Cross-Trading by ERISA Plan Managers

Final Report

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Executive Summary

ERISA prohibits cross trades, the exchange of assets between two accounts without going through a public market. There have been numerous exemption requests motivated by a desire to reduce transaction costs. Mutual funds are permitted to cross trade under Rule 17a-7. Opportunities for cross trades arise when some funds within a group have cash inflows and others have cash outflows and due to differences of opinion among managers for a given mutual fund group about the desirability of holding particular assets. Cross trades represent an economically significant source of savings for mutual funds.

With a view toward identifying insights relevant to cross-trading, this study reviews the academic literature dealing with the way financial markets are organized and how this organization affects transaction costs, dealer quotes and prices, and other market characteristics. Transaction costs include direct costs such as commissions and indirect costs such as the bid-ask spread, which covers order processing costs (the normal expenses of providing liquidity) and asymmetric information costs (dealer losses to informed traders). Additional indirect costs are market impact costs, delay costs, and the opportunity costs of missing a trade. Transaction costs typically range from one to four percent, depending on a number of factors such as the type of asset (equities, debt, derivatives, and currencies), daily trading volume in the asset, the size of the order, market conditions (recent news, whether others are buying or selling), and the country in which the asset is traded. Because investment managers often have one- or two-year

investment horizons, transaction costs are of sufficient size to be a significant drag on performance.

Dealer quotes reflect asymmetric information costs and trade size. Trade prices exhibit regularities, including U-shaped patterns in returns, volume, variability of returns, and bid-ask spreads. There are other systematic features of trading such as the tendency of the last trade of the day to be on the ask. Further, buys and sells do not have the same market impact. Without a market trade, it is impossible to know what price each counterparty would have paid or received.

If both parties are equally motivated and seek to trade at the same time, it makes sense to simply use the average of the bid and ask price as the cross trade price so that the buyer and seller split the savings in commissions, market impact costs, delay costs, and opportunity costs. But if one party typically uses patient trading strategies or is accommodating the counterparty, determination of a fair crossing price is difficult. Consider a manager of two ERISA plans, one of which needs to raise funds to pay participants and plans to sell an illiquid security. The quoted market price is considered low. In fact the price represents such a "good deal" that the ERISA manager would like to purchase the security in a second ERISA plan. The second plan may not have sufficient cash, but can sell very marketable securities to raise the needed funds. In this case, the second fund incurs extra costs to purchase the securities and is motivated to make this investment only because obtaining these securities at such a good price will enhance the return of the fund. In this case the average of the quoted bid and ask in the market would not represent a fair price for the second fund. Instead, the second fund should probably receive the entire benefit of the "good deal."

If the goal is to minimize risk, cross trading should be prohibited. In a cost-benefit context, steps can be taken to reduce risk of abuse including limiting cross trading to large plans and requiring a written plans and monitoring. This would permit plans receiving an exemption to benefit from the savings available from cross trading.

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Abstract

ERISA prohibits cross trades, the exchange of assets between two accounts without going through a public market. There have been numerous exemption requests motivated by a desire to reduce transaction costs (typically one to four percent). Mutual fund cross trades under Rule 17a-7 achieve economically significant savings.

Transaction costs comprise commissions, market impact, and opportunity costs of missed trades. Further, round trip trades incur a bid-ask spread, which covers order processing costs (the normal expenses of providing liquidity) and asymmetric information costs (dealer losses to informed traders). Dealer quotes reflect asymmetric information costs and trade size. Trade prices exhibit regularities, including U-shaped patterns in returns and volume. Without a market trade, it is impossible to know what price each counterparty would have paid/received.

If both parties are equally motivated and seek to trade at the same time, it makes sense to cross at the spread midpoint. But if one party typically uses patient trading strategies or is accommodating the counterparty, determination of a fair crossing price is difficult. If the goal is to minimize risk, cross trading should be prohibited. In a cost-benefit context, steps such as having written implementation plans and strong monitoring can reduce risk of abuse.

Cross-Trading by ERISA Plan Managers

1. Introduction

This study reviews the academic literature dealing with market microstructure[1] with a view to shedding light on the benefits and costs of cross trading. [2] Cross-trades are prohibited by ERISA unless they are consummated pursuant to an exemption. There have been numerous requests for exemptions to allow cross trading under specific circumstances. A principal motivation for these exemption requests is that trading costs are substantial. The costs of trading vary across types of financial products such as equities, debt, derivatives, and currencies and also from country to country. Trading costs include direct costs such as commissions and taxes and indirect costs such as the bid-ask spread,[3] market impact costs, delay costs, and the opportunity costs of missing a trade. Trading costs can amount to four percent and more of the amount of money involved. Because both sides of a cross-trade avoid commissions and other transaction costs, the benefits are clear and substantial.

The Department of Labor (DOL) has identified a number of potential abuses that might result from cross trading.[4] These concerns have focused on the types of securities subject to cross trading, the way cross-trading affects investment decision and the like.

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[1]Market microstructure is "the study of the way financial markets are organized and how this organization affects prices, risk, trading costs, and other market characteristics." (McInish, 2000).

[2]We define a cross-trade as the sale of an asset for one portfolio and the purchase of that same asset for another portfolio where both portfolios are under the control of the same individual or firm.

[3]The ask (bid) is the price at which a liquidity provider is willing to sell (buy) and the difference between the ask and the bid is called the **spread,** an important cost of trading. On each round-trip trade (a purchase and sale) investors expect to pay a spread and suppliers of immediacy expect to earn a spread.

[4]These include: providing artificial liquidity to favored accounts, allocating cross-trade opportunities to favored accounts, and allowing cross-trade opportunities to affect investment decision. Department of Labor, Pension and Welfare Benefits Administration, (March 20) 1998, Federal Register (Volume 63, number 54).

Here, we extend these concerns to additional issues related to the behavior of markets and the way that trading is conducted. A few of these concerns may be indicative. In the microstructure literature, the initiator of a transaction is viewed as the demander of liquidity and the counterparty as the supplier of liquidity.[5] The demander of liquidity typically compensates the supplier. Some investment strategies call for more urgent execution of orders than others. Plans with less urgent needs may use patient trading strategies such as the use of limit orders rather than market orders.[6] By becoming suppliers of liquidity rather than demanders, patient traders may dramatically reduce transaction costs. By becoming a party to a cross trade, a plan foregoes the possibility of using patient trading strategies.

On the other hand, investment managers already face difficult allocation decisions that may involve ERISA plans. Wagner (2000) discusses the problems facing managers in executing orders when the manager has a fiduciary duty to multiple clients, possibly including multiple ERISA plans. In accumulating positions in the same asset for multiple accounts, all accounts that trade on the same day typically get the same average price. However, rather than allowing investment managers a free hand in selecting brokers to execute trades, some clients require the investment manager to direct trades to a particular broker. The investment manager selects a broker to execute the non-directed orders. In this case it may not be fair for non-directing customers to suffer or benefit form directed orders. Separation of trade execution channels in this way requires some

[5]The microstructure literature often considers two types of traders. Informed traders' orders are motivated by information about the value of assets. On the other hand, liquidity motivated traders do not trade because of information. A mutual fund might have an inflow of cash that must be invested. The terms noise trader, uninformed trader, and liquidity trader are synonymous. Noise traders may include traders who think the have information, but do not.

[6]Order types are described in appendix 1.

orders to go first with subsequent orders likely experiencing greater market impact costs and opportunity costs due to execution failures. Most managers require trades with constraints to go last.[7]

One group seeking permission to cross trade between ERISA plans are in-house asset managers (INHAMS[8]). INHAMs are required to be Registered Investment Advisors and, therefore are subject to SEC inspections. Trading, including cross-trading, is a focus of these inspections (see appendix 2). It is unlikely that SEC inspectors would note or comment on DOL regulations in their inspection reports if these differed from SEC requirements. But the fact that these INHAMS are subject to the inspections indicates that have experience with maintaining the types of records that would be useful to plan fiduciaries in evaluating cross trading.[9]

2. Mutual funds

Mutual funds can cross trade under Rule 17a-7 of the Investment Company Act of 1940.[10] Many mutual fund groups take advantage of this rule to effect cross trades, but some benefit to a greater extent than others. Many cross-trades are liquidity motivated. Events that trigger a cross-trade may arise from the normal inflow and outflow of fund

[7]Wagner (2000).

[8]The INHAM concept is described in PTE 96-23 60 Fed. Reg. 15597 (Mar. 24, 1995).

