

Financial Services Alert

**Financial Services Forum
College of Management
University of Massachusetts Boston**

Liquidity in Massachusetts

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Volume 3, Fall 2007



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Liquidity in Massachusetts

**Foreword by Arindam Bandopadhyaya
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Ever since the development of the Massachusetts Investment Sentiment Index (MISI) the Financial Services Forum has been keenly interested in firms that are in the Massachusetts Bloomberg Index (MBI). The MISI uses the MBI to capture daily sentiment of investors towards firms in Massachusetts, and finds that events that affect Massachusetts are quickly reflected in the investment sentiment measure.

In this study, the Forum investigates the liquidity of firms in the MBI. The report begins with details on the composition of the MBI and continues with an analysis that finds that trading strategies that are capable of generating high returns cannot be effectively implemented on firms in the MBI because of lack of liquidity. This has serious implications since low liquidity increases the cost of capital and restricts the firms' ability to most efficiently use capital markets.

Liquidity in the Massachusetts Bloomberg Index
Introduction by Dr. Atreya Chakraborty
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“I see Massachusetts as the research and development center of the world in biotech, biomedical and alternative energy industries. I see an economy marked by innovation, converting new technologies created in our universities and research laboratories into products and services in demand worldwide.” – Governor Deval Patrick
(http://www.devalpatrick.com/issues_economy.cfm)

A growth strategy based on high technology is a bold vision for Massachusetts’s future. This has important implications for the local financial markets that have a comparative advantage in evaluating the true contribution of such industries. Will the local financial market be able to assist the process of price discovery as the emerging high-tech industries mature? Will the market for securities be efficient in directing the badly needed capital to its most productive use?

One of the key drawbacks of high tech industries is that they start small and remain opaque for a long time – by the very design these firms cannot continually and credibly reveal what they are up to. Hence, there is a great premium for price discovery. Investors who are able to discern good firms from bad one’s have significant opportunity to profit. However, to profit the stocks of these firms need to be traded at will. The lack of liquidity is a significant drawback to any trading strategy in such markets.

This study examines the implications of lack of liquidity upon a simple trading strategy on the Massachusetts Index (MI). A very simply trading strategy is designed to show that strategies that are profitable on the more liquid NASDAQ Index (QQQ) may not work on the MI because of lack of liquidity. The results point to potential problems with price

discovery for firms in the MI index. A detailed description of the MI index and its composition relative to the QQQ highlights the technology heavy nature of the MI index.

Composition of the Massachusetts Index

The MI is a price weighted index that tracks Massachusetts based firms. At any given point there are roughly 250 companies that comprise this index, this number fluctuates as companies enter and leave the market place. Currently, during the time period examined for this study there was 249 listed securities.

The major industries are technology (software, internet, computers, semiconductors), banking/financial (financial services, S&L, commercial, and fiduciary), and an overwhelming number of various elements of the medical industry (bio-med, pharmaceutical, instruments, products, and therapeutics). Thirty percent (75) of the 240 companies that make up the index are related to the medical field and twenty six percent (63) are tech based, banking/financial comprise another eleven percent (27).

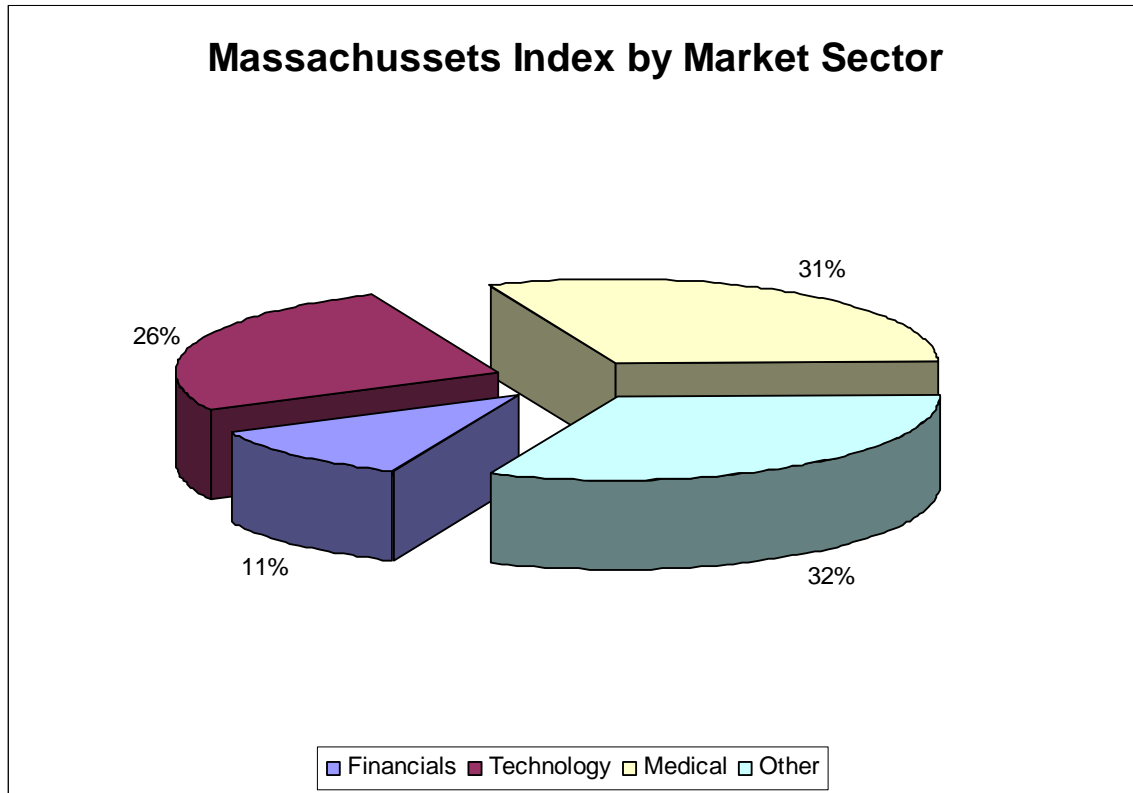
The index is heavily weighted toward medical and tech firms. For comparison, we can look at the QQQ composite which is 14% medical, 52% technology, and 11% financial.¹ Exhibit 1 and 2, respectively, depict the MI by industry and compares the breakdown of the MI to the QQQ Composite. Medical services, such as pharmaceuticals, bio-med, therapeutics, etc. are clearly the driving force behind the Mass Index and the Massachusetts economy as well.

