13 percent in Holthausen, Leftwich, and Mayers (1987); 75.27 percent in Holthausen, Leftwich, and Mayers (1990); 124.20 percent in Keim and Madhavan (1995); 214.34 percent in Keim and Madhavan (1996); 92.10 percent in Keim and Madhavan (1997); 21.40 percent in Chan and Lakonishok (1993, 1995); and 58.09 percent in Chan and Lakonishok (1997). All the numbers suggest strongly bullish market conditions. The only exception is −6.25 percent in Kraus and Stoll (1972), which can be classified as only a mildly bearish market condition. In contrast, we are able to perform a more balanced analysis by looking at two different market conditions.

Panel B of Table I characterizes institutional trading decisions in 36 foreign countries during 1997 to 1998 and 2001. It also breaks down the decisions into purchases and sells. In 2001, the average quarterly number of decisions is 124,251, and the dollar volume is $138.81 billion. The trading volumes examined by Plexus have grown approximately fourfold since 1997 to1998.[5] In dollar terms, the decisions are almost evenly split between buys and sells for both 1997 to 1998 and 2001. The average number of shares and the average dollar volume per decision are 136,552 and $1.19 million, respectively. These numbers have declined slightly compared to 1997 to 1998. Two possible reasons for this decline are that institutions are now more open to trading smaller stocks or are breaking their decisions into smaller pieces. The latter explanation seems more likely because the average market capitalization of firms has doubled in 2001. Evidently, these smaller decisions are also often broken up before being sent to trading desks just as they were in 1997 to 1998. On an average, a decision is broken into slightly more than two transactions[6] and 1.3 brokers are used to complete the transactions associated with a decision. The duration, defined as number of calendar days elapsed to complete an order, declines from 2.88 in 1997 to 1998 to 2.19 in 2001. The observed patterns of institution trading in international markets are consistent with a theoretical model such as Kyle (1985) and prior empirical studies of U.S. markets, such

[5] This increase is not entirely from the existing clientele because Plexus Group added a significant number of new clients in this period.

[6] In Plexus data, brokers prepare one report per trading day and multiple trades on the same day are counted as one transaction. Therefore, the total number of transactions is likely to underestimate the number of trades.

as Chan and Lakonishok (1995, 1997) and Keim and Madhavan (1995, 1997), which report that difficult orders are broken up by institutions.

Once a decision is made, it is sent to an order desk for trade execution. Order and transaction characteristics are presented in Panel C. The average number of shares traded (dollar volume) per order has declined sharply from 89,964 in 1997 to 1998 to 54,211 in 2001. The dollar volume has also declined by a similar proportion providing further evidence of an increased use of order breaking strategy. Order complexity is calculated as the ratio of decision-size to the average daily trading volume in the previous five trading days for that stock. The order complexity for our international sample is about one-third of the average daily volume. This is clearly an indication that institutional trading volume is considerably large when they decide to establish, accumulate, or unload positions in a given stock. On average, over 98.58 percent of decisions are at least 80 percent filled and the average order completion stands at 99.12 percent in 2001, which is higher than it was in 1997 to 1998.

Note that the patterns of decision and order characteristics such as dollar volumes, number of transactions per decision, average duration, number of brokers, and fill rates in both 1997 to 1998 and 2001 are very similar for purchases and sells. Even when these characteristics are marginally different for buys and sells, those differences are persistent and display no dramatic changes between 1997 to 1998 and 2001. It appears reasonable to assume that these differences cannot be the main drivers of the asymmetric price impact of institutional purchases versus sells, and particularly of the reversal in this asymmetry in 2001.

We further investigate the trading behavior of institutions in international stocks in Table II by partitioning the sample based on factors considered important determinants of trading behavior and trading costs. These factors include firm characteristics (market capitalization), relative order size (complexity of decision), duration of orders (single vs. multiple days), order splitting (single vs. mutiple broker), and the nature of foreign markets (developed vs. emerging markets). The discussion below focuses on 2001 for brevity, although the key differences between the two periods are highlighted. In Panel A, we divide the sample firms equally into three groups of 2,092 firms each ranked by the market capitalization. Apparently, the majority (84 percent) of institutional orders concentrate on stocks of large market capitalization, which is consistent with both how institutions trade in domestic stocks (Keim and Madhavan (1995)) and the international evidence that foreigners (institutions) tend to hold large companies (e.g., Kang and Stulz (1997) for Japan, and Choe, Kho, and Stulz (1999) for Korea). Except for duration, the statistics in the panel are statistically different for the three categories at the 1 percent level. Panel B of Table II classifies institutional trading activities into three equal groups (easy, moderate, and difficult) by the complexity of decision. As expected, size of decisions, number of transactions, and duration all increase with the complexity of a decision.

Next, in Panels C and D, we examine the trading characteristics based on order duration and order splitting among several brokers. In 2001, 94,260 decisions are completed in a single day and 29,991 take multiple days. Thus, 76

Table II

Institutional Trading Characteristics in International Stocks

This table presents institutional trading characteristics in 1997 to 1998 and 2001 for sample partitions based on market capitalization in Panel A, order complexity in Panel B, order duration in Panel C, number of brokers in Panel D, and developed versus emerging markets in Panel E.

Panel A: Market Capitalization (1,636 firms in each class for 1997–1998 and 2,092 firms each for 2001)

	1997–1998			2001		
	Large	Medium	Small	Large	Medium	Small
Average market cap. (million $)	11,414	616	146	22,640	579	142
Number of decisions	21,969	4,426	1,542	104,051	16,179	4,021
Average decision size (in dollars)	1,591,264	617,724	364,962	1,344,031	407,848	254,859
No. of transactions per decision	2.31	2.16	1.87	2.29	1.82	1.79
Duration (days)	2.89	2.82	2.93	2.20	2.12	2.26
Number of brokers	1.36	1.25	1.20	1.31	1.15	1.10
Order complexity (%)	22.17	78.74	166.57	19.51	77.29	192.98
Average order completion (%)	96.12	94.39	90.67	98.88	97.45	95.31

Panel B. Complexity of Decision (Order Complexity)

	1997–1998			2001		
	Easy	Moderate	Difficult	Easy	Moderate	Difficult
Order complexity (%)	0.47	5.42	111.44	0.12	1.22	96.66
Number of decisions	9,315	9,312	9,309	41,431	41,430	41,390
Average decision size (in dollars)	200,331	933,952	2,974,607	105,596	555,040	2,901,719
No. of transactions per decision	1.26	1.79	3.75	1.27	1.67	3.71
Duration (days)	1.79	2.66	4.19	1.45	2.00	3.13
Number of broker	1.15	1.33	1.52	1.14	1.29	1.43
Average order completion	98.35%	97.09%	91.18%	99.54%	99.32%	96.85%

Panel C. Single Versus Multiple Days

	1997–1998		2001	
	Single	Multiple	Single	Multiple
Number of decisions	19,838	8,098	94,260	29,991
Average decision size (in dollars)	623,402	3,196,752	532,269	3,244,305
No. of transactions per decision	1.11	5.11	1.29	5.14
Duration (days)	1.00	7.49	1.00	5.93
Number of broker	1.02	2.09	1.05	2.02
Order complexity (%)	21.45	82.33	16.40	83.69
Average order completion (%)	96.99	92.01	99.01	97.21