[9]The types of records that might be useful are described in the letter of Mr. Ivan Strasfeld to the U.S. Department of Labor dated July 10, 2000. These include the trade date, the name of the issuer/security, the type of transaction, the principal amount of number of shares; the price and the basis for the price, the high and low price for the security on the trade date, and a certification regarding compliance with the firm's procedures.

[10]Rule 17a-7 -- Exemption of Certain Purchase or Sale Transactions Between an Investment Company and Certain Affiliated Persons Thereof, Investment Company Act of 1940.

assets. However the initiation and termination of funds within a group may increase the opportunities for cross trades.

Consideration of several actual mutual fund groups may be useful. Longleaf funds manage more than $4.5 billion of assets and had more than $700 million of security purchases in 2001. Yet, Longleaf funds typically effect only a few cross trades each year. However, the closing of one of Longleaf's four funds in 2001 allowed for the increased use of cross trading.[11] Longleaf's opportunities to cross trade are limited by the fact that all of its funds are value funds that seek to acquire securities that are assessed to be undervalued. A more important source of cross trading opportunities arises from opportunities to trade among different managers within a fund group. If a fund group has different types of managers or managers with differing opinions, there are increased opportunities for cross trading. American Century has more than $85 billion under management. Cross trading opportunities have resulted from a shift of investors' assets from growth to value managers within the group. The American Century Small Cap Value Fund's assets grew from $225 million at the end of 2001 to $1,286 million at the middle of June 2002, a growth of $1,061 million. Assuming that 1% of this asset growth was accomplished through cross trades and that a cross trade saves 1% of the transaction value round trip, the resulting savings are ($1,061 million X 0.01 X 0.01) =) $106,100.[12]

[11]The Longleaf funds operated four funds during 2001 including the Partners, Small-Cap and Realty funds. The Realty fund was closed. The Longleaf Partners Funds annual report at December 31, 2001 states: "Purchases in the Partners and Small-Cap Fund include securities purchases from the Realty Fund in conjunction with its liquidation. The securities were purchased from the Realty Fund at the last sales price on the security's primary exchange, without brokerage commission in accord with procedures previously adopted by the Boards of Trustees of the Funds pursuant to Rule 17a-7 of the investment Company Act of 1940."

[12]One half of the savings accrues to the Small Cap fund and one-half to the fund with the cash outflow.

As the amount of assets under management increases, the potential savings from cross trading grows at an even faster rate. One reason for this is that larger funds trade in larger blocks, which have greater market impact. Another reason is that larger funds have more managers leading to more disagreements as to whether a given stock should be included in a portfolio. Fidelity Investments manages more than 150 mutual funds. Conversations with industry executives indicate that perhaps 8% to 10% of equity trades are cross trades at Fidelity. Fidelity has an ERISA exemption, but this exemption is not a significant factor in Fidelity cross trades.[13] Consider just one Fidelity Fund, the Fidelity Aggressive Growth Fund, which had assets of $5,324 million and a turnover rate of 118% in 2001.[14] Assume that all trades are equity trades, that cross trades save 1% round trip, and that 8% of trades are cross trades. Then the savings for this fund in 2001 due to cross trades was ($5,324 million X 1.18 X 0.08 X 0.01 =) $5.026 million, not counting any savings due to purchases made as a result of fund growth. Even though the Fidelity Magellan Fund had a turnover rate of only 15%, because its assets total almost $72 billion, the savings from cross trades would likely have more than ($72,000 million X 0.15 X 0.08 X 0.01 =) $8.6 million. Clearly, cross trades represent economically significant sums for Fidelity Investments.

These considerations lead to the following observations that are applicable to ERISA plans. The larger the ERISA plan the greater the potential savings from cross

[13]PTE 94-43.

[14]For a mutual fund, the portfolio turnover rate is an annualized rate found by dividing the lesser of purchases or sales by the average of portfolio assets. Suppose that a fund is growing so that purchases of assets are greater than sales. In this case, a turnover rate of 1.0 indicates that sales of assets equaled average fund assets and purchases of assets equaled sales of assets plus any purchases of assets due to fund growth.

trading and the potential savings grows at a much faster rate than the rate of asset growth. The main considerations that lead to this result are:

1. Market impact and delay costs. Larger investment size leads to greater market impact costs. If 50,000 shares are traded each day, an order for 20,00 shares can typically be executed quickly with little market impact while an order for 200,000 shares will take more time to execute and incur more market impact. An order for 400,000 shares is typically more than twice as difficult and takes more than twice as long to execute as an order for 200,000 shares.
2. Larger funds may involve more ERISA plans. The likelihood that there will be inflows for one plan and outflows from another at the same time is much greater if there are five plans than if there are only two plans.
3. Larger funds have more investment managers. Investment managers may disagree about the merits of a particular investment. The greater the number of investment managers the greater the likelihood that one manager will want to buy a security that another manager is selling. This observation is most applicable to plans that employ multiple external investment managers.

3. Transactions costs

Transactions costs are all of the costs associated with the management of investments, including the time involved in making investment decisions.[15] Transaction costs are classified as explicit or implicit. Explicit costs are itemized separately and paid for like any other expenses. The most common explicit costs are commissions and

[15]For additional information see Schwartz and Whitcomb (1988).

transfer taxes and fees. The most common implicit transaction costs are the bid-ask spread, market impact costs, delay, and opportunity costs. Table 1 provides an estimate of each of these costs for equities.[16] Note that commissions are the smallest component of execution costs. Delay costs are the largest cost. Market impact costs are also substantial totaling 50% more than commissions. The costs of executing the average small cap order are more than four times as high as that of the average large cap order.[17] A study of 31 stocks whose weighting in the Toronto Stock Exchange 300 index was changed due to a redefinition of public float showed that the price impact of the change on these 31 stocks was 2.34 percent.[18] Because of market impact costs, it is common for institutions to break up large orders for execution. Define a trade package as orders on the same side of the market by a single investment manager. One study of 37 large institutions found that more than one-half of the dollar value of executed trade packages required four or more days for completion. This finding provides strong evidence that

[16]Taking a different approach, Hasbrouck and Schwartz (1988) reason that execution costs due to **bid-ask bounce** (the movement of stock prices between the bid and the ask), market impact, and the like, temporarily push trading prices away from their true value. Hence, comparison of volatility over different periods can be used to investigate the impact of transaction costs. These authors calculate the ratio of the variance of 12-hour returns to 24 times the variance of half-hour returns. Because these intervals cover the same calendar period, we know that the actual volatility is the same over these two measurement intervals. Therefore, the value of the ratio should be 1.0. Any temporary deviations provide a measure of execution costs. Using this methodology these authors report average execution costs of 0.148% of the transactions amount for NYSE-listed stocks. The comparable costs reported by Hasbrouck and Schwartz for American Stock Exchange and more liquid NASDAQ stocks are 0.123% and 0.438%, respectively. If the assumption that the entire difference in the variance ratios is due to transaction costs does not hold, the Hasbrouck and Schwartz measure will overestimate execution costs. Stabilization activities of the specialist, the presence of limit orders, or the sequential arrival of information causing price adjustment delays might also affect short-term price volatility.

[17]In this example large (small) cap (capitalization) is more (less) than one billion dollars.

[18]Kaul, Mehrotra and Morck (2000).

many institutional orders could not be executed without substantial market impact.[19] There is evidence that execution costs for institutions have increased recently.[20]

Table 2 compares equity execution costs for seven countries. In every country commissions represent only a fraction of total execution costs. Trading costs can also be large for debt instruments. One study reports that trading costs for bonds are about $0.27 for each $100 of face value.[21] Small institutions pay more than large institutions and small trades cost more than large trades.[22]

In the next two parts of this section, direct and indirect transaction costs are considered, in turn. Then, issues related to transaction costs—price improvement, ECNs, patient trading, and monitoring transactions costs—are considered.

Implicit transaction costs: The bid-ask spread

The bid-ask spread was the focus of much of the early work dealing with transaction costs and the earliest investigations of spreads focused on **order processing costs**. These include the costs of the dealer's time, paper-work costs, transfer taxes, and other expenses incurred by the dealer in providing immediacy. In the process of making a market the dealer may have money invested in the asset, incurring opportunity costs

[19]Chan and Lakonishok (1995).

