CHAPTER 5

MANY A SLIP: TRADING, EXECUTION AND TAXES

As investors consider different investment strategies, they have to keep two important issues in mind – trading costs and taxes. It costs to trade, and some strategies create larger trading costs than others. The cost of trading clearly imposes a drag on the performance of all investors and turns otherwise winning portfolios into losing portfolios. As we debate the extent of these costs, we need to get a measure of what the costs are, how they vary across investment strategies and how investors can minimize these costs. In this chapter, we will take an expansive view of trading costs and argue that the brokerage costs (which is what many investors consider as the only trading cost) is only one component (and often the smallest) of trading costs. We will also look at the trading costs associated with holding real assets (such as real estate) and non-traded investments (like equity in a private business) We will also discuss the trade off between trading costs and trading speed and how to devise ways of keeping the trading costs low.

There is a second equally important element in investment success. Investors get to take home after-tax returns and not before tax returns. Thus, strategies that perform exceptionally well before taxes may be money losers if considered after tax. Taxes are particularly difficult to deal with, partly because they are investor and investment specific (different investors have different tax rates) and partly because the tax code itself changes over time, often in unpredictable ways. We will consider the evidence that has accumulated that mutual funds have done their investors a disservice by not considering taxes and that the after-tax returns lag pre-tax returns considerably. We will also look at ways in which we can adjust our investment strategies to keep our tax liabilities low.

The Trading Cost Drag

While we debate what constitutes trading costs and how to measure them, there is a fairly simple way in which we can estimate, at the minimum, how much trading costs affect the returns of the average portfolio manager. Active money managers trade because they believe that there is profit in trading, and the return to any active money manager has three ingredients to it:

Return on active money manager = Expected $\text{Return}_{\text{Risk}}$ + Return from active trading - Trading costs

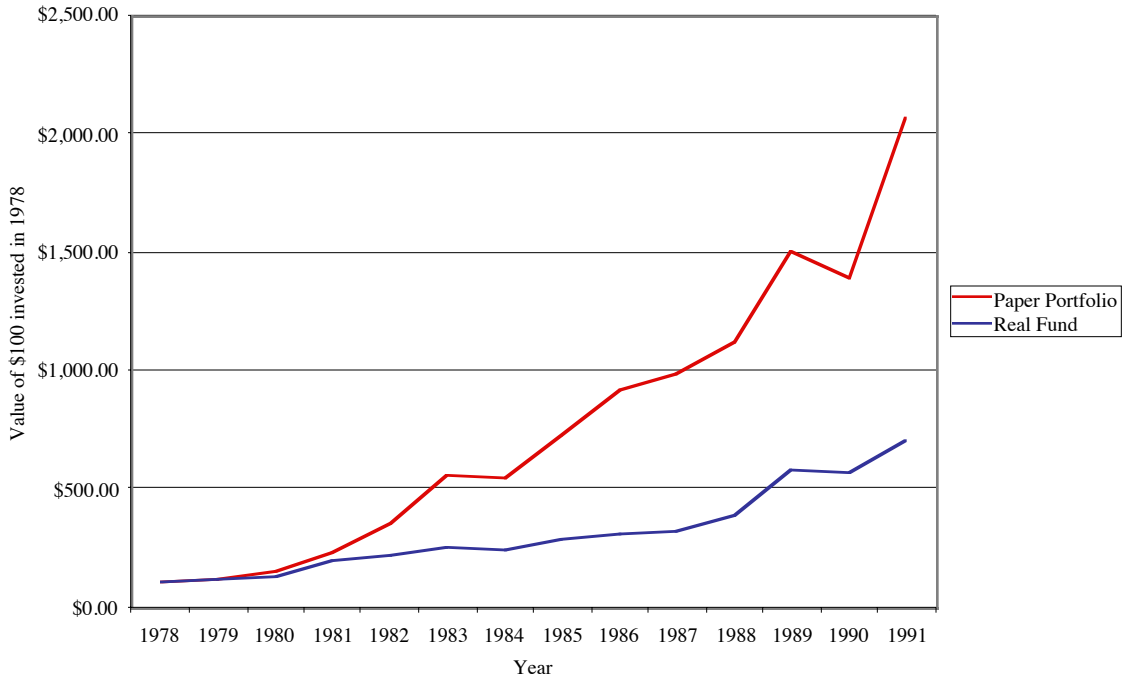
Looking across all active money managers, we can reasonably assume that the average expected return has to be equal to the return on the market index. Thus, subtracting the average return made by active money managers from the return on the index should give us a measure of the payoff to active money management:

Average Return$_{\text{Active Money Managers}}$ - Return on Index = Return from Active Trading - Trading Costs

Here the evidence becomes quite depressing. The average active money manager has underperformed the index in the last decade by about 1%. If we take the view that active trading adds no excess return, on average, the trading costs, at the minimum, should be 1% of the portfolio on an annual basis. If we take the view that active trading does add to the returns, the trading costs will be greater than 1% of the portfolio on an annual basis.

There are also fairly specific examples of real portfolios that have been constructed to replicate hypothetical portfolios, where the magnitude of the trading costs are illustrated starkly. For decades, Value Line has offered advice to individual investors on what stocks to buy and which ones to avoid, and ranked stocks from 1 to 5 based upon their desirability as investments. Studies by academics and practitioners found that Value Line rankings seemed to correlate with actual returns. In 1979, Value Line decided to create a mutual fund that would invest in the stocks that it was recommending to its readers. In figure 5.1, we consider the difference in returns between 1979 and 1991 between the fund that Value Line ran and the paper portfolio that Value Line has used to compute the returns that its stock picks would have had.

Figure 5.1: Value Line - Paper Portfolio versus Real Fund



The paper portfolio had an annual return of 26.2%, whereas the Value Line fund had a return of 16.1%. While part of the difference can be attributed to Value Line waiting until its

subscribers had a chance to trade, a significant portion of the difference can be explained by the costs of trading.

Looking at the evidence, there are a couple of conclusions that we would draw. The first is that money managers either underestimate trading costs, over estimate the returns to active trading or both. The second is that trading costs are a critical ingredient to any investment strategy, and can make the difference between a successful strategy and an unsuccessful one.

The Components of Trading Costs: Traded Financial Assets

There are some investors who undoubtedly operate under the misconception that the only cost of trading stocks is the brokerage commission that they pay when they buy or sell assets. While this might be the only cost that they pay explicitly, there are other costs that they incur in the course of trading that generally dwarf the commission cost. When trading any asset, they are three other ingredients that go into the trading costs. The first is the spread between the price at which you can buy an asset (the ask price) and the price at which you can sell the same asset at the same point in time (the bid price). The second is the price impact that an investor can create by trading on an asset, pushing the price up when buying the asset and pushing it down while selling. The third cost, which was first proposed by Jack Treynor in his article[1] on transactions costs, is the opportunity cost associated with waiting to trade. While being a patient trader may reduce the first two components of trading cost, the waiting can cost profits both on trades that are made and in terms of trades that would have been profitable if made instantaneously but which became unprofitable as a result of the waiting. It is the sum of these costs that makes up the trading cost on an investment strategy.

The Bid-Ask Spread

There is a difference between that a buyer will pay and the seller will receive, at the same point in time for the same asset, in almost every traded asset market. The bid-ask spread refers to this difference. In the section that follows, we will examine why this difference exists, how large it is as a cost, the determinants of its magnitude and its effects on returns in different investment strategies.

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[1] This was proposed in his article titled "What does it take to win the trading game?", published in the Financial Analysts Journal, January-February 1981.

Why is there a bid-ask spread?

In most markets, there is a dealer or market maker who sets the bid-ask spread, and there are three types of costs that the dealer faces that the spread is designed to cover. The first is the risk and the cost of holding inventory; the second is the cost of processing orders and the final cost is the cost of trading with more informed investors. The spread has to be large enough to cover these costs and yield a reasonable profit to the market maker on his or her investment in the profession.

1. The Inventory Rationale

Consider a market maker or a specialist on the floor of the exchange who has to quote bid prices and ask prices, at which he is obligated to execute buy and sell orders from investors[2]. These investors, themselves, could be trading because of information they have received (informed traders), for liquidity (liquidity traders) or based upon their belief that an asset is under or over valued (value traders). In such a market, if the market makers set the bid price too high, they will accumulate an inventory of the stock. If market makers set the ask price too low, they will find themselves with a large short position in the stock. In either case, there is a cost to the market makers that they will attempt to recover by increasing the spread between the bid and ask prices.

Market makers also operate with inventory constraints, some of which are externally imposed (by the exchanges or regulatory agencies) and some of which are internally imposed (due to capital limitations and risk). As the market makers' inventory positions deviate from their optimal positions, they bear a cost and will try to adjust the bid and ask prices to get back to their preferred position.

2. The Processing Cost Argument

Since market makers incur a processing cost with the paperwork and fees associated with orders, the bid-ask spread has to cover, at the minimum, these costs. While these costs are likely to be very small for large orders of stocks traded on the exchanges, they become larger for small orders of stocks that might be traded only through a dealership market. Furthermore, since a large proportion of this cost is fixed, these costs as a percentage of the price will generally be higher for low-priced stocks than for high-priced stocks.

Technology clearly has reduced the processing cost associated with trades as computerized systems take over from traditional record keepers. These cost reductions

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[2] This model was set up by Amihud and Mendelson to explain why bid-ask spreads are different for different firms.

should be greatest for stocks where the bulk of the trades are small trades - small stocks held by individual rather than institutional investors.

