Opportunities After Sarbanes-Oxley: Can Outsiders Earn Abnormal Profits by Mimicking Insider Trades?

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Abstract
This study offers an examination of market efficiency following the enactment of Sarbanes-Oxley. There have been many empirical analyses that have examined insider trading and have concluded that insiders legally trading on nonpublic, immaterial information earn abnormal profits. While insiders earn abnormal profits, studies examining whether outsiders can generate abnormal returns by mimicking insiders have largely concluded that they cannot because too much time elapses between when insiders trade and when news of those trades becomes public. The enactment of Sarbanes-Oxley in 2002, however, significantly changed the insider trading laws. Whereas prior to Sarbanes-Oxley news of insider trades had become public as long as 40 days after the trades had occurred, after Sarbanes-Oxley news of insider trades often became public within two days. In this study I tested whether outsiders mimicking only the most valuable insider trades could have earned abnormal returns after Sarbanes-Oxley. I tested six strategies of mimicking insider trades and I found substantial evidence that outsiders could have earned abnormal returns, marking a significant violation of the semi-strong form of the Efficient Market Hypothesis. While I found that outsiders could not have earned significant returns before Sarbanes-Oxley, I found that outsiders could have earned abnormal returns of between 4.89% and 17.67% in the 27 months following Sarbanes-Oxley. When I analyzed the returns after Sarbanes-Oxley more closely I found that while substantial abnormal returns were available to outsiders for over a year following Sarbanes-Oxley, by 2004 the market had become efficient and outsiders were no longer able to earn abnormal returns.

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1 Introduction

The fundamental question in financial economics is: can investors systematically beat the market? Interestingly, the two groups to whom this question is most central are largely divided on the answer.

On Wall Street, it is assumed to be self-evident that some people can systematically beat the market. Security analysts are employed to scour annual reports to find what the market is not pricing in; star traders are rewarded with multi-million dollar bonuses for beating the market; and hot-hand mutual fund managers are paid exorbitant fees for their stock picking prowess. Indeed, the whole investment management business is grounded on the premise that abnormal returns can be made and that the star talent that produce abnormal returns should be rewarded.

Academics, whose jobs are less dependent of generating abnormal returns, take a more skeptical view. In academia, the Efficient Market Hypothesis has been the most popular theory regarding the movement of the stock market over the past few decades. In its strong form the Efficient Market Hypothesis states that prices in the market reflect all available information (both public and private). In its semi-strong form the Efficient Market Hypothesis loosens its assumptions of efficiency and states that at any point in time the market efficiently reflects all publicly available information. Taken to hold in either form, an implication of the Efficient Market Hypothesis is that investors cannot outperform the market without being correspondingly more risky.

Thus the Efficient Market Hypothesis, especially taken in its semi-strong form, is of essential importance to financial economics and to the finance industry. If the
Efficient Market Hypothesis holds, then a lot of “star” talent is getting greatly overpaid for getting lucky a few times in a row. Conversely, if the Efficient Market Hypothesis does not hold, then strategies which can earn systematic abnormal returns must exist—an issue of great importance to anyone who has ever invested.

My study offers a test of market efficiency through the use of insider trade data. Insiders are allowed to trade in their own securities so long as they report their trades to the Security Exchange Commission (SEC) and do not trade on “material, non-public” information. It seems logical that an insider’s close knowledge of his company and his company’s industry would allow him to time his investments better than an outsider. Indeed this is the case; nearly every study on insider trades has found that insiders earn abnormal returns. Abnormal returns for insiders, however, do not have profound implications for market efficiency. Since insiders trade on information that is not public their abnormal profits mark only a violation of the strong form of the Efficient Market Hypothesis, which itself enjoys little empirical support. If outsiders can earn abnormal returns by mimicking insider trades, however, it would be a violation of the semi-strong form of the Efficient Market Hypothesis. In light of the wealth of support for the semi-strong of the hypothesis, summarized well by Fama (1970), a violation of this sort would mark a serious anomaly.

Historically, studies examining insider trading have not found evidence of this anomaly. The majority of studies have concluded that while insiders can earn abnormal profits, outsiders mimicking insider trades cannot earn abnormal returns. Largely, studies have concluded that outsiders cannot earn abnormal returns because there is a significant delay between when insiders trade and when news of their trades becomes public. Prior
to 2002 the SEC granted insiders up until the 10\textsuperscript{th} of the month following the month in which they traded to report their transactions and studies examining a mimicking strategy in this environment often assumed that outsiders would mimic insider trades as much as two months after the event. Since recent studies have shown that the abnormal returns to insider trades dissipate very quickly\textsuperscript{1} it is not surprising that there has been little empirical support for outsiders earning abnormal returns.

The enactment of Sarbanes-Oxley in 2002, however, made quickly mimicking insider trades feasible. The Sarbanes-Oxley Act changed the laws regarding the reporting of insider trades in two significant ways. The act required that all trades be reported electronically, and that all trades be reported to the SEC within two business days of having been executed. The net effect of these changes was that following Sarbanes-Oxley outsiders could have monitored insider trades conveniently (from the SEC website for example) and mimicked them quickly.

I use the enactment of Sarbanes-Oxley as a launching point for conducting a study on the Efficient Market Hypothesis. On the one hand, it seems intuitive that outsiders mimicking insider trades more immediately should have been able to earn some abnormal returns. On the other hand, the well supported Efficient Market Hypothesis states that the market should have quickly adapted. To test how market efficiency held up amidst the regulatory changes, I constructed six experimental portfolios which mimicked insider trades in 98 securities particularly sensitive to insider information and I estimated the abnormal returns these portfolios would have earned from 1999-2004.\textsuperscript{2} I estimated

\textsuperscript{1} Jeng, Metrick, and Zeckhauser (2003) found that half of all the returns to insider trades accumulate within the first month following the trade.

\textsuperscript{2} I initially wanted to construct portfolios consisting of 100 securities. The nature of Excel spreadsheets, however, made 99 securities an easier number since I could track 9 securities per worksheet. Once I had
abnormal returns by comparing the risk-adjusted returns earned by the experimental portfolios to the risk-adjusted returns earned by control portfolios composed of the same 98 securities.

I found that outside investors could have initially beat the market by mimicking insider trades, but that this strategy can longer yield abnormal returns. I found that while outsiders could not have earned statistically significant abnormal returns in the 43 months preceding Sarbanes-Oxley, they could have earned dramatic abnormal returns by mimicking insider trades in the 29 months following the enactment of the law. The six experimental portfolios I examined earned annualized abnormal returns of between 4.89% and 17.67% (after transaction costs) in the 29 months following the enactment of Sarbanes-Oxley. After decomposing the returns in the post Sarbanes-Oxley period, I found that abnormal returns were entirely driven by the experimental portfolios’ extremely strong performance in the first 17 months following the enactment of Sarbanes-Oxley and that, in fact, the experimental portfolios earned no statistically significant abnormal returns in the last 12 months. My results offer both evidence of a serious violation of the semi-strong form of the Efficient Market Hypothesis and evidence that the market is efficient enough that abnormal profits will not last.

2 Review of the Previous Literature

There are essentially three different motivations for examining insider trades: policy, science, and profit (Jeng, Metrick, and Zeckhauser 2003). Studies examining selected 99 securities and followed their returns for a significant period of time, however, I realized that one of the 99 companies was a French company which would have never been selected in the first place by a fund manager wishing to use insider information to achieve better returns since the SEC insider trading laws would not apply to this company. I accordingly decided to remove it from the portfolios and was thus left with 98 securities.
policy issues have approached insider trading from both theoretical and empirical frameworks and have sought to determine whether government regulation of insider trading is appropriate. Studies examining the scientific aspects of insider trading have used insider trades to test market efficiency. Lastly, studies focused on profit have sought to identify strategies that allow outsiders to earn abnormal returns by using publicly available information about insider trades.

2.1 Policy Literature

The literature focused on the policy implications of legal insider trading has sought to answer one question— is regulation appropriate? The SEC has taken the position that it is appropriate, arguing that insider trading is harmful because it leads to distorted managerial incentives and a loss of liquidity in the market as investor confidence is lost due to a sense of unfairness. A strand of the academic literature dating back to Manne (1966), however, has argued that regulation may not be useful. Manne argues that because informed traders make markets more efficient, unregulated trading by company executives should make the markets more efficient as well, since they are just a special kind of informed trader whose information is precise and has been acquired at no cost. Empirical evidence exists for both sides. Garfinkel (1997) and Kabir and Vermaelen (1996) both found evidence of reduced volumes and slower speeds of price adjustments following the passage of insider trading laws. In contrast, Bettis, Coles, and Lemmon (2000) found that US market spreads are narrower when company charters forbid insider trading. Fishman and Hagerty (1992) reviewed the literature and examined the question from a theoretical framework. They found that under certain circumstances
markets can be made informationally more efficient by prohibiting trading on the basis of information that is not publicly available and allowing trading on information that is available. They conclude that either public disclosure laws or insider trading laws are needed, but that either type of law in an absolute form would lead to disincentives in the collection of information. Therefore they conclude that a “disclose or abstain from trading” rule, very similar to SEC rule 10b-5\textsuperscript{3}, is ideal.

Adding to the policy discussion is a study by Jeng, Metrick, and Zeckhauser (2003) which attempted to quantify the costs to counterparties of legal insider trading resulting from the current SEC rules. They approached this question by estimating the abnormal returns earned by all insiders due solely to “insider” content and by calculating this as a percentage of all trades. They estimated that the expected cost of insider trading to outsiders is 10 cents for each $10,000 transaction. They conclude that the costs of insider trading under the current laws are quite small.

