

# An Empirical Analysis of Quantitative Trading Strategies

by

Masaharu Aiuchi

B.S., Physics, The University of Tokyo (1990)

M.S., Physics, The University of Tokyo (1992)

Ph.D., Artificial Intelligence, The University of Tokyo (2005)

Submitted to the MIT Sloan School of Management  
in partial fulfillment of the requirements for the degree of  
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Author .....

MIT Sloan School of Management

May 9, 2008

Certified by .....

Andrew W. Lo

Harris & Harris Group Professor, MIT Sloan School of Management

Director, MIT Laboratory for Financial Engineering

Thesis Supervisor

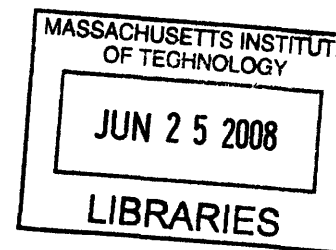
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Stephen J. Sacca

Director,

MIT Sloan Fellows Program in Innovation and Global Leadership,

MIT Sloan School of Management



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## **Abstract**

Along with the increasing computing power, growing availability of various data streams, introduction of the electronic exchanges, decreasing trading costs and heating-up competition in financial investment industry, quantitative trading strategies or quantitative trading rules have been evolving rapidly in a few decades.

They challenge the Efficient Market Hypothesis by trying to forecast future price movements of risky assets from the historical market information in algorithmic ways or in statistical ways. They try to find some patterns or trends from the historical data and use them to beat the market benchmark.

In this research, I introduce several quantitative trading strategies and investigate their performances empirically i.e. by executing back-tests assuming that the S&P 500 stock index is a risky asset to trade. The strategies utilize the historical data of the stock index itself, trading volume movement, risk-free rate movement and implied volatility movement in order to generate buy or sell trading signals.

Then I attempt to articulate and decompose the source for successes of some strategies in the back-tests into several factors such as trend patterns or relationships between market information variables in intuitive way.

Some strategies recorded higher performances than the benchmark in the back-tests, however it is still a problem how we can distinguish these winner strategies beforehand from the losers at the beginning of our investment horizon. Human discretion such as macro view on the future market trend is considered to still play an important role for quantitative trading to be successful in the long-run.

Thesis Supervisor: Andrew W. Lo

Title: Harris & Harris Group Professor, MIT Sloan School of Management  
Director, MIT Laboratory for Financial Engineering



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# Chapter 1

## Introduction

### 1.1 Motivation

If the market is efficient, current prices of risky assets have been determined such that nobody cannot exploit profit by forecasting price movements with certainty. In other words, current market prices are determined with all the available information at present which is useful for prediction (Fama, 1970).

If it is true, all the efforts to beat the market by predicting future prices/returns becomes merely vain. If somebody beat the market, it is just a luck and he or she cannot keep beating the market. Because, if somebody could forecast future prices based on some information with certainty, that information would spread out, other people would follow the same strategy, and finally the current prices would be adjusted not to allow any sure profit in future.

On the other hand, quantitative trading strategies or quantitative trading rules have been evolving rapidly in a few decades along with the growing computing power, increasing availability of various data streams, introduction of the electronic exchanges, decreasing trading costs and heating-up competition in financial investment industry.

These strategies challenge the Efficient Market Hypothesis by trying to forecast future price movements of risky assets from the historical market information in algorithmic ways or in statistical ways. They are trying to find some patters or

trends out of the historical data and to use them to beat the market benchmark.

Thinking about any possible source for inefficiency, it would be important to recognize that majority of market participants are still humans such as institutional traders and individuals, even though the trading volume by algorithmic trading has been growing recently. As human, more or less, they could have behavioral biases such as over/under-reaction to new market information, risk-aversion rather than seeking upside opportunity, framing by situational context, herding toward a certain direction, and so on. Therefore, aggregated behaviors in the market could be affected by these human natures and that could be a source of market inefficiency.

Motivated by the possibilities of market inefficiency as well as market predictability as a consequence, this study examines the performances of multiple quantitative trading strategies using the historical data of a stock index and related market information data for decades.

## 1.2 Overview

Here I present an overview of the following chapters. Firstly, I review the literature on the Efficient Market Hypothesis and the literature on the quantitative trading strategies in chapter 2.

Next, in chapter 3, I introduce several quantitative trading strategies. Those strategies contain various types of strategies from simple rules to data-mining algorithms, from linear approaches to non-linear approaches, and from time proximity-based approaches to pattern proximity-based approaches, even though these strategies are for trading a single stock index. As for historical information to use, the strategies utilize the historical data of the stock index itself, trading volume movement, risk-free rate movement and implied volatility movement in order to generate buy or sell trading signals.

In chapter 4, I present how to evaluate and compare the performances of multiple strategies. In addition to the traditional metrics such as risk-adjusted return, I introduce a viewpoint of total holding periods of a risky asset in relation to whole



time horizon of trading. The reason is that a strategy with smaller number of periods for market exposure would be more favorable than a strategy with larger number of exposure periods with the same return in terms of the market crunch risk.

In chapter 5, firstly, I examine the statistical properties of the historical data including correlation analysis among the variables used for the strategies. Results of the analysis are used to understand the performances of the strategies later. Next, I examine the performances of the introduced strategies empirically, i.e. by executing back-tests assuming that daily S&P 500 stock index is a risky asset to trade. Then, I attempt to articulate and decompose the source for successes of some strategies in the back-tests into several factors in intuitive way.

Lastly, in chapter 6, I conclude the study by reviewing the findings from the empirical analysis on the effectiveness of the quantitative trading strategies.

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# Chapter 2

## Literature Review

### 2.1 Studies on Market Efficiency

An issue on market efficiency or the Efficient Market Hypothesis (EMH) had started to be addressed empirically by Kendall (1953) with the strong support of computing technology and financial data sets. Interestingly, at the time, it was considered that price movements could be predicted to some extent. Kendall (1953) studied the time series of weekly stock prices and weekly commodity prices in exchanges and found that “The data behave almost like wandering series”.

As the first formal economic approach to the issue, Samuelson (1965) introduced the concept of a martingale and provided a mathematical framework to explain the formulation of future asset price.

Fama (1970) defined the efficient market as “A market in which prices at any time “fully reflect” available information” and classified the EMH in three levels in terms of the available information set: 1. *weak form* in which the information set is historical prices, 2. *semi-strong form* in which the information set is all the publicly available information in addition to the historical prices, 3. *strong form* in which the information set is all information relevant to price forecast including private information.

Fama (1970) reviewed literature which addressed the first level EMH based on Expected Return Models and the Random Walk Model, literature about the second level EMH based on the Submartingale Model, and literature to study the third level

EMH by Sharpe-Lintner Model, concluding that “with but a few exceptions, the efficient markets model stands up well”. Even though statistically significant serial correlations were often reported in the studies reviewed, Fama (1970) is pointing out that statistical significance does not necessarily mean financial/economic significance which are able to be exploited in practice.

In the middle of dominance of the EMH, Lo and MacKinlay (1988) found that weekly stock returns from 1962 to 1985 had serial-correlations and rejected the Random Walk Hypothesis by applying the asymptotical variance ratio test they developed. Other evidences against the Random Walk had been found as well. DeBondt and Thaler (1985) examined monthly stock returns finding that they were consistent with the market over-reaction hypothesis. In contrast, Abarbanell and Bernard (1992) found the evidence that analysts’ forecasts tend to under-react to recent information about a firm’s earnings. Market seasonality such as the January effect (Rozeff and Kinney, 1976) and the Monday effect (French, 1980) had been reported repeatedly. Fama and French (1996) showed that stock returns could be explained well by the size of firm and book-to-market equity. The weather effect found by Saunders (1993) implies that market participants are affected by their moods from a large point of view.

As an alternative to provide reasonable explanations for those market anomalies, behavioral finance which traces back to cognitive science has discovered suggestive economic behaviors such as loss aversion (Tversky and Kahneman, 1979), mental accounting (Tversky and Kahneman, 1981), biased estimation of probabilities (Slovic, Fischhoff, and Lichtenstein, 1982), overconfidence (Fischhoff, Slovic, and Lichtenstein, 1980), herding (Huberman and Regev, 2001), and so on.

There is a strong criticism that behavioral approach is not well formulated and it can explain any anomaly by combining “right” biases. However, it is clear that market participants are under the effect of behavioral and cognitive biases to some extent if not dominated. Subrahmanyam (2007) is reviewing the both empirical and theoretical literature in this field over the past two decades.

As a study to understand a detailed mechanism of information-driven behavior,

Lo and Repin (2002) studied the relationships between three types of market events: deviations, trend reversals, and volatility events, and physiological reactions of professional securities traders to those events. They found that aroused emotions were taking an important role even for the experienced traders to make rational decisions if not analytical.

Lo (2004) takes the behavioral approach as a key component to integrate the EMH and its counter evidences and is proposing the Adaptive Markets Hypothesis (AMH) as follows.

Specically, the Adaptive Markets Hypothesis can be viewed as a new version of the EMH, derived from evolutionary principles. Prices reflect as much information as dictated by the combination of environmental conditions and the number and nature of species in the economy or, to use the appropriate biological term, the ecology.

From the discussion on the AMH, Lo (2004) is deriving practical implications such as time-varying risk/reward relation, temporal existence of arbitrage opportunities, existence of investment opportunities, and the importance of innovation to survive.

## **2.2 Studies on Quantitative Trading Strategies**

Quantitative trading strategies or mechanical trading rules have been studied as tests of the EMH as introduced in previous section. James (1968) examined trading rules based on the unweighted moving average and the exponentially smoothed moving average. Lo and MacKinlay (1990) examined a contrarian portfolio allocation strategy whose expected profits were decomposed into three terms. Jegadeesh (1990) studied portfolio allocation strategy based on lagged returns. Brock et al. (1992) examined the two simplest technical trading rules: moving average-oscillator, also called moving average divergence convergence (MACD), and trading range break-out, also called filter rule. The same strategies were tested in European markets by Fifield et al. (2005) and in Asian markets by Cai et al. (2005). Conrad and Kaul (1998) examined

momentum and contrarian strategies for stock portfolio. Kwon and Kish (2002) examined moving average strategies in combination with momentum and trading volume. Shen (2003) examined market timing strategies based on spreads between E/P ratio and interest rate. Giannetti (2007) tested a market timing strategy based on E/P ratio. Kaminski and Lo (2007) examined a stop-loss rules for market timing. In these literature, the principal object of consideration is not trading strategy itself but whether the EMH holds or not.

On the other hand, trading strategies have been developed and studied as relatively important objects of interest and application mainly in other communities than finance such as computer science, applied mathematics and statistics, even if the studies were conducted in the context of the EMH. Ammann and Herriger (2002) examined statistical arbitrage strategy based on relative implied-volatility. Schittenkopf et al. (2002) tested strategies based on linear autoregression, non-linear neural network, symbolic Markov model, mixture of them, and GARCH. Andrada-Félix et al. (2003) proposed trading rules based on non-linear nearest neighbor predictor and linear ARIMA predictor. Pérez-Rodríguez et al. (2005) developed and tested three non-linear strategies: smooth transition auto-regressive models, artificial neural networks, and nearest neighbors. Matilla-García (2006) applied genetic algorithms to seek optimal combination of gene solutions. Warburton and Zhang (2006) analyzed the properties of a strategy with stop-loss, take-profit and price breakout rules.