3. The Adverse Selection Problem

The adverse selection problem arises from the different motives investors have for trading on an asset - liquidity, information and views on valuation. Since investors do not announce their reasons for trading at the time of the trade, the market maker always runs the risk of trading against more informed investors. Since market makers can expect to lose on such trades, they have to charge an average spread that is large enough to compensate for such losses. This theory would suggest that spreads will increase with the proportion of informed traders in an asset market, the "differential" information possessed, on average, by these traders and uncertainty about future information on the asset.

The Magnitude of the Bid-Ask Spread

The New York Stock Exchange reported[3] that the average bid-ask spread across all NYSE stocks in 1996 was $0.23, which seems trivial especially when one considers the fact that the average price of a NYSE stock is between $ 40 and $ 50. This average, however, obscures the large differences in the cost as a percentage of the price across stocks, based upon capitalization, stock price level and trading volume. A study[4] by Thomas Loeb in 1983, for instance, reported the spread as a percentage of the stock price for companies as a function of their marker capitalization for small orders. These results are summarized in Figure 5.2:

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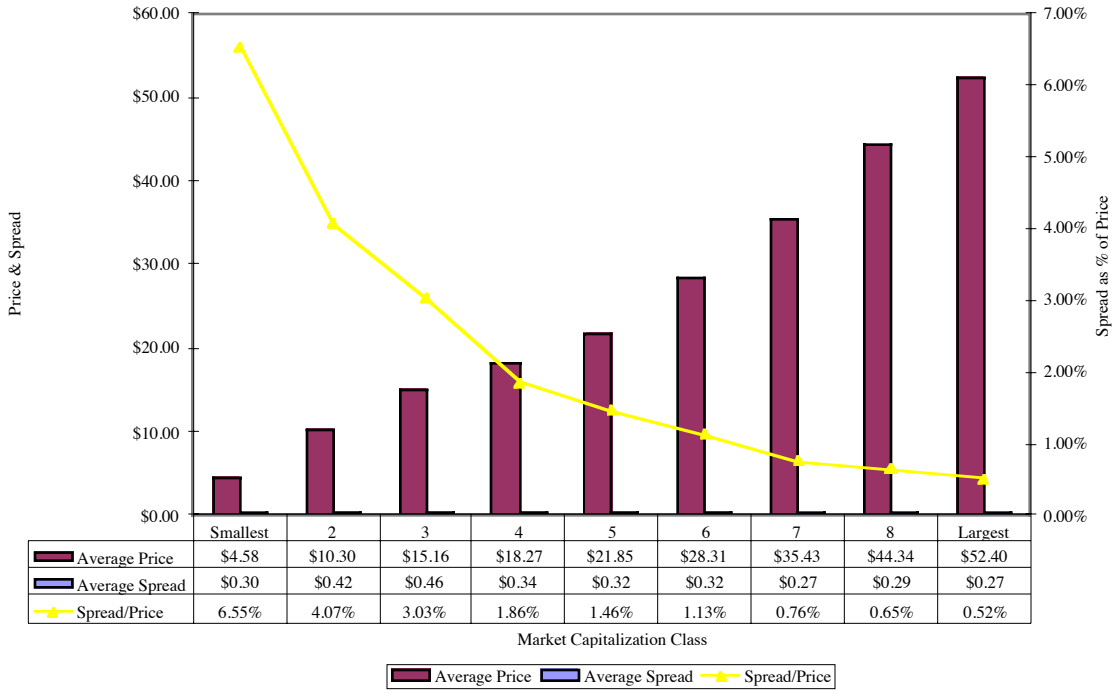
[3] See 1996 NYSE Fact Book for a listing of the average spread across all NYSE stocks, by month.

[4] See "Trading Costs: The Critical Link Between Investment Information and Results" in the Financial Analysts Journal, May/June 1983.

Figure 5.2: Prices and Spreads by Market Cap



	Smallest	2	3	4	5	6	7	8	Largest
Average Price	$4.58	$10.30	$15.16	$18.27	$21.85	$28.31	$35.43	$44.34	$52.40
Average Spread	$0.30	$0.42	$0.46	$0.34	$0.32	$0.32	$0.27	$0.29	$0.27
Spread/Price	6.55%	4.07%	3.03%	1.86%	1.46%	1.13%	0.76%	0.65%	0.52%

While the dollar spread is not that different across market capitalization classes, the smallest companies also tend to have lower priced stocks. Consequently, the spread is as high as 6.55% of the price for small capitalization stocks and as low as 0.52% of the price for large capitalization companies. Another study by Huang and Stoll found that the stocks in the top 20% in terms of trading volume had an average spread of only 0.62% of the price while the stocks in the bottom 20% had a spread of 2.06%. There are also large differences in bid-ask spreads across different exchanges in the United States. Looking at only NASDAQ stocks, researchers found[5] that the average was almost 6% of the price in 1992, and much higher for low-priced stocks on the exchange. Some of the difference can be attributed to the fact that NASDAQ stocks are generally much smaller and riskier than stocks listed on the NYSE or AMEX.

Stocks with highest Bid-ask Spreads: Take a look at the 50 stocks with the highest bid-ask spreads.

While these studies looked at traded U.S. equities, there are bid-ask spreads in other markets as well. While no single comprehensive study of all these spreads exists, the following conclusions seem warranted:

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[5] See "Trading Costs and the Trading Systems for NASDAQ stocks" by M. Kothare and P.A. Laux in Financial Analysts Journal (March/April 1995)

1. The spreads in U.S. government securities are much lower than the spreads on traded stocks in the United States. For instance, the typical bid-ask spread on a Treasury bill is less than 0.1% of the price.
2. The spreads on corporate bonds tend to be larger than the spreads on government bonds, with safer (higher rated) and more liquid corporate bonds having lower spreads than riskier (lower rated) and less liquid corporate bonds.
3. The spreads in non-U.S. equity markets are generally much higher than the spreads on U.S. markets, reflecting the lower liquidity in those markets and the smaller market capitalization of the traded firms.
4. While the spreads in the traded commodity markets are similar to those in the financial asset markets, the spreads in other real asset markets tend to be much larger.

The Determinants of the Bid-Ask Spread

A number of studies have looked at the variables that determine (or, at the very least, correlate with) the bid-ask spread. Studies[6] find that spreads as a percentage of the price are greater for low-priced stocks with higher volatility and lower trading volume; spreads also seem to increase as the number of market makers or dealers in the stock decreases. Each of these findings is consistent with the theory on the bid-ask spread. The negative correlation with price level can be explained by the higher processing cost as a percentage of the price. Higher volume reduces the need for market makers to maintain inventory and also allows them to turn over their inventory rapidly, resulting in lower inventory costs. The higher volatility leads to higher bid-ask spreads partly because the adverse selection problem is greater for more volatile stocks; there will generally be more informed traders, a greater "information differential" and greater uncertainty about future information on these stocks. It is also worth noting that variables such as price level, volatility and trading volume are not only correlated with each other, but are also correlated with other variables such as firm size.

The study quoted in the previous section, by Kothare and Laux, that looked at average spreads on the NASDAQ also looked at differences in bid-ask spreads across stocks on the NASDAQ. In addition to noting similar correlations between the bid-ask spreads, price level and trading volume, they uncovered an interesting new variable. They

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[6] See "Competition and the Pricing of Dealer Service in the Over-the-Counter Market" by S.Tinic and R. West in Journal of Financial and Quantitative Analysis (June 1972), "The Pricing of Security Dealer Services: An Empirical Analysis of NASDAQ stocks" by H. Stoll in Journal of Finance (November 1978) and "Liquidity Effects of the Introduction of the S&P 500 Futures Contract on the Underlying Stocks" in Journal of Business (April 1993).

found that stocks where institutional activity increased significantly had the biggest increase in bid-ask spreads. While some of this can be attributed to the concurrent increase in volatility in these stocks, it might also reflect the perception on the part of market makers that institutional investors tend to be informed investors with more or better information. Note, though, that institutional investors also increase liquidity which should reduce the order processing cost component of the bid-ask spread, and in some cases the net effect can lead to a lower spread.[7]

Can firms affect the bid-ask spreads on their stocks? There is some evidence that they can by improving the quality of information that they disclose the financial markets, thus reducing the advantages that informed traders may have relative to the rest of the market. In 2001, Heflin. Shaw and Wild looked at 221 firms and examine the relationship between information disclosure quality – they measure this using disclosure quality scores assigned by the Corporate Information Committee of the Financial Analysts Federation – and the bid-ask spread. They find that bid-ask spreads decrease as information quality increases.

While most of the studies quoted above have looked at differences in spreads across stocks, Hasbrouck investigated why spreads change for the same stock at different points in time. He notes that large trades cause spreads to widen, relative to small trades, and hypothesizes that this is because large trades are more likely to contain information.

Market Microstructure and Bid-Ask Spreads

Does the market in which a stock trades matter, when it comes to how big the bid-ask spread should be? Studies indicate that bid-ask spreads have historically been much higher on the NASDAQ than on the New York Stock Exchange, even after controlling for differences in the variables mentioned above – trading volume and price level. In fact, the bid-ask spreads of stocks drop when they switch from the NASDAQ to the NYSE.[8]

A 1994 study by Christie and Schultz provided one explanation for the phenomenon. They found that there were a disproportionately large number of 1/4 quotes and far too few 1/8 quotes.[9] They argued that dealers on the NASDAQ were colluding to set quotes too high and that investors were therefore paying the price with larger bid-ask

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[7] Dey and Radhakrishna (2001) provide some evidence of this for stocks listed on the NYSE.