2.2 Scientific Literature

2.2.1 Early Studies

The majority of the literature on insider trading motivated by science has focused on trading profits and market efficiency. The earliest studies traditionally sought to test whether portfolios of stocks selected on insider trade criteria could outperform the market. These studies would typically form a buy portfolio and a sell portfolio. A buy portfolio, for example, would consist of all the stocks for a given month in which the number of insider traders buying the stock exceeded the number of insider traders selling the stock. The studies then measured the returns to the buy (or sell) portfolio over time.

\textsuperscript{3} SEC rule 10b-5 makes it illegal to trade when in “knowing possession” of material nonpublic information.
and compared these with average market returns. Early representative studies which used this beat-the-market method of evaluation were Rogoff (1966), Glass (1966), and Lorie and Neiderhoffer (1968). Lorie and Neiderhoffer found significant evidence that both insider buy and sell portfolios could outperform the market. Rogoff (1966) and Glass (1966) better quantified the performance, and estimated that portfolios constructed from insider trades could earn above the market returns of 9.5% and 10% over a period of six and seven months respectively.

The next round of empirical studies sought to elaborate on the simplistic beat-the-market method and attempted to measure whether risk-adjusted returns could still beat the market. The earliest studies attempting to partial out market risk used the Capital Asset Pricing Method (CAPM). These studies constructed portfolios much in the same manner as the beat-the-market studies did, but in their analysis they controlled for returns that were due solely to market correlation. Jaffe (1974) and Finnerty (1976) are two representative studies of this nature. While using slightly different criteria for constructing portfolios, both studies found that after controlling for market risk and transaction costs, insiders could still earn abnormal returns. Jaffe (1974) estimated that insiders could earn abnormal returns of three percent in the eight months following their transactions.

### 2.2.1 “Insider” Content

Subsequent studies questioned the precision of the CAPM model for estimating the extent to which the abnormal returns are solely attributable to the “inside” nature of the trades. Finnerty (1976) pointed out that insiders who decide to buy their companies’
stock purchase the securities of companies distinguished by certain characteristics such as smaller size, larger earnings ratios, and larger dividends. Since numerous studies, including Banz (1981) and Cook and Rozell (1984), had established that the stocks of companies characterized by smaller size, smaller market-to-book ratios, and larger earnings ratios earned abnormal returns, later studies attempted to estimate the abnormal returns to insider trades after controlling for these effects. Rozell and Zaman (1988) found that over a twelve-month period, abnormal insider returns dropped from 8.64% to 5.16% when these effects were controlled for. More recent studies have supported Rozell and Zaman’s findings of economically significant, but lower abnormal returns when firm characteristics are controlled for. Using the CAPM, Jeng, Metrick, and Zeckhauser (2003) found that abnormal returns to insider trades were 4.08% over six months. When they controlled for factors such as firm size, price-earnings ratio, and stock momentum, however, they found that the abnormal returns due to the “insider” component of insider trades were only 3.12%.

2.2.3 Information Asymmetry

At the same time some studies sought to isolate the returns solely attributable to the “insider” nature of insider trades, others began to examine the sources of insider returns. Since insider returns come from insiders exploiting their information asymmetry, these studies reasoned, insider returns must be greatest in situations in which this asymmetry is most unbalanced. Carpenter and Remmer (2001) hypothesized that higher ranked executive insiders have a greater information asymmetry to exploit than other insiders. They found that higher ranked officers earn greater abnormal returns than
lower ranked officers in the timing of their options exercises. Other work by Etebari, Tourani-Rad, and Gilbert (2003) and Lakonishok and Lee (2001) confirmed the importance of insider information asymmetry. These two studies found that insider managers earn greater abnormal returns than non-manager insiders and that higher-ranked executives earn greater abnormal returns than lower ranked executives.

Another source of information asymmetry was examined by Aboody and Lev (2000). Aboody and Lev (2000) hypothesized that there is greater information asymmetry in firms with significant research and development (R&D) activities. They point out that R&D is firm specific relative to other forms of capital, that it is not traded in organized markets, and that its value is not clearly disclosed in corporate reports. Aboody and Lev (2000) found that insiders trading in R&D intensive firms earn abnormal returns that are over two percent greater than the returns of insiders trading in non-R&D intensive firms.

2.2.4 Short Term Gains

Another recent contribution to the literature has been an analysis of the short-term gains earned by insiders. As I have discussed, traditional studies estimating the returns earned by insiders constructed monthly-event portfolios and measured the long run return across a number of months. In reality, insiders do not buy all their stock on the last day of the month. In practice, insiders buy their stock at some point within a month and then either earn or lose money as the stock moves up or down within that month. Rozeff and Zaman (1988) acknowledged this shortcoming and were among the first to estimate the returns to insider trading within the transaction month. Looking at the actual dates on
which insider made their purchases, Rozeff and Zaman found that insiders earn abnormal profits of 0.4% within the initial month in which they buy stock.

Friedrich, Gregory, Matatko, and Tonks (2002) analyzed the short run returns to insider trading on the London Stock Exchange. They found that insiders buy shares of stocks that have recently fallen (3% on average during the prior 20 days of trading) and that shares of stock tend to rise abnormally after they have been bought by insiders (1.9% on average during the 20 days of trading following the event-purchase). They conclude that insiders earn significant abnormal returns in the short run and they point out that previous studies have not accounted for these gains.

Jeng, Metrick, and Zeckhauser (2003) found similar results for short run returns to insider trades on three major U.S. stock exchanges. While Jeng, Metrick, and Zeckhauser found abnormal returns to insider trades to be 4.08% over six months, they found that most of these gains accumulate very quickly. They estimate that one fourth of all gains accumulate within the first five days after a transaction and that one half of all gains accumulate within the first month.

2.3 Outsider Abnormal Returns

The timing of abnormal returns is central to the question of whether outsiders can earn abnormal returns. If most of insiders’ abnormal gains accumulate before news of their transaction becomes public, then the possible gains to outsiders mimicking their trades will be slight. If most of the abnormal returns accumulate over several months following the trade, however, then it will be possible for outsiders trading on publicly available information to earn abnormal returns. Whether outsiders can earn abnormal
returns from trading off of publicly available information is a question that is central both to studies examining the scientific implications of insider trades on the semi-strong form of the Efficient Market Hypothesis and for studies focusing on identifying profitable investment strategies.

### 2.3.1 Outsider Returns through a Scientific Framework

The majority of studies focusing on the question of whether outsiders can earn abnormal returns have addressed this question through a scientific framework. While the results of these studies have been mixed, the overall consensus has been that once transaction costs are accounted for outsiders cannot earn economically significant abnormal returns. Early work by Finnerty (1976) found that the stocks which experience insider trade events continue to earn abnormal returns over the market for up to 11 months following the trade. While this was encouraging for outsiders, Finnerty found that the greatest part of these returns accumulated in the first two months, presumably before news of the trade was public. While Finnerty did not explicitly examine potential returns to outsiders, his numbers suggest that after transaction costs it would have been difficult for outsiders to have earned economically significant abnormal returns. Jaffe (1974) used similar methods as Finnerty, but explicitly approached the question of abnormal returns to outsiders. He found that while insiders earn abnormal profits, outsiders do not in most situations. Jaffe (1974) also decomposed insider trading months by intensity (number of insiders trading in a given month) and he found that outsiders can earn abnormal profits of 2.5% over 8 months if they mimic only the most intensive trading samples (3 or more different buyers in a month).
Later studies focused on whether outsiders could earn abnormal returns solely from the “insider” content of trades. In order to isolate the “insider” content of trades these studies partialled out factors such as firm size, market-to-book ratio, and earnings ratio. Seyhun (1986) found that while insiders can earn abnormal profits solely off the “insider” content of their trades, outsiders cannot earn economically significant abnormal profits. Similarly, Rozeff and Zaman (1988) found that outsiders mimicking insider trades can earn abnormal profits, but that these profits disappear when transaction costs of two percent are assumed and firm size and earnings ratio effects are controlled for. These studies tended to conclude that outsider profits do not mark a violation of the semi-strong form of the Efficient Market Hypothesis since outsiders cannot earn abnormal returns from the stand alone “insider” content of insider trades.

2.3.2 Outsider Returns in the For-Profit Literature

At the same time studies focused on policy and science tried to distill the returns of insider trading down to their sole “insider” content, the literature focused on maximizing profits for outsiders did just the opposite: it aggregated information across many parameters in order to find where the greatest returns could be earned. In the most comprehensive work motivated by the goal of helping outside investors improve their stock portfolios by using publicly available information, Seyhun (1998) analyzed twenty years of insider trade data along five parameters to determine an optimal stock picking strategy. Seyhun examined the predictive content of: 1) the identify of the insiders 2) the number of shares traded 3) firm size 4) sales and purchases and 5) the existence of a consensus among insiders. Seyhun defined abnormal returns as the raw (not adjusted for
risk) returns earned by his experimental portfolios over the raw returns of an equally weighted index of securities trading on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and the National Association of Securities Dealers Automated Quotation System (NASDAQ).