In Exhibit 3, there is a graph illustrates market cap distribution of the index. The distribution is heavily weighted toward the small and micro-cap firms; these firms comprise 71% of the index. The MI is devoid of mega-cap stocks which have a market cap of over \$200 billion. The type of firms found in each market cap group are fairly diverse; the only industry type that really stands out based on market cap is the

¹ <http://www.streetauthority.com/terms/index/nasdaqcomposite.asp>

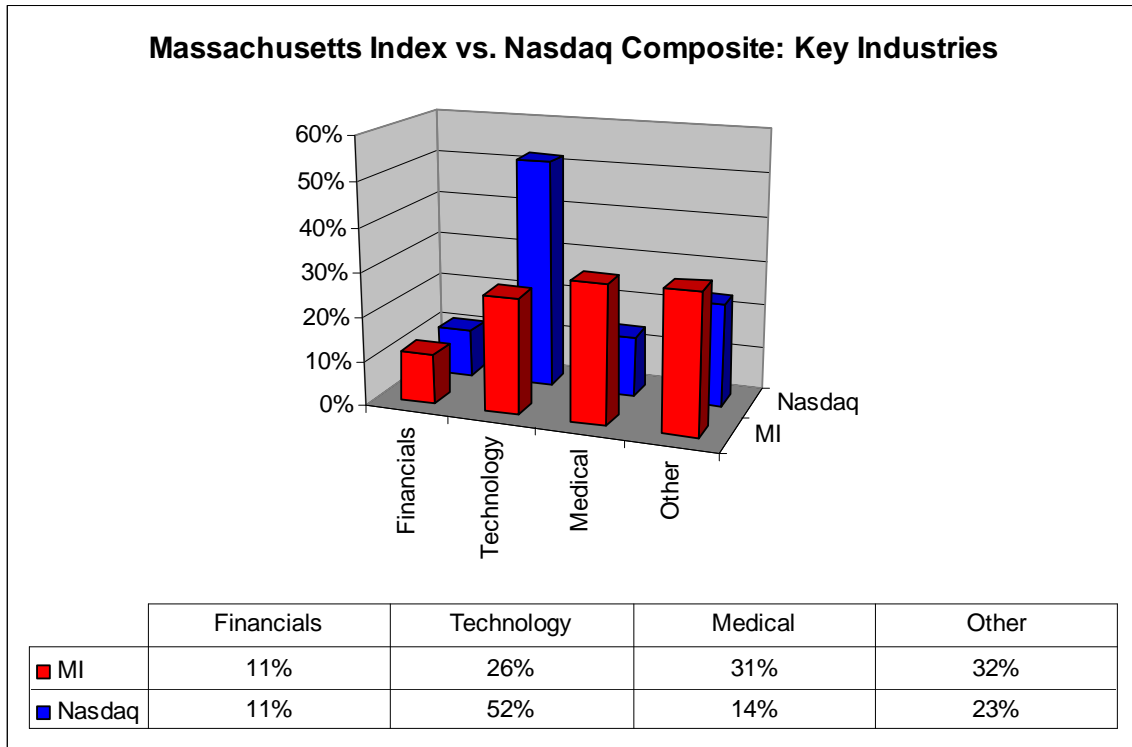
banking/financial industry and the medical industry, which are overwhelmingly small and micro-cap stocks.

Exhibit 1
Massachusetts Index by Sector



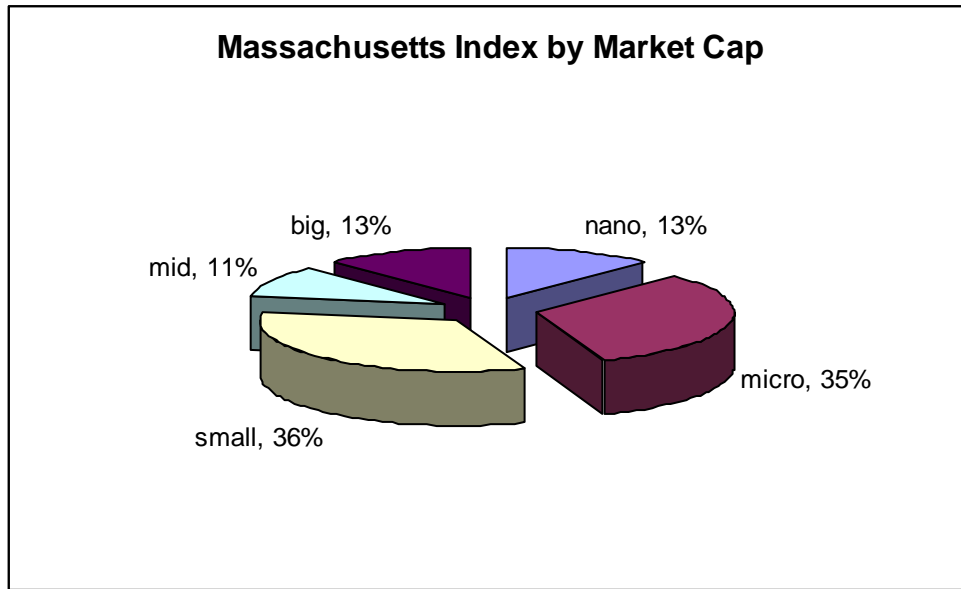
This exhibit depicts the breakdown of the MI into its three main industries.