## Chapter 3

# Quantitative Trading Strategies

Quantitative trading strategies or mechanical trading rules can be defined as a combination of an algorithm to generate buy and sell trading signals and a set of policies to trade assets using the generated signals, with an expectation to beat some target benchmark. An algorithm to generate buy and sell signals can be based on historical price data only or based on other information such as macro economic data, financial data of corporations, some relationships with other assets prices, trading volume data, weather and climate data, and so on.

In any case, the objective of analyzing the historical data is to predict future price or return to a certain extent. It is different from arbitrage strategy which exploits an existing price discrepancy between the same assets in different markets or between an asset and its synthesized equivalent. A set of policies to trade assets with generated trading signals would be such as usage of short position, usage of financial leverage, maintenance of proportions among assets, and so on. Therefore we can create several different trading strategies with the same trading signals followed by different trading policies.

In this study, I focus on market-timing trading strategies for a single risky asset based on historical data of asset price, trading volume, implied volatility and risk-free rate, with a simple trading policy which employs long position only without any leverage. Also I assume that interest earnings of cash position is zero in order to detect and analyze performances and predictability of trading strategies comparing

to the buy-and-hold benchmark more clearly.

As for specific strategies to examine, I consider two groups of strategies. One group is strategies based on time proximity which try to extract predictive information from recent trends in data. The other group is strategies based on pattern proximity which try to find similar pattern from the past data with a belief that history repeats itself. In addition to the two main groups, I also examine effectiveness of meta-level strategies which integrate predictive powers of multiple trading strategies.

In the following sections, firstly I formally define trading strategy for a single risky asset. Then, I explain specific trading strategies to use for empirical analysis in the following order, strategies based on time proximity, strategies based on pattern proximity, and meta-level strategies.

### 3.1 Strategy for a Single Risky Asset

Assume we trade a single risky asset during  $T$  years which is divided into  $N$  trading periods. The  $k$ th period starts at time  $\frac{T}{N}(k-1)$  and ends at time  $\frac{T}{N}k$ .

A rate of return of the asset during a single period  $r_k$  is calculated at time  $\frac{T}{N}k$  from the asset prices at time  $\frac{T}{N}(k-1)$  and  $\frac{T}{N}k$  ( $P_{k-1}$  and  $P_k$  respectively) as  $\ln P_k - \ln P_{k-1}$ .

A rate of return during the whole trading periods  $R$  is a sum of rates of return in each period, and a geometric mean of a single period return  $r$  is obtained by dividing  $R$  by the number of periods  $N$ .

Trading horizon :  $T$  years with  $N$  periods

$k$ th period : from time  $\frac{T}{N}(k-1)$  to time  $\frac{T}{N}k$

Asset price at time  $\frac{T}{N}k$ :  $P_k$

Rate of return of the asset during  $k$ th period :  $r_k = \ln P_k - \ln P_{k-1}$

Rate of return of the asset during all periods :  $R = \sum_{k=1}^N r_k = \ln P_N - \ln P_0$



$$\text{Average rate of return for a single period : } r = \frac{R}{N} = \frac{1}{N} \sum_{k=1}^N r_k = \frac{1}{N} (\ln P_N - \ln P_0)$$

A trading decision about the asset and a subsequent trading for the  $k$ th period are made at time  $\frac{T}{N}(k-1)$  and the position is maintained until time  $\frac{T}{N}k$ . For simplicity and clarity of later analysis, assume that interest earnings of cash position is *zero*.

$$\text{Interest rate for cash position : } r_{cash} = 0$$

### 3.1.1 Trading Signal

Define a trading signal (for a single risky asset)  $sig$  as a set of instructions whether to stay in a long position of the asset (*In*) or to stay out of the position (*Out*) for each trading period.

Therefore a trading signal divides a set of trading periods  $TP$  with  $N$  periods into two subsets  $TP_{in}$  with  $N_{in}$  periods to stay in and  $TP_{out}$  with  $N_{out}$  periods to stay out.

A trading signal for period  $k$  generated at the end of period  $k-1$ :  $sig_k = In$  or  $Out$

A set of trading signals during trading horizon :  $sig = (sig_1, sig_2, \dots, sig_N)$

$$sig : TP \rightarrow \{TP_{in}, TP_{out}\} \text{ s.t. } TP_{in} \cup TP_{out} = TP, TP_{in} \cap TP_{out} = \phi$$

where

$$TP = \{k | k = 1, 2, \dots, N\}$$

$$TP_{in} = \{I_i | i = 1, 2, \dots, N_{in}\}$$

$$TP_{out} = \{O_j | j = 1, 2, \dots, N_{out}\}$$

$$N_{in} + N_{out} = N$$

### 3.1.2 Trading Policy

Define a trading policy (for a single risky asset)  $tp$  as a method to trade the asset based on trading signals. In this study, assume we can take one of the following three trading policies without any financial leverage.

$$tp = \{L, S, LS\}$$

$L$  : a trading method which holds only long position when in  $TP_{in}$

$S$  : a trading method which holds only short position when in  $TP_{out}$

$LS$ : a trading method which switches between long position and short position depending on whether in  $TP_{in}$  or in  $TP_{out}$

### 3.1.3 Trading Strategy

Define a trading strategy (for a single risky asset)  $ts$  as a combination of a trading signal  $sig$  and trading policy  $tp$ . As a benchmark, consider a simple buy-and-hold strategy.

$$ts = ts(sig, tp)$$

$BH$ : a bench mark strategy which just buys the asset and holds a long position during all trading periods

In the following sections about specific strategies, I only focus on how to generate trading signal  $sig$  with a trading policy ( $tp$ ) fixed to the same one. Because, a quality of trading signal is the most essential factor for a certain trading strategy to be successful.

Trading policies such as financial leverage and usage of short position can amplify the effect of trading signals. However any trading policy cannot make up for the

deficiency in trading signals. Therefore, regarding choice of trading policy, I use long position only policy ( $tp = L$ ) as a fixed policy for all strategies. The reason is that performances with other policies such as  $S$  and  $LS$  have linear relations to performance with policy  $L$  as we will see in chapter 4 about evaluation of strategies.

By fixing trading policy to the long position only, we can compare performances of various trading strategies in terms of trading signal  $sig$  which is the most essential.

Under the long position only policy  $L$ , actual trading based on trading signals  $sig$  is executed by the following rules.

$$\left\{ \begin{array}{l} \text{Buy the asset at the beginning of period } t, \text{ if } sig_t = In \text{ and } sig_{t-1} = Out \\ \text{Sell the asset at the beginning of period } t, \text{ if } sig_t = Out \text{ and } sig_{t-1} = In \\ \text{Hold the previous position of the asset/cash during period } t, \text{ if other cases} \end{array} \right.$$

## 3.2 Strategies Based on Time Proximity

We can expect that recent trends such as price movements contain some information to predict future return or price if market behavior is biased to a certain extent. Strategies based on time proximity have this motivation in common.

Specifically I introduce contrarian strategy, momentum strategy, moving average based strategy, and the other trend-based strategy in the following sections.

### 3.2.1 Contrarian and Momentum

Contrarian strategy is based on an assumption that market tends to over-react both positively and negatively to new information. If it is the case, over-shooted price will be adjusted in next periods.

Therefore, its basic trading rule is that being in the market after negative return periods and being out of the market after positive return periods with a certain non-

negative threshold  $\theta$  based on historical rate of return volatility  $\bar{\sigma}$  at the time of prediction.

$$\text{Contrarian}(\text{period}, \theta) : \text{sig}_t = \begin{cases} \text{In}, & \text{if } r_{t-1} < -\theta \bar{\sigma}_{t-1} \\ \text{Out}, & \text{if } r_{t-1} > \theta \bar{\sigma}_{t-1} \\ \text{sig}_{t-1}, & \text{if } \theta \bar{\sigma}_{t-1} \geq r_{t-1} \geq -\theta \bar{\sigma}_{t-1} \end{cases}$$

where

$$\text{period} = \{\text{daily}, \text{weekly}, \text{monthly}, \text{yearly}\}$$

$r_t$  = rate of return between time points based on *period*

$\bar{\sigma}_t$  = historical rate of return volatility at time t

$$\theta = \text{threshold}, \theta \geq 0$$

On the other hand, momentum strategy assumes that market tends to under-react and current trend will be maintained for certain periods. Therefore its trading strategy is the opposite of contrarian.

$$\text{Momentum}(\text{period}, \theta) : \text{sig}_t = \begin{cases} \text{In}, & \text{if } r_{t-1} > \theta \bar{\sigma}_{t-1} \\ \text{Out}, & \text{if } r_{t-1} < -\theta \bar{\sigma}_{t-1} \\ \text{sig}_{t-1}, & \text{if } \theta \bar{\sigma}_{t-1} \geq r_{t-1} \geq -\theta \bar{\sigma}_{t-1} \end{cases}$$

where

$$\text{period} = \{\text{daily}, \text{weekly}, \text{monthly}, \text{yearly}\}$$

$r_t$  = rate of return between time points based on *period*

$\bar{\sigma}_t$  = historical rate of return volatility at time t

$\theta = \text{threshold}, \theta \geq 0$

### 3.2.2 Contrarian and Momentum on an Arbitrary Market Information Variable

Contrarian and momentum strategies in the previous section utilize the past return as a predictor of the future return. However we don't have to restrict the predictor to the past return. For example, change of trading volume or change of risk-free rate could be better predictors of the future return of an asset.

Therefore I expand the contrarian and momentum strategies by replacing the past return with an arbitrary market information variable  $v$  as follows.

$$\text{Contrarian}(\text{period}, v, \theta) : \text{sig}_t = \begin{cases} In, & \text{if } v_{t-1} < -\theta \bar{\delta}_{t-1} \\ Out, & \text{if } v_{t-1} > \theta \bar{\delta}_{t-1} \\ \text{sig}_{t-1}, & \text{if } \theta \bar{\delta}_{t-1} \geq v_{t-1} \geq -\theta \bar{\delta}_{t-1} \end{cases}$$

where

$\text{period} = \{\text{daily}, \text{weekly}, \text{monthly}, \text{yearly}\}$

$v = \text{market information variable}$

$v_t = \text{time series of } v$

$\bar{\delta}_t = \text{historical volatility of } v$

$\theta = \text{threshold}, \theta \geq 0$

In the same way, momentum strategy based on market information variable  $v$  is,

$$Momentum(period, v, \theta) : sig_t = \begin{cases} In, & \text{if } v_{t-1} > \theta \bar{\delta}_{t-1} \\ Out, & \text{if } v_{t-1} < -\theta \bar{\delta}_{t-1} \\ sig_{t-1}, & \text{if } \theta \bar{\delta}_{t-1} \geq v_{t-1} \geq -\theta \bar{\delta}_{t-1} \end{cases}$$

where

$$period = \{daily, weekly, monthly, yearly\}$$

$v$  = market information variable

$v_t$  = time series of  $v$

$\bar{\delta}_t$  = historical volatility of  $v$

$\theta$  = threshold,  $\theta \geq 0$

As we can easily see from above, the original contrarian and momentum strategies are the special cases in which  $v$  is set to the rate of return of an asset.

### 3.2.3 Moving Average Convergence Divergence

A strategy based on convergence and divergence of moving averages with different time windows is one of the most popular trading rule among technical analysis traders. It is called Moving Average Convergence Divergence or MACD in abbreviation.

Its underlying assumption is that a robust trend line exists in price movements and it can be detected by filtering daily ripples. In order to detect the trend this strategy uses two (or three in some cases) moving averages of price with shorter time window and longer time window.

It generates buy signal when shorter window moving average crosses longer window moving average from beneath and generates sell signal when shorter window

moving average crosses longer window moving average from above. By construct, as we can see from the algorithm, this strategy doesn't predict future trend proactively but try to follow a trend which has been becoming tangible already.