Table II—*Continued*

Panel D. Single versus Multiple Brokers				
	1997–1998		2001	
	Single	Multiple	Single	Multiple
Number of decisions	22,321	5,616	100,567	23,684
Average decision size (in dollars)	902,366	3,225,491	713,515	3,196,908
No. of transactions per decision	1.47	5.45	1.59	4.86
Duration (days)	1.59	8.00	1.43	5.44
Number of broker	1.00	2.66	1.00	2.50
Order complexity (%)	31.43	69.59	25.15	64.49
Average order completion (%)	96.31	92.57	98.65	98.29
Panel E. Developed versus Emerging Countries				
	1997–1998		2001	
	Developed	Emerging	Developed	Emerging
Number of countries	21	15	21	15
Number of securities	3,907	985	5,397	878
Number of decisions	24,704	3,232	114,822	9,429
Average decision size (in dollars)	1,429,235	911,604	1,216,479	826,503
No. of transactions per decision	2.25	2.37	2.23	2.08
Duration (days)	2.87	2.96	2.18	2.31
Number of broker	1.35	1.24	1.30	1.18
Order complexity (%)	34.13	77.10	26.07	112.74
Average order completion (%)	95.88	92.97	98.64	97.81

percent of the total number of decisions are completed within a day. However, total dollar volume of such orders is almost half when compared to total volume of multiple-day orders because multiple-day orders are six times larger on an average. Similarly, Panel D shows that 81 percent of the decisions use a single broker, but the total dollar volume of multiple-broker orders is 4.5 times larger. Thus, smaller orders are typically executed within a day with one broker, but larger orders are worked upon by several brokers over several days.

Lastly, Table II compares institutional trading activities grouped by the originating countries of the stocks traded. We classify our sample into developed and emerging markets based on Morgan Stanley Capital International's (MSCI) classification system. Institutions reported in the Plexus database traded 5,397 stocks from 21 developed countries and 878 stocks from 15 emerging markets. The decision size appears bigger for emerging markets with 189,288 shares per decision compared to 132,189 for developed markets (not reported in the

Table). However, in terms of dollar value, decision size in developed markets is \$1.22 million, which is higher than the \$0.83 million in emerging markets. This discrepancy is merely a reflection of the lower average stock prices in emerging markets. It takes longer to complete the orders in emerging markets, which is not surprising considering the greater order complexity in emerging markets than that in developed markets. Consequently, the fill rate is also higher in developed markets.

III. Empirical Methodology and Results

A. Price Impact

In this section, we turn our attention to institutional trading costs by measuring the price impact of trades. Studies on institutional trading costs have attempted to measure implicit cost such as price impact, as well as explicit cost such as commissions. We compute both components for 2001.[7] One popular method for measuring price impact is comparing the average price at which an order is executed with an unperturbed price prior to a decision or an order. If a trader executes too much of a buy order too soon, for instance, it may drive up the price of the stock, making the price of the execution much higher compared to the benchmark price. In contrast, a proficient trader will be able to keep the execution price close to the benchmark by trading skillfully.[8] Alternative measures of the unperturbed price have been proposed in the literature to calculate price impact. We choose to adopt two of the widely used benchmark prices. First, following Keim and Madhavan (1997), we calculate price impact at decision level (PI_d) as the ratio of volume-weighted trade price (WTP) of the component trades in an order to the closing price on the day before the decision to trade is made (P_{d-1}). Mathematically, this can be expressed as follows:

$$PI_d = \frac{WTP}{P_{d-1}} - 1 \quad \text{for buy orders and negative of this expression for sell orders.} \tag{1}$$

Second, following Jones and Lipson (2001), we calculate price impact at release level (PI_r) as the ratio of volume-weighted trade price of the component trades in an order to the price prevailing at the time the institutions release an order to a trading desk (P_r):

$$PI_r = \frac{WTP}{P_r} - 1 \quad \text{for buy orders and negative of this expression for sell orders.} \tag{2}$$

Equations (1) and (2) calculate price impact costs without adjusting for market-wide price movement. According to Keim and Madhavan (1997), this

[7] The Plexus data on international transactions do not have information on commissions for 1997 to 1998.

[8] Of course, trading slowly can also lead to opportunity costs of nonexecution as discussed later.

approach is appealing to institutions' trading desks because they include the so-called market timing costs that arise from a failure to execute the trade in a timely manner. They suggest that when a market is moving against the trader, subtracting market-wide return underestimates the implicit price impact costs for slow traders. Nevertheless, in equations (3) and (4) below, we do adjust for market-wide movements to calculate price impact. In our view, this alternative measure is also important because general market movements can potentially bias the measures discussed above. For instance, in a bullish market phase all stock prices increase on successive dates. As a result, all stock prices are likely to be higher on transaction dates than on decision dates, irrespective of an institution's trading skills. In those circumstances, even an efficient trader's implicit cost of buying will be somewhat overstated. The prior literature on international institutional trading has not controlled for market-wide price movements.[9] For our study, we have obtained the daily time series of market indices (MI) for all the countries from Datastream International. This enables us to control for market-wide returns and compute two more measures of market-returns adjusted price impact as follows:

$$PI_{dm} = \frac{WTP}{P_{d-1}} - \frac{MI_{i,t}}{MI_{i,d-1}} \quad \text{for buy orders and negative of this expression for sell orders,} \tag{3}$$

$$PI_{rm} = \frac{WTP}{P_r} - \frac{MI_{i,t}}{MI_{i,r}} \quad \text{for buy orders and negative of this expression for sell orders,} \tag{4}$$

where $MI_{i,t}$ is the level of market index in the stock's country of origin, i, on the date of execution of trade, $MI_{i,d-1}$ is the level of that index on the day before the decision is made, and $MI_{i,r}$ is the same index on release date.[10] These measures are similar to those used by Keim and Madhavan (1996) for domestic markets.

As a robustness check, we use another common measure of price impact. Instead of the closing price on the day before the decision or the release price, we use a different benchmark price provided by Plexus, which is the volume-weighted average price (VWAP) for all trades in a given stock on a given day. The VWAP is used widely by practitioners, consulting firms, and in Domowitz et al. (2001) as a benchmark for evaluating trading performance. We call this price impact measure PI_{vwap} and compute it as follows:

$$PI_{vwap} = \sum_{e=1}^{K} \left(\frac{P_e}{VWAP_t} - 1 \right) \Big/ K \quad \text{for buy orders and negative of this expression for sell orders,} \tag{5}$$

[9] A few papers that analyze domestic institutional trading adjust for market-wide price movements (see Keim and Madhavan (1996), Conrad, Johnson, and Wahal (2001), and Chan and Lakonishok (1995)).

[10] If trades are executed over multiple days, the market index on the day of the last execution is taken to compute $M_{i,t}$.

where P_e is the transaction price, K is the number of transactions in a given decision, $VWAP_t$ is the VWAP on the day when the transaction was executed.