[20]On June 24, 2001, the New York Stock Exchange lowered its minimum price increment or tick size from $0.125 to $0.0625. Examining institutional orders, this change decreased total execution costs for small orders of less than 1,000 shares, did not change execution costs for orders of from 1,000 shares to 9,999 shares, and increased costs for order of more than 10,000 shares. Institutional orders of more than 100,000 shares cost one-third more to execute (Jones and Lipson, 2001). These authors measure execution costs as the proportional difference between the volume-weighted average execution price of trades executed as part of the order and the price prevailing at the time the order was released to the trading desk.

[21]Schultz (2001).

[22]Schultz (2001).

that contribute to order processing costs. Another cost of providing immediacy is **inventory holding costs,** dealer losses resulting from a positive or negative inventory position.[23]

More recently, a third cost incurred by dealers who provide immediacy has received attention, namely, **asymmetric information costs**.[24] Some investors are likely better informed than the dealer. When these informed investors buy from the dealer, subsequently, prices are likely to rise. And when informed investors sell to the dealer, subsequently, prices are likely to decline. Therefore, in dealing with informed investors the dealer is buying just before price decreases and selling just before price increases.[25] A buy transaction arriving after a long time interval has a lower price impact than a buy transaction arriving right after a previous buy. Because informed traders typically seek to trade quickly before their information becomes generally known, liquidity suppliers infer a higher likelihood of traders being informed if the trades are close together.[26]

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[23]Inventory holding costs are the costs incurred or anticipated by a dealer as a result of inventory positions acquired in the process of market making. An example of the inventory holding cost model is provided by Ho and Stoll (1981) who propose that after a dealer purchase bid prices are lowered to discourage additional sales and ask prices are also lower to encourage purchases from the dealer. Thus, the new bid and ask prices must reflect prices that make the dealer indifferent between a transaction at the bid and a transaction at the ask.

[24]Asymmetric information costs are the costs incurred or anticipated by a dealer as a result of trading with counterparties who are motivated by the possession of superior insight into the appropriate equilibrium price of the asset. Of course, the loss to the less knowledgeable party is the gain to the party with superior insight. A trader with knowledge that current prices are not at true value would is motivated to trade immediately rather than provide liquidity to others.

[25]If this were not the case the market maker's counterparties would not truly be informed. For examples of asymmetric information models see Copeland and Galai (1983) and Glosten and Milgrom (1985).

[26]Dufour and Engle (2000). There is evidence that order processing costs have little intra- or inter-day variation, but adverse selection costs are high at the beginning and end of the trading day relative to the middle of the day. Adverse selection costs are also higher on Mondays than on other days of the week for actively traded firms.

Glosten and Harris (1988), among others, have developed a methodology for estimating order processing costs and asymmetric information costs. Inventory holdings costs, which are small, are not estimated separately, but are included in order processing costs. For a sample of 856 equities traded on the New York Stock Exchange in 1999, the costs as a percentage of the spread are: order process costs, 61.1%; asymmetric information costs, 38.9%.[27]

Implicit transaction costs: Market impact costs

The execution of an order has the potential to move the market price. Here we are talking about more than the change from the bid to the ask. Market impact involves moving the bid and/or ask either temporarily (in response to liquidity motivated trades) or permanently (in response to information-based trades). Suppose that a market has sellers willing to sell 5,000 shares at 50 and 5,500 shares at 50.10. An order to buy more than 5,000 shares will exhaust the supply at 50 and if immediate execution is required will necessitate executing part of the order at 50.10. Hence, this order will have market impact. Market impact is a cost associated with implementing an investment decision. Empirical evidence shows that for a given price change, the size of the associated trade is larger for sells than for buys. An early study reports that a decline of $0.125 is associated with a trade size of 451 shares while an increase of $0.125 is associated with a trade size of 427 shares.[28] Hence, if the market impact of buys and sells differs, determining a

[27]Van Ness, Van Ness, and Warr (2001).

[28]Wood, McInish, and Ord (1985).

cross-trade price by, say, taking the midpoint of the bid and ask, may be unfair to one of the parties.

It may take several days to execute an order. There is a trade off between market impact costs and delay costs. Table 1 shows that delay costs are much larger than commissions and, in fact, are almost 60% larger than commissions and market impact combined (0.60/0.38 = 1.58). Opportunity costs result when the order cannot be completed due to market price movements or other factors. Table 1 shows that for one sample the opportunity costs of the ten percent of trades not completed were twenty percent greater than commissions.

Block trades

A block trade is commonly defined as a trade of 10,000 shares or more. According to one study, the price impact of block trades on Nasdaq is -0.55% for sales and 0.53% for purchases. Comparable figures for the NYSE are –0.48% for sales and 0.46% for purchases.[29]

The relationship between trade size and transaction cost is not as simple as larger trades cost more. In fact, one study reports "no evidence that larger trades are associated with higher indirect execution costs."[30] Larger trades have greater impact, but the relationship between trade size and market impact is not linear in trade size.[31] The information content of a block trade increases with trade size using earnings forecast

[29]LaPlante and Muscarella (1997).

[30]Block, French, and McInish (1994).

[31]Koski and Michaely (2000).

errors as a proxy for information asymmetry.[32] Large trades have a greater price impact during times when asymmetric information is greatest.[33]

Buys and sells have different market impact. A price change of 1/4 is associated with an average trade size of more than 1,400 for a price increase and more than 1,700 shares for a price decrease.[34] Researchers have found that block purchases have a larger permanent price impact than block sales.[35] Similar results are reported for institutional trades.[36] Prices go up on purchases and down on sales, but the sale prices quickly revert to their pre-trade price while the increased prices due to purchases are permanent.[37] The effects of transactions and cumulative order activity on the price schedule increase as the average trading volume decreases.[38]

The probability of information based trading is lower in high volume stocks. High volume stocks tend to have a higher incidence of information events than low volume stocks, leading to a higher arrival rate of informed traders. But the effects of the higher arrival rate of informed traders are more than offset by an even higher rate of arrival of liquidity traders.[39] The majority of trades are small, but most of the cumulative stock-price change is due to medium-sized orders. Informed traders would prefer to trade

[32]Seppi (1992).

[33]Koski and Michaely (2000).

[34]Wood, McInish and Ord (1985).

[35]Kraus and Stoll (1972) and Keim and Madhavan (1996).

[36]Chan and Lakonishok (1993).

[37]Chan and Lakonishok (1993).

[38]Kavajecz and Odders-White (2001).

[39]Easley, Kiefer, O'Hara, and Paperman (1996).

in moderate size because a very large order attracts attention and a small order does not allow the accumulation of enough shares.[40] The source of these medium-sized trades that generate most of the cumulative returns is institutions.[41]

An upstairs market is a market in which larger orders are given special handling. On the NYSE brokers in the upstairs market can solicit counterparty orders, a practice not permitted on the trading floor. On the Toronto Stock Exchange most of the orders that are executed in the upstairs market are liquidity motivated so that they have no information content. Orders for blocks that have information content are executed through the normal computer process.[42] The upstairs market plays an important role in identifying liquidity-motivated orders, which then receive more favorable executions.[43] In the U.S. a significant fraction of large-block trades in equities are accomplished through the upstairs market. One study reports that for block trades executed in the upstairs market:

- there is significant price movement prior to the trade, indicating information leakage as the block is shopped,
- the market impact of Nasdaq trades is considerably greater than for trades exposed to an exchange floor,

[40]Barclay and Warner (1993).

[41]Chakravarty (2001).

[42]Like many exchanges throughout the world, the Toronto Stock Exchange executes trades through a computerized central limit order book system and does not operate a trading floor. The Toronto Stock Exchange pioneered computer-based trading, launching the world's first computerized trading system in 1977, but thick (actively-traded) stocks continued to be traded on the exchange floor until it was closed in 1997.

[43]The Toronto Stock Exchange operates an electronic trading system. Dealers in the upstairs market can ask more questions about the parties initiating an order. As a result "the upstairs market almost entirely screens out any trades motivated by adverse information" Smith, Turnbull, and White (2001, p. 1724).