Seyhun’s findings along each parameter are summarized below. 1) Seyhun found the identity of insiders to be a good predictor of net profits. He found that trades by large shareholders are only marginally profitable (large shareholders earn net profits of only 0.7% over twelve months), but that trades by both officers and directors are significantly profitable (net profits of 3.9% and 3.6%). 2) Seyhun found the number of net shares traded in a given month is also a good predictor of net profits. He found that trades between one and 100 shares are practically meaningless and that net profits increase in shares traded until 100,000 net shares, at which point the signal starts to be less valuable. The most profitable trades to mimic are net month transactions involving between 10,000 and 100,000 shares. 3) Seyhun found that insiders’ profits increase as firm size decreases. He estimated that insiders earn net profits of 1.7% when trading in firms with over $1 billion in equity and net profits of 6.2% when trading in firms with under $25 million in equity. 4) Seyhun confirmed that insider purchases are significantly more predicative of future stock performance than insider sales. 5) Seyhun found that consensus among insiders is valuable, but offers diminishing returns. He estimated that when the buying consensus is only one insider, 12-month profits are 4.2%, but that when the consensus goes to two insiders profits increase to 5.6%.

Seyhun found that his parameters could be combined to further increase profits. He points out that while he found average profits for all insider trades to be 3.5%, he
found the average profits for trades of top executives buying stock in firms with less than $25 million in equity to be 12.3%.

Although not a scientific study, Seyhun’s findings still enjoy a wealth of support in the scientific literature. Frankel and Li (2001) and Lakonishok and Lee (2001) showed that insiders trading in small and less researched firms earn greater abnormal returns. Finnerty (1976), Rozeff and Zaman (1988), and Friederich, Gregory, Matatko, and Tonks (2002) found that abnormal returns are greater following insider purchases than sales. As I have already discussed, Carpenter and Remmer (2001), Etebari et al (2003) and Lakonishok and Lee (2001) found the identity of insiders to be an important predictor of abnormal profits. Jeng, Metrick and Zeckhauser (2003) and Friederich, Gregory, Matatko, and Tonks (2002) found that medium and high volume insider purchases are significantly more profitable than low volume insider purchases. Finally, the literature going back to Jaffe (1974) has shown that outsiders can earn greater abnormal returns by mimicking only trades in which there is a consensus among multiple insider buyers.

2.4 My Study within the Literature

My study attempts to build on both the profit driven and the scientific driven literature as I attempt to answer a simple question: could a strategy using specific profit maximizing parameters have earned abnormal returns in the post Sarbanes-Oxley environment? My study addresses old questions on market efficiency in the light of the new insider trading laws. The previous literature examining the Efficient Market Hypothesis through the paradigm of insider trading has largely suffered from one of two errors—it has examined too many potential strategies or it has too aggressively sought to
isolate the sources of abnormal returns. My methodology attempts to correct those problems.

Although studies such as Seyhun (1998) have shown that some insider trades are significantly more valuable to mimic than others, very few studies have examined a strategy of mimicking only the most profitable trades. Consequently, studies have examined many strategies, have found few to be profitable, and have largely then dismissed these few profitable strategies as not serious violations of market efficiency. These studies are not to blame for treating their findings with skepticism because, statistically, when many strategies are looked at, a few are bound to be found profitable.

The key to avoiding this problem is examining only a small number of strategies to begin with. One of the few studies that limited itself to examining only particularly profitable mimicking strategies found very interesting results. Rather than mimicking all trades and then decomposing the results, Bettis, Vickrey and Vickrey (1997) chose to mimic only large-volume purchases by high-ranking insiders. They found that by only mimicking these trades, outsiders can earn significant abnormal, transaction-cost-adjusted returns. By limiting the number of strategies they examined Bettis, Vickrey, and Vickrey successfully shielded their results from criticisms of data mining. I build on the success of Bettis, Vickrey, and Vickrey by testing a similar strategy of mimicking only the most profitable trades, now in the post Sarbanes-Oxley environment.

The second error is common in more recent studies which have focused on both policy and science. Studies examining policy questions—such as the question of how much insider trading costs counterparties—need to isolate the effects of the “insider” content of insider trades. While insider abnormal returns may come in part from the
asymmetric information they possess and in part from the fact that they are buying particular types of stocks which tend to outperform the market, a study focused on policy implications only cares about the profits insiders earn from their asymmetric information since that is all policy can affect. These studies err when they blur their goals in policy and science. It is necessary to isolate the effects of “insider” content in answering policy questions. It is not necessary to entirely isolate effects of “insider” content in testing the semi-strong form of the Efficient Market Hypothesis. Any proof that outsiders can earn abnormal returns trading off of publicly available information will mark a violation of the Efficient Market Hypothesis. Thus the goal of studies concerned with market efficiency should be testing whether outsiders can earn abnormal returns off publicly available information. Isolating the extent to which abnormal returns are due solely to the “insider” content of trades is interesting, but it is answering a different question. I sought to improve on previous studies in my measurement of abnormal returns by using a control portfolio to appropriately control for market risk and random market shifts while simultaneously avoiding the partialling out of other sources of abnormal returns that would have been available to outsider investors.

In sum, many studies have suffered from two errors. Studies suffering from the first error have examined too many strategies and have left their results open to data-mining criticisms. Studies suffering from the second error have obfuscated their goals in science and policy and have unnecessarily controlled for sources of abnormal returns. I tried to avoid the first problem by limiting the stocks I followed and the transactions I mimicked to only those that studies had previously established as particularly profitable. I
tried to avoid the second problem by using a control portfolio of precisely the same narrow range of stocks from which I drew my experimental portfolio.

3 Methodology

3.1 Overview

In order to test whether outsiders could have earned abnormal returns following Sarbanes-Oxley, I constructed six experimental portfolios (which were adjusted to mimic insider trades) and two control portfolios (which did not reflect insider trades) and I compared their returns from January 1999 through December 2004. This sample period offers 43 months of data before Sarbanes-Oxley and 29 months of data after Sarbanes-Oxley. To maximize potential abnormal profits I chose to mimic only trades that previous studies had established as particularly informative and to only trade in stocks which would have been particularly sensitive to insider information. I estimated abnormal returns as the risk-adjusted returns earned by an experimental portfolio less the risk-adjusted returns earned by its counterpart control portfolio. I used a likelihood ratio test to determine if the returns to the experimental portfolios were statistically different from the returns of the control portfolios.

3.2 Portfolio Construction

I built the experimental portfolios in a manner that a mutual fund seeking to earn better returns using insider trades would have constructed its portfolio. Since I follow the returns of stocks starting in 1999, I selected the initial 98 securities using information that would have been available to a fund manager starting his fund at this time. Since at the
beginning of the 1999 many of the 1998 annual reports would not have been released yet, I used financial information from the end of fiscal year 1997.

In selecting the initial portfolio of 98 stocks I had two goals in mind: ensure reasonable liquidity and choose stocks in which inside information would be most valuable. In order to achieve the first goal I restricted my sample to stocks trading on the New York Stock Exchange. In order to achieve the second goal I picked the stocks of companies that were relatively small and that were R&D intensive. As discussed in the Review of Previous Literature, Seyhun (1998), Frankel and Li (2001), and Lakonishok and Lee (2001) have shown that insiders trading in smaller firms earn greater abnormal returns and Aboody and Lev (2000) have shown that abnormal returns to insiders are greater in firms that are more R&D intensive. I began by restricting my sample of NYSE stocks to those which were relatively small, which I arbitrarily defined as having a market capitalization between $200 and $800 million at year end 1997. Using data from COMPUSTAT, I then ranked these securities according to their total R&D expenditures as a percentage of revenue in fiscal year 1997. Excluding foreign companies, for which insider trade information would not have been available, I took the 98 companies with R&D expenditures as the greatest percentage of their revenues to comprise my initial sample.

When I began to follow portfolio returns in January 1999, both the experimental and control portfolios consisted of the same 98 stocks in the same proportions. On

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4 It should be noted that the Aboody and Lev study was published two years after the time when my fictional fund manager would have selected his stocks. While this may unrealistically bias the returns of my portfolios prior to 2001, it does not affect the returns in the post Sarbanes-Oxley environment. Since the focus of my study is on insider returns in the post Sarbanes-Oxley period, I am willing to accept the slight bias that choosing R&D intensive stocks might have had on returns prior to 2001.
January 1st, 1999, each security comprised a proportion of the experimental portfolio that was equal to the security’s baseline market capitalization fraction, as defined below:

\[
B_j = \frac{C_{j,1997}}{\sum_{j=1}^{98} C_{j,1997}}
\]

While a given security’s market weighted fraction of the total portfolio would change, that company’s baseline fraction always remained the same. The concept of the baseline fraction will be discussed further when I discuss the rebalancing of the experimental portfolios.

Many of the securities that were included in 1999 merged or were taken over during the six year window of observation. If the post-merger company no longer fit the initial criteria for belonging in the portfolios, I removed it and replaced it with another security. The replacement securities were selected in the exact same manner that the initial 98 securities were; they were securities trading on the NYSE which had a market capitalization between $200 million and $800 million at the end of 1997. The first replacement security, ranked by R&D expenditures as a percentage of revenue would have been the 99th security included in the initial portfolios. Over the six year period, 31 of the initial securities included in the portfolios merged or were taken over. They were replaced, on the day following the merger by replacement securities. Therefore, a total of 129 different securities were included in my portfolios over the six year window of observation.
3.3 Trading Rules for the Experimental Portfolios

Constructing rules for mimicking insider trades involved making a number of arbitrary decisions. In order to clearly explain the decisions I made in constructing and rebalancing the experimental portfolios, I will discuss trading rules in three steps. I will first discuss the mechanism by which I rebalanced the experimental portfolios to respond to insider trades. I will then explain the criteria I used to determine which insider trades to mimic. Finally, I will discuss the criteria I used to determine when to rebalance the portfolios.