$MACD(ShortWindowSize, LongWindowSize, \theta)$  :

$$sig_t = \begin{cases} In, & \text{if } sig_{t-1} = Out \text{ and } shortMA_{t-1} > (1 + \theta) longMA_{t-1} \\ In, & \text{if } sig_{t-1} = In \text{ and } shortMA_{t-1} \leq (1 + \theta) longMA_{t-1} \\ Out, & \text{if } sig_{t-1} = In \text{ and } shortMA_{t-1} < (1 - \theta) longMA_{t-1} \\ Out, & \text{if } sig_{t-1} = Out \text{ and } shortMA_{t-1} \geq (1 - \theta) longMA_{t-1} \end{cases}$$

where

$$shortMA_t = \frac{1}{ShortWindowSize} \sum_{k=t-ShortWindowSize}^t r_k$$

$$longMA_t = \frac{1}{LongWindowSize} \sum_{k=t-LongWindowSize}^t r_k$$

$ShortWindowSize$  = number of periods to calculate short term moving average

$LongWindowSize$  = number of periods to calculate long term moving average

$\theta$  = threshold,  $\theta \geq 0$

$r_t$  = daily rate of return

### 3.2.4 Trend-Based Regression

In addition to the previous popular strategies, I examine a simple statistical strategy which I developed and named trend-based regression strategy. The idea is to predict future return from recent trend by regression.

Its procedure is the following. Firstly, select a length of time window for trend pattern,  $W$ , and number of recent trend series with the time window,  $K$ , and regress returns at the end of time window in  $K$  trend series on previous  $W - 1$  returns in  $K$  trend series.

$$\begin{pmatrix} r_{t-1} \\ r_{t-2} \\ \vdots \\ r_{t-K} \end{pmatrix} = \begin{pmatrix} 1 & r_{t-2} & r_{t-3} & \cdots & r_{t-W-1} \\ 1 & r_{t-3} & r_{t-4} & \cdots & r_{t-W-2} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & r_{t-K-1} & r_{t-K-2} & \cdots & r_{t-W-K} \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_W \end{pmatrix}$$

Next predict a return for next period based on ordinary least squares estimators of  $\beta_i$ .

$$\hat{r}_t = \hat{\beta}_0 + \hat{\beta}_1 r_{t-1} + \hat{\beta}_2 r_{t-2} + \cdots + \hat{\beta}_W r_{t-W}$$

$$\hat{\beta}_i = \text{ordinary least squares estimator of } \beta_i$$

Finally generate trading signals based on the prediction with threshold. The threshold is based on a discrepancy measured by the historical volatility from the historical average return.

$$\text{Trend based Regression}(W, K, \theta) : sig_t = \begin{cases} In, & \text{if } \hat{r}_t > \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ Out, & \text{if } \hat{r}_t < -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ sig_{t-1}, & \text{if } \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \geq \hat{r}_t \geq -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \end{cases}$$

where

$\hat{r}_t$  = forecasted daily return for period  $t$

$\bar{r}_t$  = historical average of daily return at  $t$

$\bar{\sigma}_t$  = historical rate of return volatility at  $t$

$W$  = time window size

$K$  = number of recent trend series,  $K > W$

$\theta$  = threshold,  $\theta \geq 0$



### 3.2.5 Trend-Based Regression with Multiple Market Information Variables

We can modify the trend-based regression strategy to utilize not only price history but also other market information such as trading volume, risk-free rate and/or implied volatility expecting that they provide additional useful information to predict future return.

If we introduce  $m$  market information variables  $v^i$  and time windows for them  $W_i, (i = 1, 2 \dots m)$ , then we can modify the original strategy as follows.

$$\begin{pmatrix} r_{t-1} \\ r_{t-2} \\ \vdots \\ r_{t-K} \end{pmatrix} = \begin{pmatrix} 1 & v_{t-2}^1 & \cdots & v_{t-W_1-1}^1 & v_{t-2}^2 & \cdots & v_{t-W_2-1}^2 & \cdots & v_{t-2}^m & \cdots & v_{t-W_m-1}^m \\ 1 & v_{t-3}^1 & \cdots & v_{t-W_1-2}^1 & v_{t-3}^2 & \cdots & v_{t-W_2-2}^2 & \cdots & v_{t-3}^m & \cdots & v_{t-W_m-2}^m \\ \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots & & \vdots & \ddots & \vdots \\ 1 & v_{t-K-1}^1 & \cdots & v_{t-W_1-K}^1 & v_{t-K-1}^2 & \cdots & v_{t-W_2-K}^2 & \cdots & v_{t-K-1}^m & \cdots & v_{t-W_m-K}^m \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1^1 \\ \vdots \\ \beta_{W_1}^1 \\ \beta_1^2 \\ \vdots \\ \beta_{W_2}^2 \\ \vdots \\ \beta_1^m \\ \vdots \\ \beta_{W_m}^m \end{pmatrix}$$

$$\hat{r}_t = \hat{\beta}_0 + \hat{\beta}_1^1 v_{t-1}^1 + \cdots + \hat{\beta}_{W_1}^1 v_{t-W_1}^1 + \hat{\beta}_1^2 v_{t-1}^2 + \cdots + \hat{\beta}_{W_2}^2 v_{t-W_2}^2 + \cdots + \hat{\beta}_1^m v_{t-1}^m + \cdots + \hat{\beta}_{W_m}^m v_{t-W_m}^m$$

$\hat{\beta}_0$  = ordinary least squares estimator of  $\beta_0$

$\hat{\beta}_j^i$  = ordinary least squares estimator of  $\beta_j^i$

*Trend based Regression*( $v^1, W_1; v^2, W_2; \dots; v^m, W_m; K, \theta$ ) :

$$sig_t = \begin{cases} In, & \text{if } \hat{r}_t > \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ Out, & \text{if } \hat{r}_t < -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ sig_{t-1}, & \text{if } \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \geq \hat{r}_t \geq -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \end{cases}$$

where

$\hat{r}_t$  = forecasted daily return for period  $t$

$\bar{r}_t$  = historical average of daily return at  $t$

$\bar{\sigma}_t$  = historical rate of return volatility at  $t$

$v_t^i$  = time series of market information variable  $v^i$

$W_i$  = time window size for  $v^i$

$m$  = number of market information variables

$K$  = number of recent trend series, ( $K > \sum_{i=1}^m W_i$ )

$\theta$  = threshold,  $\theta \geq 0$

### 3.2.6 Conditional Probability Table

It is possible to trade an asset based on the expected future return given certain combination of market information variables. I call this strategy conditional probability table (CPT) strategy here.

To obtain the conditional probabilities, we can segment the values of variables in decile for example. However this procedure leads to creating a huge number of events, in case of the example, 10 to the power of the number of variables to use.

In order to obtain the expected return avoiding this curse of dimensionality, mar-

ket information variables are encoded as binary numbers (1 or -1) in this study. To estimate the conditional probabilities, count the number of events occurred during the time window  $K$ .

$$\text{Prob}(r_t > 0 | \text{sgn}(v^1) = \text{sgn}_1 \wedge \dots \wedge \text{sgn}(v^m) = \text{sgn}_m) = \frac{1}{2n_{\text{sgn}_1, \dots, \text{sgn}_m}} \sum_{j=1}^{n_{\text{sgn}_1, \dots, \text{sgn}_m}} (\text{sgn}(r_{t_j+1}) + 1)$$

where

$n_{\text{sgn}_1, \dots, \text{sgn}_m}$  = number of an event ( $\text{sgn}(v^1) = \text{sgn}_1 \wedge \dots \wedge \text{sgn}(v^m) = \text{sgn}_m$ ) from  $t-K-1$  to  $t-2$

$t_j$  = periods when the event occurred ( $t-K-1 \leq t_1 \leq t_2 \leq \dots \leq t_n \leq t-2$ )

$v_t^i$  = time series of market information variable  $v^i$

$m$  = number of market information variables

$K$  = number of recent trend series or time window

$$\text{sgn}(x) = \begin{cases} 1, & \text{for } x > 0 \\ 0, & \text{for } x = 0 \\ -1, & \text{for } x < 0 \end{cases}$$

Then, given the event occurred at  $t-1$ , refer the conditional probability of positive future return at  $t$ , and generate a trading signal for period  $t$ .

$CPT(v^1, v^2, \dots, v^m; K)$  :

$$\text{sig}_t = \begin{cases} In, & \text{if } \text{Prob}(r_t > 0 | \text{sgn}(v^1) = \text{sgn}(v_{t-1}^1) \wedge \dots \wedge \text{sgn}(v^m) = \text{sgn}(v_{t-1}^m)) > 0.5 \\ Out, & \text{if } \text{Prob}(r_t > 0 | \text{sgn}(v^1) = \text{sgn}(v_{t-1}^1) \wedge \dots \wedge \text{sgn}(v^m) = \text{sgn}(v_{t-1}^m)) < 0.5 \\ \text{sig}_{t-1}, & \text{if } \text{Prob}(r_t > 0 | \text{sgn}(v^1) = \text{sgn}(v_{t-1}^1) \wedge \dots \wedge \text{sgn}(v^m) = \text{sgn}(v_{t-1}^m)) = 0.5 \\ \text{or the event}(\text{sgn}(v^1) = \text{sgn}(v_{t-1}^1) \wedge \dots \wedge \text{sgn}(v^m) = \text{sgn}(v_{t-1}^m)) & \text{is not found during } K \end{cases}$$

### 3.3 Strategies Based on Pattern Proximity

So far I have introduced strategies based on time proximity. Here I introduce strategies based on pattern proximity which search similar patterns of market movement from the past, being indifferent to whether one pattern is more recent than another. The underlying assumption is that history tends to repeat itself.

In order to develop strategies based on pattern proximity, I introduce a popular data-mining algorithm, the Nearest Neighbors algorithm, which searches similar patterns to a reference from data repository.

#### 3.3.1 Nearest Neighbors Algorithm

Nearest Neighbors (NN) algorithm is popular in context of data-mining. It is used to search similar samples to a cue from a data repository and to predict value of objective variable based on values of objective variables for those similar samples called nearest neighbors.

More specifically, each sample with a certain objective value and multiple attributes is represented as a vector in multiple-dimension space. By defining some distance norm between samples, a certain number of nearest neighbors to a sample of interest are searched. Lastly, with a certain function of objective variables for searched samples given, value of objective variable for the reference sample is predicted.

For the purpose of stock return forecast, we can set rate of return series of certain periods as a sample. Objective variable for each sample is the next return after the end of the periods.

Based on the method of Andrada-Félix et al. (2003), let the number of sample periods  $m$  and the number of nearest neighbors to search  $k$ . Use absolute value of correlation coefficient  $\rho$  between return series as a distance norm in order to search  $k$  nearest neighbors as follows.