[8] See Barclay, M. "Bid-Ask Spreads and the Avoidance of Odd-Eighth Quotes on Nasdaq: An Examination of Exchange Listings." *Journal of Financial Economics*, 45 (1997), 35-60.

[9] If 1/8 and 1/4 quotes are equally likely to show up, roughly half of all quotes should end with an eighth (1/8, 3/8, 5/8 or 7/8) and half should end with a quarter (1/4, 1/2, 3/4).

spreads. This triggered an investigation by the Securities and Exchange Commission (SEC) which agreed that dealers were indeed engaged in anti-competitive behavior. Eventually, the exchange settled the lawsuit for more than a billion dollars. An alternative explanation is that the higher spreads on the NASDAQ, relative to the NYSE, can be explained by structural differences across the markets. Consider, for example, how limit orders are handled on the two exchanges. The specialists on the floor of the New York Stock Exchange are required to reflect in their bid-ask spread the limit prices, if they are better than their own quotes, and this has the effect of reducing the bid-ask spread. On the NASDAQ, limit orders do not affect the bid-ask quotes, and are executed only if prices move against the limit. You would expect larger bid-ask spreads as a consequence.[10]

In 2000, the New York Stock Exchange abandoned its historical practice of quoting prices in fractions (1/8, 1/4… etc) and shifted to decimal prices. Since you can get finer gradations of prices in decimals, it was hypothesized that this should lead to lower bid-ask spreads. Studies since the shift indicate that there has been a decline in spreads on the smaller, less liquid stocks but no discernible impact on the more liquid listings.

Role in Investment Strategies

Looking at the evidence, it is clear that bid-ask spreads will affect the returns from investment strategies, but that the effect will vary, depending upon the strategy. While a strategy of buying under valued companies in the S&P 500 and holding for the long term should not be affected very much by the bid-ask spread, a strategy of buying small over-the-counter stocks or emerging market stocks after information releases, and trading frequently, might lose its allure, when bid-ask spreads are factored into the returns.

To show the effect of the bid-ask spread on returns, consider the strategy of buying "losers". Researchers present evidence[11] that a strategy of buying the stocks that have the most negative returns over the previous year and holding for a five-year period earns significant positive returns. A follow-up study, however, noted that many of these "losers" were low-priced stocks, and that putting in a constraint that the prices be greater than $10 on this strategy resulted in a significant drop in the excess returns. Since bid-ask spreads tend to be largest for low-priced stocks, it is an open question as to whether an investment

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[10] Chung, Van Ness and Van Ness (2001) tested both explanations. While they find that the treatment of limit orders does lower the bid-ask spread on the NYSE, they conclude that collusion among dealers still leads to higher spreads on the NASDAQ.

[11] See "Does the Stock Market Overreact?" by F.M DeBondt and R. Thaler in Journal of Finance (July 1985)

strategy of buying losers will yield excess returns in practice. In fact, similar concerns should exist about any strategy that recommends investing in low-priced, illiquid and small-cap stocks, or in asset classes that have high volatility and low liquidity.

The Price Impact

Most investors assume that trading costs become smaller as portfolios become larger. While this is true for brokerage commissions, it is not always the case for the other components of trading costs. There is one component where larger investors bear a more substantial cost than do smaller investors and that is in the impact that their trading has on prices. If the basic idea behind successful investing is to buy low and sell high, pushing the price up as you buy and then down as you sell reduces the profits from investing.

Why is there a price impact?

There are two reasons for the price impact, when investors trade. The first is that markets are not completely liquid. A large trade can create an imbalance between buy and sell orders, and the only way in which this imbalance can be resolved is with a price change. This price change that arises from lack of liquidity, will generally be temporary and will be reversed as liquidity returns to the market.

The second reason for the price impact is informational. A large trade attracts the attention of other investors in that market because if might be motivated by new information that the trader possesses. Notwithstanding claims to the contrary, investors usually assume, with good reason, that an investor buying a large block is buying in advance of good news and that an investor selling a large block has come into possession of some bad news about the company. This price effect will generally not be temporary, especially when we look at a large number of stocks where such large trades are made. While investors are likely to be wrong a fair proportion of the time on the informational value of large block trades, there is reason to believe that they will be right almost as often.

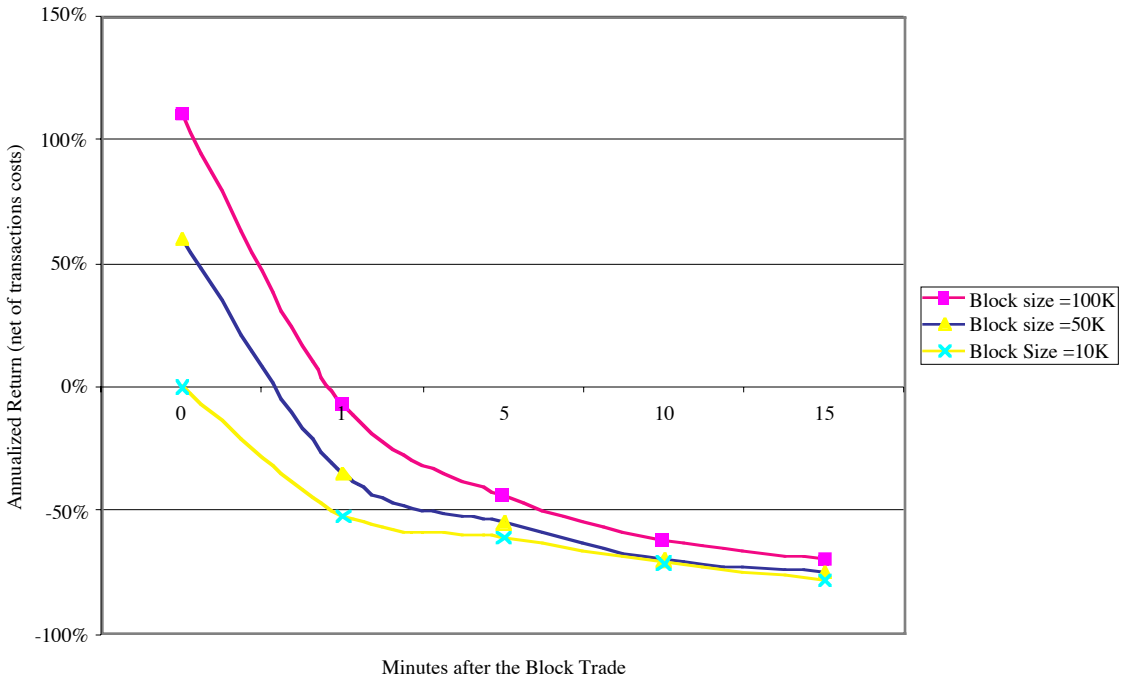
How large is the price impact?

There is conflicting evidence on how much of an impact large trades have on stock prices. On the one hand, studies of block trades on the exchange floor seem to suggest that markets are liquid and that the price impact of trading is small and is reversed quickly. These studies, however, have generally looked at heavily traded stocks at the New York Stock exchange. On the other hand, there are others who argue that the price impact is likely to be large, especially for smaller and less liquid stocks.

Studies of the price reaction to large block trades on the floor of the exchange conclude that prices adjust within a few minutes to such trades. An early study examined the

speed of the price reaction by looking at the returns an investor could make by buying stock right around the block trade and selling later[12]. They estimated the returns after transactions as a function of how many minutes the acquisition took place after the block trade, and found that only trades made within a few minutes of the block trade had a chance of making excess returns. (See Figure 5.3) Put another way, prices adjusted to the liquidity effects of the block trade within five minutes of the block. While this may be understated because of the fact that these were block trades on large stocks on the NYSE, it is still fairly strong evidence of the capacity of markets to adjust quickly to imbalances between demand and supply.

Figure 5.3: Annualized Returns from buying after block trades



This study suffers from a sampling bias - it looks at large block trades in liquid stocks on the exchange floor. Studies that look at smaller, less liquid stocks find that the price impact tends to be larger and the adjustment back to the correct price is slower than it is for the more liquid stocks.[13] There are other interesting facts about block trades that have emerged from other studies. First, while stock prices go up on block buys and go down on block sell, they are far more likely to bounce back after sell trades. In other words, when

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[12] See Dann, Mayers and Rabb.(1978)

[13] Joel Haasbrouck looked at a detailed data set that contained information on quotes, trades and spreads of stocks listed on the NYSE and came to this conclusion.

prices go up after a block buy, they are more likely to stay up.[14] A recent study[15] looks at both liquid and illiquid stocks on the NYSE also finds a tendency on the part of markets to overshoot. When a block buy is made, the price seems to go up too much and it can take several days for it to revert back to a normal level for illiquid stocks.