- temporary price impacts are significant for seller-initiated trades, but not for buyer-initiated trades, and
- medium-sized trades had more market impact than larger- or smaller-sized trades.[44]

A study of upstairs trading on the Paris Bourse[45] finds strong evidence that: "(1) upstairs brokers lower the risk of adverse selection by certifying block orders as uninformed, (2) upstairs brokers are able to tap into pools of "hidden" or "unexpressed" liquidity, (3) traders strategically choose across the upstairs and downstairs markets to minimize expected execution costs, (4) trades are more likely to be routed upstairs if they are large, or are in stocks with less overall liquidity, and (5) buyer-initiated trades are less welcome and pay higher costs in the upstairs markets." Further, "those trades selectively routed upstairs pay lower execution costs."[46]

Market architecture: Price improvement

On the New York Stock Exchange market orders frequently perform better than the prevailing opposite side quote, indicating that these orders receive what the NYSE terms "price improvement."[47] In markets where the spread equaled the minimum tick size, at-the-quote limit orders achieved price performance superior to market orders, but

[44]Keim and Madhavan (1996).

[45]Bessembinder and Venkataraman (2001).

[46]Bessembinder and Venkataraman (2001).

[47]Harris and Hasbrouck (1996).

at the cost of higher variability.[48] In some markets dealers may post wide quotes and offer price improvement to uninformed traders.

Market architecture: Electronic Communications Networks (ECNs)

ECNs are typically computer systems thorough which institutions can trade with each other without the necessity of using a broker. ECNs such as Island, Instinet, and Posit now account for more than one-third of trading in Nasdaq stocks.[49] ECNs are now attempting to increase market share in NYSE-listed issues.[50] Some ECNs operate matching systems that cross trades at the mid-point of the bid and ask, but there is no guarantee that the order will be executed.[51] ECNs may provide a low cost alternative to cross trading. Nasdaq's limit order display rule "requires that market makers display investors' limit orders that are priced better than the market maker's quote."[52] Some brokers accomplish this by displaying the customer's quotes on an ECN. Similar reasoning might apply to cross-trade orders.

ECNs attract more informed trades than market makers. Nevertheless, quoted, realized, and effective spreads are lower for ECNs than for market maker trades. Smaller trades receive more price improvement from market makers, but medium and larger sized

[48]Harris and Hasbrouck (1996). At the time of this study the minimum tick size was $0.125.

[49]Source: the island web site located at www.island.com. The Instinet and Posit web addresses are www.instinet.com and www.itginc.com, respectively.

[50]Barclay, Hendershott, and McCormick (2001).

[51]For example, Instinet Global Crossing began in 1986 as the first electronic crossing service, electronically matching natural buy and sell orders at fixed points in time. The end-of-day cross matches listed and OTC issues at the day's closing prices. Source: http://www.instinet.com/equity_marketplace/products/crossing.shtml.

[52]McInish, Van Ness, and Van Ness (1998).

trades receive better prices for executions on ECNs. This suggests that institutions route their orders dynamically to ECNs when depth is sufficient.[53]

Urgency of the order: Patient trading

One way to reduce transactions costs is to supply liquidity by executing orders using limit orders rather than market orders. Limit orders are described in appendix 1 and the patient-trading program of RJR Investment Management is described in appendix 3. Many limit orders are not executed so that there is a trade-off between the better price for executed orders and the loss due to unexecuted orders. Nevertheless, a study of the trades of 37 large institutions found that investment styles that required less patient execution of orders resulted in larger price impact and execution costs.[54] One study reports that the best limit order strategies for reducing transaction costs are the most frequently used strategies.[55]

Monitoring transaction costs

ERISA stimulated an interest in measuring and monitoring transaction costs. Several firms including Abel/Noser Corporation and Plexus Group provide investment managers with analysis and tools for analyzing transaction costs. Plexus has about 200 clients who collectively manage nearly $4.5 trillion dollars in equities. Plexus clients also include a small number of plan sponsors. As mentioned above, many

[53]Barclay, Hendershott, and McCormick (2001).

[54]Chan and Lakonishok (1995).

[55]Harris and Hasbrouck (1996).

investment managers also have systems for monitoring other aspect of the trade process such as the way transactions for multiple clients are mapped into specific accounts. Investment managers subject to the Investment Company Act of 1940 are inspected by the Securities and Exchange Commission.

4. Liquidity

Liquidity is the "the ability to buy and sell an asset readily without substantial impact on its price and at low cost."[56] Liquidity is also closely connected with transaction costs since liquidity determines market impact costs. And the liquidity of buy and sell orders typically differs. The Chicago Board Options Exchange changed the settlement price of many of its index contracts from the close to the open because of the open's greater liquidity. Liquidity is also a concern on international exchanges. Japanese equities are traded on the Tokyo Stock Exchange in a morning and afternoon session. Stock returns and spreads tend to be high at the beginning of trading in the morning and at the end of trading in the afternoon. Volume tends to be higher at the beginning and end of each of the two sessions.[57] The Tokyo Stock Exchange operates an elaborate system for advertising order imbalances, generating liquidity from its member firms and slowing down the trading process when liquidity imbalances occur.[58]

[56]McInish (2000, p. 34).

[57]Hamao and Hasbrouck (1995).

[58]Lehmann and Modest (1994). The Tokyo Stock Exchange limits the size of price changes between consecutive trades and also the maximum price change from the precious close. If two orders arrive on the same side of the market that would require execution with a price change larger than the permitted price variation the orders will eventually be executed after one or more indicative quotes by an exchange official.

5. Intraday patterns

In the mid-1980s finance academics studying U.S. equities discovered that over the trading day there are U-shaped patterns in returns (Figure 1), volatility of returns (Figure 3), volume (Figure 5), bid-ask spreads (Figure 8), and the ask (Figure 10). Returns are high at the beginning of the day, level off, and increase somewhat at the end of the day. A majority of the market return is concentrated in the first thirty minutes of the trading day.[59]

Similar patterns exist in non-U.S. equities (Figures 2, 4, 6, 7, 9, and 11),[60] debt (Figure 12),[61] and foreign exchange (Figure 13).[62] Liquidity is high at the beginning of trading, levels off, and increases near the end of trading, but is still lower than at the beginning of the trading day. Stocks that are traded on markets outside their home country tend to follow the intraday pattern of the market on which trading occurs.[63] The existence of these intraday patterns raises a number of issues that are relevant to cross trading.

[59]Wood, McInish, and Ord (1985), McInish and Wood (1990, 1992), and Jain and Joh (1988).

[60]See Hamao and Hasbrouck (1995) for Japanese evidence and McInish and Wood (1990) for Canadian evidence.

[61]Cyree and Winters (2001).

[62]Goodhart and Antomis (1991).

[63]Werner and Kleidon (1996).

The trading process

The existence of intraday patterns means that the decision of when to trade during the day is a strategic decision made by the trader.[64] Selection of an arbitrary time to trade or to price a trade necessarily eliminates any potential gain from superior execution strategy.

When an institutional investment manager makes a decision to buy or sell, the order is typically given to the firm's **trader** for execution. Also, when a brokerage firm's retail or institutional salesperson receives an order, that order is transmitted to the brokerage firm's trader (traders work at a trading desk) for execution. Hence, in this usage a trader is an employee of a firm charged with the task of executing a buy or sell order.

The relative importance of brokerage commissions and indirect costs have implications for the strategies portfolio managers use to minimize execution costs. In evaluating the quality of execution services provided by brokerage firms, it must be kept in mind that, despite their importance, transaction costs are not the only concern of brokerage firm clients. Another and probably more important concern is **best execution**. According to the National Association of Security Dealers:

> "In any transaction for or with a customer, a member ... shall use reasonable diligence to ascertain the best inter-dealer market for the subject security and buy or sell in such market so that the resultant price to the customer is as favorable as possible under prevailing market conditions."[65]

[64]Many portfolio managers are not knowledgeable about these intraday patterns and, consequently, submit orders to traders late in the day, missing much of the day's liquidity (Plexus Group, 2002).

[65]NASD Rules of Fair Practice, NASD Manual (CCH), Art. III, Sec. 1, ¶ 2151.03.

But best execution does not necessarily mean best price because the customer may have other priorities such as speed of execution. Also, there may be differences from one firm to another in the routing by which the order is conveyed from the customer to the trader so that market conditions may cause customers who place orders with different firms to receive different prices. In comparing the execution costs of one firm with another, an inferior execution is an additional cost that must be taken into account.[66]

Wagner and Banks (1992, p. 9) identify four factors that increase transaction costs:

- "Speed: Faster trades may demand more supply than is readily available.
- Size: Similarly, size of trade can overwhelm the marker's ability to accommodate the transaction.
- Momentum: It will be more expensive to buy a stock in a crowd of buyers than in a crowd of sellers.
- Liquidity: Thin or dull markets extract higher transaction costs than markets that are robust and vibrant."