Exhibit 2
Massachusetts Index versus NASDAQ Composite



This figure compares the MI to the NASDAQ composite in regards to the three industries which are most prominent on each index. These figures may be slightly skewed due to the different ways that each index is calculated.

Exhibit 3
Massachusetts Index by Market Capitalization



This figure displays the percentage of firms located in each market cap distinction. The small and micro cap companies comprise 71% of the index.

The Effects of Liquidity on a Simple Trading Strategy

Robert E. Sipe

Robert Sipe is currently pursuing his MBA with a specialization in finance from the University of Massachusetts Boston. He attended Southern Illinois University Carbondale where he earned a Bachelors degree in Management Information Systems. Robert Sipe is currently working for State Street in their fund accounting department. His interests span a wide variety of finance related topics but there is a particular emphasis on stock market related topics such as a portfolio and security analysis.

I. Introduction

This study examines the impact and implications of liquidity upon a simple trading strategy. In theory, there is good evidence that a lack of liquidity affects the ability to trade efficiently and effectively. The lack of liquidity may also contribute to the persistent systematic mispricing of the securities listed on the exchange. Hence, a priori, it is not clear how the reduction of liquidity will affect the profitability of a particular trading strategy.

We develop a very simply trading strategy designed to capture the quick up tick in a stock's price after it has particularly steep decline; this is often referred to as a "dead cat bounce"². These set of trading rules were applied to the NASDAQ index (QQQ).³ The results were astounding, achieving a return of 352% over a six-month period. The focus of this paper is to investigate the impact of the same strategies on the Massachusetts Index (MI). This results of this study are useful to firms trading on the MI because they yield insight into potential problems that these firms will likely experience in the capital market. Chief among the potential problems caused by a lack of liquidity is that it will

² Phrases.org: <http://www.phrases.org.uk/meanings/108600.html>

³ Previous work on testing the base trading strategy on the QQQ index was conducted with Hugo Smoter. The current study is part of a more detailed study with Professor Atreya Chakraborty.

make it harder for an organization to manage its stock price and individual traders may affect the price more than it would be by the successes or failures of the organization.

The trading method, in its raw form, yielded exceptional results, returning over 800% during the nearly one-year period examined extending from April 16th, 2005 until March 1st, 2006. Examining the individual trades revealed that the liquidity concerns were valid as our level of investment would have accounted for over 100% of the trading volume of an individual security in several instances and as such would not be possible in the real world. Looking at each trade also revealed that it would not be possible to quickly enter/exit a position since many of the firms would not trade for several days and when they did it was usually as a single large purchase/sale. There was very little depth in the market for a significant number of the listed firms. Numerous variations of the base portfolio were constructed with each having a unique characteristic that helped explain the impact liquidity would play. The findings showed conclusively that as more real world restrictions were imposed the returns that the trading method generated were reduced substantially. This was further supported when we created sets of risk adjusted returns were calculated. Metrics such as the Sharpe ratio showed a dramatic decline in the quality of the returns and in some cases producing negative returns. The risk-adjusted returns also revealed that there was less of a performance gap between the various alternatives than the initial performance results indicated.

II. Methodology

a. The Method

The trading method is rather simple; it is based upon the adage “buy low sell high.” This trading method attempts to exploit the observation that after a particularly sharp downturn in price one day, stocks often rebound in price the next day. Buying at the bottom, the point where a stocks price falls so low that it becomes attractive and will begin venturing back up is a common tactic in the market. The reasoning is simple but finding that bottom is the hard part. The trading method rests on the idea that a tradable bottom is reached, more often than not, after a large single day decline in price. For each trading day, the three worst performing securities were selected. They were “purchased” using the closing prices. They were then “sold” at the closing prices for the next trading day. In the actual marketplace, a trader would be selling stocks at 3:45pm and buying stocks at 3:50pm. By holding the stocks overnight, it is possible to bypass the restrictions put on day-trading. Using the full proceeds from this sale, three new daily losers are purchased and the cycle continues.

b. The Study

Data were gathered from April 19, 2005 until March 1, 2006 for all securities that trade on the MI, and for the benchmark QQQ. The MI is comprised of 250 companies with a large percentage of them being pharmaceutical, biotech, and technology based firms. The companies listed are generally small and micro cap stocks. These types of firms are thought to be conducive to the trading method since their price behavior is rather volatile, a condition under which the trading method thrives. We expect the MI to

yield results more reflective of the key intuition of our paper – that liquidity in trading matters. Relative to QQQ, the MI represents, on average, smaller companies. These companies serve a dual purpose of capturing both the impact of higher volatility and lower liquidity associated with size. Both these factors affect trading strategies.

Several portfolios were constructed based upon the MI that attempted to deal with the problem of liquidity constraints. The first was termed the “Raw” portfolio; the criterion was simply the three companies with the worst performing stock price for that day, as described above. The second group was called the “liquid” portfolio. This portfolio had the liquidity limitation that its daily losers had to have an average trading volume of \$500,000. A third portfolio, known as Raw Alternative (RA), was designed with constraints that dealt with capital appreciation; instead of reinvesting the full proceeds from the prior day the winnings were removed from the table or losses were replenished to keep the base investment the same. A fourth portfolio was created that focused primarily on the illiquid stocks, stocks were selected that did not trade often and instead of using the next day’s closing price they instead used the closing price for the next day that the security actually traded.