These studies, while they establish a price impact, also suffer from another selection bias, insofar as they look only at actual executions. The true cost of market impact arises from those trades that would have been done in the absence of a market impact but were not because of the perception that it would be large. In one of few studies of how large this cost could be, Thomas Loeb collected bid and ask prices from specialists and market makers, at a point in time, for a variety of block sizes. Thus, the differences in the spreads as the block size increases can be viewed as an expected price impact from these trades. Table 5.2 summarizes his findings across stocks, classified by market capitalization:

Table 5.2: Round-Trip Transactions Costs as a Function of Market Capitalization and Block Size

	Dollar Value of Block ($ thoustands)								
Sector	*5*	*25*	*250*	*500*	*1000*	*2500*	*5000*	*10000*	*20000*
Smallest	17.30%	27.30%	43.80%						
2	8.90%	12.00%	23.80%	33.40%					
3	5.00%	7.60%	18.80%	25.90%	30.00%				
4	4.30%	5.80%	9.60%	16.90%	25.40%	31.50%			
5	2.80%	3.90%	5.90%	8.10%	11.50%	15.70%	25.70%		
6	1.80%	2.10%	3.20%	4.40%	5.60%	7.90%	11.00%	16.20%	
7	1.90%	2.00%	3.10%	4.00%	5.60%	7.70%	10.40%	14.30%	20.00%
8	1.90%	1.90%	2.70%	3.30%	4.60%	6.20%	8.90%	13.60%	18.10%
Largest	1.10%	1.20%	1.30%	1.71%	2.10%	2.80%	4.10%	5.90%	8.00%

The sectors refer to market capitalization, and show the negative relationship between size and price impact. Note, however the effect of increasing block sizes on expected price impact, within each sector; larger trades elicit much larger price impact than do smaller trades.

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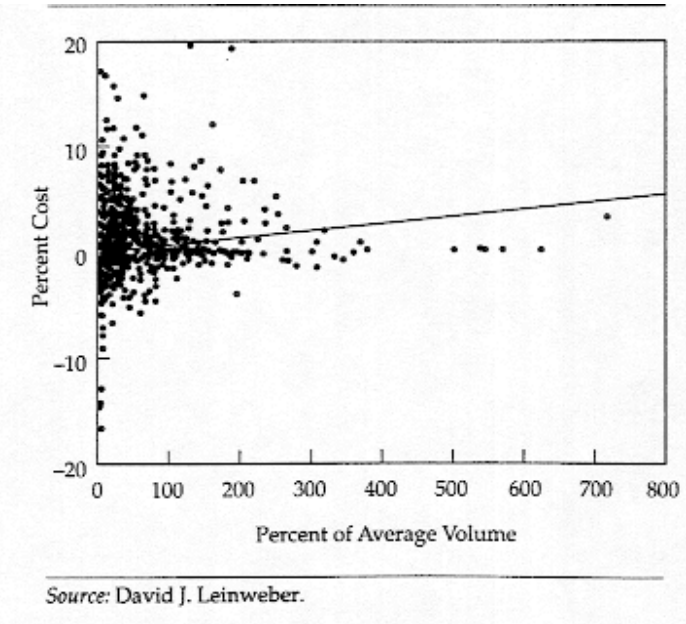
[14] See Holthausen, R. W., R. W. Leftwich, and D. Mayers, 1990, Large-Block Transactions, the Speed of Response, and Temporary and Permanent Stock-Price Effects," Journal of Financial Economics, 26, 71-95. and Keim, D. B., and A. Madhavan, 1995, Anatomy of the Trading Process: Empirical Evidence on the Behavior of Institutional Trades," Journal of Financial Economics, 37, 371-398.

[15] See Spierdijk, Nijman, and van Soest (2002)

While the Loeb studies suggest that price impact can create very large costs, studies of actual equity transactions suggest that institutional investors have learned how to reduce, if not eliminate, these costs by modifying their trading behavior. A study by Leinweber, who looked[16] at 13,651 equity transactions, totaling about $ 2 billion, by a large corporate pension plan in 1991, found a very weak relationship between trade size and trading cost. Figure 5.4 presents his findings on the percent trading cost and the size of the trade as a percent of the three-day average trading volume:

Figure 5.4: Percent Trading Costs and Trade Size

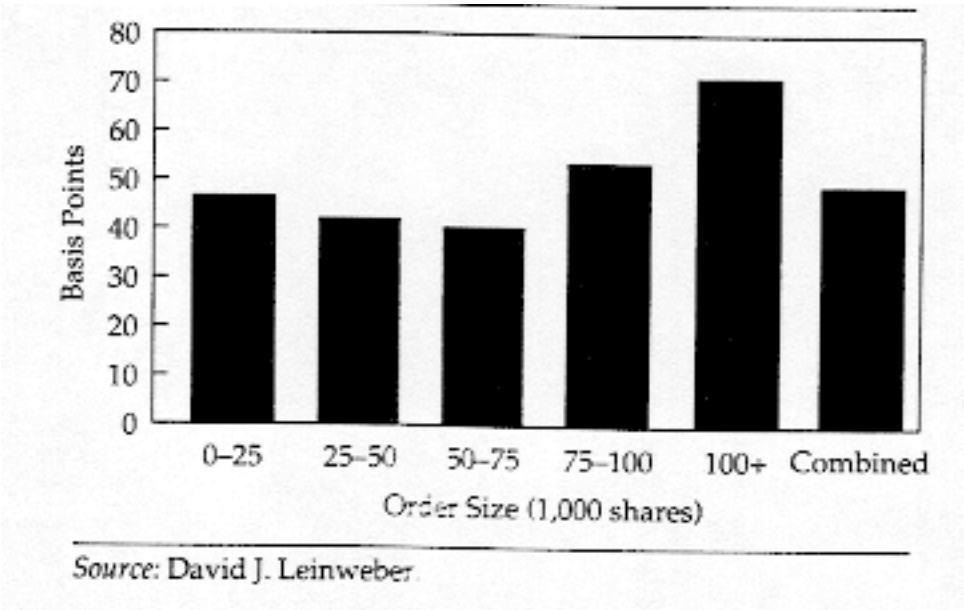


Source: David J. Leinweber.

Note the bulge around the smallest trades, which seem to have both the lowest cost and the highest cost trades. Figure 5.5 presents the net trading loss by order size:

[16] See "Using Information from Trading in Trading and Portfolio Management" by D.J. Leinweber in Execution Techniques, True Trading Costs and Microstructure of Markets, AIMR.

Figure 5.5: Net Trading Loss By Order Size



In fact, while smaller trades (<25,000 shares), on average, had lower trading costs than larger trades, they cumulatively accounted for almost 30% of the total trading costs for the fund. Thus, it may be just as important to worry about trading costs on small trades as on large trades, especially given the sheer number of small trades made by many portfolio managers and investors.

Determinants of the Price Impact

Looking at the evidence, the variables that determine that price impact of trading seem to be the same variables that drive the bid-ask spread. That should not be surprising. The price impact and the bid-ask spread are both a function of the liquidity of the market. The inventory costs and adverse selection problems are likely to be largest for stocks where small trades can move the market significantly.

Since you can reduce the price impact of trades by breaking them up into smaller trades, the price impact cost is likely to be greatest for investment strategies that require instantaneous trading. Thus, a portfolio manager who buys small, illiquid stocks because they are under valued is likely to face a smaller price impact cost than an investor who buys the same stocks after positive earnings announcements. The former can afford to spread his trades over time whereas the latter has to trade right after the announcement. We will consider this issue in more detail in the next section.

The Opportunity Cost of Waiting

The final component of trading costs is the opportunity cost of waiting. An investor can reduce the bid-ask spread and price impact costs of trading by trading patiently. If, in fact, there was no cost to waiting, even a large investor could break up trades into small lots and buy or sell large quantities without affecting the price or the spread significantly. There is, however, a cost to waiting. In particular, the price of an asset that an investor wants to buy because he or she believes that it is undervalued may rise while the investor waits to trade, and this, in turn, can lead to one of two consequences. One is that the investor does eventually buy, but at a much higher price, reducing expected profits from the investment. The other is that the price rises so much that the asset is no longer under valued and the investor does not trade at all. A similar calculus applies when an investor wants to sell an asset that he or she thinks is overvalued.

The cost of waiting will depend in great part on the probability that the investor assigns that the price will rise (fall) while he or she waits to buy (sell). We would argue that this probability will be a function of why the investor thinks the asset is under or over valued. In particular, the following factors should affect this probability:

1. *Is the valuation assessment based upon private information or is based upon public information?* Private information tends to have a short shelf life in financial markets, and the risks of sitting on private information are much greater than the risks of waiting when the valuation assessment is based upon public information. Thus, the cost of waiting is much larger when the strategy is to buy on the rumors (or information) of a possible takeover than it would be in a strategy of buying low PE ratio stocks.
2. *How active is the market for information?* Building on the first point, the risks of waiting, when one has valuable information, is much greater in markets where there are other investors actively searching for the same information. Again, in practical terms, the costs of waiting might be greater when there are dozens of analysts following the target stock than when there are few other investors paying attention to the stock.
3. *How long term or short term is the strategy?* While this generalization does not always hold, short-term strategies are much likely to be affected by the cost of waiting than longer term strategies. Some of this can be attributed to the fact that short term strategies are more likely to be motivated by private information, whereas long term strategies are more likely to be motivated by views on value.
4. *Is the investment strategy a "contrarian" or "momentum" strategy?* In a contrarian strategy, where investors are investing against the prevailing tide (buying when others are selling or selling when others are buying), the cost of waiting is likely to be smaller precisely because of this behavior. In contrast, the cost of waiting in a "momentum"

strategy are likely to be higher since the investor is buying when other investors are buying and selling when others are selling.

In summary, the cost of waiting is likely to be greatest for short term investment strategies, based upon private information or momentum, in markets with active information gathering. It will be less of an issue for long term investment strategies based upon public information and for contrarian strategies.