The five measures of price impact discussed above reflect the cost of almost completely filling the orders. Apart from price impact and commissions, timing costs and opportunity cost of nonexecution can be important factors to consider. Wagner and Edwards (1993) designed the implementation shortfall approach to measure these opportunity costs. Berkowitz, Logue, and Noser (1988) and Perold (1988) also suggest inclusion of opportunity costs in total costs. However, the fill rate in our sample exceeds 97 percent. Thus, the opportunity cost of nonexecution (not filling the orders) is not a major concern here. Nevertheless, as a robustness check we calculate the total costs of trading, TC, defined as follows:

$$TC = (PI_d + Commisions) * w_e + \left(\frac{P_{t+10}}{P_{d-1}} - 1\right) * (1 - w_e) \text{ for buys and analogously for sells,} \quad (6)$$

where PI_d is the price impact described in equation (1), w_e is the proportion of decision shares that actually executed, $(1 - w_e)$ is the proportion of nonexecuted shares, P_{t+10} is the price 10 days after the last trade, and the term in the bigger parenthesis captures the opportunity cost of nonexecution.

Panel A of Table III presents the price impact of institutional trading using two alternative benchmarks as discussed in equations (1) and (2), respectively. Panel B reports the corresponding market-return adjusted price impact (equations (3) and (4)) for various partitions of the sample. The VWAP based measure in equations (5) could be computed only for 2001 and is reported later for each country for the purpose of making comparisons with prior literature.

The overall price impact for all international trades is 0.45 percent for 1997 to 1998 and 0.37 percent for 2001 based on the decision-price benchmark. The numbers with release-price benchmark are 0.41 percent and 0.31 percent, respectively, for 1997 to 1998 and 2001. The commission cost in 2001 is 0.17 percent, thus generating a total cost of 0.54 percent based on decision price. We compare these numbers to the trading costs documented in prior studies at other time-periods. Perold and Sirri's estimate is 0.99 percent for implicit price impact costs and 1.39 percent for total cost based on data from 1987 to 1991. Domowitz et al. (2001) report 0.46 percent for explicit commissions and fees and 0.25 percent for implicit price impact costs, giving a total cost of 0.71 percent for 1996 to1998. There appears to be a declining trend in trading costs due to increased competition, globalization of the capital markets, and technological advancements.

There is a very interesting difference between the price impact classified by direction of trades for 1997 to 1998 and 2001. Whereas the price impact cost for institutional purchases is higher in 1997 to 1998, sells have a bigger price impact in 2001. For instance, using the decision price benchmark, price impact

Table III

Panel A: Price Impact of Institutional Trades

This table presents estimates of implicit costs, that is, price impact (in percent) of institutional trading decisions in 1997 to 1998 and 2001. Two benchmarks of unperturbed prices are used to calculate the price impact. The Decision column (PI_d) represents price impact calculated as follows:

$$PI_d = \frac{WTP}{P_{d-1}} - 1 \quad \text{for buy orders and negative of this expression for sell orders,}$$

where WTP is the volume-weighted trade price of the component trades and P_{d-1} is the closing price on the day before the decision to trade is made. The Release column (PI_r) is computed similarly except that the benchmark price in the denominator is now the price prevailing at the time the institution releases an order to trading desk. The numbers for 2001 include the explicit commission costs, and the total of explicit and implicit costs. All numbers are in percentages. For example, average price impact of purchases in 1997 using decision price benchmark is 0.54 percent.

		1997–1998		2001				
		Implicit			Implicit		Total	
Order Characteristics	Benchmark	Decision	Release	Explicit	Decision	Release	Decision	Release
All trades		0.45	0.41	0.17	0.37	0.31	0.54	0.48
Purchase versus sell	Purchase	0.54	0.49	0.18	0.21	0.13	0.40	0.31
	Sell	0.35	0.31	0.16	0.56	0.53	0.72	0.68
Market capitalization	Large	0.40	0.35	0.16	0.32	0.25	0.49	0.41
	Medium	0.58	0.55	0.21	0.57	0.56	0.77	0.76
	Small	0.84	0.77	0.24	0.80	0.81	1.04	1.05
Complexity of decision	Easy	0.17	0.15	0.15	0.23	0.13	0.38	0.28
	Moderate	0.36	0.35	0.16	0.42	0.21	0.58	0.37
	Difficult	0.82	0.72	0.20	0.66	0.57	0.86	0.77
Single versus multiple days	Single	0.31	0.28	0.17	0.32	0.24	0.49	0.41
	Multiple	0.81	0.72	0.18	0.53	0.50	0.71	0.68
Single versus multiple broker	Single	0.39	0.35	0.17	0.36	0.31	0.53	0.48
	Multiple	0.70	0.63	0.17	0.40	0.30	0.57	0.47
Developed versus emerging	Developed	0.40	0.37	0.16	0.35	0.29	0.51	0.44
	Emerging	0.82	0.69	0.35	0.62	0.56	0.97	0.91

for purchases in 1997 is 0.54 percent, which is higher than 0.35 percent for sells. The pattern reverses in 2001 with price impact for purchases falling to 0.21 percent and that for sells rising to 0.56 percent. The patterns of price impact of institutional trading in U.S. stocks (not reported in Table III) are just as striking; 0.59 percent for purchases and 0.21 percent for sells in 1997 in contrast to 0.16 percent for purchases and 0.83 percent for sells in 2001. This is in sharp contrast with findings reported in most papers on institutional trading. Chan and Lakonishok (1995, 1997), Keim and Madhavan (1996), and other papers find that the price impact for institutional purchases is greater than that for sells. This has been attributed to higher informed trading in buys than in sells. Our results using 1997 to 1998 data, when markets were rising,

Table III—*Continued*

Panel B: Price Impact after Controlling for Market-Wide Returns

This table is similar to Panel A of Table III and it presents estimates of price impact (implicit costs) for institutional trading decisions in 1997 to 1998 and 2001 after controlling for market-wide returns. Two benchmarks of unperturbed price are used to calculate the price impact. The Decision column represents price impact calculated as follows:

$$PI_{dm} = \frac{WTP}{P_{d-1}} - \frac{MI_{i,t}}{MI_{i,d-1}}$$ for buy orders and negative of this expression for sell orders.

The Release column is computed similarly except that the benchmark price in the denominator is now the price prevailing at the time the institution releases an order to trading desk.