A \$50,000 base investment was selected and would be split equally among the three securities. Based on this investment level the liquidity requirement was set at a \$500,000 daily trading volume. This investment was split equally among the three securities, initially \$16,667 per security. The previous study based upon the QQQ index revealed that a certain base level of investment was required to overcome trading costs. An investment of \$50,000 showed little difference in regards to the percentage returns

when a comparison was conducted with the only variable being the inclusion of trading costs.

c. Metrics

Several metrics were used to gauge the results of the study. They include Total Returns, Average Daily Returns, Moving Averages, Sharpe Ratios, and Sortino Ratios. The moving average used as a risk metric, a general sense of volatility can be gained by looking at how many times the actual returns cross over the moving average. The Sharpe Ratio provides a comparison between the returns and their volatility. This ratio shows if the results are simply the excess returns associated with taking on large amounts of risk or if they are something more. The Sortino Ratio is an alternative to the Sharpe ratio that measures the same things but makes a distinction between downside and upside deviations. If the returns continuously trend upwards they will deviate from the average continuously causing a lower risk adjusted return when using the Sharpe Ratio; however this “upside” volatility is desirable and should be treated as such.

III. Results

The “Raw” portfolio’s results were astounding. The return for the period was 821%; this large return is a result of the compounding inherent with the trading strategy. The Raw Alternative portfolio returned 249.89%. The liquid portfolio returned 20.37% while the illiquid portfolio returned 181%. The benchmark, QQQ returned a respectable 18.82% during this period. Exhibit 1 is a graph illustrating the disparity between the performances of the various portfolios.

Exhibit 2 depicts the appreciation of the invested capital over the time period of the study. The performance gap between the liquid portfolio and the alternative portfolio options highlights the importance of this study. It is evident that liquidity does play a role in the success of the trading strategy. It should be noted that all variations of the trading strategy were successful in outperforming their benchmark QQQ index. The majority of the portfolios beat the index by a considerable amount; prompting further investigation into why exactly there were so successful and what knowledge can be gained from these results.

IV. Analysis

a. Reasons for Performance Decline of Liquid Portfolio

The purpose of this study was to determine the effect of liquidity on this simple trading strategy. The performance gap makes it evident that it does in fact play a key role. What is it about the liquidity of these firms that caused such a performance drop in the returns?

One possible solution is that the number of investment choices is severely limited when imposing dollar trading volume restrictions, particularly when using a small state index as the majority of the firms are already lightly traded. If a 10% price decline is considered to be an acceptable level of price decline in order to initiate a price bounce we can compare the raw vs. liquid portfolios in terms of how many securities that were initially selected remain after the 10% decline restriction is imposed. The raw portfolio retained 334 securities, while the liquid portfolio declined to 161 remaining securities.

Smaller indexes contain fewer companies than Nasdaq and they are often much less

liquid, it is possible that the trading strategy is not suitable for such an environment since the trader would be faced with far fewer choices in regards to price losers and would have to make selections that did not have a sufficient price decline in order to cause the bounce.

Another factor that affected the results of the liquid portfolio was a very large early loss. On 5/24/06 one of the securities lost 64% (it declined a further 20% the following day) contributing to a 20% overall decline in the portfolio in a single day. If that decline had not occurred the total return would have been 54% for the portfolio. This translates into a roughly 10% performance decline, highlighting the compounding that takes place as the investable capital grows.

b. Risk Adjusted Returns

This trading method thrives on volatility; this makes it rather difficult to properly assess the risks associated with it. In testing it has proven successful and generated incredible returns but it is evident that there could certainly be downside potential. Traditional risk metrics, such as beta, fail to adequately assess the situation so alternatives such as moving averages, Sharpe ratios, and Sortino ratios were used.

The moving average was the simplest measure. It does not show the daily volatility but instead shows the more solid trend line for the price. Risk can be assessed by how often the daily price line crosses its moving average. Given the relatively short period of time of the study a 20 day moving average was selected. In Exhibit 3 it is seen that the price line for the Raw portfolio rarely crosses the moving average. This indicates that this trading strategy is somewhat low risk as the price is continually following its average on the way up.

1. Sharpe Ratio

A common measure used for risk-adjusted returns is the Sharpe Ratio. This ratio is useful for comparing returns since it removes the excess returns that are earned by taking on more risk. It is in the same vein as the P/E ratio, it provides a common base so that a reasonable comparison can be made. For the Sharpe Ratio, a higher number is better, as it is the excess reward. The trading method produced rather disappointing risk adjusted returns for most of the portfolios. The ratios were as follows: Raw and RA .13707, Liquid -.07224, Illiquid .14467, and QQQ had a return of .06804 (see Exhibit 4). One pitfall of this ratio is that fails to distinguish between good volatility and bad volatility. These trading tactics produce a large amount of volatility; it is this large denominator in the equation that is dragging down the performance. It also fails to distinguish between the risk return relationship between the Raw and RA portfolios. To gain a better perspective on the risk-adjusted returns we can use the Sortino Ratio.

2. Sortino Ratio

The Sortino Ratio is very similar to the Sharpe Ratio; the major distinction being that instead of using the standard deviation of the returns for the denominator is uses downside deviations. Downside deviations, as discussed in “A Brief History of Downside Risk Measures,” are simply the standard deviations only for those trading days where the pick would have lost money, these are then averaged to get the denominator in the equation.⁴ A significant improvement can be seen in the ratios, highlighting the

⁴ Nawrocki, D. “A brief history of downside risk measures”, J. Investing, pp. 9--26, Fall 1999.

aforementioned problem of the Sharpe Ratio failing to distinguish between good upward volatility and the bad downward variety. This version of the ratio also makes the distinction between the Raw and the RA portfolios. The ratios are as follows: Raw 1.192, RA .3442, Liquid .0018, Illiquid .7996, and QQQ .1238 (see Exhibit 5). The performance of the Raw portfolio shows through, the high returns are not diminished by the large denominator figure for volatility. The Sortino Ratio also illustrates how well the trading method outperformed QQQ, even in a risk adjusted sense.