3.3.1 The Rebalancing Mechanism

At any given time during the six year window of observation the experimental and control portfolios contained the same 98 stocks. The difference between the portfolios was that the experimental portfolios were adjusted to weigh more heavily into the stocks which insiders bought when news of these buys became public. The extent to which an experimental portfolio weighed more heavily into a stock experiencing an insider buy depended on the stock’s initial baseline fraction, the portfolio’s signal multiplier, and the number of trading signals the stock had experienced. The mechanism by which these factors worked together to determine a security’s weight within a portfolio at a given time is explained below:
I examined experimental portfolios which use three signal multipliers: four, six, and 10,000. I used signal multipliers of four and six because these would have feasibly been used by a mutual fund wishing to maintain significant diversification. I used the signal multiplier of 10,000 as a proxy for the returns the experimental portfolio would have earned if it were, at any given time, invested entirely in stocks that had experienced recent insider buys. I also tested the effect that a 10% limit, restricting securities from comprising more than 10% of a portfolio, would have had on the portfolios using signal multipliers of four and six.

My simplistic rebalancing process had an unintended effect that I should discuss. Whenever one of the 98 securities in an experimental portfolio got a new buy signal, its new percentage of the total portfolio was derivative of its baseline fraction (which was its 1997 market weighted fraction of the portfolio), not of its current market-weighted fraction of the entire portfolio. The net effect of baseline fraction weighting was that, at the time of rebalancing, the portfolio slightly oversold stocks which had outperformed and slightly undersold stocks which had underperformed. While this over-selling of winners and under-selling of losers was unintentional, I was able to control for its effect on the experimental portfolios by adjusting the control portfolios to over-sell winners and

\[ M = \text{signal multiplier} \]
\[ N_{ij} = \text{number of buy signals for security } j \text{ at time } t \]
\[ B_j = \text{baseline fraction for security } j \]
\[ R_{ij} = \text{raw adjusted fraction for security } j \text{ at time } t \]
\[ F_j = \text{fraction of the total portfolio that security } j \text{ comprises at time } t \]

If \( N_{ij} > 0 \)
\[
R_{ij} = B_j \times M \times N_{ij}
\]

If \( N_{ij} = 0 \)
\[
R_{ij} = B_j
\]

\[
F_j = \frac{\sum_{j=1}^{98} R_{ij}}{\sum_{j=1}^{98} R_{ij}}
\]
under-sell losers in exactly the same manner on exactly the same dates.\textsuperscript{5} Since I examined experimental portfolios which rebalanced on two different sets of dates (one used a six month holding period and one used a three month holding period) I used two different control portfolios to control for the effects of baseline fraction weighting.

### 3.3.2 Criteria for Qualifying as a Signal

There are many different types of insider transactions which outsiders can potentially mimic. Many studies have shown that not all insider trades are equal in their predictive powers and some (such as large CEO buys) may be significantly more valuable than others. The signals with truly large predictive content, however, are rare. Thus, I sought to only mimic trades which would have significant predictive content, but at the same time I tried to ensure that there would be a sufficient number of signals to distinguish the experimental portfolios from the control portfolios.

As discussed in the Review of the Previous Literature, there is significant evidence that insider trades by executives and directors contain more predictive content than trades by large shareholders (Lakonishok and Lee 2001 and Seyhun 1998); that insider purchases are more informative than insider sales (Finnerty 1976, Seyhun 1998, etc.); and that large transactions of over 10,000 shares are better predictors than smaller transactions (Seyhun 1998). Therefore, I defined insider events as open market purchases by officers or directors with total values exceeding $50,000. While the $50,000 threshold

\textsuperscript{5} Since the source of bias is that my experimental portfolio rebalanced all securities according to their baseline fraction (not the current market weighted fraction) at the time of a rebalance event, I controlled for this bias by rebalancing all the securities in my control portfolio according to their baseline fractions on the exact same dates. The aggregate effect of this bias on the raw returns was actually quite small. The control portfolio rebalanced on the same dates as the experimental portfolio using a six month holding period only earned annualized raw returns of 1.1% percent over the un-rebalanced control portfolio.
is arbitrary, choosing a dollar figure is more meaningful than choosing a number of shares. Choosing a transaction size criterion based on the number of shares traded would favor mimicking insider transactions in stocks with smaller per share values—a factor which is neither useful nor relevant. I acquired all of the insider trade data from Thomson Financial. Table I displays the summary statistics for the insider buy events that the experimental portfolios used.

Table I

<table>
<thead>
<tr>
<th>Insider Purchasing Events: Summary Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Events Decomposed by</strong></td>
</tr>
<tr>
<td><strong>Date of Purchase</strong></td>
</tr>
<tr>
<td>Pre Sarbanes-Oxley</td>
</tr>
<tr>
<td>Post Sarbanes-Oxley</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

| **Events Per Security**                       |
| **Total Buy Events**                          |
| **Number of Securities**                      |
| **Total Signals**                             |
| 0 Buys                                       | 38  |
| 1 Buy                                        | 25  |
| 2 Buys                                       | 20  |
| 3 Buys                                       | 11  |
| 4 Buys                                       | 13  |
| 5 Buys                                       | 11  |
| **Total**                                     | 129 |

| **Yearly Breakdown**                          |
| 1999  84                                      |
| 2000  63                                      |
| 2001  36                                      |
| 2002  29                                      |
| 2003  34                                      |
| 2004  37                                      |
| **Total**                                     | 283 |

Table I shows that most of the securities that are included in the portfolios (91 out of 129) experienced an insider buy event at some point over the six year window of examination. While a few securities experienced a large number of buy events (five securities accounted for 42 buy events), on the whole buy events were distributed fairly evenly across the sample (80 securities experienced between one and five buy events). It should also be noted that 1999 and 2000 accounted for a disproportionately large number
of buy signals. The economic bubble taking place at this time probably resulted in above average insider trading volume.

3.3.3 Timing Issues

There were two questions central to the rebalancing of the experimental portfolios that I had to answer: when should a new insider buy be incorporated, and for how long should the buy signal be held? With regard to the first issue, I tried to incorporate news of insider trades quickly. I chose a strategy which mimicked insider trades at the close of the trading day following the day on which news of the insider trade became public. Since 1996, the SEC has posted insider filings on its website roughly within 24 hours of when an insider’s filings are received. I used the date at which the insider filings were posted on the website, as reported by Thomson Financial, as a reference for when news of insider trades had become public. Since these filings were sometimes posted only after the market had closed, I chose to buy the security at the closing price on the day following the day on which the filings were posted. As would be expected, the lag time between when insiders traded and when news of their trades was made public through the SEC website changed dramatically with the enactment of Sarbanes-Oxley. The average lag time for the 193 buy events prior to the enactment of Sarbanes-Oxley was 23.0 days.

---

6 I used the “create date” reported by Thomson Financial as a reference for when the SEC file was created. The “create date” is reported by Thomson Financial to be the date of the creation of the record. This differs from the “SEC receipt date,” also reported by Thomson Financial, which is defined as the date on which the SEC received the filing from the Insider. Empirically every “create date” in my sample was either on the same date or, more often, one or more days after the SEC receipt date. While it is not explicitly said by Thomson Financial that the “create date” is the date on which the file was posted on the SEC website, after speaking to several officials at the SEC it seems that files are posted on the website at the time they are created. I was told that at the moment of creation, the SEC assigns a filing number to a file and posts it on the website. Therefore, the “create date” a file appears to be a very good proxy for when the news of a trade became public.
whereas the average lag time for the 90 buy events after the enactment of Sarbanes-Oxley was only 4.2 days.

The date on which a trade qualified as a purchase of a total value over $50,000, however, was itself sometimes arbitrary. In some instances, one insider may have sold stock at the same time another insider bought stock. To ensure that I did not assign a signal to a stock that one insider had recently purchased but that many had recently sold, I used an inside purchase as a signal only if net buying exceeded net selling by $50,000 over the 10 day window. Similarly, while I allowed stocks to have multiple buy signals, I tried to make sure that one large insider purchase spread over several days would only be counted as one buy signal. To achieve this, after an insider trading event occurred, I would disregard all insider buying in that security for the following 10 days.

A second timing concern was the issue of for how long to “hold” a buy signal. While Finnerty (1976) found that insider purchases can predict abnormal future stock returns for as long as 11 months after the event, he found that most of these abnormal returns accumulate in the first two months. Similarly Jeng, Metrick, and Zeckhauser (2003) found that insiders earn abnormal returns in the six months following insider trades, but they estimated that half of these returns accumulate in the first month following the transaction. In short, the literature does not point to an obvious holding period for my study. On the one hand, insider trading signals seem to conclusively contain valuable content for at least the six months following an insider buying event. On the other hand, these abnormal returns become increasingly diluted as the holding period is increased. Since there was a trade-off between having more weak signals or fewer

---

7 In the previous paragraph I report average lag times. If a trade is aggregated over a series of days, lag time is reported from the day at which the aggregated trade surpassed the $50,000 level.
strong signals, I chose to examine the returns to using both a six month holding period and a three month holding period.

3.4 Measurement of Abnormal Returns

While the fundamental goal of a study examining the semi-strong form of the Efficient Market Hypothesis is to test whether outsiders can earn abnormal returns trading off of publicly available information, abnormal returns are difficult to define. Early studies using the CAPM, such as Jaffe (1974), sought to define abnormal returns as the returns to insider trading portfolios after controlling for market correlation. The CAPM regresses security returns against market returns, and defines abnormal returns as the security returns that are not explained by market correlation. The CAPM method is illustrated below, where alpha is a security’s abnormal returns.

\[
R_s - R_f = \alpha_s + \beta_s (R_m - R_f) + \epsilon_s
\]

Later studies seeking to improve on the simplistic CAPM used a Fama-French Three Factor Model (or some permutation of it) to control additional market factors. These studies, such as Rozeff and Zaman (1988) defined abnormal returns as the returns earned due to solely the “insider” content of trades. The Fama-French Three Factor Model uses the same framework as the CAPM, but it includes other variables such as firm size and market-to-book ratios, along with market returns.