		1997–1998		2001				
		Implicit			Implicit		Total	
Order Characteristics	Benchmark	Decision	Release	Explicit	Decision	Release	Decision	Release
All trades		0.35	0.38	0.17	0.33	0.31	0.50	0.48
Purchase versus sell	Purchase	0.35	0.43	0.18	0.33	0.18	0.51	0.36
	Sell	0.34	0.32	0.16	0.42	0.46	0.58	0.61
Market capitalization	Large	0.27	0.32	0.16	0.29	0.25	0.45	0.41
	Medium	0.52	0.55	0.21	0.48	0.55	0.69	0.75
	Small	0.85	0.80	0.24	0.70	0.77	0.94	1.00
Complexity of decision	Easy	0.08	0.14	0.15	0.23	0.14	0.38	0.29
	Moderate	0.23	0.30	0.16	0.35	0.22	0.51	0.38
	Difficult	0.73	0.70	0.20	0.60	0.56	0.80	0.76
Single versus multiple days	Single	0.23	0.25	0.17	0.27	0.24	0.44	0.41
	Multiple	0.62	0.69	0.18	0.51	0.51	0.69	0.69
Single versus multiple broker	Single	0.31	0.33	0.17	0.32	0.30	0.49	0.47
	Multiple	0.49	0.60	0.17	0.37	0.31	0.54	0.48
Developed versus emerging	Developed	0.32	0.34	0.16	0.31	0.29	0.47	0.44
	Emerging	0.54	0.66	0.35	0.48	0.49	0.83	0.85

are similar to prior literature and consistent with both this explanation and the alternative explanation given in our main hypothesis. However, our result for the bearish period of 2001 is opposite, that is, the impact of sell orders is higher than that of buys. This result is consistent only with our new hypothesis and rejects the old hypothesis. Thus, it appears that institutions are subject to the market conditions and their informational advantages for purchases may not be as strong as previously suggested. Price impact is a function of market liquidity on the opposite side. Institutions pay for consuming liquidity (immediacy) when buying in rising markets and selling in falling markets. On the contrary, when trading against the market, institutions effectively provide liquidity and, therefore, face lower price impact. We further verify the validity of this finding in a correlation analysis and a regression analysis conducted later in the paper.

Consistent with both theoretical and empirical studies, price impact costs for small firms are the largest and those for large market-capitalization firms are the smallest. This is true for all measures of price impact and for both sample periods. The total costs, which include commissions, yield the same result as well. Overall, our results bode well with studies that show the preference of fund managers to hold large and liquid firms, and their tendency to avoid large holdings in small stocks, partly due to the difficulty of trading small firms.

Next, we analyze subsamples classified by the complexity of decision. As expected, there is a positive relation between price impact cost and the complexity of decision, regardless of the price impact measures used. The price impact costs for the difficult decisions are much greater than that for the easy decisions. One strategy that institutions use to lower the cost is to split difficult orders across brokers and also trade them gradually over several days. Next, we examine how this strategy affects price impact. Our data suggest that the price impact is higher on multiple-day and multiple-broker orders. Thus, even though splitting and working an order would somewhat lower the cost of difficult orders, it still does not make the costs of difficult orders comparable to single-day and single-broker (presumably easier) orders.

Finally, Table III displays price impact cost classified by developed versus emerging markets. Price impact costs are larger in magnitude for emerging markets than in developed markets. In this respect, our results are consistent with Domowitz et al. (2001) and Jain (2002).

B. Adjustments for Commissions and Market-Wide Returns

In this section, we adjust price impact for commissions and market-wide price movements. Commission-adjusted price impact measures are more representative of the total costs of trading. Market-return adjusted price impact can arguably be more representative of the net trading costs after removing the effect of systematic or normal price-change.

The last two columns in Table III report the total cost of trading including commissions for 2001 using decision-price and release-price benchmarks. The commissions are reported separately under the column labeled explicit costs. The conclusions about differential price impact for the various partitions of the sample remain unchanged even after we take commissions into consideration. For instance, the sell decisions in 2001 still have a bigger average price impact of 0.72 percent compared to 0.40 percent for purchases. This is so because the differences in commissions for different categories are not very large. Further, in most cases the commissions follow similar patterns as the price impact of trade decisions, that is, categories with bigger price impact generally have bigger commissions as well. Thus, our results on institutional trading costs are robust to inclusion of commissions.

The adjustment for market returns was outlined in equations (3) and (4). Market-return adjusted price impacts are shown in Panel B of Table III. Once again, our findings about the price impact patterns of various categories remain unchanged. Market-return adjusted price impact is higher for purchases than

sells in 1997 to 1998 and vice versa in 2001. All other results are similar to those in Panel A as well.

C. Further Evidence on Asymmetric Price Impact

In this section, we further explore the asymmetry of price impact of institutional purchases and sells and its relation to the market condition. For each month in the sample, we compute the average market return, average price impact of purchases, and average price impact of sells. This analysis allows for the possibility of some negative-return months within our broadly bullish sample of 1997 to 1998 and some positive-return months within our broadly bearish sample of 2001. More importantly, this analysis addresses a potential criticism of our paper that structural changes in the markets between 1997 to 1998 and 2001, which are unrelated to the market condition, might have been substantial enough to change the patterns of price asymmetry.[11] Moreover, this analysis lets us hold our sample of firms and clients constant within each sample period. Since we hypothesize that the market condition is a key driver of price impact asymmetry, we expect that negative-return months, even in the broadly bullish phase of 1997 to 1998, will be associated with higher sell price impact compared to buy price impact. In Figure 1A, we plot these monthly market returns, the corresponding price impact of purchases, and the corresponding price impact of sells. This new cut in the data provides further support to our hypothesis. Whenever the market return is positive (negative), price impact of purchases (sells) increases. The correlation between market return and price impact of purchases is a positive 0.69 and the correlation between market return and price impact of sells is a negative -0.62! Thus the market condition appears to be the key driver of asymmetric price impact of purchases and sells. This relation is reinforced in Figure 1B, where we plot monthly returns against the corresponding asymmetry of price impact (difference between impact of purchases and sells). The asymmetry moves in chorus with market returns. The reversal of price impact asymmetry can be observed even in the bearish months of 1997 to 1998. This rules out the possibility that addition of new firms or clients in the 2001 sample would drive our results.

We also examine the issue of market condition as the main driver of asymmetric price impact for buys and sells on a country-by-country basis. This relation is plotted in Figure 2 for the United States and 36 foreign countries for 1997 to 1998 and 2001. Each of the 74 points in the plot represents a pair of market condition and the degree of asymmetry. Market condition (MC) is shown on the x-axis and is gauged by the buy-and-hold return for the respective period as measured by the change in the level of a particular country's Datastream stock market index from January 1, 1997 to March 31, 1998 for 1997 to 1998. Buy and hold returns for 2001 are calculated from January 1, 2001 to September 30, 2001.[12] On the y-axis is the degree of asymmetry in price impact, which is

[11] We thank an anonymous referee for pointing this out.

[12] U.S. numbers are based on a shorter sample, as discussed previously.