V. Observations

The Raw Alternative portfolio was not initially planned. It came about while conducting research for the basic Raw portfolio when it became evident that the invested capital was growing at such a rate that liquidity would become a real concern. The earlier study using the Nasdaq index did not expose this problem as those companies were had a large enough trading volume that it would be unlikely that even the above average individual trader could move the price of the securities. The alternative approach was to keep the base investment the same and then either remove the profits or replenish the base amount each day to keep the invested amount at \$50,000. This trading method proved to be very successful and is more realistic in regards to being useful in the actual trading world. The net profit taken from this trading method was nearly \$125,000, representing a return of just under 250%. Exhibit 6 depicts the performance of this method against the raw results. The returns are not as high due to a lack of compounding, however they are still incredibly good and also much more stable than the raw portfolio.

The RA portfolio highlighted the compounding nature of the investment method. It is comprised of the exact same trades; the only difference between the two is that the RA portfolio is not fully reinvesting the earnings. While the returns are not as high as the Raw portfolio they are significantly less volatile. As time progresses and the investment base grows the Raw portfolio takes off but shows a noticeable increase in volatility. The larger investment base allows for larger price movements, fortunately they are generally upward in nature.

Another interesting observation was that certain companies appeared frequently and they all happened to be small tech oriented firms, they also produced excellent returns when they occurred. These firms included Glycogenesys, Greenman Tech, Macrochem, and Avitar Inc. These four firms appeared a combined total of 89 times in the raw portfolio transactions. They earned an average of 2.68% each time they traded. These firms are extremely volatile and are the proverbial bread and butter of the trading method. Wildly volatile stocks will plunge and rise further than efficient market theory allows for; panic selling depressing prices and people hopping on an already rising stock pushing it higher than it should be are not something that can be effectively priced into a security. The shotgun approach taken by this trading method captures these inefficiencies and profits when the prices rise back to up to normal level, more often than not it is successful.

VI. Implications for Mass Index Firms

This study has produced some very interesting implications for the firms trading on the MI. There have been several studies that compare the characteristics of regional

exchanges to the NYSE and Nasdaq and they have found several factors that could contribute to the poor performance of the trading method when applied to an illiquid market. Small regional exchanges have poorer execution of trades, worse information asymmetry, and less efficient markets in general due to a far fewer number of market participants.⁵ There are major firms that are included in the MI, names such as Staples, Genentech, and Raytheon, but the MI is really home to those companies that are simply too small to be listed on the major exchanges. These small firms benefit greatly from their ability to go public somewhere and raise money. It is the traders who must be wary of these stocks. Liquidity became an apparent problem in achieving returns for a number of firms and for some of these companies a single trader could easily move the market, in some instance it was evident that a trade of \$500 would have been enough to shift a stock several percentage points in either direction. One problem that could arise from this, in light of current options scandals, is that an individual with stock options in one of these small firms would have to do very little to move the market in his/her favor to increase their option return and then could crush the stock afterwards when they dump their position. Another problem firms may face that is related to liquidity is that it would be relatively cheap for a shareholder activist to get a large percentage of their stock and then use that as a bargaining chip to impose their will on the corporation with the threat that they will dump their holdings and crush the stock price if the company does not comply. This is typically a difficult and costly process requiring hundreds of millions of dollars when dealing with major firms that are listed on the NYSE or Nasdaq since the market is

⁵ Van Ness, R.A. & B.F., Warr, R. "A Comparison of NYSE and Regional Trading," Stock Exchanges, IPO's, and Mutual Funds. Ed. Klein, Nova Science Publishers, 2004. pp. 1-21.

liquid enough that there would be buyers that would offset threats of a massive sell-off, small illiquid firms on the MI do not have this protection.

VI. Conclusion

This study set out with the objective of testing the effects of liquidity on a simple trading strategy. We found conclusive evidence supporting the idea that a lack of liquidity can negatively impact the returns of a successful trading strategy. Several portfolios were constructed in an attempt to deal with liquidity restraints in a variety of ways and each showed a significant decline in terms of their total returns indicating that trading method would be negatively impacted if faced with an illiquid market. A variety of risk metrics were utilized and these showed a significant reduction in the performance gap between the various alternatives. As a whole, it can be said that a lack of liquidity will have a negative impact for both traders and the organizations which are traded.