Both the CAPM and the Fama-French Three Factor Model are appropriate in certain instances for measuring abnormal returns. Neither is appropriate for my study.
The Fama-French Three Factor Model is a poor fit for my study because it isolates the sources of abnormal returns. While understanding the extent to which abnormal returns aggregate due solely to “insider” content is suitable for studies focused on policy, it offers an unnecessarily weak test of market efficiency. Since I attempt to test market efficiency, I include all abnormal returns that were available to outside investors using publicly available information.

The CAPM, on its own though, is not appropriate for my study either. Since I did not mimic insider trades across the entire market, a lurking variable in my raw returns is the performance of the sector of stocks from which I drew my sample. Specifically, I chose to only mimic trades in securities of companies with relatively small market capitalizations that invested heavily in R&D. Since I only examined a narrow, six year time period, if some trend affected only the stocks in this sector, correlation with the market alone would not have been enough to control for these factors.

In order to measure the true abnormal returns earned by the experimental portfolios, I needed to control for shifts that may have affected the small universe of securities from which I chose to mimic insider trades. I accomplished this by comparing the returns of the experimental portfolios to the returns of the control portfolios which, as mentioned, were composed of exactly the same 98 securities. The weighting of the portfolios, though, differed by design. While the control portfolios maintained an even balance, the experimental portfolios were, at times, very heavily weighted in only a few securities with buy signals. Hence, it can be argued that since the experimental portfolios were less well-diversified, they were more risky. This is a legitimate criticism and indeed comparing the raw returns of the experimental portfolios to the raw returns of the control
portfolios would not be appropriate since the experimental portfolios may have been
earning greater returns because they were taking on systematically greater risk. In order
to measure the extent to which the returns of the experimental portfolios were truly
abnormally greater than the returns to the control portfolios, I compared only their risk-
adjusted returns. I used the CAPM to estimate risk-adjusted returns for both types of
portfolios and I compared the returns of the experimental portfolios with the returns of
the control portfolios to control for sector shifts. I used the formula below to calculate
abnormal returns.

\[
\begin{align*}
R_e - R_f &= \alpha_e + \beta_e (R_m - R_f) + \epsilon_e \\
R_c - R_f &= \alpha_c + \beta_c (R_m - R_f) + \epsilon_c \\
A_e &= \alpha_e - \alpha_c
\end{align*}
\]

It should be reiterated that while I controlled for the excess risk that the
experimental portfolios might have been taking on over the control portfolios, I did not
control for other biases that the experimental portfolios might have exhibited. It is
possible that within my 98 security portfolio, insiders disproportionately bought stock in
companies characterized by larger earnings ratios or smaller market-to-book ratios.
While this type of within-sample bias might exist, I do not consider it a problem. There is
no excess risk associated with buying in this manner and if naïve investors
disproportionately buying stocks characterized by smaller market-to-book ratios could
have earned a fraction of the abnormal profits investors mimicking insiders could have,
so be it. The semi-strong form of the Efficient Market Hypothesis is violated if outside
investors could have earned abnormal returns from the use of publicly available information. The outsider returns need not be solely attributable to the “insider” content of publicly available information.

3.4.1 Statistical Significance

An important issue with regard to abnormal returns is their statistical significance. Since I defined the abnormal returns from my mimicking insider trades strategy as the risk-adjusted returns of the experimental portfolio less the risk-adjusted returns of the control portfolio, I determined statistical significance by comparing the returns of the two portfolios using the likelihood-ratio test (LRT) and testing the null hypothesis that both portfolios had the same alpha. The LRT is a statistical goodness of fit test between two models, which is traditionally used to compare a simple model to a more complex model in order to determine if additional parameters should be used in subsequent analysis.

I used the LRT to test whether there was a statistically significant goodness of fit difference between one model which allowed alphas to vary for the two portfolios and another model which artificially imposed the alphas of the experimental and control portfolios as being equal (see Appendix I for the algebra behind this transformation). To describe the likelihood score of two models, the LRT compares the goodness of fit of these two models using a ratio called the LRT statistic. The LRT statistic approximately follows a chi-square distribution which requires the degrees of freedom to be considered. The degrees of freedom are calculated as the number of parameters the more complex model has over the simpler model. In my study, I only restricted one variable (when I
imposed equal alphas in the null-portfolio) therefore the appropriate chi-squared distribution had one degree of freedom.

If, according to the chi-squared table, the LRT statistic was statistically significant, this implied that the goodness of fit of the model allowing alphas to vary across portfolios was significantly better than the goodness of fit of the model that imposed the alphas as being equal. Since the goodness of fit was taken to be significantly better, the alphas were assumed to differ a statistically significant amount. Thus if the LRT statistic was significant, the abnormal returns from the strategy were considered to be statistically significant.

4 Results

The results of my study vary across several parameters. The abnormal returns earned by the experimental portfolio depend on the signal multiplier, the holding period, the imposition of a 10% limit, and, most importantly, on the delay between when insiders traded and when they reported their trades. Accordingly, I will explain the results of my study across each of parameter.

4.1 Signal Multipliers

Table II shows the raw returns and the risk-adjusted returns decomposed by signal multiplier for four portfolios using a six month holding period for buy signals. Figure I shows the raw returns that would have been earned from 1999 to 2004 by investing $10,000,000 in the S&P 500, the control portfolio, and each of the experimental portfolios. For the six year period the control and experimental portfolios greatly
outperformed the S&P on both an absolute basis and a risk-adjusted basis. While these returns might have been due to some movement in the smaller, R&D intensive firms trading on the NYSE, the absolute returns and the risk-controlled returns of the experimental portfolios notably exceeded those of the control portfolio. In addition, the experimental portfolios which used larger signal multipliers earned larger returns. The experimental portfolio using a signal multiplier of six (x6 portfolio) earned risk-adjusted returns exceeding those of the portfolio using a multiplier of four (x4 portfolio) by 0.8% on an annualized basis. Even more dramatically, the risk-adjusted returns of the portfolio using a signal multiplier of 10,000 (x10,000 portfolio) exceeded those of the portfolio using a multiplier of four by over 4.5% on an annualized basis. As hypothesized, the risk-adjusted returns increase in the signal multiplier used, reaching an upper bound of around 23.84% as the entire portfolio is devoted solely to stocks experiencing insider trading events in the x10,000 portfolio.

Table II

<table>
<thead>
<tr>
<th>6 Month Holding Period</th>
<th>Control</th>
<th>x4</th>
<th>x6</th>
<th>x10,000</th>
<th>S&amp;P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Returns</td>
<td>20.66%</td>
<td>23.58%</td>
<td>24.42%</td>
<td>28.24%</td>
<td>4.11%</td>
</tr>
<tr>
<td>Risk-Adjusted Returns</td>
<td></td>
<td>16.50%</td>
<td>19.29%</td>
<td>20.09%</td>
<td>23.84%</td>
</tr>
<tr>
<td>(Annualized)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alpha</td>
<td>0.0061</td>
<td>0.0071</td>
<td>0.0074</td>
<td>0.0086</td>
<td></td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.0019</td>
<td>0.0021</td>
<td>0.0022</td>
<td>0.0027</td>
<td></td>
</tr>
</tbody>
</table>

Alphas are for 10 day portfolio returns regressed on 10 day S&P returns

Figure I
4.2 Holding Period

Table III compares the raw returns and risk-adjusted returns of a strategy using a six month holding period to those of a strategy using a three month holding period. The results show that the experimental portfolios using the shorter holding period outperformed the portfolios using the longer holding period and that the divergence between the two portfolios was greater when greater signal multipliers were used. Using a signal multiplier of four, the three month holding period earned annualized risk-controlled returns of almost 1.3% over the three month holding period, while using a multiplier of 10,000, the three month holding period portfolio earned annualized risk-controlled returns of almost 6.7% over the six month holding period portfolio. These results imply that the benefits of using only the most recent signals outweigh the costs of having fewer signals at any time. Interestingly, although insiders are required by law to
hold purchases for six months,\(^8\) Table III shows that a strategy mimicking insider returns can improve its performance by selling well before insiders would be allowed to.

Table III

<table>
<thead>
<tr>
<th></th>
<th>6 Month</th>
<th></th>
<th>3 Month</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>x4</td>
<td>x6</td>
<td>x10,000</td>
</tr>
<tr>
<td><strong>Raw Returns</strong></td>
<td>20.66%</td>
<td>23.58%</td>
<td>24.42%</td>
<td>28.24%</td>
</tr>
<tr>
<td><strong>Risk-Adjusted</strong></td>
<td>16.50%</td>
<td>19.29%</td>
<td>20.09%</td>
<td>23.84%</td>
</tr>
<tr>
<td>Returns (Annualized)</td>
<td>0.0061</td>
<td>0.0071</td>
<td>0.0074</td>
<td>0.0086</td>
</tr>
<tr>
<td><strong>Alpha</strong></td>
<td>0.0019</td>
<td>0.0021</td>
<td>0.0022</td>
<td>0.0027</td>
</tr>
<tr>
<td><strong>Standard Error</strong></td>
<td>0.0019</td>
<td>0.0021</td>
<td>0.0022</td>
<td>0.0027</td>
</tr>
</tbody>
</table>

Alphas are for 10 day portfolio returns regressed on 10 day S&P returns.