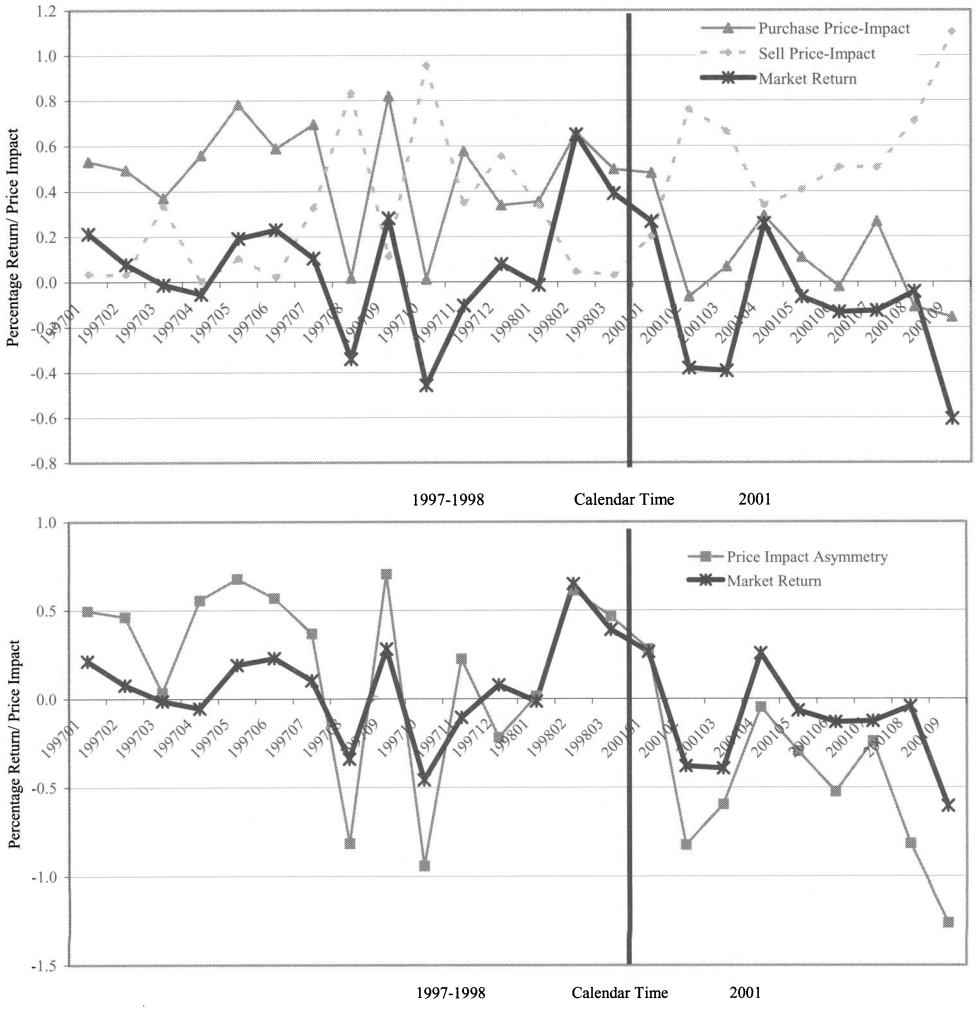

Figure 1. (A) Market sentiment and price impact of institutional purchases and sells. This figure plots the average price impact of purchases, price impact of sells, and the contemporaneous market returns. The vertical line divides 1997 to 1998 and 2001. **(B) Market sentiment and price impact asymmetry of institutional trades.** This figure plots the average price impact asymmetry between purchases and sells and the contemporaneous market returns. The vertical line divides 1997 to 1998 and 2001.

the difference between the average price impact for buy orders and the average price impact for sell orders for stocks originating in that particular country for the corresponding period.

If the price impact for buys and sells is not asymmetric, the plotted points should align along the x-axis or randomly scatter around it in all four quadrants. If price impact is asymmetric with purchases being more informative, then the points should cluster in quadrants I and II. However, if our hypothesis

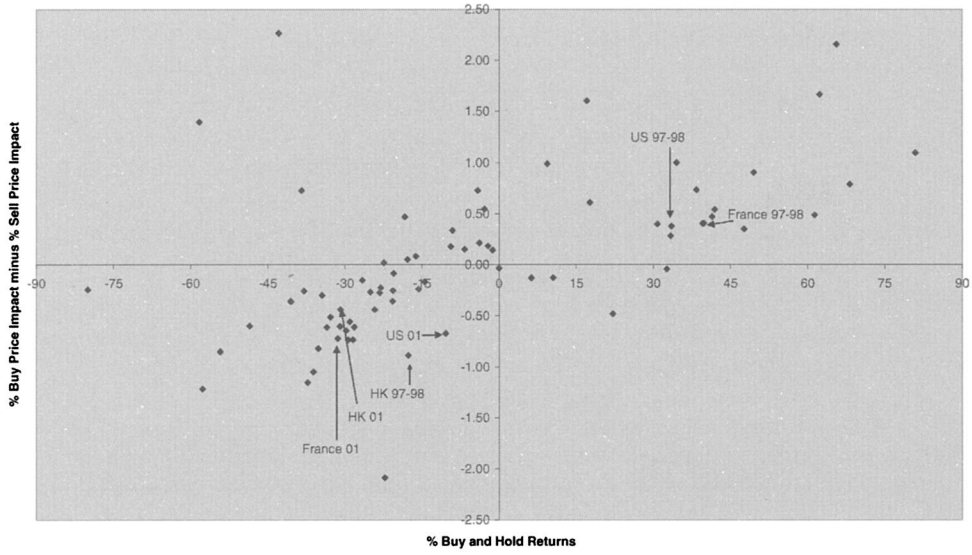

Figure 2. Market condition and asymmetry of price impact. This graph shows the relation between the average buy-and-hold returns and the asymmetry of price impact between buys and sells. The 74 points in the picture represent the United States and 36 international countries in the sample and the two periods of 1997 to 1998 and 2001. Price impact is calculated according to equation (1) in the paper as follows: $PI_d = \frac{WTP}{P_{d-1}} - 1$ for buy orders and negative of this expression for sell orders.

is true and the price impact asymmetry is correlated with the market condition then the points should be distributed along the 45-degree line on the graph and cluster in quadrants I and III. The actual plot is closest to this latter representation. Once again the correlation between buy-and-hold returns and asymmetric price impact is a positive 0.61 and statistically significant. With price impact asymmetry as a dependent variable, the regression coefficient of 1.10 on market return suggests an almost one-to-one correspondence between these two variables.[13]

The graph provides very robust controls for country-specific variables because we are able to look at the same country's stocks in the two sample periods. For example, France has a buy-and-hold return of 39.52 percent in the bullish period of 1997 to 1998 resulting in a positive price impact asymmetry of 0.40 percent. In the bearish period of 2001, the same country's stocks generate a negative buy-and-hold return of −31.39 percent, which indeed results in the reversal of price impact asymmetry to −0.72 percent. Another case in the point is Hong Kong, which has a bearish condition in both 1997 to 1998 and 2001 with buy-and-hold returns of −17.70 percent and −30.83 percent, respectively. Consistent with our hypothesis, Hong Kong has a negative price asymmetry

[13] This coefficient has a p-value < 0.0001, and the R-square is 33.68 percent for release price based regression and 36.73 percent for the decision price based regression. Tables for the regressions are not created for brevity.

measure in both periods at −0.88 percent and −0.44 percent. Similarly, trades in U.S. stocks experienced positive price impact asymmetry in 1997 when the stock market was rising and a negative price impact asymmetry in 2001 when the market was falling. These are not the only examples. In 1997 to 1998, 25 countries have positive buy-and-hold returns and 20 of those have a positive price impact asymmetry. In the same period, 12 countries have a negative buy-and-hold return and seven of those have a negative price asymmetry. In 2001, 36 countries produce a negative buy-and-hold return. Of these, 26 have a negative price asymmetry measure and the number goes up to 32 once we control for market-wide returns.