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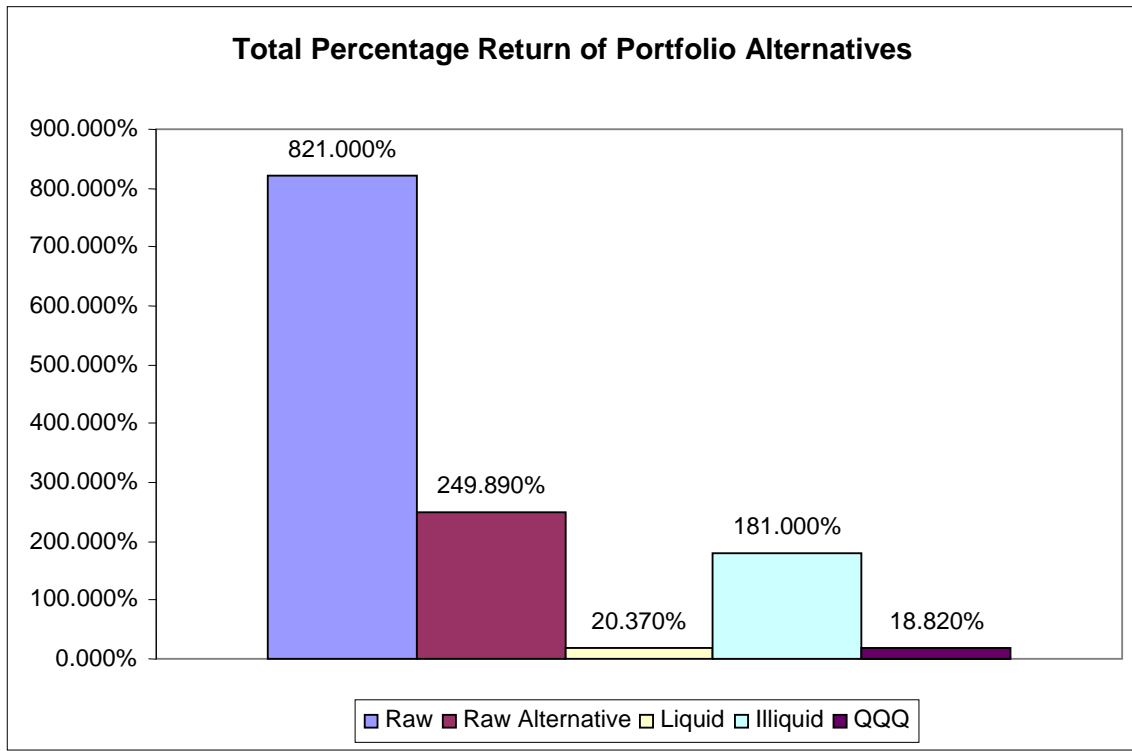
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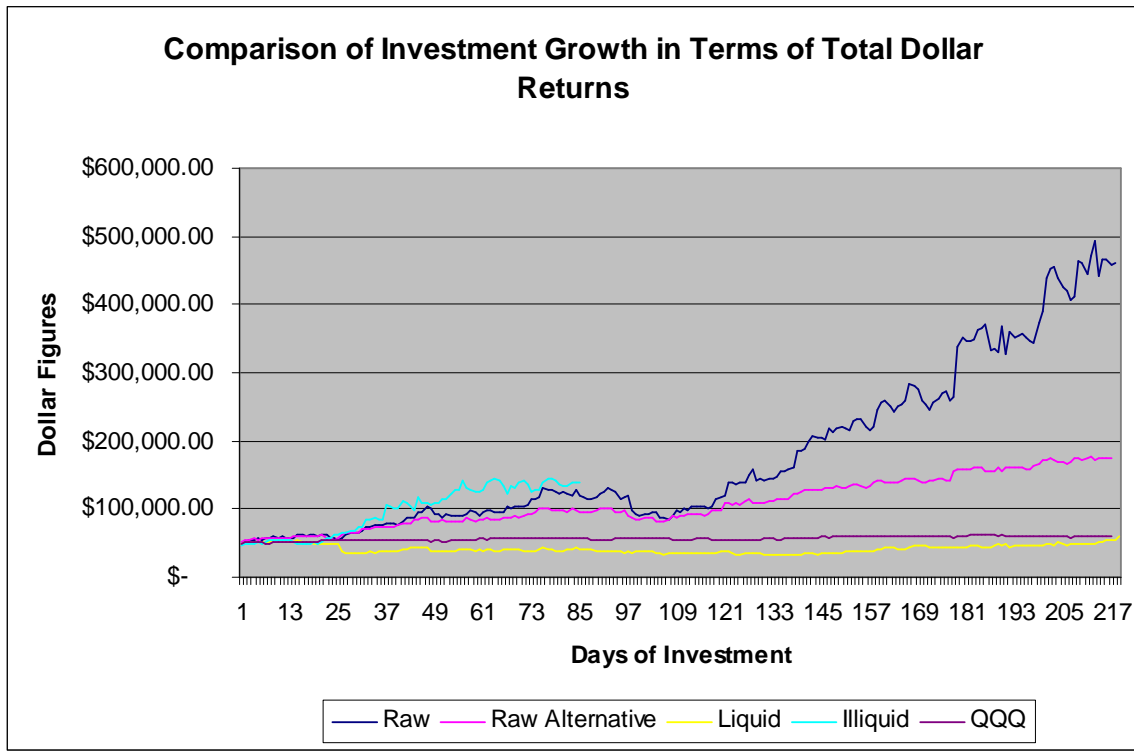
Van Ness, R.A. & B.F., Warr, R., "A Comparison of NYSE and Regional Trading," *Stock Exchanges, IPO's, and Mutual Funds*. Ed. Klein, Nova Science Publishers, 2004. pp. 1-21.