$k$  nearest samples to  $\mathbf{r}_0 = (r_{t-1}, r_{t-2}, \dots, r_{t-m})$

$$\mathbf{r}_1 = (r_{t_1-1}, r_{t_1-2}, \dots, r_{t_1-m})$$

$$\mathbf{r}_2 = (r_{t_2-1}, r_{t_2-2}, \dots, r_{t_2-m})$$

$\vdots$

$$\mathbf{r}_k = (r_{t_k-1}, r_{t_k-2}, \dots, r_{t_k-m})$$

where

$$\max |\rho(\mathbf{r}_0, \mathbf{r}_i)| = |\rho(\mathbf{r}_0, \mathbf{r}_1)| \geq |\rho(\mathbf{r}_0, \mathbf{r}_2)| \geq \dots \geq |\rho(\mathbf{r}_0, \mathbf{r}_k)|$$

$$t_i < t - 1 \quad (i = 1, 2, \dots, k)$$

$m$  nearest neighbors in hand, predict next period return  $\hat{r}_t$  by regression or by arithmetic average. When use regression, estimators of  $\beta$  can be obtained by regressing next period returns of  $k$  nearest neighbors on  $k$  nearest neighbors return vectors with size  $m$ .

$$\begin{pmatrix} r_{t_1} \\ r_{t_2} \\ \vdots \\ r_{t_k} \end{pmatrix} = \begin{pmatrix} 1 & \mathbf{r}_1 \\ 1 & \mathbf{r}_2 \\ \vdots & \vdots \\ 1 & \mathbf{r}_k \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \end{pmatrix}$$

$$\hat{r}_t = \hat{\beta}_0 + \hat{\beta}_1 r_{t-1} + \hat{\beta}_2 r_{t-2} + \dots + \hat{\beta}_m r_{t-m}$$

$\hat{\beta}_i$  = ordinary least squares estimator of  $\beta_i$

When use arithmetic average to forecast, we can estimate next period return as follows.

$$\hat{r}_t = \frac{1}{k} \sum_{j=1}^k r_{t_j}$$

Finally generate trading signals as follows.

$$NN(m, k, \theta, method) : sig_t = \begin{cases} In, & \text{if } \hat{r}_t > \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ Out, & \text{if } \hat{r}_t < -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ sig_{t-1}, & \text{if } \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \geq \hat{r}_t \geq -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \end{cases}$$

where

$\hat{r}_t$  = forecasted daily return for period  $t$

$\bar{r}_t$  = historical average of daily return at  $t$

$\bar{\sigma}_t$  = historical rate of return volatility at  $t$

$m$  = time window size

$k$  = number of nearest neighbors

$\theta$  = threshold,  $\theta \geq 0$

$method = \{regression, arithmetic\ average\}$

### 3.3.2 Nearest Neighbors Algorithm with Multiple Market Information Variables

Just like a modification in case of trend-based regression with multiple market information in previous section, NN algorithm can include multiple market information variables as follows.

Find  $k$  samples which are the nearest to a recent trend. In case of the NN with multiple variables, the recent trend is represented as a synthesized vector whose elements are parts of time series of multiple market information variables.

The norm of distance between two samples is an absolute value of correlation coefficient between two samples, as introduced in case of the NN with single variable.

$$k \text{ nearest samples to } (\mathbf{v}_0^1, \mathbf{v}_0^2, \dots, \mathbf{v}_0^m) = (v_{t-1}^1 \cdots v_{t-W_1}^1, v_{t-1}^2 \cdots v_{t-W_2}^2, \dots, v_{t-1}^m \cdots v_{t-W_m}^m)$$

$$(\mathbf{v}_1^1, \mathbf{v}_1^2, \dots, \mathbf{v}_1^m) = (v_{t_1-1}^1 \cdots v_{t_1-W_1}^1, v_{t_1-1}^2 \cdots v_{t_1-W_2}^2, \dots, v_{t_1-1}^m \cdots v_{t_1-W_m}^m)$$

$$(\mathbf{v}_2^1, \mathbf{v}_2^2, \dots, \mathbf{v}_2^m) = (v_{t_2-1}^1 \cdots v_{t_2-W_1}^1, v_{t_2-1}^2 \cdots v_{t_2-W_2}^2, \dots, v_{t_2-1}^m \cdots v_{t_2-W_m}^m)$$

⋮

$$(\mathbf{v}_k^1, \mathbf{v}_k^2, \dots, \mathbf{v}_k^m) = (v_{t_k-1}^1 \cdots v_{t_k-W_1}^1, v_{t_k-1}^2 \cdots v_{t_k-W_2}^2, \dots, v_{t_k-1}^m \cdots v_{t_k-W_m}^m)$$

where

$$\begin{aligned} & \max |\rho((\mathbf{v}_0^1, \mathbf{v}_0^2, \dots, \mathbf{v}_0^m), (\mathbf{v}_i^1, \mathbf{v}_i^2, \dots, \mathbf{v}_i^m))| = \\ & |\rho((\mathbf{v}_0^1, \mathbf{v}_0^2, \dots, \mathbf{v}_0^m), (\mathbf{v}_1^1, \mathbf{v}_1^2, \dots, \mathbf{v}_1^m))| \geq \dots \geq |\rho((\mathbf{v}_0^1, \mathbf{v}_0^2, \dots, \mathbf{v}_0^m), (\mathbf{v}_k^1, \mathbf{v}_k^2, \dots, \mathbf{v}_k^m))| \end{aligned}$$

$$t_i < t - 1 \quad (i = 1, 2, \dots, k)$$

Return forecast by regression method is,

$$\begin{pmatrix} r_{t_1} \\ r_{t_2} \\ \vdots \\ r_{t_k} \end{pmatrix} = \begin{pmatrix} 1 & \mathbf{v}_1^1 & \mathbf{v}_1^2 & \dots & \mathbf{v}_1^m \\ 1 & \mathbf{v}_2^1 & \mathbf{v}_2^2 & \dots & \mathbf{v}_2^m \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & \mathbf{v}_k^1 & \mathbf{v}_k^2 & \dots & \mathbf{v}_k^m \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1^1 \\ \vdots \\ \beta_{W_1}^1 \\ \beta_1^2 \\ \vdots \\ \beta_{W_2}^2 \\ \vdots \\ \beta_1^m \\ \vdots \\ \beta_{W_m}^m \end{pmatrix}$$

$$\hat{r}_t = \hat{\beta}_0 + \hat{\beta}_1^1 v_{t-1}^1 + \dots + \hat{\beta}_{W_1}^1 v_{t-W_1}^1 + \hat{\beta}_1^2 v_{t-1}^2 + \dots + \hat{\beta}_{W_2}^2 v_{t-W_2}^2 + \dots + \hat{\beta}_1^m v_{t-1}^m + \dots + \hat{\beta}_{W_m}^m v_{t-W_m}^m$$

$\hat{\beta}_0$  = ordinary least squares estimator of  $\beta_0$

$\hat{\beta}_j^i$  = ordinary least squares estimator of  $\beta_j^i$

Return forecast by arithmetic average method is,

$$\hat{r}_t = \frac{1}{k} \sum_{j=1}^k r_{t_j}$$

Generation of trading signals is,

*NN with Multiple Information*( $v^1, W_1; v^2, W_2; \dots; v^m, W_m; k, \theta, method$ ) :

$$sig_t = \begin{cases} In, & \text{if } \hat{r}_t > \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ Out, & \text{if } \hat{r}_t < -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \\ sig_{t-1}, & \text{if } \theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \geq \hat{r}_t \geq -\theta \bar{\sigma}_{t-1} + \bar{r}_{t-1} \end{cases}$$



where

$\hat{r}_t$  = forecasted daily return for period  $t$

$\bar{r}_t$  = historical average of daily return at  $t$

$\bar{\sigma}_t$  = historical rate of return volatility at  $t$

$v_t^i$  = time series of market information variable  $v^i$

$W_i$  = time window size for  $v^i$

$m$  = number of market information variables

$k$  = number of nearest neighbors

$\theta$  = threshold,  $\theta \geq 0$

$method = \{regression, arithmetic\ average\}$

### 3.4 Meta-Level Strategies

Until now I have introduced multiple strategies to trade single risky asset. However, those individual strategies have a serious problem in trading practice. That is how to select the right strategy from a number of strategies with different parameter values. To cope with this problem, we can consider meta-level strategies which integrate individual strategies and automatically select a particular strategy for next period. Here I introduce two meta strategies.

One is a strategy which selects the best performer from multiple strategies in previous period and apply the strategy to the next period. In this way, we don't have to forecast which strategy is going to be better.

The other is a strategy which selects several top performers and makes them vote for the next period action. This also allows us not to select a strategy based on our guesswork.

### 3.4.1 Best Performer Selection

Even though only one strategy is used for actual trading in a certain period, we can calculate the performances of all other strategies in parallel. This meta strategy selects the best performance strategy using the tracking information of performances.

First pick up a strategy with maximum rate of return in the previous period. Then apply the selected strategy to the next period and repeat this procedure during investment time horizon.

$$\text{Best Performer Selection}(\text{period}) : \text{sig}_t = \text{sig}(s_{max})_t, s_{max} = \underset{s \in \text{strategies}}{\text{argmax}} r(s)_{t-1}$$

### 3.4.2 Voting

Instead of selecting just one strategy, we can pick up multiple best performing strategies and determine the next trading decision by voting of those multiple best strategies. Underlying assumption is that the integration of individual signals provides better forecast.

$$\text{Voting}(k, \text{period}) : \text{sig}_t = \begin{cases} In, & \text{if } n_{in,t} > n_{out,t} \\ Out, & \text{if } n_{in,t} < n_{out,t} \\ \text{sig}_{t-1}, & \text{if } n_{in,t} = n_{out,t} \end{cases}$$

where

$$\max_{s \in \text{strategies}} r(s)_{t-1} \geq r(s_1)_{t-1} \geq r(s_2)_{t-1} \geq \dots \geq r(s_k)_{t-1}$$

$n_{in,t}$  = number of *In* signals among the  $k$  best strategies predicted at the end of  $t-1$

$n_{out,t}$  = number of *Out* signals among the  $k$  best strategies predicted at the end of  $t-1$

$$n_{in,t} + n_{out,t} = k$$

# Chapter 4

## Evaluation of Strategies

Consider how to evaluate a trading strategy  $ts$  when reaching a trading time horizon  $T$ . Resulting rate of return and risk-adjusted rate of return of a trading strategy in comparison to the buy-and-hold benchmark could be the most important measures. However there is other factors to be taken into account.

Firstly, there is an issue of trading costs. If two trading strategies have the same risk-adjusted return, the strategy with the smaller number of trading during the time horizon is better.

Secondly, two trading strategies with the same rate of returns could have the different proportions of in-the-market periods to the entire time horizon. A strategy which tends to have the smaller proportion of in-the-market periods to the time horizon could be more immune to a jump event or the market crunch.

Thirdly, If the proportion is zero, which means always being out-of-the-market, then rate of return is going to be zero under the assumption in this study that interest earnings of cash position is zero. In reverse, if the proportion is one, rate of return is going to be equal to that of the benchmark. Between the two cases, we will be able to obtain the largest return, if we can correctly chose in-the-market periods with the largest period returns from all periods. Therefore we can also evaluate a performance of a trading strategy in relation to the possible boundary of return. I present these ideas in detail in the following sections.

## 4.1 Property of a Trading Signal

Define  $r_{in}$  and  $r_{out}$  as average single period rate of returns during  $TP_{in}$  and  $TP_{out}$ .

$$r_{in} = \frac{1}{N_{in}} \sum_{i=1}^{N_{in}} r_{I_i}$$

$$r_{out} = \frac{1}{N_{out}} \sum_{j=1}^{N_{out}} r_{O_j}$$

$$N_{in}r_{in} + N_{out}r_{out} = Nr = R$$

Also define  $p_{in}$  and  $p_{out}$  as proportions of  $N_{in}$  and  $N_{out}$  to  $N$ .  $p_{in}$  and  $p_{out}$  can be interpreted as probabilities that a certain period falls in  $TP_{in}$  or  $TP_{out}$  under a trading signal  $sig$ .

$$p_{in} = \frac{N_{in}}{N}$$

$$p_{out} = \frac{N_{out}}{N}$$

$$p_{in} + p_{out} = 1$$

## 4.2 Upper Boundary for Rate of Return

Consider a set of trading signals which generate the same number of periods to stay in the market (and the same number of periods to stay out of the market). Each element of this set of trading strategies gives us its average rate of return with the same number of in-the-market periods.