One study reports that there is a large stochastic component to quote exposure costs relative to the deterministic intraday "U" shape. The implication is that trading strategies must assess current market conditions rather than just focusing on the time of the day.[67]

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[66] Macey and O'Hara (1996).

[67] Hasbrouck (1999).

U-shaped patterns and execution timing for cross trades

For actively managed accounts, decisions to buy or sell might be made following an assessment of individual stock or market conditions. The occurrence of certain triggers might motivate transactions for index and similar accounts. If buy and sell decisions are made throughout the day, there is a likelihood that the two sides of a potential cross will materialize at different times. If cross trades are available, managers might be tempted to alter their strategies to synchronize the various decision points to the detriment of certain plans.

End-of-day pricing

There are a number of problems associated with the choice of the end-of-the day price as a benchmark. We focus on U.S. and Canadian equities markets, but similar considerations might apply internationally and to non-equity assets. The intraday U-shaped patterns in returns and spreads indicate that the closing price of the day comes from a different distribution than other intraday prices.[68] This may be explained, at least in part, by the finding that the last trade of the day is more likely to be at the ask than at the bid in both the U.S. and Canada (figures 10 and 11).[69] [70] Also, following stock splits there are numerous small buyers and fewer small sellers, which causes closing prices to occur more frequently at the ask price and specialists' spreads to increase.[71]

[68]Wood, McInish, and Ord (1985), McInish and Wood (1992).

[69]Porter (1992).

[70]Lawrence (1989) and Porter (1992).

[71]Conrad and Conroy (1994). The increase in specialists' spreads may be due to the need for increased inventory.

Liquidity is lower at the end of the trading day than at the beginning. In a thinner market prices are more easily manipulated by the placing of small orders. The problematic nature of using closing prices as benchmarks can be seen in that on the New York Stock Exchange, orders executed at the open for small liquidity traders consistently produce better prices than market or limit orders executed later in the day. Avoiding the continuous market is so effective a strategy for small liquidity traders that it even pays to wait overnight to execute at the next day's open.[72]

ECNs account for a large share of transaction volume for many Nasdaq stocks, but their prices are often not considered in determining end-of-the-day prices. Moreover, according to the Option Clearing Corporation, "investors should also be aware that there is no single opening or closing price for securities primarily traded on the NASDAQ stock market."[73,74]

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[72]Brooks and Su (1997).

[73]Characteristics and Risks of Standardized Options (1994, p. 28).

[74]For the opening trade, the New York Stock Exchange and American Stock Exchange have a call market mechanism that batches all buy and sell orders accumulated overnight and executes them at a single price. In contrast, the Nasdaq opening prices are really the 9:29:59 a.m. inside bid and ask prices. Usually, the first trade price is at the ask if a buy execution is the first trade of the day or at the bid price if a sell execution is the first trade of the day. This is somewhat random, so there is no official Nasdaq opening trade price. Additionally, some Nasdaq market makers run their own opening batch. So, a trader who wants a batched opening price can send orders to the market makers that cross customer orders at the open on Nasdaq. It is not a market-wide mechanism like the NYSE or Amex, but orders can still get the benefit of crossing with other customers without the delays and costs associated with forcing every order through one market center. Greene and Watts (1996) find that the first trade on both Nasdaq and the NYSE account for most of the price response to overnight events.

Traders can place a market-on-close order (MOC) order on the NYSE. These orders will be crossed, but any excess of supply or demand can be executed against the prevailing bid or ask, depending on the side of the imbalance, so that MOC orders may not actually receive the last trade price of the day. All Nasdaq securities have closing prices and it is possible to submit market on close orders to market makers that are executed at these prices (not all market makers accept market on close orders, however). Nasdaq does not have a closing call auction like the New York Stock Exchange and the American Stock Exchange, but you can still execute at the Nasdaq closing price using a market maker that accepts MOC orders. MOC orders are common on Nasdaq.

6. Discussion

To begin, it may be useful to consider how a transfer price for a cross trade might be determined. Suppose that a dealer is bidding $50 for a particular security. As discussed above, this quote is for a particular quantity. A larger quantity might result is an inferior price, which is called market impact cost.[75] On the other hand the $50 quote is made not knowing anything about the potential counterparty and, hence, must cover potential asymmetric information costs. If the dealer could be certain that the trader was a liquidity trader, a higher price might be offered. This is the source of price improvement achieved in many dealer markets, in the upstairs market (for large blocks), and in ECN matching procedures. Both the quoted bid and ask are subject to these considerations.

Consider two ERISA plans with a potential cross trade for a normal size block of a liquid security. At a minimum the commission would be saved. Since both sides are liquidity traders price improvement from the market would be warranted. However, such price improvement might not be forthcoming. On the Stock Exchange of Singapore the minimum tick size for many stock is ten cents (Singapore currency). Hence, the best price that could be achieved would be a ten cent differential between the purchase and sale price. Ability to cross trade insures saving not only the commission (which is fixed and relatively high in many international markets) but also the asymmetric information costs. A cross trade at the average of the bid and ask makes sense.

[75] An order for an odd lot might also receive an inferior price. An odd lot is a quantity that is less than the usual unit of trading. An order for $500,00 face amount of bonds might be an odd lot in some markets.

If both sides of the trade are equally motivated, it makes sense to simply use the average of the bid and ask price as the cross trade price. However, in some circumstances one side of the trade may be more motivated that the other. Consider a manager of two ERISA plans, one of which needs to raise funds to pay participants and plans to sell an illiquid security. The quoted market price is considered low. In fact the price represents such a "good deal" that the ERISA manager would like to purchase the security in a second ERISA plan. The second plan may not have sufficient cash, but can sell very marketable securities to raise the needed funds. In this case, the second fund incurs extra costs to purchase the securities and is motivated to make this investment only because obtaining these securities at such a good price will enhance the return of the fund. In this case the average of the quoted bid and ask in the market would not represent a fair price for the second fund. Instead, the second fund should probably receive the entire benefit of the "good price."

Several conclusions can be made from the foregoing presentation in this section and previously.

If cross trading were permitted, the realized savings to ERISA plans would no doubt be economically substantial, amounting to many millions of dollars for all plans together.

On the other hand there is risk of potential abuse of cross trades:

1. In the absence of an actual market trade, it will be impossible to know what price each counterparty would have paid or received. There are simply too many variables involved, including the extent of market impact costs, whether

the trade would have been buyer- or seller- initiated, the motivation for the trade, and when the transaction takes place during the day.

2. Clearly some potential cross trades, such as those involving relatively illiquid bonds or international securities, require sophistication to administer.
3. There is a possibility that investment managers might advantage one plan and disadvantage another inadvertently by failing to fully understand the complexities involved in developing a cross trading plan and a cross trading price.

Hence, if the goal is to prevent potential harm, regardless of the potential benefit, clearly cross trading should not be permitted. On the other hand, if the decision as to whether to allow cross trading is related to costs versus benefits, additional factors are important and ways that potential abuse can be minimized are relevant.

Some additional factors are:

1. In terms of the impact of potential abuse, ERISA plans face other risks that are substantially larger than those posed by cross trading. Selection of inappropriate securities for a plan could lead to the loss of the entire investment. Losses due to abusive cross trading are likely to be limited to the (typically small) fraction of the value of a security represented by transaction costs.
2. The incentives for abuse of cross trades seem weak. Why would an investment manager favor one plan over another? Perhaps the investment manager is a participant in a particular plan or reports to individuals in an organization that are participants in a particular plan. The incentives for abuse

in these types of cases are no larger than numerous other decisions made in the investment process.

Also, there are ways that ERISA plans can reduce the risk arising from cross trades:

1. If permitted, limiting cross trading to large sophisticated plans such as INHAMs will retain most of the savings while limiting risk.
    a. Large plans will experience greater savings not only because they are larger, but also because cross trading opportunities increase at a faster rate than plan size.
    b. If there were an abuse of cross trading by larger plans, the aggregate size of the potential loss will also be larger, but there is no reason to believe that this would result in a greater impact on individual participants and beneficiaries because such impact is related solely to the size of each of their accounts. However, abuses by a larger plan might have a greater impact on society as a whole.
2. Clearly, an ERISA plan engaging in cross trading will need a written plan. Such a plan needs to include a description of the normal trading strategy and normal holdings of the plan, how and under what circumstances a decision to cross trade will be made, and how the cross trading price will be calculated.
3. Since large INHAMS are associated with even larger organizations, these firms would likely have the incentive and expertise to monitor

the INHAM investment managers. However, this monitoring may be weaker than for mutual funds where stockholders, potential stockholders, and independent organizations such as Morningstar monitor performance. Moreover, mutual fund inflows and outflows, which affect the compensation of the investment manager, often are determined by performance. In contrast, incentives and capabilities for individual plan participants to monitor ERISA plans are often limited. Cross trading exemption might be contingent on certification by the INHAM's parent that it is monitoring cross trading. There is also the possibility of requiring an outside entity, preferably one with trading expertise, to monitor cross trading or even to certify the cross trade price.