4.3 Imposition of a 10 % Limit

A mutual fund using publicly available information on insider trades to improve its returns, while concerned with profits, would still be concerned with diversification. Since a fund would not want to be too heavily exposed to any one stock at a given point in time, I considered the effect that a rule limiting portfolios to having at no more than 10% of their value in one security would have had. Table IV shows how the returns to experimental portfolios using signal multipliers of four and six differed when a 10% limit was imposed.

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\(^8\) Section 16(b) of the Securities Exchange Act of 1934 prohibits short-swing profits (profits realized in any period less than six months) for insiders, except in very limited circumstances.
Table IV

<table>
<thead>
<tr>
<th></th>
<th>x4</th>
<th>x6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Limit</td>
<td>10% Limit</td>
</tr>
<tr>
<td><strong>Alpha</strong></td>
<td>0.00708</td>
<td>0.00706</td>
</tr>
<tr>
<td><strong>Standard Error</strong></td>
<td>0.00211</td>
<td>0.002113</td>
</tr>
</tbody>
</table>

Alphas are for 10 day portfolio returns regressed on 10 day S&P returns

Table IV shows that the imposition of a 10% limit did not significantly affect returns. The experimental portfolios using signal multipliers of four and six earned nearly identical returns both with and without the imposition of a 10% limit. In addition, regression analysis showed that the returns of the x4 portfolio explain 99.998% of the returns to the x4 portfolio with a 10% limit imposed. Similarly, the returns of the x6 portfolio explained 99.989% of the returns of the x6 portfolio with a 10% limit imposed. Since the difference was so negligible between the portfolios using a 10% limit and those not using a 10% limit, I will not discuss the portfolios which imposed a 10% limit further.

4.4 Sarbanes-Oxley and Statistical Significance

The returns to the control and experimental portfolios are decomposed across time period in Tables V, VI, and VII. Table V shows the raw returns earned by each portfolio before the enactment of Sarbanes-Oxley (enacted on July 30th, 2002), after the enactment, and for the whole period from 1999-2004. Table VI displays the risk-adjusted returns earned by each portfolio decomposed across these same periods. Finally, Table VII shows the abnormal returns earned by each portfolio and the corresponding p-values to its LRT statistic.
Table V

<table>
<thead>
<tr>
<th>Annualized Raw Returns: Pre vs. Post Sarbanes-Oxley</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pre</td>
</tr>
<tr>
<td>Post</td>
</tr>
<tr>
<td>Total Period</td>
</tr>
</tbody>
</table>

Table V shows that while the raw returns to all portfolios were positive and large (above 10%) for both periods, the raw returns earned after Sarbanes-Oxley were considerably greater than the raw returns earned prior to the act. The returns to the S&P, however, were also significantly greater after Sarbanes-Oxley. Table VI addresses the question of, to what extent were the risk-adjusted returns greater in the post Sarbanes-Oxley period?

Table VI

<table>
<thead>
<tr>
<th>Risk-Adjusted Returns: Pre vs. Post Sarbanes-Oxley</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Risk-Adjusted Returns (Annualized) Pre</td>
</tr>
<tr>
<td>Post</td>
</tr>
<tr>
<td>Total Period</td>
</tr>
<tr>
<td>Alpha Pre</td>
</tr>
<tr>
<td>Post</td>
</tr>
<tr>
<td>Total Period</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Post</td>
</tr>
<tr>
<td>Total Period</td>
</tr>
<tr>
<td>Alpha</td>
</tr>
</tbody>
</table>

Alphas are for 10 day portfolio returns regressed on 10 day S&P returns.
Interestingly, Table VI shows that risk-adjusted returns for the experimental portfolios were very similar both before and after the enactment of Sarbanes-Oxley. These similar risk-adjusted returns imply that a large portion of the raw returns earned after Sarbanes-Oxley were attributable to market correlation. The most important piece of information illustrated in Table VI, though, is that the risk-adjusted returns of the control portfolios were considerably less after Sarbanes-Oxley than they were before the act. This divergence, when compared with the risk-adjusted returns of the experimental portfolios, shows that while the experimental portfolios earned strong returns prior to Sarbanes-Oxley because of strong sector performance, the experimental portfolios earned strong risk-adjusted returns after Sarbanes-Oxley because of their use of insider trading signals. The strong risk-adjusted returns earned by the experimental portfolios after Sarbanes-Oxley cannot be attributable to strong sector performance because the control portfolios did not share in these returns.

Table VII addresses this issue more precisely by reporting the risk-adjusted returns the experimental portfolios earned over the control portfolios and the extent to which these returns are statistically significant. Table VII shows that the experimental portfolios earned considerably greater returns after Sarbanes-Oxley than they did before the act. While all six experimental portfolios earned some abnormal returns prior to Sarbanes-Oxley, these returns were small and not statistically significant. In stark contrast, after Sarbanes-Oxley every experimental portfolio earned statistically significant returns of economic significance. The smallest abnormal returns earned by any experimental portfolio in the 29 months following Sarbanes-Oxley were still over
5.2% and the abnormal returns earned by every portfolio are statistically significant at the 1% level. Indeed, the abnormal returns to the most profitable portfolio, the portfolio which used a three month holding period and a signal multiplier of 10,000 were staggering. This portfolio earned abnormal returns of nearly 20% on an annualized basis. Figure II illustrates the especially strong performance of the x10,000 portfolio immediately following the enactment of Sarbanes-Oxley.

Table VII

<table>
<thead>
<tr>
<th>Abnormal Returns: Pre vs. Post Sarbanes-Oxley</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Returns (Annualized)</td>
<td>x4</td>
<td>x6</td>
</tr>
<tr>
<td>Pre</td>
<td>0.30%</td>
<td>0.50%</td>
</tr>
<tr>
<td>Post</td>
<td>**5.21%</td>
<td>**6.61%</td>
</tr>
<tr>
<td>Total Period</td>
<td>2.41%</td>
<td>3.10%</td>
</tr>
</tbody>
</table>

| Alpha                                        | Pre     | 0.0001  | 0.0002  | 0.0008  | 0.0007  | 0.0009  | 0.0020  |
| P-Value                                      |         |         |         |         |         |         |         |
| Post                                         | 0.1248  | 0.1685  | 0.3805  | 0.8094  | 0.7778  | 0.7172  |
| Total Period                                  | 0.9948  | 0.9954  | 0.9973  | 0.9991  | 0.9993  | 0.9995  |

| Alpha                                        | Pre     | 0.0010  | 0.0012  | 0.0025  | 0.0013  | 0.0018  | 0.0045  |
| P-Value                                      |         |         |         |         |         |         |         |
| Post                                         | 0.8170  | 0.8332  | 0.8886  | 0.9798  | 0.9792  | 0.9798  |
| Total Period                                  |         |         |         |         |         |         |         |

*significant at 95% level
**significant at 99% level

Alphas are for 10 day portfolio returns regressed on 10 day S&P returns.
4.5 Transaction Costs

A final issue that should be discussed regarding the abnormal returns earned after Sarbanes-Oxley is the issue of transaction costs. Since the experimental portfolios responded to buy events and the control portfolios did not, there was considerably more turnover in the experimental portfolios than there was in the control portfolios. Since turnover is costly, the returns of the experimental portfolios should be adjusted downward to reflect their greater transaction costs.

While historically studies examining returns to insider trades have assumed transaction costs between one and two percent per round trip trade, decimalization, implemented in 2001, along with the growth of online brokerage firms have greatly reduced real transaction costs. I assumed transaction costs of 40 basis points per round trip trade. Table VIII shows abnormal returns after deducting the transaction costs.
associated with the extra trading involved in the mimicking insider trading strategy.\textsuperscript{9} The particular assumption regarding transaction costs lends itself to a false precision, though, and the figures in Table VIII should be taken only as reference point for understanding the extent to which abnormal returns should be revised.

Table VIII

<table>
<thead>
<tr>
<th>Abnormal Returns (Annualized)</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x4</td>
<td>x6</td>
</tr>
<tr>
<td>Pre</td>
<td>-0.04%</td>
<td>0.02%</td>
</tr>
<tr>
<td>Post</td>
<td>4.89%</td>
<td>6.17%</td>
</tr>
<tr>
<td>Total Period</td>
<td>2.07%</td>
<td>2.64%</td>
</tr>
</tbody>
</table>

\*transaction costs are assumed to be 40 basis points per transaction

Table VIII shows that the assumption of 40 basis point transaction costs did not significantly affect abnormal returns. Overall, while the inclusion of transaction costs left most of the statistically insignificant abnormal returns in the pre Sarbanes-Oxley period economically insignificant, the abnormal returns in the post Sarbanes-Oxley period remained large. In fact, I would have to assume transaction costs greater than four percent to render the extra abnormal returns to the experimental portfolios economically insignificant in the post Sarbanes-Oxley period. Since transaction costs do not significantly affect the qualitative nature of any of my findings I will not discuss them further.

\textsuperscript{9} In order to estimate the affect of transaction costs, I calculated portfolio turnover ratios. I defined portfolio turnover ratios as the absolute value of all portfolio changes within the year divided in half (to reflect the round trip nature of trades) over each portfolio’s value at the end of the year. (The x10,000, 3 month holding period experimental portfolio had the highest turnover ratio of 6.53). The appropriate control portfolios turnover ratio was then subtracted from each experimental portfolios turnover ratio in order to get the excess turnover of each portfolio. The excess turnover was then multiplied by 40 basis points to get the annual costs of excess transactions and the annual abnormal returns were then reduced to reflect these excess transaction costs.
The results suggest that the change in the reporting time of insider trades created significant opportunities for outsiders to earn abnormal returns following the enactment of Sarbanes-Oxley. Whereas mimicking insider trades before Sarbanes-Oxley was only a marginally profitable practice even when a very large signal multiplier and short holding period were used, mimicking insider trades in the post Sarbanes-Oxley period yielded great abnormal returns even in portfolios which used weak multipliers and long holding periods. While the portfolios earned greater raw returns in the post Sarbanes-Oxley period in part because the market experienced a rally at this time, the greater abnormal returns they earned after Sarbanes-Oxley can only be attributable to the diminished lag time between when insiders traded and news of their trades became public.