Investment Strategy and Total Trading Costs

The fact that assets which have high bid-ask spreads also tend to be assets where trading can have a significant price impact makes it even more critical that we examine investment strategies that focus disproportionately in these assets with skepticism. With the price impact, the effect of the size of the portfolio becomes much more critical, since large portfolios beget large trading blocks, which, in turn, have the biggest price impact. Thus, a strategy of investing in low-priced stocks which are not followed by analysts may yield excess returns, even after the bid-ask spread is considered, for a portfolio of $ 25 million but cease to be profitable if that same portfolio becomes $ 500 million.

Keim and Madhavan illustrate the interrelationship between total trading costs – implicit (including price impact and opportunity costs) as well as explicit (commissions and spreads) – and investment strategies.[17] Not surprisingly, they find that strategies that require large block trades have much higher total trading costs than strategies with smaller trades. They also find that the total trading costs are much greater for investors who buy small stocks as opposed to large ones. Table 5.3 provides a summary of their estimates of total trading costs for small cap and large cap companies listed on the NYSE and NASDAQ from 1991 to 1993.

Table 5.3: Total Round Trip Trading Costs and Market Capitalization

Market Capitalization	*Implicit Cost*	*Explicit Cost*	*Total Trading Costs (NYSE)*	*Total Trading Costs (NASDAQ)*
Smallest	2.71%	1.09%	3.80%	5.76%
2	1.62%	0.71%	2.33%	3.25%
3	1.13%	0.54%	1.67%	2.10%
4	0.69%	0.40%	1.09%	1.36%
Largest	0.28%	0.28%	0.31%	0.40%

[17] See "The Cost of Institutional Equity Trades" by Keim, D.B. and A. Madhavan in the Financial Analysts Journal, July/August 1998.

Note that the smallest companies have total round-trip trading costs that are significantly higher than the largest companies. They also find significant differences in costs between managers with different trading styles, with technical traders having the highest costs (presumably because of their need for immediate execution) and value traders the lowest costs.

Trading Costs with Non-traded Assets

If the cost of trading stocks can be substantial, it should be even more significant if your investment strategy requires you to hold assets that are not traded regularly such as collectibles, real estate or equity positions in private companies. In this section, we will consider these costs.

Trading Costs on Real Assets

If your investment strategy requires you to hold real assets, you may be exposed to very large trading costs. Real assets can range from gold to real estate to fine art and the transactions costs associated with trading these assets can also vary substantially. The smallest transactions costs are associated with precious commodities – gold, silver or diamonds – since they tend to come in standardized units. With residential real estate, the commission that you have to pay a real estate broker or salesperson can be 5-6% of the value of the asset. With commercial real estate, commissions may be smaller for larger transactions, but they will be well in excess of commissions on financial assets. With fine art or collectibles, the commissions become even higher. If you sell a Picasso through one of the auction houses, you may have to pay15-20% of the value of the painting as a commission. Why are the costs so high? The first reason is that there are far fewer intermediaries in real asset businesses than there are in the stock or bond markets; this reduces competition. The second is that real estate and fine art are not standardized products. In other words, one Picasso can be very different from another, and you often need the help of experts to judge value. This adds to the cost in the process.

Trading Costs on Private Equity/ Businesses

If your strategy requires you to take positions in private businesses – private equity as it is called – you have to allow for the fact that lucrative though the returns from these investments may be, they are illiquid. It is common, in fact, for investors in private businesses to assess an illiquidity discount on value to reflect their expectation that the cost of getting out of the position will be high. In this section, we will consider some of the factors that will determine this cost and empirical assessments of how big the cost may be.

Determinants of Illiquidity Cost

The cost of illiquidity is likely to vary across both firms and buyers, which renders rules of thumb useless. Let us consider first some of the factors that may cause the cost to vary across firms.

1. *Liquidity of assets owned by the firm*: The fact that a private firm is difficult to sell may be rendered moot if its assets are liquid and can be sold with no significant loss in value. A private firm with significant holdings of cash and marketable securities should have a lower illiquidity costs than one with factories or other assets for which there are relatively few buyers.

2. *Financial Health and cashflows of the firm*: A private firm that is financially healthy should be easier to sell than one that is not healthy. In particular, a firm with strong income and positive cash flows should be subject to a smaller illiquidity cost than one with negative income and cash flows.

3. Possibility of going public in the future: The greater the likelihood that a private firm can go public in the future, the lower should be the illiquidity cost. In effect, the probability of going public is built into the valuation of the private firm.

4. Size of the Firm: If we state the illiquidity cost as a percent of the value of the firm, it should become smaller as the size of the firm increases. In other words, the illiquidity discount should be smaller as a percent of firm value for firms like Cargill and Koch Industries, which are worth billions of dollars, than it should be for a small firm worth $15 million.

The illiquidity cost is also likely to vary across potential buyers because the desire for liquidity varies among individuals. It is likely that those buyers who have deep pockets and see little or no need to cash out their equity positions will face lower illiquidity costs, for similar firms, than buyers that have less of a safety margin.

Empirical Evidence on Illiquidity Cost

How large is the cost of being illiquid? This is a very difficult question to answer empirically because the discount attached to an asset's value itself cannot be observed. Even if we were able to obtain the terms of all private firm transactions, note that what is reported is the price at which private firms are bought and sold. The value of these firms is not reported and the illiquidity discount is the difference between the value and the price.

In fact, much of the evidence on illiquidity discounts comes from examining "restricted stock" at publicly traded firms. Restricted securities are securities issued by a publicly traded company, but not registered with the SEC, that can be sold through private placements to investors, but cannot be resold in the open market for a two-year holding

period, and limited amounts can be sold after that. When this stock is issued, the issue price is set much lower than the prevailing market price, which is observable, and the difference is viewed as a discount for illiquidity. There have been several studies of restricted stock, and while they vary on the degree of the discount at which restricted stock are place, they all report significant discounts.[18]

In summary, then, there seems to be a substantial discount attached, at least on average, when an investment is not liquid. Much of the practice of estimating illiquidity discounts seems to build on these averages. For instance, rules of thumb often set the illiquidity discount at 20-30% of estimated value and there seems to be little or no variation across firms.

The Management of Trading Costs

The preceding discussion make clear out not only how large the "trading cost" problem is for active money managers, but also how difficult it is to develop a strategy to minimize the collective cost. Actions taken to reduce one type of trading cost (say, the brokerage commission or bid-ask spread) may increase another (for instance, the price impact). Strategies designed to minimize the collective impact of the bid-ask spread and the price impact (such as breaking up trades and using alternative trading routes) may increase the opportunity cost of waiting. In this section, we will examine ways in which trading costs can be managed within the broader construct of maximizing portfolio returns, given an investment philosophy.

Step 1: Develop a coherent investment philosophy and a consistent investment strategy

The first step in managing trading costs is developing and staying with a coherent investment philosophy and strategy. The portfolio managers who pride themselves on style switching and moving from one investment philosophy to another are the ones who bear the biggest burden in terms of transactions costs, partly because style switching increases turnover and partly because it is difficult to develop a trading strategy without a consistent investment strategy.

Step 2: Estimate the cost of waiting given the investment strategy

[18] Maher reports a discount of 35.43% on restricted stock issues made between 969 and 1973. Moroney, using data from 1970, reports an average discount of 35%. Silber looked at restricted stock issues from 1949 to 1989 and estimates a discount of 33.75%.

Mutual funds with highest trading costs. Take a look at the 50 mutual funds with the highest trading costs.

The second step in the process is determining the cost of waiting for the investment strategy that is being followed. As noted in the previous section, the cost of waiting is likely to small for long-term, contrarian strategies and greater for short-term, information-based and momentum strategies. If the cost of waiting is very high, then the objective has to be minimize this cost, which essentially translates into trading as quickly as one can, even if the other costs of trading increase as a consequence.

Step 3: Look at the alternatives available to minimize transactions costs, given the cost of waiting

Once the cost of waiting has been identified, the investor can consider the third step which is to minimize the effect of the bid-ask spread and the price impact on portfolio returns. While we have talked about trading primarily in terms of trading on the floor of the exchange, there are a number of options that an investor can use to reduce the trading costs. Rose and Cushing[19] make some of the following suggestions to reduce trading costs on a portfolio for an institutional investor.

1. Take advantage of the alternatives to trading on the floor of the exchange. Among these alternatives are using the upstairs block market (where large buyers and sellers trade with each other), the dealer market (where trades are made with a dealer) and crossing networks, where trades are executed over a network. The trade off is straightforward - the approaches that yield the most liquidity (the exchange floor and the dealer market) are also the ones that have the highest trading costs.
2. Trade portfolios rather than individual stocks, when multiple orders have to be placed. Portfolio trades generally result in lower trading costs and allow for better risk-management and hedging capabilities.
3. Use technology to reduce the paperwork associated with trading and to keep track of trades which have already been made. By allowing traders to have information on whether their trades have been executed, and on trades that have already been made, technology can help control costs.
4. Be prepared prior to trading on ways to control liquidity and splits between manual and electronic trading. This "pre-trade" analysis will allow traders to identify the least costly and most efficient way to make a trade.
5. After the trade has been executed, do a post-trade analysis, where the details of the trade are provided in addition to a market impact analysis, which lists among other

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[19] See "Making the Best Use of Trading Alternatives" by J.D. Rose and D.C. Cushing in Execution Techniques, True Trading Costs and the Microstructure of Markets, AIMR>

information, the benchmarks that can be used to estimate the price impact, including the mid-point of the bid-ask spread before the trade and the previous day's close. These post-trade analyses can then be aggregated across types of trades., securities and markets to give portfolio managers a measure of where their costs are greatest and how to control them.