We can pick up the maximum average return given a proportion of in-the-market  $p_{in}$ . Define this possible maximum average return given  $p_{in}$  as  $r^{upper}(p_{in})$ .

After observing asset price  $P_k$  for all periods, we can calculate  $r^{upper}(p_{in})$  by picking up the  $N_{in}$  largest rates of return.

$$r^{upper}(p_{in}) = \frac{1}{N} \sum_{l=1}^{N_{in}} r_{D_l}$$

where

$\max_k r_k = r_{D_1} > r_{D_2} > \dots > r_{D_N}$ ,  $D_l =$  index to sort rates of return in descending order

In case of that the number of periods  $N$  is sufficiently large and the distribution of observed asset prices is close to a lognormal distribution with average rate of return  $r$  and standard deviation (return volatility)  $\sigma$ , we can estimate  $r^{upper}(p_{in})$  as follows.

$$r^{upper}(p_{in}) = \frac{1}{\sqrt{2\pi}\sigma} \int_{r^*(p_{in})}^{\infty} q \exp \left[ -\frac{(q-r)^2}{2\sigma^2} \right] dq$$

where

$$r^*(p_{in}) = \sigma N^{-1}(1 - p_{in}) + r$$

$N^{-1}(\cdot)$ : Inverse normal cumulative distribution function

### 4.3 Statistical Significance of Rate of Return (Lower Boundary)

Now consider a statistical significance of a trading performance for given  $p_{in}$ , using  $z - statistic$  for 5% single-sided significance level.

$$z_0 = \frac{r_{in} - r}{\sqrt{\frac{\sigma^2}{N_{in}}}} > 1.6448$$

Therefore, when  $p_{in}$  is given, a lower boundary which provides 5%-level statistical significance criteria is the following.

$$r^{lower}(p_{in}) = \frac{N_{in}}{N} r_{in}^{lower} = 1.6448 \sqrt{\frac{p_{in} \sigma^2}{N}} + p_{in} r$$

## 4.4 Performance Measures of a Trading Strategy

Given the results of a trading strategy, we can calculate the following measures to evaluate the performance of the strategy.

Annualized Return = geometric average of rate of return during the trading horizon

Annualized Volatility = volatility of rate of return during the trading horizon

SR = risk adjusted rate of return (Sharpe ratio) during the trading horizon

$p_{in}$  = proportion of in the market periods to the whole trading horizon

*NumOfTrade* = number of executed trading during the trading horizon

The first three measures Annualized Return, Annualized Volatility and SR are the traditional measures of investment performance. In this study, SR is calculated not from the excess return to risk-free rate but from the return itself.

The fourth measure  $p_{in}$  can be used as a proxy of a jump risk immunity, because

a trading strategy which constantly records smaller  $p_{in}$  is in the out-of-the-market position in many cases. Therefore the strategy can lower the risk of being hit by a jump event such as the market crunch.

The last measure  $NumOfTrade$  stands for a proxy of trading costs. This measure might seem to be similar to  $p_{in}$ , however they are measuring different properties of a strategy. For example, if one strategy bought an asset at the beginning and sold it in the middle of the horizon, then  $p_{in}$  is 0.5 and  $NumOfTrade$  is 2. On the other hand, if the other strategy continued buy and sell periodically, then  $p_{in}$  is still 0.5 but  $NumOfTrade$  is equal to  $N$ , the number of periods in the horizon.

In other studies, the number of trading is often converted to rate of return which is used to adjust the original raw rate of return. In this study, I use  $NumOfTrade$  instead of adjusting rate of return with the similar procedure, because the estimate of the accurate trading costs for financial institutions is hard to obtain.

Lastly, I present the relationships among the rate of returns from three trading methods, long position only  $L$ , short position only  $S$  and both positions available  $LS$ . Define  $r_L$ ,  $r_S$ , and  $r_{LS}$  as average rate of returns for the three trading methods and define  $\Delta r_L$ ,  $\Delta r_S$ , and  $\Delta r_{LS}$  as average excess return comparing to an average rate of return  $r$  of the benchmark strategy  $BH$ .

$$r_L = \frac{1}{N} \left( \sum_{i=1}^{N_{in}} r_{I_i} + \sum_{j=1}^{N_{out}} 0 \right) = \frac{N_{in}}{N} r_{in} = p_{in} r_{in}$$

$$r_S = \frac{1}{N} \left( \sum_{i=1}^{N_{in}} 0 + \sum_{j=1}^{N_{out}} (-r_{O_j}) \right) = \frac{N_{out}}{N} (-r_{out}) = \frac{1}{N} (N_{in} r_{in} - N r) = p_{in} r_{in} - r$$

$$r_{LS} = \frac{1}{N} \left( \sum_{i=1}^{N_{in}} r_{I_i} + \sum_{j=1}^{N_{out}} (-r_{O_j}) \right) = 2p_{in} r_{in} - r$$

$$\Delta r_L = \frac{N_{in}}{N} r_{in} - r = p_{in} r_{in} - r$$

$$\Delta r_S = \frac{N_{in}}{N} r_{in} - 2r = p_{in} r_{in} - 2r$$

$$\Delta r_{LS} = 2\left(\frac{N_{in}}{N} r_{in} - r\right) = 2(p_{in} r_{in} - r)$$

As we can see from the equations above, in order to beat the market,  $r_{in}$  has to be greater than  $\frac{r}{p_{in}}$  for  $L$  and  $LS$ , if  $r$  is positive. On the other hand  $r_{in}$  has to be greater than  $2\frac{r}{p_{in}}$  for  $S$  *i.e.* twice as large as a threshold for  $L$  and  $LS$  as long as  $r$  is greater than zero.

If  $r > 0$ ,

$$\Delta r_L, \Delta r_{LS} > 0 \iff r_{in} > \frac{r}{p_{in}}$$

$$\Delta r_S > 0 \iff r_{in} > \frac{2r}{p_{in}}$$



# Chapter 5

## Empirical Analysis

In this chapter, I present the results and findings from the back-testing of the introduced strategies. Firstly I explain a procedure of the back-test with historical data of market information in order to examine performances of the introduced trading strategies. Secondly, I examine correlation relationships between key market variables to seek any possibility of price/return predictability which could affect the performances of tested strategies. Lastly, I examine the results of the back-tests, strategy by strategy, and try to understand the mechanisms of the observed performances from the perspective of the correlation analyses between key variables.

### 5.1 Back-Testing

Back-testing is a popular way to examine the performance of a quantitative trading strategy. It simulates trades of assets utilizing historical data of the assets and any other additional information if necessary. One important assumption here is that we could have bought and sold the assets at the realized prices in the past such as daily closing prices, even though this might not have been the case in reality.

In addition to the issue, high performance in back-testing does not assure the same high performance in future at all. Because, back-testing is a kind of backward-looking methodology by its very nature and there is no guarantee that the future market will behave like the past.

Despite these drawbacks, the back-testing can still give us useful information to understand why one strategy works well and the other doesn't depending on various market situations which occurred in history.

For the purpose of performance examination of the strategies, I choose the S&P 500 stock index as a trading asset and use its historical closing price as a price at which we could have traded the stock index. The reason of choosing the S&P 500 index is that the index is based on large capitalization stocks which are frequently traded in the market and also the index is market-value-weighted.

Procedures of back-testing in this study are the following.

- Trading horizon for the strategies is set to 10 years from the beginning of 1998 to the end of 2007. Unit of trading period is daily or weekly or monthly or quarterly or yearly depending on strategy. Except for daily-basis, each period starts from the first trading day of the period and ends the last trading day during the period.
- If a strategy contains parameters, assign values for the parameters by grid search method to examine the favorable ranges of parameter values later.
- Generate trading signals based on the historical data of market information variable(s). All market information variables used in this study are the S&P 500 stock index, return of the index, its trading volume, the change of the trading volume, the 13-week treasury bill rate, the change of the treasury bill rate, the CBOE volatility index (VIX), and the change of VIX.
- Simulate trading of the stock index based on trading signals generated by a strategy utilizing long position only. Assume that we could have traded at the closing price and cash position wouldn't earn interest.
- Calculate the performance metrics introduced in chapter 4: annualized rate of return, annualized volatility, Sharpe ratio, proportion of in-the-market periods  $p_{in}$ , and the number of trading during the 10-year time horizon.

In this study, trading costs are not taken into account to calculate rate of return. If accurate trading costs which apply for quantitative trading desks or hedge funds will be available in future study, it will be appropriate to subtract the estimated trading costs from the original rate of return.

## **5.2 Examination of Historical Data**

In this section, firstly, I present basic statistical properties of market information variables. Secondly I examine the historical data more in detail to see if there is any pattern or relationship which could be a source for a strategy's success.

### **5.2.1 Basic Properties of Market Information Historical Data**

For back-tests of strategies in this study, eight market information variables are used. Half of them are primary variables such as the S&P 500 index, its trading volume, the 13-week T-bill rate and the VIX.

The other half are secondary variables derived from the primary variables such as rate of return of the S&P 500 index, change of the trading volume, change of the T-bill rate and change of the VIX. In figure 5-1, I present historical changes of these eight variables from 1960 to 2007 (as for VIX, from 1990 to 2007). We can observe several jump events in history.

In table 5.1, I present basic statistical properties of the eight variables calculated both from 1960 to 2007 and from 1998 to 2007. The latter is the trading horizon of back-test. We can observe negative skewness and fat tails for the stock index return and the T-bill rate change from 1960 to 2007. From 1998 to 2007, the tendency for the stock index return was weakened to be closer to normal distribution.

As for the trading volume and the change of trading volume, the differences of kurtosis between the two time spans are considerably large. This is thought to be caused by the decrease of half-day operation trading days, according to the NYSE's official records. Lastly, the VIX as well as change of the VIX are positively skewed and their tails are relatively less fat in contrast to the index return.