These results offer convincing evidence that the market was not entirely pricing in the informational value of insider trades in the 29 months following Sarbanes-Oxley. Accordingly, an astute trader using the SEC website could have earned abnormal returns by mimicking insider trades as news of the trades became public. These findings mark an important violation of the semi-strong form of the Efficient Market Hypothesis, which states that market efficiently prices all publicly available information.

4.6 Can Outsiders Still Earn Abnormal Returns?

The large abnormal profits earned by a strategy of mimicking insider trades in the 27 months following Sarbanes-Oxley begs one very important question: Looking forward, can outsiders still earn abnormal returns by mimicking insider trades? In order to address this question, I decomposed the returns earned in the post-Sarbanes-Oxley to see if there was a trend towards decreasing abnormal returns. Table IX shows the risk-
adjusted returns earned by the portfolios in the 17 months immediately following the enactment of Sarbanes-Oxley (from August 1st, 2002 through December 31st, 2003) and in the 12 months following that period (from January 1st 2004 through December 31st, 2004). Table X displays the abnormal returns decomposed across these same two periods. Figure III shows a scatter-plot of abnormal returns earned by the experimental portfolio using a signal multiplier of 10,000 and a holding period of three months in the 27 months following the enactment of Sarbanes-Oxley.

### Table IX

**Risk-Adjusted Returns Within the Post Sarbanes-Oxley Period**

<table>
<thead>
<tr>
<th>Risk-Adjusted Returns (Annualized)</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>x4</td>
</tr>
<tr>
<td>Aug-02 thru Dec-03</td>
<td>19.65%</td>
<td>29.26%</td>
</tr>
<tr>
<td>Jan-04 thru Dec-04</td>
<td>-0.43%</td>
<td>0.73%</td>
</tr>
<tr>
<td>Total Post</td>
<td>11.07%</td>
<td>16.83%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alpha Standard Error</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>x4</td>
</tr>
<tr>
<td>Aug-02 thru Dec-03</td>
<td>0.0072</td>
<td>0.0103</td>
</tr>
<tr>
<td></td>
<td>0.0033</td>
<td>0.0042</td>
</tr>
<tr>
<td>Jan-04 thru Dec-04</td>
<td>-0.0002</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>0.0034</td>
<td>0.0034</td>
</tr>
<tr>
<td>Total Post</td>
<td>0.0042</td>
<td>0.0062</td>
</tr>
<tr>
<td></td>
<td>0.0026</td>
<td>0.0030</td>
</tr>
</tbody>
</table>

Alphas are for 10 day portfolio returns regressed on 10 day S&P returns.
Table X

<table>
<thead>
<tr>
<th>Abnormal Returns (Annualized)</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x4</td>
<td>x6</td>
</tr>
<tr>
<td>Aug-02 thru Dec-03</td>
<td>**8.09%</td>
<td>*10.30%</td>
</tr>
<tr>
<td>Jan-04 thru Dec-04</td>
<td>1.17%</td>
<td>1.44%</td>
</tr>
<tr>
<td>Dec-04 Total Post</td>
<td>**5.22%</td>
<td>**6.61%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 Day Abnormal Returns</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug-02 thru Dec-03</td>
<td>0.0031</td>
</tr>
<tr>
<td>Jan-04 thru Dec-04</td>
<td>0.0005</td>
</tr>
<tr>
<td>Dec-04 Total Post</td>
<td>0.6370</td>
</tr>
<tr>
<td>Total Post</td>
<td>0.0020</td>
</tr>
<tr>
<td></td>
<td>0.9948</td>
</tr>
</tbody>
</table>

*significant at 95% level
**significant at 99% level

Table IX shows that risk-adjusted returns earned after Sarbanes-Oxley were initially great and then decreased significantly. Whereas all portfolios earned economically and statistically significant risk-adjusted excess returns in the first 17 months following the enactment of Sarbanes-Oxley, no portfolio earned risk-adjusted excess returns that were economically or statistically significant in 2004. Similarly, Table X shows that while the portfolios earned dramatic, statistically significant abnormal returns in the first 17 months, they earned negligible and sometimes negative abnormal returns in 2004. Taken in sum, Table IX and Table X seem to suggest that the experimental portfolios earned abnormal returns in the first 17 months that were so great that they were responsible for almost all of the abnormal returns earned in the larger 29 month post Sarbanes-Oxley period.

Likewise, Figure III, which shows the abnormal returns earned over periods of 10 business days in 29 months after Sarbanes-Oxley, illustrates a notable declining trend for
abnormal returns. The scatter plot shows that the 10 day periods with the greatest abnormal returns were clustered closely around the time immediately following the enactment of Sarbanes-Oxley and that more recent 10 day periods have been earning abnormal returns close to zero. Figure III seems to suggest a reversion to zero abnormal returns over time.

**Figure III**

*Abnormal Returns in the Post-Sarbanes Oxley Period*

![Graph showing abnormal returns over time.](image)

The data largely suggest that while the market was not efficiently pricing in news of insider trades for around 17 months following Sarbanes-Oxley, eventually it caught up. The experimental portfolios earned abnormal returns in 2004 that were even less than they were before the enactment of Sarbanes-Oxley. The dramatic decline of abnormal returns in 2004 suggests that after 17 months investors largely caught on to a strategy of mimicking insider trades and that by the time my experimental portfolios purchased securities, on the close of the day following the day on which news became public, news of the insider trade had been fully priced in. Anecdotally this conclusion is supported by
the arrival of dozens of websites which offered streaming real-time information about insider trades as they are filed. Thus while mimicking insider trades was a wildly successful strategy that could have earned annualized abnormal returns as great as 39% (for the portfolio which used a signal multiplier of 10,000 and a 3 month holding period), it appears that mimicking insider trades can no longer yield abnormal returns. In a couple years, future studies should revisit a strategy of mimicking insider trades when more data in the post Sarbanes-Oxley era is available.

4.7 Robustness of Results

Two additional analyses were performed to scrutinize the robustness of the results I report. The first analysis sought to test for statistical significance in light of the possible presence of heteroskedasticity. I performed heteroskedasticity robust regressions estimating abnormal returns before Sarbanes-Oxley, after Sarbanes-Oxley, and within the post Sarbanes-Oxley period. The results of these regressions are offered in Appendix II and Appendix III. While the heteroskedasticity robust regressions estimated very similar abnormal returns for all experimental portfolios, in some instances they do not find Heteroskedasticity robust significance where I found LRT significance. This indicates either that the Heteroskedasticity robust regressions do not find significance because of small sample sizes (the disagreement with LRT over significance occurs only in smaller samples) or that in some instances the LRT test is not to be trusted because of the presence of heteroskedasticity.

The second analysis that was performed was a style analysis which sought to test whether the experimental portfolios would have outperformed passive portfolios
constructed in the same style. Passive portfolios were constructed by following the returns to the experimental portfolios for twelve months and then using quadratic programming to estimate the combination of major asset classes that would best approximate the portfolios’ exposures. Abnormal returns were defined as the returns earned by the experimental portfolios over the returns earned by the passive portfolios. Style analyses were performed on two portfolios using a holding period of three months (signal multipliers of four and six) and on a portfolio using a holding period of six months (signal multiplier of four).10 The abnormal returns to the portfolios, as estimated by style analyses, are reported in Appendix IV.

Largely style analysis offers further support of my findings. Similar to my initial analyses, style analyses found that the experimental portfolios earned statistically insignificant abnormal returns before Sarbanes-Oxley, statistically significant abnormal returns in the 17 months following the act, and statistically insignificant abnormal returns in 2004. Interestingly, style analysis found abnormal returns to be considerably greater than my initial analysis. These results may indicate that my estimates of abnormal returns are conservative.

Taken as a whole, the two additional analyses seem to conclusively support my initial findings. All analyses conclude that the returns earned by the portfolios using three month holding periods and signal multipliers of four and six earned abnormal returns in the 17 months following Sarbanes-Oxley. Additionally, all analyses point to initially small, statistically insignificant abnormal returns followed by large, more significant abnormal returns.

10 Style analysis was meant to be performed on an experimental portfolio using a signal multiplier of six and holding period of six months as well but I made an error when sending out the data for this portfolio.
abnormal returns after the enactment Sarbanes-Oxley. Finally, all analyses agree that abnormal returns were greatly diminished by 2004.

5 Conclusion

I tested the hypothesis that outsiders using a strategy that incorporates publicly available information on insider trades could have earned abnormal returns in the post Sarbanes-Oxley environment. I tested this strategy by composing an experimental portfolio of stocks particularly sensitive to the asymmetric information insiders possess and by rebalancing this portfolio according to rules which use only the most valuable insider trades. In order to measure abnormal returns I then compared these returns to the returns of a control portfolio of the same stocks in periods both before and after the enactment of Sarbanes-Oxley. I created six experimental portfolios, varying both the signal multiplier I used to weigh the value of insider trades and the holding period for which the signal of insider trades was deemed valuable.