Step 4: Stay within a portfolio size that is consistent with the investment philosophy and trading strategy that has been chosen

While it is tempting to most portfolio managers to view portfolio growth as the fruit of past success, there is a danger that arises from allowing portfolios to become too big. How big is too big? It depends upon both the portfolio strategy that has been chosen, and the trading costs associated with that strategy. While a long-term value investor who focuses well-known, large-capitalization stocks might be able to allow his or her portfolio to increase to almost any size, an investor in small-cap, high growth stocks or emerging market stocks may not have the same luxury, because of the trading costs we have enumerated in the earlier sections.

Step 5: Consider whether your investment strategy is yielding returns that exceed the costs

The ultimate test of an investment strategy lies in whether it earns excess returns after transactions costs. Once an investor has gone through the first four steps, the moment of truth always arrives when the performance of the portfolio is evaluated. If a strategy consistently delivers returns that are lower than the costs associated with implementing the strategy, the investor has one of two choices - he or she can switch to a passive investing approach (such as an index fund) or to a different active investing strategy, with higher expected returns or lower trading costs or both.

Taxes

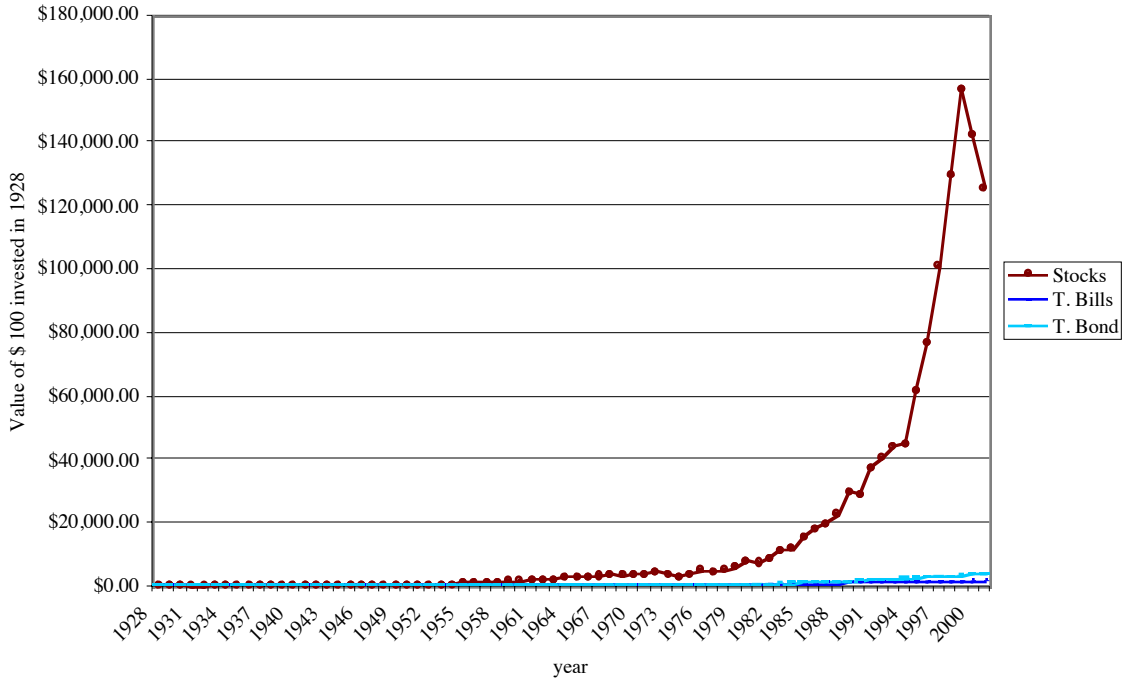
As has often been said, the only two things that are certain in life are taxes and death. While investors may get a chance to pause and admire the pre-tax returns they make on their investment portfolios, they can spend only the returns that they have left after taxes. Strategies that yield attractive pre-tax returns can generate sub-standard after tax returns. There are two reasons why taxes are ignored by both researchers looking at investment strategies and portfolio managers who put these strategies into practice. The first is that taxes affect different investors differently, ranging from no impact on tax-exempt investors such as pension funds to very large effects on older and wealthier individual investors. The second is the complexity of the tax laws is such that the same investor may face different tax

rates on different parts of his or her income (dividends versus capital gains) and different portions of his or her portfolio (pension fund versus savings).

Investment Returns and Taxes

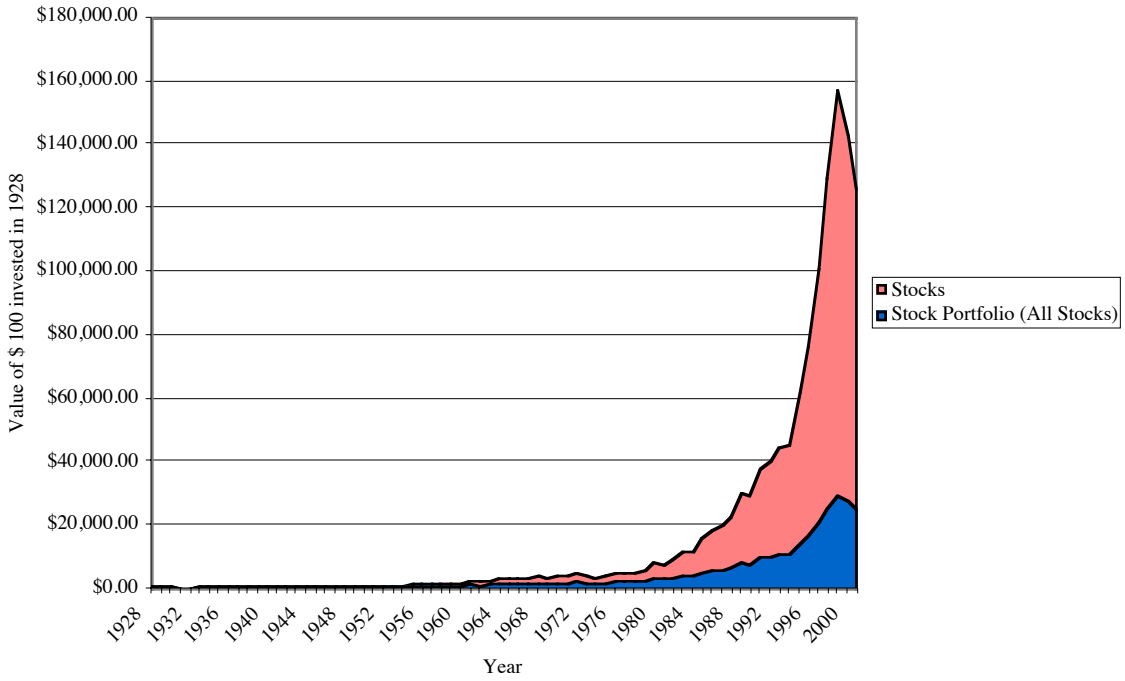
How big of a drag are taxes on investment returns? Studies that look at returns on the U.S. stock market and government bonds show that stocks have generated much higher returns and ending portfolio managers for investors than treasury bills or bonds. Figure 5.6 presents the ending value of $ 100 invested in stocks, treasury bonds and treasury bills in 1928 and held through the end of 2001.

Figure 5.6: Portfolio Value from 1928 to 2001 - Stocks, T.Bonds and T.Bills



Thus, $ 100 invested in stocks would have grown to $ 125,599, significant higher than what your portfolio would have been worth if invested in T.Bills ($1,713) or T.Bonds ($3,587). This is impressive but it is also before taxes and transactions costs. Let us for the moment consider the effects of taxes on these returns. Assume that the investor buying these stocks faced a tax rate of 35% on dividends and 20% on capital gains over this period. To compute the effect of taxes on returns, we do have to consider how often this investor trades. If we assume that he turns over his entire portfolio at the end of each year, he would have to pay taxes on both dividends and the price appreciation each year. Figure 5.7 shows the effect on the portfolio value over the period and the effect of taxes on the ending portfolio:

Figure 5.7: Value of $ 100 invested in Stocks: Before and After Taxes



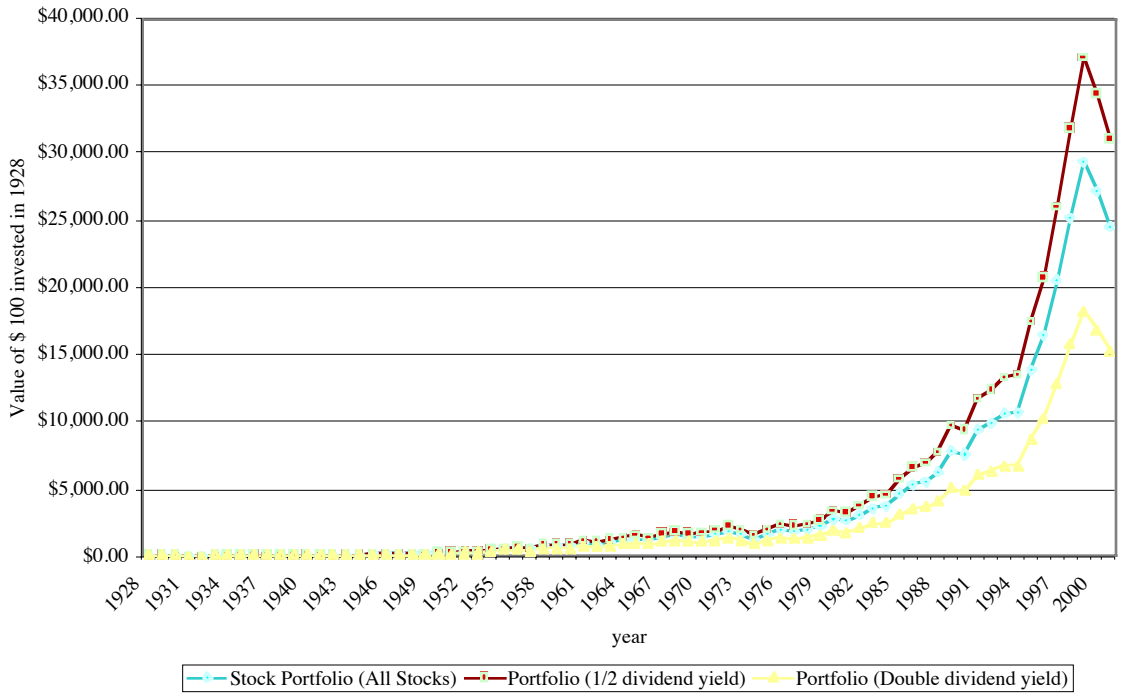
Note that introducing taxes into returns reducing the ending value of the portfolio by more than two thirds from $125,598 to $39,623.

But what if this investor, instead of turning over his entire portfolio once every year, had turned it over once every 2 years (or 3 or 5). Trading less often does not reduce the tax bite from dividends but it does allow investors to delay paying capital gains taxes, thus increasing the ending portfolio value. This insight about the relationship between taxes and trading frequency is a key one. Since much of the return when investing in stocks comes from price appreciation, the more frequently you trade, the higher your tax bill is likely to be for any given pre-tax return. In fact, the effect is likely to be exacerbated by the higher tax rates on short-term capital gains (which have been generally similar to ordinary tax rates) than long-term capital gains.

There is one final point to be made about the tax effect. While the taxes on capital gains can be deferred by not trading on your winners, the taxes on dividends have to be paid each period that you receive dividends. Thus, a strategy of investing in stocks that have higher dividend yields than average will result in less flexibility when it comes to tax timing and more taxes, at least relative to investing in low dividend yield stocks for the long term. We illustrate this in figure 5.8 for an investor by contrasting the performance of a portfolio

with a dividend yield half that of the market each year to one with twice the dividend yield, keeping the total returns constant.[20]

Figure 5.8: Value of $ 100 invested in stocks in 1928 & Dividend Yields



Note that the portfolio of stocks with half the dividend yield of the market has an ending value of just over $ 30,000 in 2001, whereas one with a dividend yield twice that of the market has an ending value of roughly half that amount.

The Tax Drag on Returns

How well do investors manage their tax liabilities? All too often, investment performance has been measured in terms of pre-tax returns. The rankings of mutual funds done by services such as Morningstar and Forbes have been based upon pre-tax returns. Until recently, the promotional material for most funds presented the pre-tax returns of these funds, contrasted with the S&P 500. This focus on pre-tax returns may be explained by the fact that investors have very different tax profiles and that it is difficult to find a typical investor, but it has also had the undesirable side effect. Money managers often adopt strategies that expose their investors to substantial tax bills because they feel that they will

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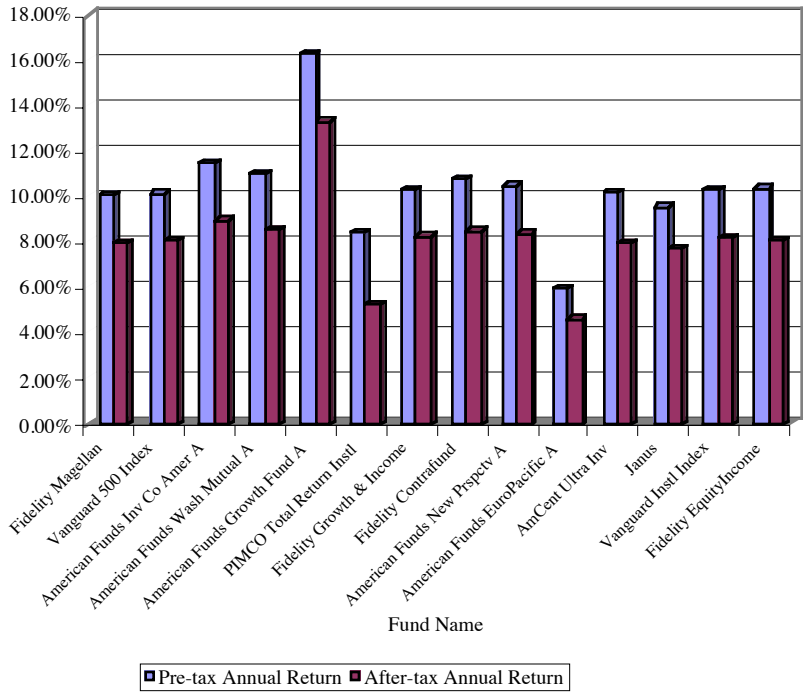
[20] To provide an example, the average dividend yield across all stocks in 1996 was 3.20% and the total return was 23.82%. The half dividend yield portfolio was estimated to have a dividend yield of 1.60% and a price appreciation of 22.22% for a total return of 23.82%. The double dividend yield portfolio had a dividend yield of 6.40% and a price appreciation of 17.42% for a total return of 23.82%.

not be penalized for this tax exposure. Figure 5.9 presents the pre-tax and after-tax returns between 1997 and 2001 at the 14 largest domestic mutual funds in the United States in March 2002.

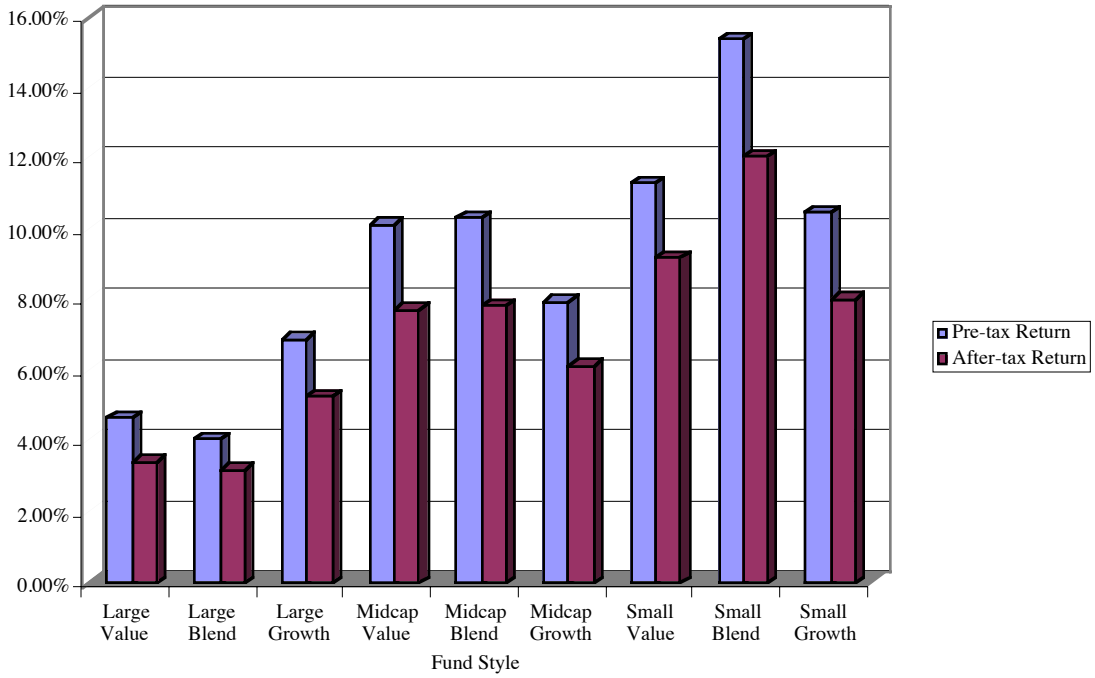
Figure 5.9: Pre-tax and After-tax Returns: Largest U.S. Mutual Funds



The after-tax returns are significantly lower than the pre-tax returns for each of the funds.