7. Conclusions

Cross-trades in which an investment manager exchanges assets between two accounts without going through a public market are prohibited by ERISA unless consummated pursuant to an exemption. There have been numerous requests for exemptions motivated by a desire to reduce transaction costs, which typically range from one to four percent.

Insights into the potential savings due to cross trades can be gleaned from examination of mutual funds, which are permitted to cross trade under Rule 17a-7. Some cross trading opportunities arise due to movements of funds from one fund to another. Disagreements among managers about the desirability of holding given securities give

rise to many cross trading opportunities. Conversations with mutual fund managers reveal that savings due to cross trades are economically substantial and amount to millions of dollars for some funds.

The academic literature dealing with the way financial markets are organized and how this organization affects prices, trading costs, and other market characteristics offers insights relevant to cross-trading. A number of regularities in intraday prices, including U-shaped patterns in returns and volume, have been discovered. There are other systematic features of trading such as the tendency of the last trade of the day to be on the ask. Collectively, these features of trading add to the possibility that cross-trading will disadvantage one of the counterparties. The cost savings from allowing cross trades must be balanced with the potential harm from disadvantaging one party.

Appendix 1

Types of orders and the supply of liquidity

A **market order** is an order to be executed immediately at the best possible price. Traders placing market orders are demanding immediacy. In some markets under some circumstances, two market orders may cross. But under most circumstances for a trade to occur there must be a counterparty willing to supply immediacy. Immediacy can be supplied by dealers who stand ready to buy and sell (Nasdaq and foreign exchange dealers), by market participants designated by an exchange (NYSE specialists), by a crowd of traders (Chicago Mercantile Exchange and the Chicago Board of Trade floor traders), or by other traders through a limit order book. A **limit order** is an order to be executed at a specified price or better (a better price is a lower price if buying and a higher price if selling). A limit order with a specified price that allows for immediate execution is called a **marketable limit order**. A limit order that cannot be executed immediately must be held for later execution. The accumulated unexecuted limit orders are called the **limit order book**. In market with a limit order book, individuals and institutions that prefer to trade only when they can respond to a trade from the other side rather than initiating a trade can also supply immediacy. These market participants are referred to as patient traders. The patient-trading program of RJR Management is an excellent illustration of this approach (see appendix 3).[76]

Some markets operate without limit order books (such as the foreign exchange market and Nasdaq[77]). Limit order books may coexist along with other providers of

[76]Bodurtha and Quinn (1989).

[77]Nasdaq dealers are required to display customer limit orders, but these are not collected in a single location to form a central or consolidated limit order book.

immediacy such as specialists on the New York Stock Exchange. The goal of the specialists and dealers is to make a profit from supplying immediacy.[78] On computer-based exchanges such as the Australian Stock Exchange the limit order book is typically the sole source of immediacy. Orders executed on computer-based exchanges are always between one party who placed a marketable limit order and another party who had an order standing in the limit order book. Price improvement is not possible on computer-based exchanges.

[78]On the New York Stock Exchange the specialist must stand ready to act as the counterparty to a market order if no other counterparty is available. On Nasdaq each stock must have a minimum of two dealers who are willing to act as counterparties to market orders to buy or sell.

Appendix 2

The SEC's monitoring of investment managers

The SEC conducts inspections of investment companies subject to the Investment Company Act of 1940. The goal of these inspections is "to ensure that the advisor is in compliance with the securities laws and that the business activities are otherwise consistent with the information described in the Form ADV, which describes how the manager manages money. The inspector is interested in seeing if the actual behavior is in line with the expectations. SEC inspectors usually look at four things:

- "What are the compliance procedures? Are they written down? How are they enforced?
- What are the brokerage and soft-dollar practices? Can the manager prove that they actually represent best execution?
- What is the procedure relating to account allocations? Is this procedure fair to all of the accounts?
- How do the wrap-fee programs[79] work?"[80]

[79]Wrap programs bundle a number of investment services together for one fee. The fee is expressed as a percentage of the value of the assets in the account. One advantage is that wrap-fee accounts mitigate conflicts between providing investment advice and charging commissions for active trading.

[80]Wagner (2000).

Appendix 3

RJR Investment Management patient trading strategy

When RJR Investment Management established a self-managed 40 million USD small capitalization investment fund, the projected costs of acquiring the 250 stocks sought for the portfolio were 2.5% to 3.5% of asset value.[81] Instead of buying these shares aggressively using market orders, the company developed a plan to buy the portfolio using limit orders as much as possible. RJR used the Perold (1988) implementation shortfall approach to evaluate the cost of acquiring the portfolio. Following this methodology, RJR compared the performance of two portfolios. The first comprised the stocks actually acquired at their actual acquisition prices and times. The second comprised a hypothetical portfolio using prices that would have been paid if the stocks had been purchased immediately. The difference between the two is the gain or loss as a result of the trading decisions. The performance of the actual portfolio was adjusted to reflect market movements comparable to those of the paper portfolio. Comparing the actual cost with the expected cost of 2.5% to 3.5%, the patient program saved 0.36% to 1.37% percentage points of the overall transaction costs.

[81] Bodurtha and Quinn (1989).

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Table 1. Explicit and implicit trading costs for equities, November 1997. The trading costs presented in this table are obtained from Plexus Group, which supplies transaction cost analysis to clients including domestic managers, global managers, sponsors, brokers, and exchanges. Plexus Group analyzes transaction costs for over 125 clients, who manage over $1.5 trillion in assets. The web site for Plexus group is http://www.plexusgroup.com/. **Commissions** are the fees charged by a brokerage firm for executing an order. **Market impact costs** arise from a change in market price resulting from the execution of an order. **Market-timing or delay costs** are incurred when the stock's price moves in response to factors unrelated to the particular transaction before the transaction can be executed. Rushing a trade to reduce market-timing costs may only result in higher market impact costs. Market-timing costs are a cost of executing a trade. If the trader fails to execute a desired trade, the trade may incur **opportunity costs**, which is the loss in profits from trades that are missed or not executed due to changes in market conditions before the execution can be completed. If market conditions change before the order can be executed a trade that would have been profitable if executed at the price prevailing at the time of the decision to trade may have to be abandoned. Transaction costs, especially implicit costs, are often difficult to measure.

	Overall	Large cap (Market cap over 1 billion USD +)	Small cap (Market cap less than 1 billion USD)
		Average Cost (%)	
Commission	0.15	0.12	0.22
Market Impact (including spread)	0.23	0.20	0.33
Total Brokerage Cost: Use These Numbers When Evaluating Brokers	**0.38**	**0.32**	**0.55**
Delay	0.60	0.53	1.72
Total Execution Cost: Use These Numbers When Evaluating Completed Trades	**0.98**	**0.85**	**2.27**
Opportunity Costs of Missed Trades (Foregone Price Movement On **10%** Of Trades Not Completed)	.18	.16	2.22
Total Implementation Cost: Use These Numbers When Planning Trading Strategy	**1.16**	**1.01**	**4.49**

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Table 2. Comparison of trading costs for top seven equity cash markets and futures markets, 1997 (bps, except as noted)