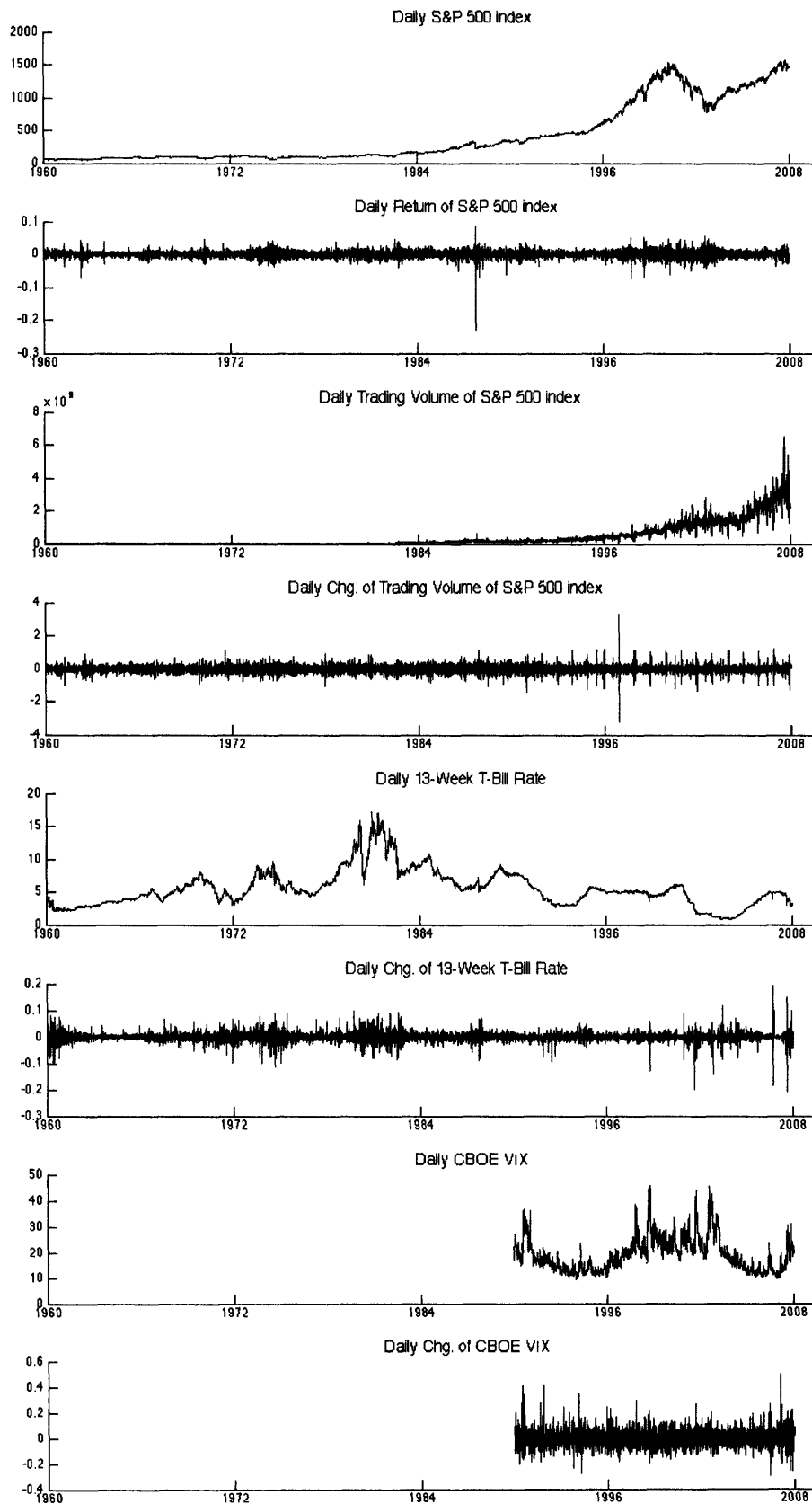


Figure 5-1: Historical Changes of the Market Information Variables  
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Table 5.1: Statistical Properties of the Market Information Variables

Statistical Properties of Key Variables (1960-2008, for VIX 1990-2007)

Variable	Mean	Std. Deviation	Maximum	Minimum	Skewness	Kurtosis
Daily S&P 500 Stock Index	416.71	447.87	1565.15	52.20	1.17	2.86
Daily Return of S&P 500	0.0003	0.0093	0.087	-0.23	-1.34	38.39
Daily Trading Volume of S&P 500	401,275,340	704,725,421	6,509,300,000	1,890,000	2.59	10.78
Daily Chg. of Trading Volume	0.0005	0.192	3.31	-3.23	-0.088	21.14
Daily 13-Week T-Bill Rate	5.52	2.74	17.14	0.79	1.14	5.01
Daily Chg. of 13-Week T-Bill Rate	0.00	0.0147	0.195	-0.20	-0.67	22.83
Daily CBOE VIX	18.98	6.38	45.74	9.31	0.97	3.79
Daily Chg. of CBOE VIX	0.0001	0.058	0.50	-0.30	0.64	7.47

Statistical Properties of Key Variables (1998-2007)

Variable	Mean	Std. Deviation	Maximum	Minimum	Skewness	Kurtosis
Daily S&P 500 Stock Index	1211.78	177.60	1565.15	776.76	-0.119	2.30
Daily Return of S&P 500	0.0002	0.0113	0.056	-0.070	-0.039	5.65
Daily Trading Volume of S&P 500	1,552,076,830	806,635,772	6,509,300,000	246,980,000	1.41	5.64
Daily Chg. of Trading Volume	0.0007	0.184	1.18	-1.35	-0.165	13.23
Daily 13-Week T-Bill Rate	3.47	1.66	6.22	0.79	-0.26	1.62
Daily Chg. of 13-Week T-Bill Rate	-0.0002	0.0173	0.195	-0.20	-1.45	38.45
Daily CBOE VIX	20.69	6.93	45.74	9.89	0.64	3.18
Daily Chg. of CBOE VIX	0.00	0.058	0.50	-0.30	0.47	6.66

## 5.2.2 Correlation Analysis between Market Information Variables

In order to see if there is any pattern or causality between the market information variables, I executed detailed correlation analysis by calculating auto-correlation/correlation coefficients between the variables, changing the window size of time series, the unit of trading period, and the time lag between two time series.

Also I examined their statistical significance by two-sided test at the 5 percent level and the 1 percent level of significance based on  $t$ -statistic of sample estimate.

$$t = \frac{\rho\sqrt{n-2}}{\sqrt{1-\rho^2}}$$

where

$\rho$  = sample estimate of correlation coefficient

$n$  = window size of time series

I present an example of the correlation analysis in figure 5-2. In the example, dotted lines represent the 5 percent level of significance for auto-correlation coefficients calculated from time series of window size 252 days with 1 day lag. Dashed-dotted line represent the 1 percent level of significance.

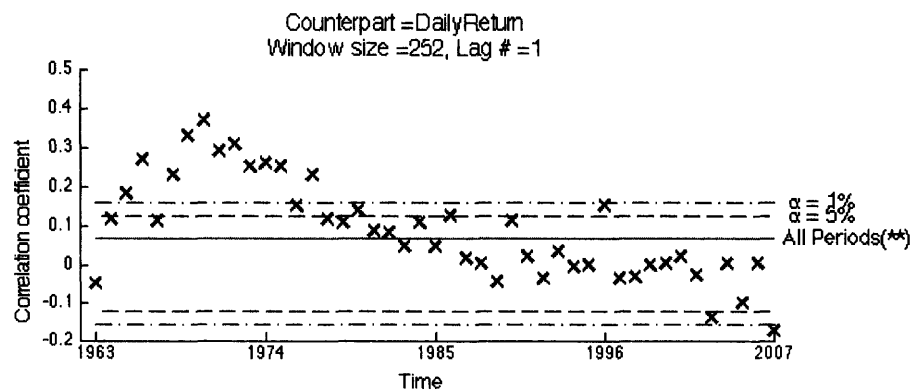


Figure 5-2: An Example of the Correlation Analysis

Solid line represents an auto-correlation coefficient calculated from time series of full window size indicated in the x-axis (time) of the figure. Asterisk symbols besides a label of the solid line represent significance of the coefficient. One asterisk represents the 5 percent level of significance and two asterisks for the 1 percent level of significance.

In appendix A, I present the results of the correlation analysis in detail. For all analysis, one of the combination of variables was set to the index return. Counterpart of the combination was set to the index return (auto-correlation), the trading volume, change of the trading volume, the T-bill rate, change of the T-bill rate, the VIX, and the change of the VIX. Therefore seven combinations were examined.

For each combination, five kinds of trading period unit (day, week, month, quarter and year) with two window sizes respectively were applied. Lags of two time series were changed from one to six in most cases.

From the results shown in appendix A, we can see that mostly correlation coefficients are between the 5 percent significant level lines and their absolute values are close to zero. However, in some combination of variables, we can observe with small absolute values but statistically significant coefficients in shorter time window and/or in longer time window.

As a summary of the results, I show observed relationships in the long run in table 5.2. We can find significant relationships in all combinations except for correlation with the trading volume and correlation with the T-bill rate.

Patterns in auto-correlation of the index return might be considered as consequences of over/under-reaction biases which has been reported in a number of literature. Patterns in correlation with the VIX as well as change of the VIX could be interpreted that the index return tends to larger after several pessimistic periods and vice versa.

In most cases, directions of correlations are positive. However, as for change of the T-bill rate, the direction is negative. This coincide with intuition that when risk-free rate decreases the relative attractiveness of stocks increases.

These patterns or relationships observed in historical data could be sources of high

performances for certain strategies so long as the strategies have capabilities to exploit the patterns. In the following sections, I examine the performances of tested strategies in relation to these observed patterns in historical data.

Significance of Correlation Coefficients (1960-2007)						
Auto-Correlation	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily	++	--				
Weekly	--					
Monthly					++	
Quarterly						
Yearly						
Correl. w/ Trad. Vol.	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily						
Weekly						
Monthly						
Quarterly						
Yearly						
Correl. w/ Chg. of Trad. Vol.	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily						
Weekly	+					
Monthly						
Quarterly						
Yearly						
Correl. w/ Risk-free rate	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily						
Weekly						
Monthly						
Quarterly						
Yearly						
Correl. w/ Chg. of Risk-free rate	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily	--					
Weekly		-	--			
Monthly	--					
Quarterly						
Yearly						
Significance of Correlation Coefficients (1990-2007)						
Correl. w/ Volatility Index	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily	+	+	+	+		
Weekly	++					
Monthly						
Quarterly						-
Yearly						
Correl. w/ Chg. of Volatility Index	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5	Lag = 6
Daily					++	
Weekly	++					
Monthly						
Quarterly	+				++	
Yearly						

+/- ... significant at the 5% level  
++/-- ... significant at the 1% level

Table 5.2: Summary of Correlation Analysis between Market Information Variables



## 5.3 Performance Analysis of Strategies

In this section, I show the results of the back-testing and examine any possible mechanism for the outcomes in terms of the observed patterns in the historical data of the market information variables.

Firstly, I explain benchmarks used in this study to compare the performances of the strategies with. Then I show the results of back-tests by strategies.

### 5.3.1 Benchmarks

As a basic benchmark for the tested strategies, firstly, I use buy-and-hold (BH) performance of the S&P 500 stock index. This benchmark is used widely in financial investment industry. I present the performance measures of BH during the time horizon I used for back-tests in table 5.3.

The table indicates annual performances from 1998 to 2007 and the total performance in the 10 years. Proportion of positive return represents the ratio of the number of trading days with positive daily return to the number of total trading days in each year. This measure is used for later analysis.

Buy-and-Hold Strategy					
	1998	1999	2000	2001	2002
Annualized Returns	0.2667	0.1953	-0.1014	-0.1304	-0.2337
Annualized Volatilities	0.2031	0.1808	0.2218	0.2153	0.2602
Sharpe Ratios	1.3129	1.0802	-0.457	-0.6059	-0.898
Proportion of Positive Returns	0.56	0.51	0.48	0.47	0.44
	2003	2004	2005	2006	2007
Annualized Returns	0.2638	0.0899	0.03	0.1362	0.0353
Annualized Volatilities	0.1711	0.1109	0.1027	0.1004	0.1596
Sharpe Ratios	1.5422	0.8112	0.2923	1.3565	0.2212
Proportion of Positive Returns	0.54	0.56	0.56	0.56	0.54
1998-2007					
Annualized Returns	0.0423				
Annualized Volatilities	0.1802				
Sharpe Ratios	0.2346				
Proportion of Positive Returns	0.52				

Table 5.3: Performance Summary of Buy-and-Hold Strategy

In addition to the BH benchmark, secondly, I use the Credit Suisse/Tremont hedge fund indexes as supplementary benchmarks. They contain the composite index, the Credit Suisse/Tremont Hedge Fund Index, and the sub-indexes provided by type of hedge funds such as equity market neutral, global macro, event driven, convertible arbitrage and so on.