I found that in all periods, the experimental portfolios outperformed the control portfolios. I also found that experimental portfolios using larger signal multipliers and shorter holding periods earned greater abnormal returns. These findings largely support the existing literature. With regard to Sarbanes-Oxley, I found that all six experimental portfolios earned economically and statistically significant returns after its passage. I also found, however, that abnormal returns were not uniform in the post-Sarbanes-Oxley period. Returns were greatest in the period immediately following the enactment and abnormal returns over 2004 were negligible and occasionally negative. As a result, I
conclude that abnormal returns for outsiders were prevalent for a significant time period following the enactment of Sarbanes-Oxley, but that they no longer exist.

The results of my study are of interest to those concerned with both profit and science. For those concerned with profit, my study suggests that profits from mimicking insider trades can be maximized by using both a shorter (three month) holding period and by using a larger signal multiplier (the three month, x10,000 portfolio earned abnormal returns of 39.38% in the 17 months following the enactment of Sarbanes-Oxley). It also suggests that a strategy of mimicking insider trades may no longer yield abnormal returns as the market has become more efficient in pricing in this public information. In a broader sense for those interested in profits, my study offers interesting proof that changing market conditions can give rise to situations which will allow the savvy investor to earn abnormal returns over a substantial, albeit temporary, time period.

For those concerned with the science of market efficiency my study offers insight into how markets function and the mechanism by which markets are made efficient. Essentially various degrees of market efficiency are just arguments for how quickly the market is able to reflect information. The strong form of market efficiency assumes that the market is able to instantaneously price in all pertinent information. The semi-strong form of the Efficient Market Hypothesis assumes that market has to wait until the information becomes public to appropriately price it in. My finding that outsiders could have earned economically significant returns after Sarbanes-Oxley suggests that sometimes the market takes a little longer to price in information. This finding would suggest that occasionally changing market conditions will allow strategies to arise that can earn abnormal returns.
My study ultimately points to the underlying paradox of the Efficient Market Hypothesis: in order for markets to be relatively efficient, investors must largely believe they are not. It is only because investors actively seek out strategies to beat the market that inefficiencies, like outsiders earning abnormal returns by mimicking insider trades, are eventually arbitraged away. If Wall Street was ever led to truly believe that the market was perfectly efficient, at that very moment it would stop being efficient since security analysts, traders, and mutual fund managers, among others, would stop scouring over annual reports and price charts in attempts to find profitable inefficiencies. Thus it is actually exactly the temporary inefficiencies like the one I identify in this study that the market is kept somewhat efficient. Clearly, the semi-strong form of the Efficient Market Hypothesis cannot always entirely hold. There will always be a fraction of a second between when news becomes public and when the market can adjust, but this slight inefficiency must necessarily exist in order for the market to remain efficient. In the end my study offers evidence that while the semi-strong form of the Efficient Market Hypothesis does not always hold, neither do sources of abnormal returns.
Appendix I

In order to test goodness of fit, I use the likelihood-ratio test to compare the residuals of an unrestricted regression to the residuals of a restricted regression.

**Unrestricted regression:**

\[
\begin{pmatrix}
\Gamma_U \\
\Gamma_R
\end{pmatrix} = \begin{pmatrix}
\alpha_\epsilon \\
\beta_\epsilon
\end{pmatrix} + \begin{pmatrix}
\beta_c \\
\beta_x
\end{pmatrix} \text{SPX}_t + \begin{pmatrix}
\text{U}_R \\
\text{U}_R
\end{pmatrix}
\]

\(\Gamma_U = \) returns to the experimental portfolio
\(\Gamma_R = \) returns to the control portfolio
\(\text{SPX}_t = \) returns to the S&P 500

Where

\[
\begin{pmatrix}
\text{U}_R \\
\text{U}_R
\end{pmatrix} = U_t
\]

and

\[
\tilde{\Omega} = \frac{1}{n} \sum_{i=1}^{n} \tilde{U}_t \times U_t
\]

In the restricted regression, I impose the restriction \(C_\epsilon = C_\epsilon\) by transforming the model using \(A\) where

\[
A = \begin{pmatrix}
1 & 1 \\
1 & 1
\end{pmatrix}
\]

**Restricted regression:**

\[
A \begin{pmatrix}
\Gamma_U \\
\Gamma_R
\end{pmatrix} = \begin{pmatrix}
\alpha_\epsilon + \alpha_c \\
\beta_\epsilon
\end{pmatrix} + A \begin{pmatrix}
\beta_c \\
\beta_x
\end{pmatrix} \text{SPX}_t + A \begin{pmatrix}
\text{V}_R \\
\text{V}_R
\end{pmatrix}
\]

Where

\[
\begin{pmatrix}
\Gamma_U \\
\Gamma_R
\end{pmatrix} = \Gamma_t
\]

The residuals are then transformed back to calculate \(\tilde{\Omega}\).

\[
\tilde{\Omega} = A^{-1} \frac{1}{n} \sum \left( \begin{pmatrix}
\text{V}_i \\
\text{V}_j
\end{pmatrix} \right) \left( \begin{pmatrix}
\text{V}_i \\
\text{V}_j
\end{pmatrix} \right)^t A
\]

Finally,

\[
\text{LRT Statistic} = 2 \ln \left( \frac{|\tilde{\Omega}|}{|\Omega|} \right)
\]
### Heteroskedasticity Robust Regressions

#### Appendix II

**Abnormal Returns: Pre vs. Post Sarbanes-Oxley**

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>6 Month</th>
<th>3 Month</th>
<th>Pre</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Returns</td>
<td></td>
<td>x4</td>
<td>x6</td>
<td>x10,000</td>
<td>x4</td>
<td>x6</td>
</tr>
<tr>
<td>(Annualized)</td>
<td></td>
<td>0.41%</td>
<td>0.66%</td>
<td>2.52%</td>
<td>2.10%</td>
<td>2.70%</td>
</tr>
<tr>
<td>Post</td>
<td></td>
<td>4.99%</td>
<td>6.28%</td>
<td>11.08%</td>
<td>*5.08%</td>
<td>*7.07%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2.43%</td>
<td>3.13%</td>
<td>6.33%</td>
<td>*3.46%</td>
<td>*4.69%</td>
</tr>
</tbody>
</table>

| Alpha                |              | 0.0002  | 0.0003  | 0.0010       | 0.0008  | 0.0011  | 0.0026  |
| Standard Error       |              | 0.0010  | 0.0012  | 0.0023       | 0.0007  | 0.0010  | 0.0027  |
| Total                |              | 0.0013  | 0.0016  | 0.0030       | 0.0011  | 0.0015  | 0.0047  |
| Period               |              | 0.0010  | 0.0012  | 0.0025       | 0.0014  | 0.0018  | 0.0046  |
|                      |              | 0.0008  | 0.0010  | 0.0018       | 0.0006  | 0.0008  | 0.0024  |

*significant at 95% level
**significant at 99% level

Alphas are for 10 day portfolio returns regressed on 10 S&P returns

#### Appendix III

**Abnormal Returns within the Post Sarbanes-Oxley Period**

<table>
<thead>
<tr>
<th></th>
<th>Aug-02 thru Dec-03</th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Returns</td>
<td></td>
<td>x4</td>
<td>x6</td>
</tr>
<tr>
<td>(Annualized)</td>
<td></td>
<td>7.94%</td>
<td>10.08%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.97%</td>
<td>1.15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.99%</td>
<td>6.28%</td>
</tr>
<tr>
<td>10 Day Abnormal</td>
<td></td>
<td>0.0031</td>
<td>0.0038</td>
</tr>
<tr>
<td>Returns</td>
<td></td>
<td>0.0020</td>
<td>0.0026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0004</td>
<td>0.0005</td>
</tr>
<tr>
<td>Standard Error</td>
<td></td>
<td>0.0011</td>
<td>0.0014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0019</td>
<td>0.0024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0013</td>
<td>0.0016</td>
</tr>
</tbody>
</table>

*significant at 95% level
**significant at 99% level
## Style Analysis

### Appendix IV

#### Style Analysis Results: Abnormal Returns

<table>
<thead>
<tr>
<th></th>
<th>6 Month</th>
<th>3 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jan. 1999 - Jul. 2002</strong></td>
<td>7.44%</td>
<td>8.88%</td>
</tr>
<tr>
<td><strong>Aug. 2002 - Dec. 2003</strong></td>
<td><strong>21.48%</strong></td>
<td><strong>22.32%</strong></td>
</tr>
<tr>
<td><strong>Jan. 2004 - Dec. 2004</strong></td>
<td>-0.36%</td>
<td>-0.72%</td>
</tr>
<tr>
<td><strong>Jan. 1999 - Dec. 2004</strong></td>
<td>9.24%</td>
<td>10.32%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>x4</th>
<th>x4</th>
<th>x6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jan. 1999 - Jul. 2002</strong></td>
<td>0.62</td>
<td>0.74</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>Aug. 2002 - Dec. 2003</strong></td>
<td>0.77</td>
<td>0.96</td>
<td>0.99</td>
</tr>
<tr>
<td><strong>Jan. 2004 - Dec. 2004</strong></td>
<td>1.79</td>
<td>1.86</td>
<td>2.28</td>
</tr>
</tbody>
</table>

*significant at 95% level
**significant at 99% level

The estimate for t-statistic for the three month x6 portfolio approaches infinity because it is estimated as alpha/(standard error - 1) and for this portfolio the standard error was exactly one. (One is subtracted to appropriately account for degrees of freedom). Suffice it to say that the returns for the three month x6 portfolio in the 17 months following the enactment Sarbanes-Oxley are very statistically significant.
List of Works Cited