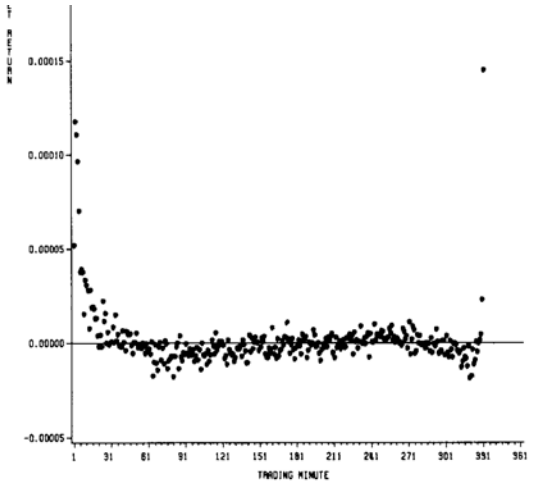
	United States	France	Canada	Germany	Japan	Switzerland	United Kingdom	Average
Panel A: Equity cash market								
One-time costs								
Commissions	12.5	26.5	23.0	22.5	26.5	27.0	15.8	
Taxes	0.0	0.0	0.0	2.0	21.0	15.8	50.0	
Bid-ask spread(a)	27.5	38.5	41.3	48.0	67.0	55.5	68.0	
Increased market spread (b)	19.5	27.5	27.5	33.0	22.5	36.3	46.0	
FX charge	0.0	5.3	5.0	3.5	7.0	4.3	8.8	
Total	59.5	97.8	96.8	112.0	144.0	138.8	187.87	99.0
Volatility of one-time costs	16.8	26.9	23.4	30.3	29.4	26.8	30.9	
Recurring costs								
Transaction costs (c)	53.3	86.3	85.5	99.1	127.6	125.1	170.4	88.5
Turnover rate (d)	x37.8%	x38.0%	x40.8%	x40.5%	x43.8%	x45.3%	x38.5%	x39.5%
Total	20.1	32.8	34.8	40.1	55.8	56.6	65.6	35.0
Maintenance costs								
Custodial costs	0.7	4.8	3.4	3.4	3.3	5.3	3.2	
Stock loan revenue	-7.5	-27.0	-7.5	-19.5	-12.0	-9.0	-7.5	
Total	-6.8	-22.2	-4.1	-16.1	-8.7	-3.7	-4.3	-7.1
Total one-year cost	72.8	108.3	127.5	136.1	191.1	191.7	249.1	128.0
Cost for half of portfolio	57.4	78.7	108.6	107.8	154.4	159.1	197.4	
Cost for double portfolio	107.2	141.5	158.2	178.0	248.6	249.9	307.0	
Panel B: Futures market								
One-time costs								
Commissions	12.5	26.5	23.0	22.5	26.5	27.0	15.8	
Taxes	0.0	0.0	0.0	2.0	21.0	15.8	50.0	
Bid-ask spread(a)	27.5	38.5	41.3	48.0	67.0	55.5	68.0	
Increased market spread (b)	19.5	27.5	27.5	33.0	22.5	36.3	46.0	
FX charge	0.0	5.3	5.0	3.5	7.0	4.3	8.8	
Total	59.5	97.8	96.8	112.0	144.0	138.8	187.87	99.0

(a) Bid-ask spread is added one-half each way.
(b) Round-trip cost incremental to the bid-ask spread. This cost is the expected cash market impact of buying/selling a portfolio for a given size.
(c) Recurring transaction costs are commissions, taxes, bid-ask spread, and incremental impact.
(d) Turnover represents a combined average for active and passive strategies.

Note: The table is reported in bps or basis points, which can be converted into percentage points by dividing by 100.

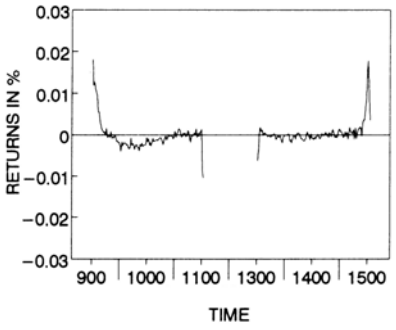
Source: Harris, T. Britton, and Charissa H. Smith, 1999, Proceedings of the Conference on Best Execution of the Association for Investment Management and Research.

Figure 1. Mean return for NYSE stocks by minute of the trading day.



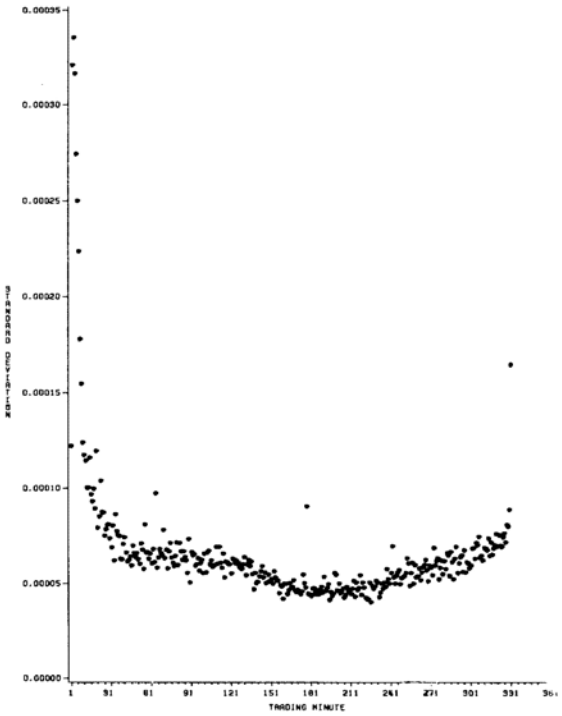
Source: Wood, McInish, and Ord (1985, p. 726).

Figure 2. Mean returns for Tokyo Stock Exchange price index by time of day.



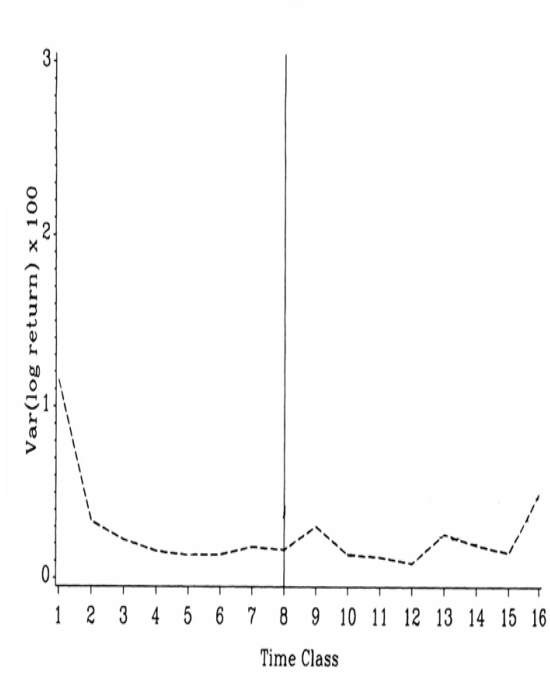
Source: Chang, Toru, Rhee, and Takana, (1993, p. 73).

Figure 3. Volatility (standard deviation)of market returns for NYSE by minute of the trading day.



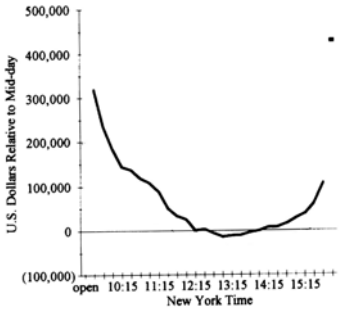
Source: Wood, McInish, and Ord (1985, p. 727).

Figure 4. Volatility of return for Japan Airlines on the Tokyo Stock Exchange by time of day.



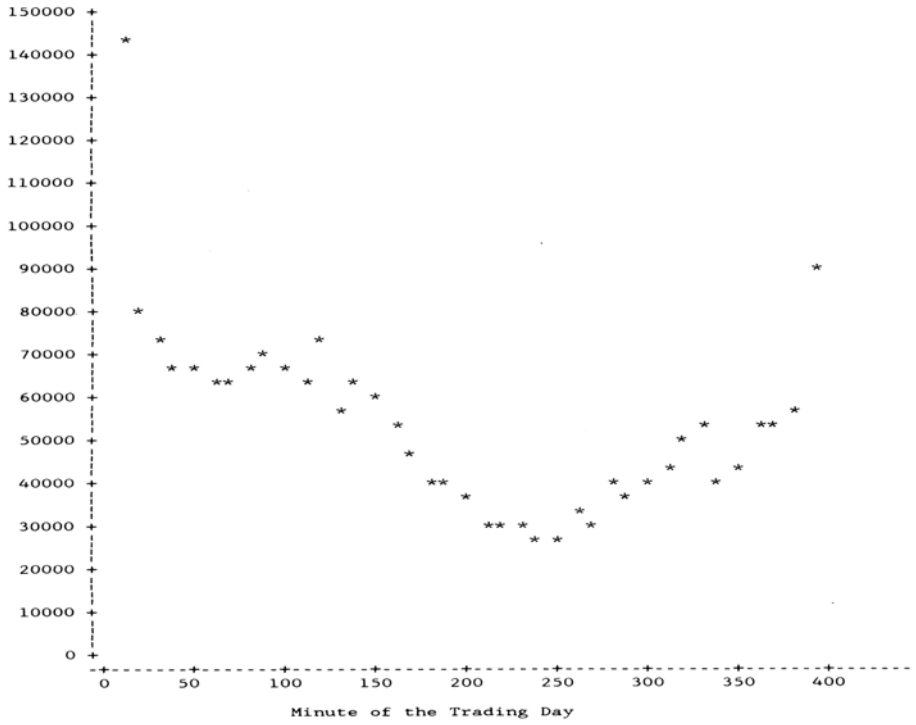
Source: Hamao, and Hasbrouck, (1995, p. 862).