The reason to utilize these supplementary indexes is in order to compare the performance of successful strategies found in the back-testing with the actual performances in industry. I present the performance of the Credit Suisse/Tremont hedge fund indexes in table 5.4.

For the purpose of reference, I present the performance changes of both BH and the hedge fund composite index in figure 5-3. The hedge fund index had not necessarily outperformed the BH every year such as in 1998 and 2003. However, the index had successfully sheltered the downturn from 2000 to 2002 and that led to the average return in the 10 years more than double of the BH's.

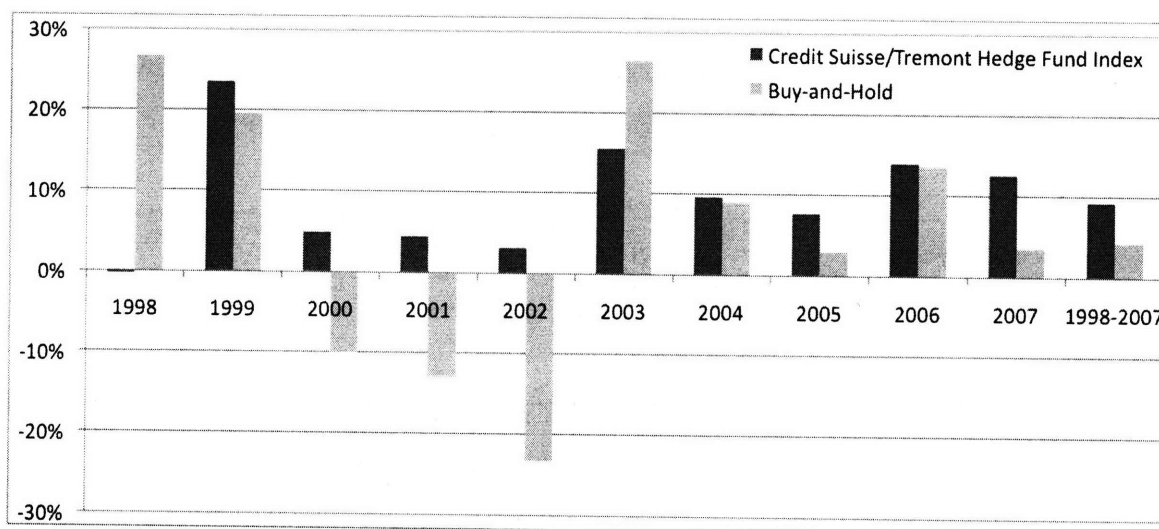


Figure 5-3: Performance Changes of Buy-and-Hold and the Credit Suisse/Tremont Hedge Fund Index

Table 5.4: Performance Summary of Credit Suisse/Tremont Hedge Fund Indexes

Credit Suisse/Tremont Hedge Fund Indexes											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Credit Suisse/Tremont Hedge Fund Index	-0.0036	0.2343	0.0485	0.0442	0.0304	0.1544	0.0964	0.0761	0.1386	0.1256	0.0925
Credit Suisse/Tremont Hedge Fund Index Convertible Arbitrage	-0.0441	0.1604	0.2564	0.1458	0.0405	0.1290	0.0198	-0.0255	0.1430	0.0517	0.0840
Credit Suisse/Tremont Hedge Fund Index Dedicated Short Bias	-0.0600	-0.1422	0.1576	-0.0358	0.1814	-0.3259	-0.0772	0.1700	-0.0661	0.0604	-0.0263
Credit Suisse/Tremont Hedge Fund Index Emerging Markets	-0.3766	0.4482	-0.0552	0.0584	0.0736	0.2875	0.1249	0.1739	0.2049	0.2026	0.0909
Credit Suisse/Tremont Hedge Fund Index Equity Market Neutral	0.1331	0.1533	0.1499	0.0931	0.0742	0.0707	0.0648	0.0614	0.1115	0.0927	0.1000
Credit Suisse/Tremont Hedge Fund Index Event Driven	-0.0487	0.2226	0.0726	0.1150	0.0016	0.2002	0.1447	0.0895	0.1573	0.1320	0.1057
Credit Suisse/Tremont Hedge Fund Index Distressed	-0.0168	0.2218	0.0195	0.2001	-0.0069	0.2512	0.1562	0.1174	0.1558	0.0835	0.1144
Credit Suisse/Tremont Hedge Fund Index Multi-Strategy	-0.0898	0.2300	0.1184	0.0679	0.0122	0.1719	0.1404	0.0721	0.1638	0.1682	0.1018
Credit Suisse/Tremont Hedge Fund Index Risk Arbitrage	0.0558	0.1323	0.1469	0.0568	-0.0346	0.0898	0.0545	0.0308	0.0815	0.0877	0.0690
Credit Suisse/Tremont Hedge Fund Index Fixed Income Arbitrage	-0.0816	0.1211	0.0629	0.0804	0.0575	0.0797	0.0686	0.0063	0.0866	0.0383	0.0506
Credit Suisse/Tremont Hedge Fund Index Global Macro	-0.0364	0.0581	0.1167	0.1838	0.1466	0.1799	0.0849	0.0925	0.1353	0.1736	0.1116
Credit Suisse/Tremont Hedge Fund Index Long/Short Equity	0.1718	0.4723	0.0208	-0.0365	-0.0160	0.1727	0.1156	0.0968	0.1438	0.1366	0.1203
Credit Suisse/Tremont Hedge Fund Index Managed Futures	0.2064	-0.0469	0.0424	0.0190	0.1833	0.1413	0.0597	-0.0011	0.0805	0.0601	0.0718
Credit Suisse/Tremont Hedge Fund Index Multi-Strategy	0.0768	0.0938	0.1118	0.0550	0.0631	0.1504	0.0753	0.0754	0.1454	0.1010	0.0944
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.0300	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Credit Suisse/Tremont Hedge Fund Index	0.1232	0.0971	0.1059	0.0227	0.0277	0.0263	0.0341	0.0397	0.0439	0.0503	0.0668
Credit Suisse/Tremont Hedge Fund Index Convertible Arbitrage	0.0839	0.0209	0.0425	0.0252	0.0507	0.0400	0.0263	0.0488	0.0212	0.0421	0.0486
Credit Suisse/Tremont Hedge Fund Index Dedicated Short Bias	0.3110	0.1476	0.2517	0.1659	0.1536	0.0925	0.1413	0.1260	0.1236	0.1485	0.1771
Credit Suisse/Tremont Hedge Fund Index Emerging Markets	0.2646	0.1952	0.1634	0.1081	0.0806	0.0543	0.0647	0.0703	0.0929	0.0788	0.1423
Credit Suisse/Tremont Hedge Fund Index Equity Market Neutral	0.0341	0.0193	0.0225	0.0217	0.0186	0.0135	0.0223	0.0181	0.0204	0.0193	0.0225
Credit Suisse/Tremont Hedge Fund Index Event Driven	0.1383	0.0393	0.0336	0.0337	0.0566	0.0217	0.0342	0.0377	0.0325	0.0540	0.0592
Credit Suisse/Tremont Hedge Fund Index Distressed	0.1464	0.0391	0.0336	0.0352	0.0775	0.0286	0.0279	0.0236	0.0306	0.0421	0.0624
Credit Suisse/Tremont Hedge Fund Index Multi-Strategy	0.1418	0.0525	0.0472	0.0386	0.0475	0.0193	0.0420	0.0520	0.0367	0.0663	0.0648
Credit Suisse/Tremont Hedge Fund Index Risk Arbitrage	0.0883	0.0526	0.0337	0.0406	0.0385	0.0313	0.0291	0.0212	0.0306	0.0445	0.0451
Credit Suisse/Tremont Hedge Fund Index Fixed Income Arbitrage	0.0873	0.0210	0.0116	0.0192	0.0405	0.0224	0.0249	0.0233	0.0216	0.0357	0.0385
Credit Suisse/Tremont Hedge Fund Index Global Macro	0.1883	0.1306	0.1090	0.0360	0.0263	0.0412	0.0303	0.0301	0.0424	0.0429	0.0840
Credit Suisse/Tremont Hedge Fund Index Long/Short Equity	0.1658	0.1503	0.1815	0.0422	0.0410	0.0417	0.0534	0.0621	0.0666	0.0622	0.1033
Credit Suisse/Tremont Hedge Fund Index Managed Futures	0.1310	0.0847	0.1206	0.1341	0.1463	0.1375	0.1339	0.1060	0.0927	0.1348	0.1208
Credit Suisse/Tremont Hedge Fund Index Multi-Strategy	0.0620	0.0437	0.0402	0.0221	0.0245	0.0227	0.0245	0.0406	0.0338	0.0478	0.0377
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Credit Suisse/Tremont Hedge Fund Index	-0.35	2.01	0.09	0.21	-0.32	4.38	1.67	0.92	2.26	1.71	0.86
Credit Suisse/Tremont Hedge Fund Index Convertible Arbitrage	-0.99	5.80	5.11	4.23	0.02	2.24	-0.75	-1.33	4.89	0.29	1.01
Credit Suisse/Tremont Hedge Fund Index Dedicated Short Bias	-0.32	-1.23	0.47	-0.45	0.92	-3.95	-0.83	1.04	-0.85	0.14	-0.35
Credit Suisse/Tremont Hedge Fund Index Emerging Markets	-1.57	2.09	-0.58	0.18	0.42	4.57	1.32	1.91	1.78	2.07	0.39
Credit Suisse/Tremont Hedge Fund Index Equity Market Neutral	2.75	5.92	4.92	2.47	1.87	2.31	1.14	1.21	3.54	2.76	2.88
Credit Suisse/Tremont Hedge Fund Index Event Driven	-0.64	4.66	0.99	2.24	-0.67	7.42	3.08	1.33	3.63	1.71	1.19
Credit Suisse/Tremont Hedge Fund Index Distressed	-0.38	4.67	-0.59	4.56	-0.60	7.41	4.18	3.31	3.80	1.05	1.27
Credit Suisse/Tremont Hedge Fund Index Multi-Strategy	-0.91	3.63	1.68	0.74	-0.57	6.87	2.40	0.63	3.39	1.94	1.03
Credit Suisse/Tremont Hedge Fund Index Risk Arbitrage	0.19	1.77	3.19	0.43	-1.92	1.61	0.52	-0.41	1.37	1.09	0.75
Credit Suisse/Tremont Hedge Fund Index Fixed Income Arbitrage	-1.39	3.89	2.03	2.13	0.45	1.80	1.17	-1.42	2.19	-0.03	0.40
Credit Suisse/Tremont Hedge Fund Index Global Macro	-0.40	0.14	0.71	4.02	4.07	3.41	1.50	1.77	2.26	3.13	0.91
Credit Suisse/Tremont Hedge Fund Index Long/Short Equity	0.80	2.88	-0.10	-1.80	-1.35	3.19	1.43	0.92	1.57	1.56	0.83
Credit Suisse/Tremont Hedge Fund Index Managed Futures	1.28	-1.02	0.03	-0.15	0.98	0.74	0.15	-0.38	0.44	0.15	0.30
Credit Suisse/Tremont Hedge Fund Index Multi-Strategy	0.60	1.25	1.80	0.70	0.97	4.90	1.47	0.89	3.14	1.29	1.57
Buy-and-Hold	1.31	1.08	-0.46	-0.61	-0.90	1.54	0.81	0.29	1.36	0.22	0.23

Lastly, in order to evaluate the quality of generated trading signals from a different point of view, I examined the back-test performances of randomly generated trading signals. The random signals were generated in daily-basis by fixing their daily in-the-market probability  $\text{Prob}(sig_t = In)$  to 0.1, 0.5, 0.9, 0.99 respectively. I present rate of return distributions of the randomly generated trading signals in figure 5-4 and present  $p_{in}$  distribution of them in figure 5-5.