D. Regression Analysis Including Other Determinants of Price Impact

The wide range of price impact across various partitions prompts us to further investigate the determinants of price impact of institutional trading. Regressions of price impact on various explanatory variables are estimated. The dependent variable is the price impact estimated according to Jones and Lipson (2001) and with release price as the benchmark.[14] The explanatory variables include order-specific and firm-specific factors such as direction of trade, order complexity, market-wide return, duration of orders, number of brokers used, market capitalization, price level, and return volatility. Further, we have five country-specific variables that capture the level of economic development, the status of financial liberalization, the legal enforcement of insider trading laws, the strength of shareholder rights, and the geographical region.

The regression equation for the price impact of all orders is described as follows:

$$\begin{aligned} PI_r = {} & \alpha + \beta_1 Buy + \beta_2 Cap + \beta_3 1/Pr + \beta_4 Complex + \beta_5 Volatility \\ & + \beta_6 Days + \beta_7 Brokers + \beta_8 Emerge + \beta_9 ITL + \beta_{10} SR \\ & + \beta_{11} Liberal + \beta_{12-15} Regions + \varepsilon, \end{aligned} \tag{7}$$

where PI_r is the measure of price impact based on Jones and Lipson (2001) as defined in equation (1); *Buy* takes the value 1 for buy orders, and 0 for sell orders; *Cap* refers to the natural logarithm of market capitalization of the firm; $1/Pr$ is the inverse of stock price at the time of decision; *Complex* is the natural logarithm of order complexity calculated as the ratio of decision shares to average daily trading volume over the prior five trading days; *Volatility* is the standard deviation of a firm's stock returns; *Days* are the numbers of days elapsed from the date of decision to the final trade for the order; *Brokers* are the number of brokers involved in the trades; *Emerge* takes the value 0 for markets classified as financially developed by MSCI, and 1 for emerging markets; *ITL* takes the value if the insider trading laws have been enforced in

[14] Reported results are based on the Jones and Lipson (2001) method as reiterated in equation (2) of our paper. We repeat the analysis using alternative benchmarks described in equations (1) and (5). The selection of benchmark does not alter the significance of our results.

the country through at least one prosecution; *SR* is the index of shareholders' right constructed by La Porta et al. (1998) and it ranges from 0 for worst to 5 for best; *Liberal* signifies whether a country has liberalized capital flow policies with minimal restrictions based on Bekaert and Harvey (2000); and the four *Regions* dummies take the value 1 if the orders are respectively from Africa, Asia, Europe, and Latin America, and 0 otherwise. As there is an intercept term in the model, no dummy is assigned to the region North America.

The combined regressions for all orders study the asymmetry of price impact in the manifestly bullish and bearish markets of 1997 to 1998 and 2001 using an indicator for buy orders. A positive coefficeint in 1997 to 1998 and a negative coefficient in 2001 for the Buy indicator would be consistent with our hypothesis that price impact asymmetry is related to market condition.We also ran separate regressions for buy orders and sell orders during each period to examine the relation between price impact asymmetry and market conditions within each sample period. This analysis is analogous to the unconditional month-by-month comparions shown in Figure 1. As we split the two types of orders, these regressions do not have an indicator for order type, but instead have an additional variable *Mkt,* which is the return on the local market index of the country where the trade was made.

Table IV presents the regression coefficients estimated for the price impact equation for all orders combined together and then separately for buys and sells for each sample period. In the combined regressions, perhaps the most striking result is the confirmation of our unconditional results on buy versus sell orders. Even after controlling for a host of other factors, purchases have a bigger price impact in 1997 to 1998 and sells have a bigger price impact in 2001. The dummy for purchases in the combined regressions changes its value from +0.21 in 1997 to 1998 to −0.41 in 2001, and both numbers are statistically and economically significant. This is further evidence, which is inconsistent with existing literature but consistent with our hypothesis. The existing literature attributed the price impact asymmetry to the possibility of purchases being more informed than sells. Even if such an effect exists, it is clearly overwhelmed by the impact of market condition, which has emerged as a key driver of asymmetric price impact of institutional purchases and sells.

Coefficients on other determinants are consistent with theory and our unconditional comparisons in Table III. Stocks with large market capitalization tend to have a significantly lower price impact. The interpretation of coefficient on 1/*Price* suggests that the price impact is higher for stocks with lower price than for those with higher price. As expected, more complex orders have a higher price impact. Price impact is also higher for more volatile stocks. These results are similar in 1997 to 1998 and 2001.

Multiple day and multiple broker orders have a bigger price impact than single day and single broker orders in 1997 to 1998; however, the effect is weaker in 2001. Earlier, we conjectured that this result might be due to the fact that institutions choose to split more difficult transactions. In the regression analysis, we control for the order complexity and continue to see higher price impact on multiple day and multiple broker orders in 1997 to 1998. Only multiple day

Table IV

Regression Analysis of Price Impact

This table presents regression analysis of price impact of institutional trading (measured in %) in international stocks for 207,833 order releases in 1997 to 1998 and 485,570 order releases in 2001 using the equation:

$$PI_r = \alpha + \beta_1 Buy + \beta_2 Cap + \beta_3 1/\Pr + \beta_4 Complex + \beta_5 Volatility + \beta_6 Days + \beta_7 Brokers$$

$$+\beta_8 Emerge + \beta_9 ITL + \beta_{10} SR + \beta_{11} Liberal + \beta_{12-15} Regions + \varepsilon,$$

where PI_r is the measure of price impact based on Jones and Lipson (2001) defined as $PI_r = (WTP/Pr) - 1$ for buy orders and negative of this expression for sell orders; Buy takes the value of 1 for buy orders, and 0 for sell orders; Cap refers to the natural logarithm of market capitalization of the firm; $1/Pr$ is the inverse of stock price at the time of decision; Complex is the natural logarithm of order complexity calculated as the ratio of decision shares relative to average daily trading volume over the prior five trading days; Volatility is the standard deviation of firm's stock returns; Days are the numbers of days elapsed from the date of decision to the final trade for the order; Brokers are the number of brokers involved in the trades; Emerge takes the value of 0 for markets classified as financially developed by MSCI, and 1 for emerging markets; ITL takes the value of 1 if the insider trading laws have been enforced in the country through at least one prosecution; SR is the index of shareholders' right constructed by La Porta et al. (1998); Liberal indicates whether a market is financially liberalized or not; and the four Regions dummies take the value of 1 if the orders are respectively from Africa, Asia, Europe, and Latin America, and 0 otherwise. As there is an intercept term in the model, no dummy is assigned to the region North America. Buy and sell columns represent separate regressions for each order type during the two periods. These regressions do not have the indicator for order direction but include the *Mkt* as an additional variable, which is the return on the local market index of the country where the trade was made. Statistical significance is indicated by ** for 1 percent level and * for 5 percent level.