Figure 5. Mean number of shares traded on the NYSE.



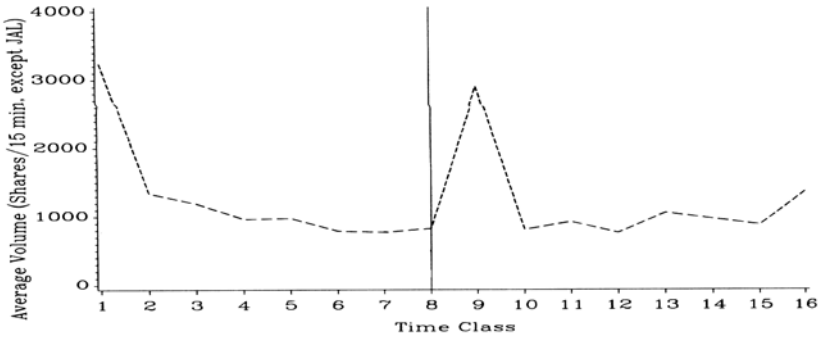
Source: Werner and Kleidon (1996, p. 646).

Figure 6. Mean number of shares traded on the Toronto Stock Exchange by time of day.



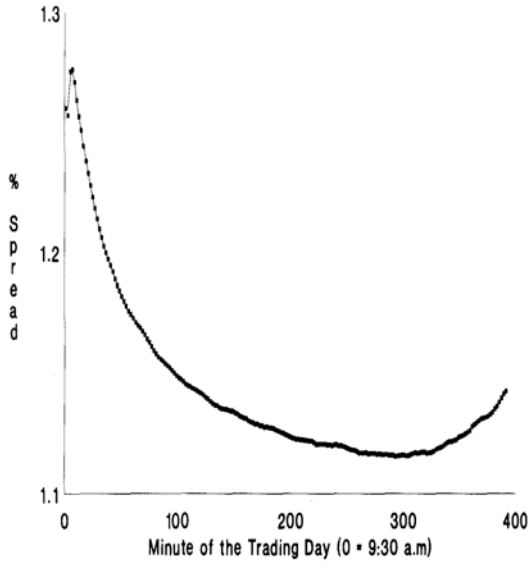
Source: McInish and Wood (1990a, p. 450).

Figure 7. Intraday trading volume for Japan Airlines on the Tokyo Stock Exchange.



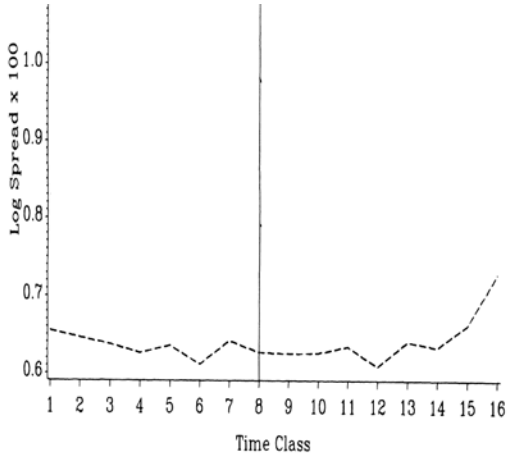
Source: Hamao and Hasbrouck (1995, p.864).

Figure 8. Mean bid-ask spread by time of day for the NYSE.



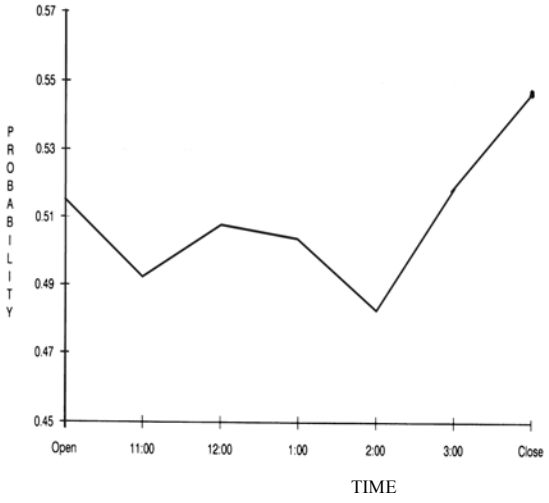
Source: McInish and Wood, (1992, p. 760).

Figure 9. Mean bid-ask spread for Japan Airlines on the Tokyo Stock Exchange.



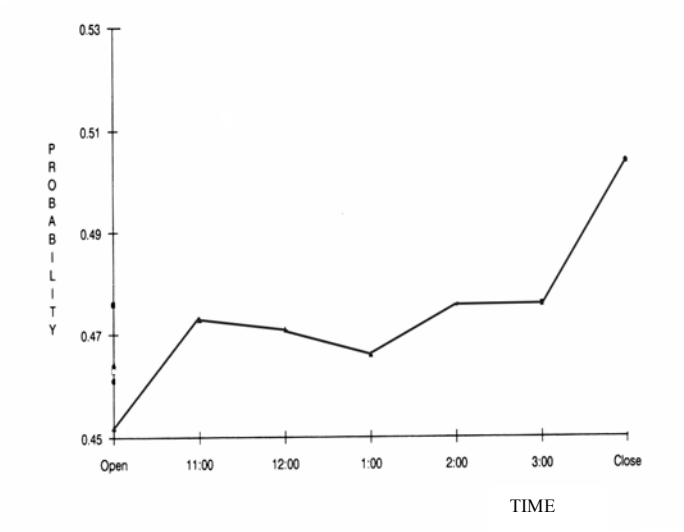
Source: Hamao and Hasbrouck, (1995, p. 863).

Figure 10. Probability of a trade at the ask for U.S. stocks.



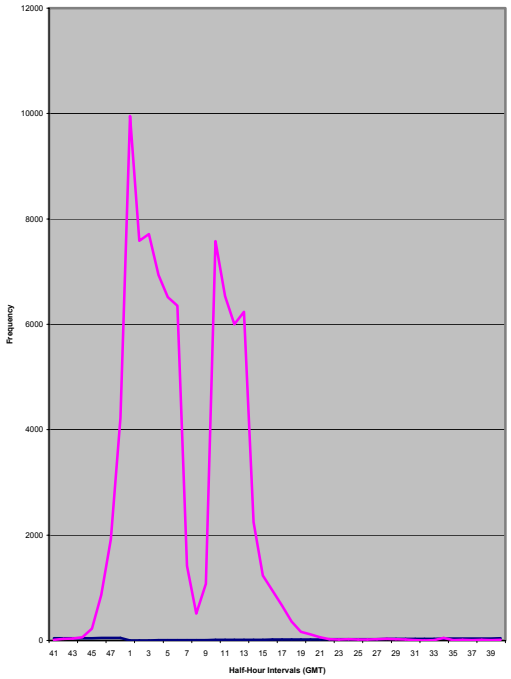
Source: Porter (1992, p. 222).

Figure 11. Probability of a trade at the ask for Canadian stocks.



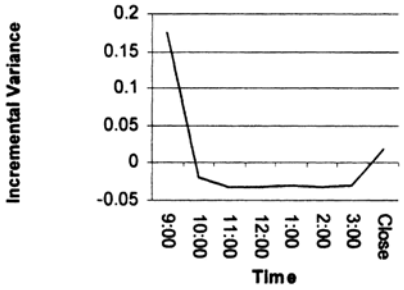
Source: Porter (1992, p. 221).

Figure 12. Frequency of Japanese yen/U.S. dollar quotes in Tokyo, by half-hour intervals (GMT).



Source: Based on McInish (2000, p. 277).

Figure 13. Volatility of Federal Funds rate.



Source: Cyree and Winters (2001, p. 552).