Exhibit 1
Total Percentage Return of Portfolio Alternatives



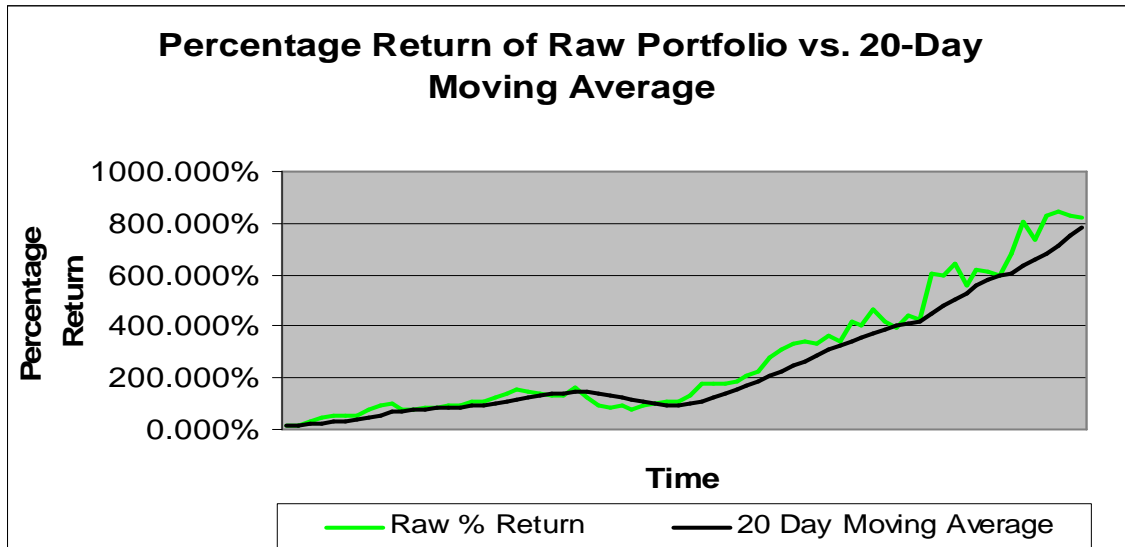
This figure represents a comparison of the total returns achieved by all the trading methods examined. The four portfolios were based on variations of the basic trading strategy as discussed while the QQQ investment used a buy and hold investment style. This graph highlights the dramatic earning power of the trading strategy in its raw base form. It also highlights the performance attribution that the small illiquid trades produced.

Exhibit 2
Comparison of Investment Growth in Terms of Dollar Returns



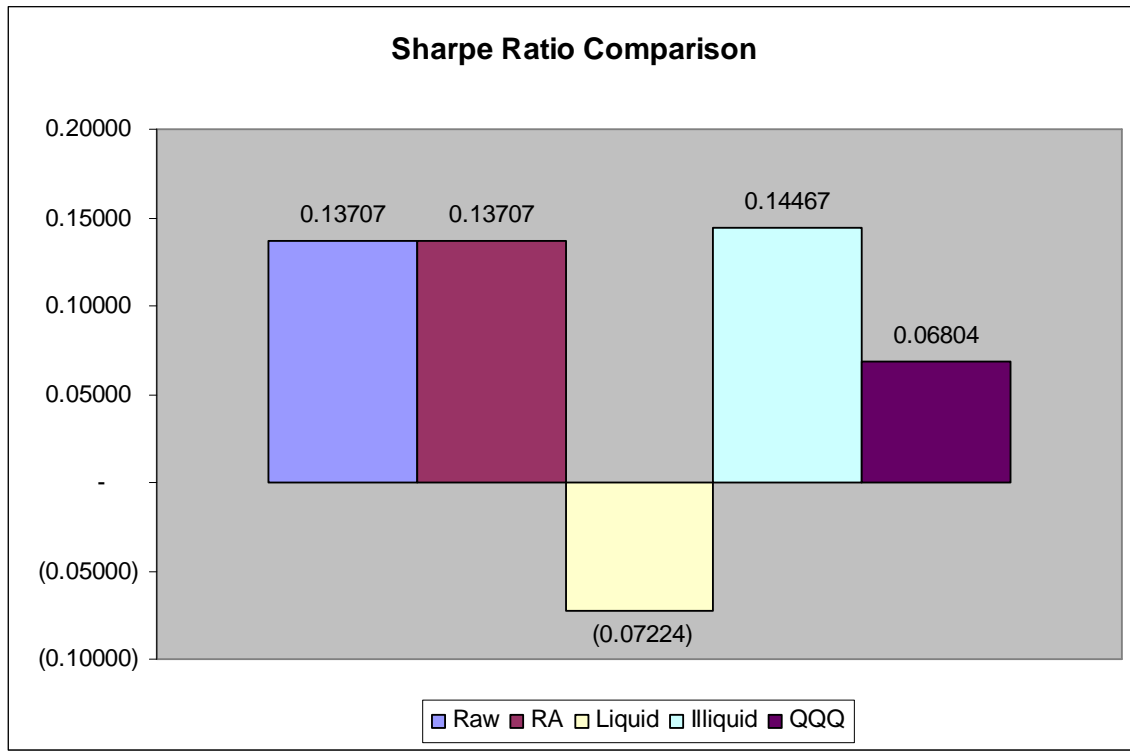
This figure represents the growth of the initial investment in terms of dollar-based returns for each portfolio created. The illiquid portfolio results are somewhat distorted since the number of days that trading actually occurred was significantly reduced; however, the time period examined was the same as the other options.