There are encouraging signs for investors concerned about taxes. The first is that the SEC has started requiring mutual funds to report their after-tax returns in conjunction with pre-tax returns in their promotional material. The second is that the mutual fund families have begun offering tax-efficient funds, where the objective is to maximize after-tax rather than pre-tax returns. The third is that the performance evaluators, such as Morningstar, have woken up to the tax costs being imposed on investors by mutual funds. In fact, the latest Morningstar reports on mutual funds report not only the after-tax returns over the last few years on these funds but also a measure of tax efficiency for each fund obtained by dividing the after-tax return by the pre-tax return. A fund that generates a pre-tax return on 9% and an after-tax return on 6% will therefore have a tax efficiency ratio of 67% (6/9). Figure 5.10 reports pre-tax and after-tax returns between 1999 and 2001 for equity mutual funds in the United States, categorized by style:

Figure 5.10: Pre-tax and After-tax Returns at U.S. equity mutual funds- 1999-2001

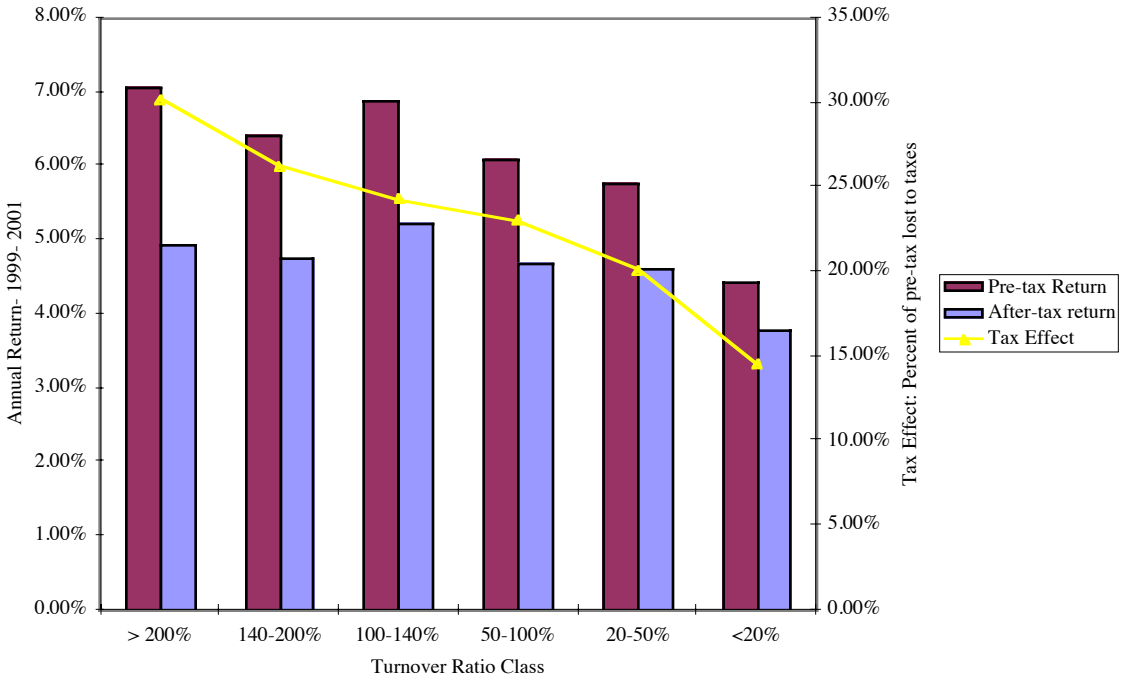


As you can see from the graph, there are significant differences between pre-tax and after-tax returns at many funds and the tax drag on returns cuts across all fund styles. While there are some funds that are tax-efficient, there are others where the after-tax return is less than 60% of the pre-tax return. What are the factors that cause it to be different? It is as function of a number of variables:

Mutual funds with highest tax drag: Take a look at the 50 mutual funds with the largest difference between pre-tax and after-tax returns

- Higher turnover ratios (and more active trading) seem to give rise to higher tax costs for investors. After all, capital gains taxes are assessed only when you sell stocks. In fact, figure 5.11 categorizes mutual funds (both bond and equity) into six classes based upon turnover ratios and reports on the difference between pre-tax and after-tax returns in each class:

Figure 5.11: Tax Effect and Turnover Ratio: U.S. Mutual funds- 1999-2001



We measure the tax effect in each category by looking at the ratio of after-tax to pre-tax returns. Thus, the firms with turnover ratios that exceed 200% are the most tax inefficient, since the after-tax returns are more than 30% lower than the pre-tax returns. In fact, the pattern is consistent with the tax effect becoming smaller as the turnover ratios decrease.

- The after-tax return is also affected by money flowing in (inflows) and out of the fund (redemptions). Why might that be? Redemptions may require a fund to sell holdings to raise cash and, in the process, convert paper gains into taxable capital gains.
- The tax cost will also vary depending upon whether the mutual fund is actively trying to manage the cost. For instance, a fund that wants to minimize tax costs will sell a few losers when it sells winners and offset the capital losses on the former against the capital gains on the latter.

Tax Management Strategies

While tax considerations alone should not determine any investor's portfolio, they clearly have to be a factor in how portfolios are put together and the type of investment strategies adopted. In this section, we consider ways in which investors may be able to reduce how much they lose because of taxes.

Minimal Turnover

The simplest and most effective way to reduce your taxes is to trade less often. As noted in the prior sections, portfolio turnover is a key determinant of tax costs. While you may not be able to reduce your turnover ratios to those of an index fund (which often has a turnover ratio of 5% or less) if you want to actively beat the market, you can still try to minimize trading, given any strategy that you adopt. In addition, your choice of strategy should be influenced by the amount of trading that goes with it. Does this mean that you should avoid strategies that require a lot of trading? Not necessarily. If you can earn a high enough return to cover the additional taxes you have to pay, you may still choose to go with this strategy.

Tax-Based Trading

The other way to minimize taxes is to consider trades specifically for the purpose of reducing your tax bill. There are several forms of tax-based trading:

- In its simplest form, you may sell stocks in your portfolio that have gone down just before a tax year ends and use the capital losses from the sale to offset capital gains on other stocks that you may have sold during the year.
- If your tax status varies over time, you may choose to claim your capital gains in a year in which your tax rate is low and your capital losses in a year in which your tax rate is high.
- In its most dangerous form, you may make investments specifically because they offer a chance to reduce your tax bill. While such tax shelters have long been utilized by investors, you should recognize that the tax authorities usually require these entities to have an economic purpose that goes beyond tax reduction. All too often, investors are beguiled by promised tax savings in tax shelters that are never delivered.

In theory, while tax-based trading offers promise, investors have to keep it in perspective. In particular, trading purely for the purposes of reducing your tax bills strikes us as more likely to reduce than increase returns. However, augmenting a sensible trading strategy with tax considerations makes sense. Thus, if you were planning to prune and rebalance your portfolio, you should probably do it before the end of the tax year and consider the effect of these trades on your tax bill. If you are trying to decide between selling two stocks in your portfolio, the fact that one of them could reduce taxes paid by $ 100,000 should tip the balance.

Tax Arbitrage

The fact that all investors do not face the same tax rates and that each investor may, in fact, be taxed differently on different parts of her portfolio does raise an interesting implication. If your tax rate as an investor is much lower than the tax rates of other investors in the market, you may be able to exploit the difference to earn excess returns. To see why, consider the following scenario. Assume that you are tax exempt and that every other investor in the market faces a 40% tax rate on both dividends and capital gains. Let us also assume that these other investors price stocks to earn an after-tax return of 9%. On a pre-tax basis, stocks will have to earn 15%. As a tax-exempt investor, you will be able to earn the 15% pre-tax return as well, but your after-tax returns will also be 15%.

Is tax arbitrage feasible if you are the only taxable investor in a tax-exempt universe? You will either have to settle for lower after-tax return than other investors in the market or not buy stocks at all. In reality, there are both tax-exempt and taxable investors in every market, and tax rates vary widely across taxable investors. The market prices of assets will reflect the relative magnitudes of each group, and there will always be groups of assets that yield more favorable returns for each group. Thus, tax exempt investors may find their best bargains in stocks that generate the greatest tax liabilities for other investors – high dividend paying stocks, for instance. High tax rate investors migrate towards stocks where they are penalized the least by their tax status – non-dividend paying, high growth stocks would be an example.

Conclusion

Trading costs are an integral part of any investment portfolio and can make the difference between a portfolio that beats the market and one that does not. The overall evidence suggests that trading costs impose a significant drag on portfolio returns, and may explain why active money managers under perform the market. The reason trading costs are large is that they include not just brokerage costs, but also the costs associated with the bid-ask spread, the price impact created by trading and the cost of waiting. The reason they are difficult to control is that actions taken to reduce one component of the trading cost tend to increase the other components. Trading costs do not impose a uniform burden on all investment strategies. They punish short term, information-based strategies far more than they do long term value-based strategies; they affect strategies that focus on less-liquid assets far more than they do strategies that are built around liquid assets. No matter what the strategy, though, it is the portfolio manager's job to manage trading costs, given the constraints of the strategy, and earn an excess return that covers these costs.

Taxes can also have significant implications for investment strategy. Since you get to keep only after-tax profits, the tax exposure generated by different investment strategies has to be an important factor in which strategy you choose. With any given investment strategy, you can try to reduce your tax bill by trading less often, tax-based trading or the use of tax shelters.

Lessons for Investors

1. The brokerage costs, which are often the most explicit costs of trading, represent only a small portion of the total trading cost. There are at least three other costs associated with trading, the bid-ask spread that you bear at the time of trading, the price impact that you have as a result of trading and the opportunity cost of waiting to trade.
2. While large investors may have an advantage over small investors when it comes to brokerage costs and even the bid-ask spread – they often face a narrower spread – they face much large price impact and opportunity costs than small investors.
3. The drag imposed by trading costs on returns will depend upon what type of stocks you invest in – it will be higher for smaller, less liquid stocks – and how much you trade – higher turnover will create higher trading costs.
4. As an investor, you get to spend after-tax income, not pre-tax income. The portion of your returns that will be devoured by taxes will depend, like trading costs, on what you hold – dividend paying stocks will create larger tax bills – and how much you trade – more trading will generate more taxes