	1997–1998			2001		
Regression Variables	All Orders	Buys	Sells	All Orders	Buys	Sells
Intercept	0.96**	1.37**	0.56**	1.42**	1.14**	1.19**
Indicator for a buy order	0.21**			−0.41**		
Market capitalization	−0.01**	−0.03**	0.01**	−0.14**	−0.16**	−0.12**
Inverse of stock price	0.30**	−0.27**	0.79**	0.10**	−0.28**	0.57**
Complexity of decision	0.09**	0.04**	0.09**	0.10**	0.13**	0.09**
Volatility	0.05**	0.07**	0.02**	0.02**	0.02**	0.02**
Local market index return		0.54**	−0.55**		0.43**	−0.47**
Multiple days	0.03**	0.03**	0.03**	0.03**	0.00	0.08**
Multiple brokers	0.05**	0.11**	0.00	−0.04	−0.04	−0.04
Emerging markets	0.23**	0.53**	−0.09	0.23**	0.32**	0.02
Insider trading laws	−0.18**	−0.08	−0.26*	−0.05	−0.20	0.17
Shareholder rights	−0.03*	−0.05**	0.02	−0.03*	0.02	−0.09**
Liberalized market	−0.64**	−0.87**	−0.18	−0.46*	−0.11	−0.71*
Geographical region–Africa	−0.63**	−0.93**	−0.16	−0.42*	−0.31	−0.40
Geographical region—Asia	0.52**	0.59**	0.20	0.35	0.10	0.53
Geographical region—Europe	0.38**	0.67**	−0.13	0.34	0.06	0.51
Geographical region—Latin America	0.43**	0.26	0.45	0.29	−0.11	0.66
Adjusted R-square	0.016	0.044	0.023	0.011	0.015	0.016

orders have higher price impact after taking into consideration order complexity in 2001. Price impact cost in emerging markets is higher than that in developed markets. The coefficient on enforcement of insider trading law is statistically insignificant for 2001. However, there is some evidence that better shareholder rights help in improving liquidity in the market and lowering the price impact. Liberalization appears to be helpful in lowering trading costs.

Finally, we turn our attention to the separate regressions for purchases and sells, which further highlight the relation between price impact asymmetry and market condition. We obtain hypothesized coefficients on local market indexes suggesting that positive returns (bullish market conditions) increase the price impact for buys and lower the price impact for sells both in 1997 to 1998 and 2001 after controlling for other differences in a regression framework. Specifically the coefficient on market returns is +0.54 in "Buy" regression and −0.55 in "Sell" regression for 1997. Similarly we have +0.43 for "Buy" and −0.47 for "Sell" in 2001. Ignoring the other variables for a moment, the intercept term suggests that in 2001 a Buy order will have a price impact of 1.14 percent and a Sell order of 1.19 percent when the effect of market return is zero. However, on days when the market rises by 1 percent, buy orders and sell orders show a positive asymmetry with price impacts of 1.57 percent and 0.72 percent, respectively. This asymmetry reverses on the days when the market declines by 1 percent and price impacts are 0.71 percent and 1.66 percent for Buys and Sells, respectively. These results are further confirmation of the validity of month-by-month results, presented in Figure 1, even after controlling for other variables.

E. Alternative Specifications, Matched Samples, and Other Robustness Checks

The direction of all regression coefficients is consistent with the Pearson bivariate correlation coefficients between the dependent variable and explanatory variables. The correlation analysis also indicates that the explanatory variables are not highly correlated, which assures us about the validity of the regression analysis. We also conduct several additional robustness tests. First, we estimate the regression with price impact based on decision price benchmark, as outlined in equation (1), as our dependent variable. The direction and significance of coefficients remain the same for all variables except for the geographic region control variables in 2001. Similarly, when we used VWAP based price impact measure, as defined in equation (5), instead of release-price benchmarked price impact, we again arrive at similar conclusions. For instance, in 2001, buy-orders faced a price-impact of 0.02 percent, which is much smaller than 0.19 percent for sell-orders. When VWAP based price impact is used as the dependent variable in the regressions, the coefficient on buy orders is −0.17, a further indication of negative price impact asymmetry in falling markets.

We also repeat the regression with total costs, TC, defined in equation (6), as the dependent variable. The average component costs in 2001 were 0.37 percent for price impact, 0.17 percent for commissions, and 0.82 percent for opportunity costs of nonexecuted shares. The regression results are very similar to those

for price impact alone. This is because the proportion of nonexecutions is only 4.35 percent. Thus the nonexecutions add only 0.04 percent to the weighted average costs. The complete regression table for total costs is not reported, but all the coefficients have similar sign, magnitude, and statistical significance. For instance, the buy order dummy in 2001 has a coefficient of −0.35 with total costs compared to −0.41 with price impact alone. Thus, the results on asymmetry of trading costs are robust to various alternative specifications.

Our next robustness check holds securities across our 1997 to 1998 and 2001 samples constant. Many more individual securities were covered in 2001 bear markets than in 1997 to 1998. The objective of this robustness test is to ensure that potential differences in characteristics of the additional securities and the ones already in the sample population do not drive the results. We form a matched sample by eliminating all stocks from the 2001 sample that are not present in the 1997 to 1998 sample. In this process, we also lose several stocks present in the 1997 to 1998 sample but not in 2001 because of mergers, delistings, and lack of institutional trading. Despite these losses, we are able to retain 53 percent of our 1997 to 1998 sample and 61 percent of our 2001 sample. The results of this matched sample analysis are reassuring in the sense that price impact asymmetry changes from positive (0.30 percent) in 1997 to 1998 to negative (−0.51 percent) in 2001.

F. Global Shifts in Institutional Trading Costs

The analysis presented so far makes it clear that institutional trading costs for different types of orders under different market conditions in a diverse set of countries do not remain constant. Therefore, it is useful to analyze the changing face of institutional trading costs over time and across countries. We present such a comparison in Table V. The table reports both implicit and explicit costs from the late 1980s to the beginning of the new millennium, for stocks from the United States, 21 other developed markets, and 15 emerging markets. The classification of countries is borrowed from Morgan Stanley Capital International. Release price benchmarked price impacts are based on equation (2) in the paper, VWAP benchmarked price impacts are based on equation (5) in the paper, and explicit costs represent the commissions. Explicit costs also include taxes in the Perold and Sirri (1998) column for 1987 to 1991. Numbers for 1987 to 1991 are reproduced from Perold and Sirri, those for 1996 to 1998 are from Domowitz et al. (2001), and we compute the remaining ones for 1997 to 1998 and 2001 from Plexus International data.[15] In general, there is a declining trend in both explicit and implicit costs. Most emerging markets appear to have costs that are higher than those in more developed financial markets. Price impact measures based on benchmark prices on order-release dates are bigger compared to VWAP measures, which use the value-weighted price on transaction date itself as the benchmark price. One reason why VWAP measures are lower is that they include the transaction being evaluated. Nevertheless, our

[15] Perold and Sirri (1998) do not use U.S. data, so we included this number from Keim and Madhavan (1997) who study a period from January 1991 to March 1993.

Table V

Global Shifts in Institutional Trading Costs

This table reports implicit and explicit trading costs (in %) for stocks from the United States, 21 other developed markets, and 15 emerging markets. The classification of countries is borrowed from Morgan Stanley Capital International. Release price benchmarked price impacts are based on equation (2) in the paper, VWAP benchmarked price impacts are based on equation (5) in the paper, and explicit costs represent the commissions. Numbers for 1987 to 1991 are reproduced from Perold and Sirri (1998) abbreviated as PS below, those for 1996 to 1998 are from Domowitz et al. (2001) abbreviated as DGM below, and the remaining ones for 1997 to 1998 and 2001 are computed by us from Plexus International data. Explicit costs also include taxes in PS column for 1987 to 1991.