Exhibit 3
Percentage Return of Raw Portfolio vs. 20-Day
Moving Average



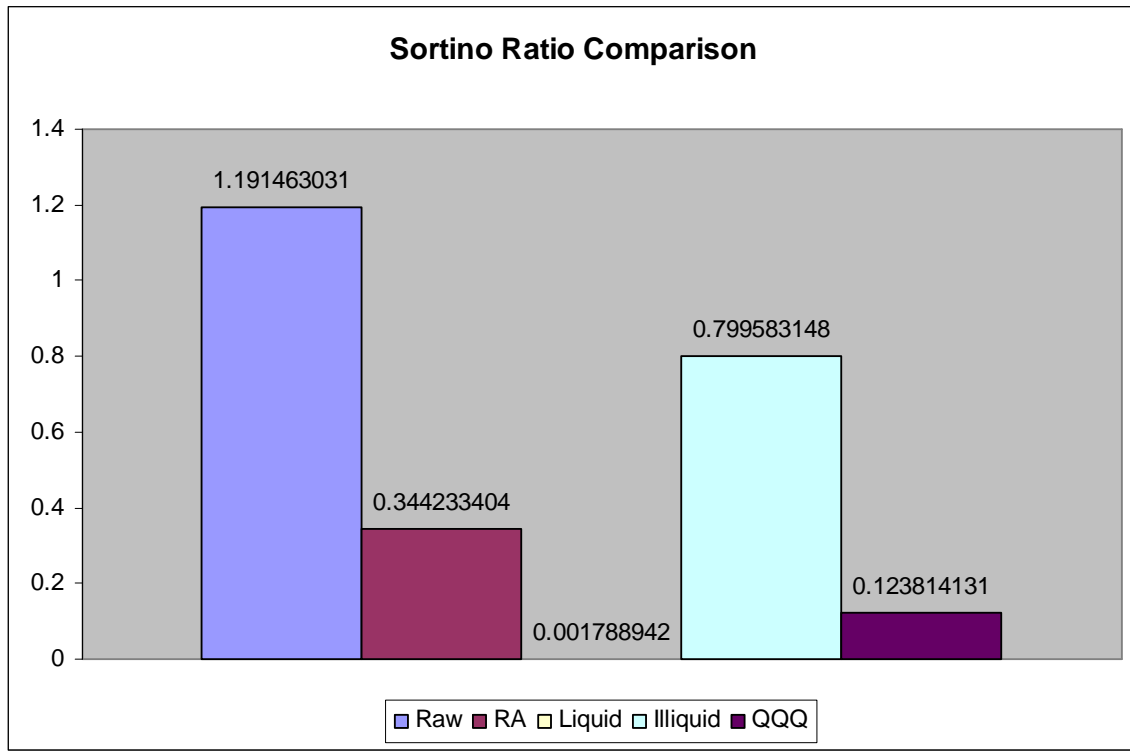
This graph depicts the return of the raw portfolio vs. its moving average. This shows that while the trading method was volatile it did exhibit a strong upwards volatility and this sort of volatility should not be as heavily discounted.

Exhibit 4 Sharpe Ratio Comparison



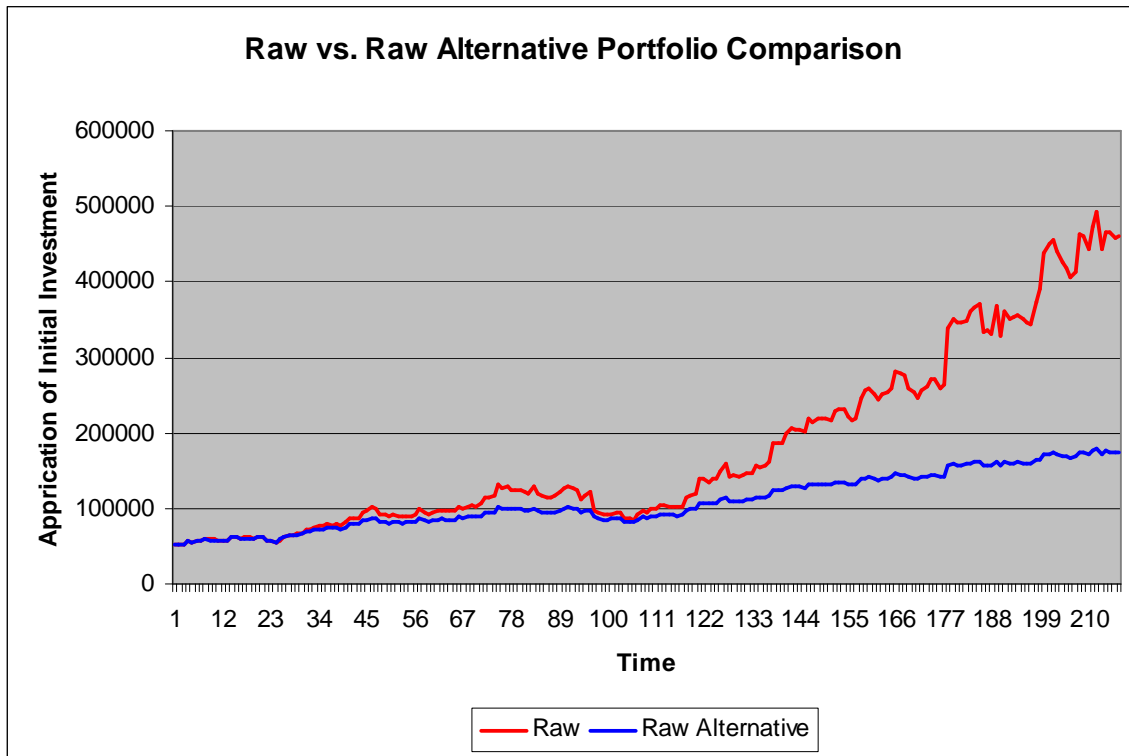
This graph depicts the various Sharpe ratios for each portfolio. This ratio is based around standard deviation of returns and gives an idea of the risk vs. return. A higher ratio is better as it indicates higher levels of return for a given amount of risk. These ratios are lower than expected because of the high volatility of returns. It is interesting to note that the liquid portfolio had decent returns but in a risk adjusted sense they were actually negative. The various portfolios all returned a significantly greater amount than QQQ but when adjusted for risk we see that there is a significant decline in the quality of these returns, although they still performed much better than the benchmark.

Exhibit 5 Sortino Ratio Comparison



This graph depicts the Sortino ratios of the various portfolios. This graph is important in that it provides a clearer picture of the performance difference between the portfolios than is possible using the Sharpe Ratio. This is due to differentiating between downside and upside deviations.

Exhibit 6
Raw vs. Raw Alternative Portfolio Comparison



This graph depicts the performance of the Raw vs. the Raw Alternative portfolio. The volatility appears to be significantly reduced in the Raw Alternative, however the returns are obviously inferior.