	Release Price Benchmark			VWAP Benchmark		Explicit Costs		
	1987–1991 (PS)	1997–1998	2001	1996–1998 (DGM)	2001	1987–1991 (PS)	1996–1998 (DGM)	2001
Developed countries								
Australia	1.41	0.34	0.20	0.05	0.04	0.43	0.50	0.21
Austria	0.73	0.60	0.56	0.13	0.19	0.57	0.31	0.18
Belgium	1.37	0.47	0.26	0.10	0.06	0.57	0.25	0.18
Canada	0.70	0.54	0.36	0.27	0.23	0.27	0.25	0.18
Denmark	0.44	0.31	0.34	0.13	0.16	0.38	0.28	0.18
Finland	4.34	0.38	0.42	0.16	0.08	0.43	0.28	0.17
France	1.28	0.27	0.28	0.07	0.08	0.29	0.23	0.14
Germany	1.20	0.32	0.33	0.13	0.11	0.22	0.24	0.13
Hong Kong	0.62	0.48	0.32	0.09	0.09	0.53	0.51	0.19
Ireland		0.57	0.41	0.25	0.16		1.06	0.45
Italy	1.44	0.42	0.23	0.09	0.11	0.33	0.26	0.11
Japan	0.72	0.44	0.29	0.10	0.06	0.21	0.32	0.09
Netherlands	0.70	0.30	0.26	0.19	0.07	0.23	0.23	0.14
Norway	0.69	0.03	0.36	0.14	0.07	0.44	0.30	0.14
New Zealand	0.96	0.33	0.35	0.13	0.18	0.40	0.34	0.17
Portugal		0.45	0.28	0.19	0.08		0.44	0.16
Sweden	1.31	0.32	0.35	0.10	0.13	0.59	0.26	0.13
Singapore	1.23	0.63	0.35	0.17	0.13	0.47	0.61	0.19
Spain	0.55	0.37	0.32	0.10	0.08	0.51	0.33	0.15
Switzerland	1.05	0.36	0.27	0.09	0.10	0.23	0.30	0.57
United Kingdom	1.13	0.29	0.26	0.15	0.13	0.45	0.39	0.17
United States	0.38	0.37	0.36	0.30	0.18	0.20	0.08	0.10
Emerging countries								
Argentina		0.27	1.01	0.30	0.21		0.47	0.33
Brazil		0.63	0.51	0.21	0.11		0.37	0.32
Czech Republic		0.77	0.52	0.65	0.05		0.79	0.54
Greece		1.24	0.69	0.07	0.12		0.58	0.37
Hungary		1.27	0.38	0.69	0.06		0.75	0.47
India		0.67	1.06	0.58	0.18		0.14	0.47
Indonesia		1.08	0.68	0.16	0.20		0.85	0.51
Korea		1.09	0.63	1.34	0.15		0.63	0.34
Malaysia		0.67	0.44	0.15	0.16		0.74	0.38
Mexico		0.52	0.41	0.27	0.15		0.34	0.26
Philippines		1.41	0.94	0.10	0.03		1.03	0.57
Poland		1.19	0.99	0.00	0.35			0.51
Taiwan		0.62	0.44	0.19	0.07		0.56	0.30
Thailand		0.24	0.21	0.19	0.03		0.70	0.75
South Africa		0.36	0.29	0.44	0.15		0.37	0.27

release price measures and VWAP measures are highly correlated with a correlation coefficient of 0.48, and statistically significant at the 1 percent level even with just 37 observations. Overall, either of these measures of price impact can serve as useful benchmarks for international microstructure and asset pricing studies.

IV. Conclusion

This paper characterizes institutional trading in international stocks using a sample of proprietary data from Plexus Group for the periods of January 1997 through March 1998, and January to September 2001. We document several statistics at decision level, order level, and transaction level across various partitions of the sample, which include institutional purchases versus sells; stocks with different market capitalization; decisions of different complexity and duration; trades in 37 countries and five geographical regions; and two calendar times, one bullish and another bearish. This is the first paper that uses Plexus Group's international institutional trading data of such a large scope to improve our understanding about institutional trading behavior and, more importantly, about the price impact of institutional trading.

Price impact is an important element of transaction cost. The scope of this data enables us to take a fresh look at some of the findings documented in earlier papers in this respect. Price impact of purchases is different from that of sells, and several studies found that block buys moved prices more than block sells. We find that this asymmetry depends on the underlying market condition. Particularly, in the bullish markets of 1997 to 1998, institutional purchases have a bigger price impact than sells; this asymmetry is reversed in the bearish markets of 2001. This is despite the fact that institutional decisions are evenly split between buys and sells in both periods. The finding is robust to the use of five alternative measures of price impact. Our paper presents institutional trading costs over time and across countries. The results on asymmetry and its reversal are confirmed in the country-by-country and the month-by-month analysis. Price impact is by no means the sole component of trading costs, and some brokers with higher price impact may offer lower commissions, research support, and other services to their clients. However, we find that price impact is indeed the main driver of total costs of institutional trading. In fact, for 2001, we are able to look at total costs including price impact and explicit commissions and the results are robust to the inclusion of commissions.

We also analyze other determinants that can help explain the cross-sectional differences in price impact in an international setting. Our results show that price impact varies with firms' characteristics; in particular, trading costs are negatively correlated with market capitalization and price level. Price impact also varies with order characteristics; the bigger the order relative to average volume, the higher the price impact. Similarly, orders that are split over multiple days or multiple brokers have bigger price impact. It also varies with country-specific characteristics; trading costs are higher for emerging markets, nonliberalized markets, and markets with poorer shareholder rights.

These findings enhance our knowledge about the interactive relation between order direction, market condition, and the price impact of institutional trading. Some of our results are in sharp contrast with the previous literature, which always found a bigger price impact for purchases. The samples used in those studies are primarily from bullish market phases. Our results shed light on the performance of institutional trades in the bearish phase of the markets, when sell orders have a bigger price impact than buy orders. One possible interpretation of our results is that liquidity available on the buy (sell) side is higher in bearish (bullish) markets. Thus, institutional buys consume liquidity, and institutional sells provide liquidity in bullish markets, but these roles are reversed in bearish markets. This explanation is intuitively appealing. Given our results, the price impact metric can actually serve to measure how bullish or bearish the market condition is. It might be quite interesting to practitioners as a real time metric. Further research in this direction can verify whether traders actually benefit from using such a measure. Our results also entreat new theoretical research to develop transaction cost measures that take into account the prevailing market conditions. At the very least, price impact, as a measure of transaction cost, should be estimated net of the market moves. Perhaps, an intraday market model could be used to obtain the abnormal price impact of a given trade. Such market-adjusted measures can improve our inference on the information content of different sizes of orders and different types of orders. Several of the other determinants of price impact documented in this paper can also serve as important policy variables for the governments trying to attract foreign portfolio investments on one hand and institutions trying to optimize their global portfolios on the other hand.

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