Summary of statistics is shown in table 5.5. It is indicated that by increasing  $\text{Prob}(sig_t = In)$  to 1, average return comes closer to return of the buy-and-hold ( $r_{BH}=4.23\%$ ). Also it is shown that probability that sample return is greater than the BH,  $\text{Prob}(r > r_{BH})$ , is coming near to the proportion of positive daily index return to all trading days in the 10-year horizon (0.52).

Performances of Randomly Generated Trading Signals					
Randomly Generated Signals with respect to $\text{Prob}(sig_t = In)$	Number of Trials	Mean of Annualized Returns	Std. Dev. of Annualized Returns	$\text{Prob}(r > r_{BH})$	Mean of $p_{in}$
$\text{Prob}(sig_t = In) = 0.1$	1000	0.52%	1.71%	0.019	0.100
$\text{Prob}(sig_t = In) = 0.5$	1000	2.16%	2.88%	0.229	0.500
$\text{Prob}(sig_t = In) = 0.9$	1000	3.78%	1.78%	0.418	0.900
$\text{Prob}(sig_t = In) = 0.99$	1000	4.16%	0.58%	0.451	0.990

Table 5.5: Performance Summary of Randomly Generated Trading Signals (1998-2007)

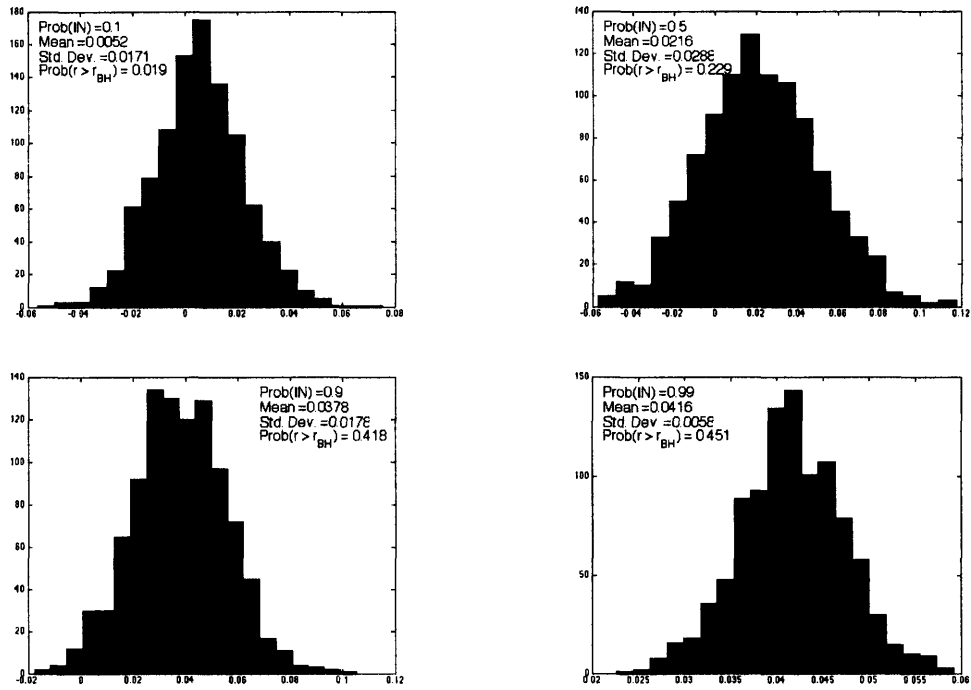


Figure 5-4: Average Annualized Rate of Return Distributions of Randomly Generated Signals (1998-2007)

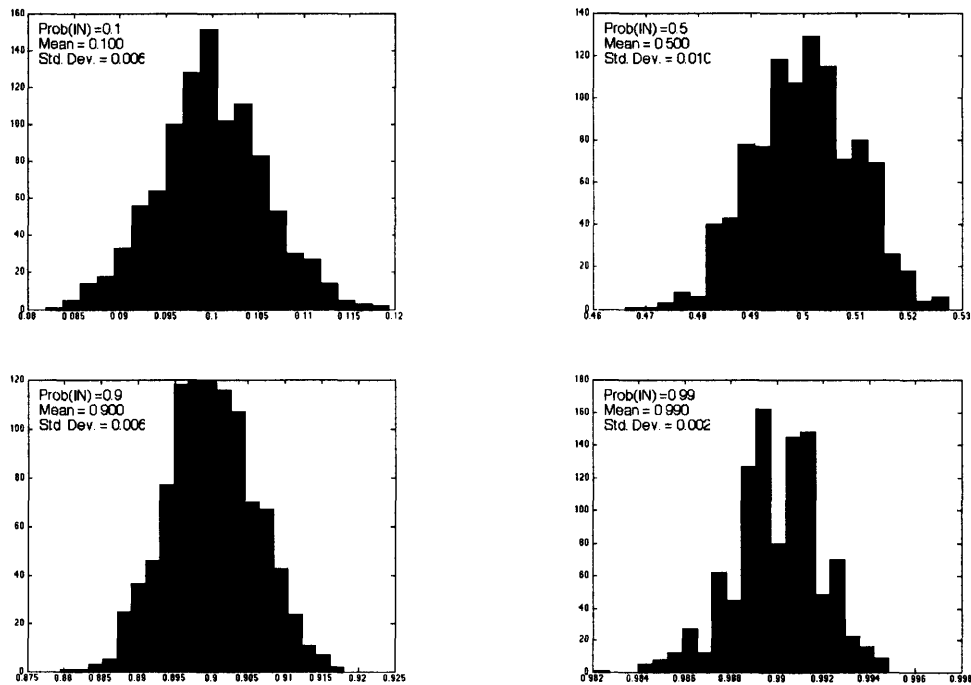


Figure 5-5: Average  $p_{in}$  Distributions of Randomly Generated Signals (1998-2007)

### 5.3.2 Contrarian and Momentum

I back-tested contrarian and momentum strategies by changing the unit of trading period in daily, weekly, monthly, quarterly and yearly. The resulting return of all strategies are shown in figure 5-6. It shows that contrarian is better than momentum for shorter units of trading period and momentum beats contrarian for longer units of period except for quarterly.

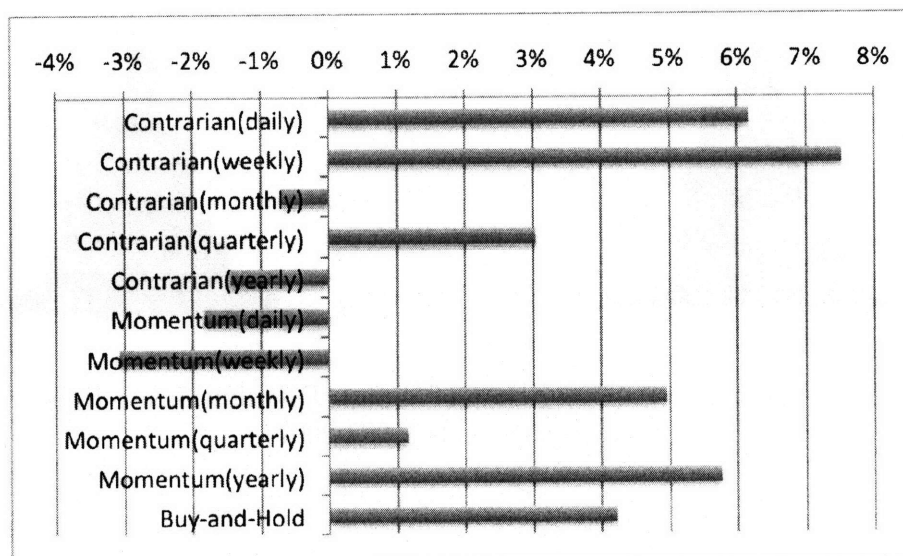


Figure 5-6: Annualized Returns of Contrarian and Momentum Strategies (1998-2007)

From the viewpoint of the correlation analysis in section 5.2.2, high performances of *Contrarian(weekly)* can be attributed to the significant negative auto-correlation of the weekly stock index return with lag of one indicated in table 5.2. However these long-run auto-correlations cannot explain the high performance of *Contrarian(daily)*, because the long-run auto-correlation with lag of one in daily basis is significant in positive direction.

When we look into the detailed analysis in appendix A, we can find that during the trading horizon, from 1998 to 2007, lag-1 auto-correlation of daily return was moving toward negative direction in figure A-2. It is considered that this mid-run trend shift supported the *Contrarian(daily)* strategy. Similarly, as it is indicated in figure A-10,

mid-run trend shift of yearly auto-correlation with lag of one toward the positive direction after 2000 explains well the high performance of *Momentum(yearly)*.

As a representative of contrarian and momentum strategies, I present the performance of the best strategy *Contrarian(weekly)* in comparison with the BH. Figure 5-7 shows change of the best strategy performance and table 5.6 indicates summary of performance measures. Detailed annual performances of contrarian and momentum strategies are presented in appendix B.

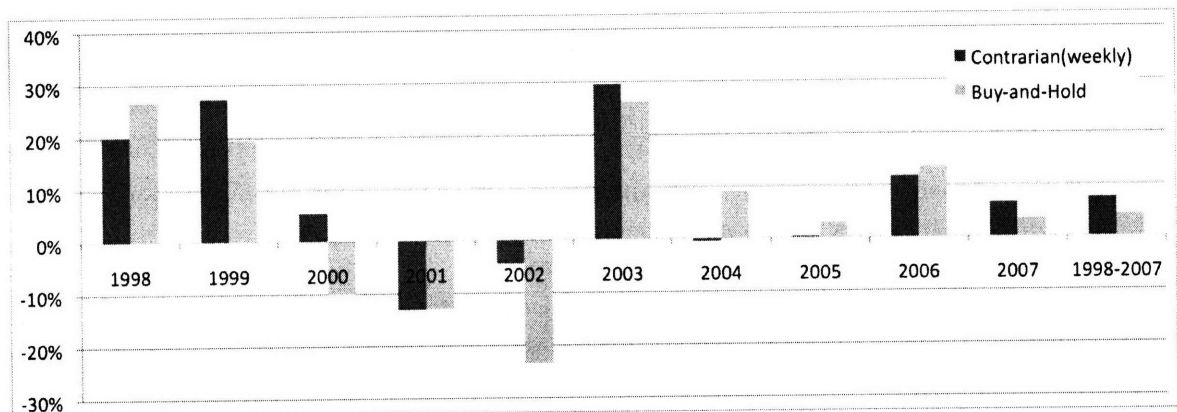


Figure 5-7: Performance Change of the Best Contrarian and Momentum Strategy:  
*Contrarian(weekly)*

1998-2007	<i>Contrarian(weekly)</i>	Buy-and-Hold
Annualized Return	7.53%	4.23%
Annualized Volatility	13.76%	18.02%
Sharpe Ratio	0.628	0.235
Average $p_{in}$	0.47	1
Average NumOfTrade	26.5	N/A

Table 5.6: Performance Summary of the Best Contrarian and Momentum Strategy:  
*Contrarian(weekly)*

### 5.3.3 Contrarian and Momentum on an Arbitrary Market Information Variable

Contrarian and momentum strategies based on other market information variables than the stock index return were examined as well. The market information variables

I used are the change of the trading volume, the change of risk-free rate, and the change of the volatility index.

The resulting annualized rate of returns of the strategies are shown in figure 5-8, figure 5-9 and figure 5-10.

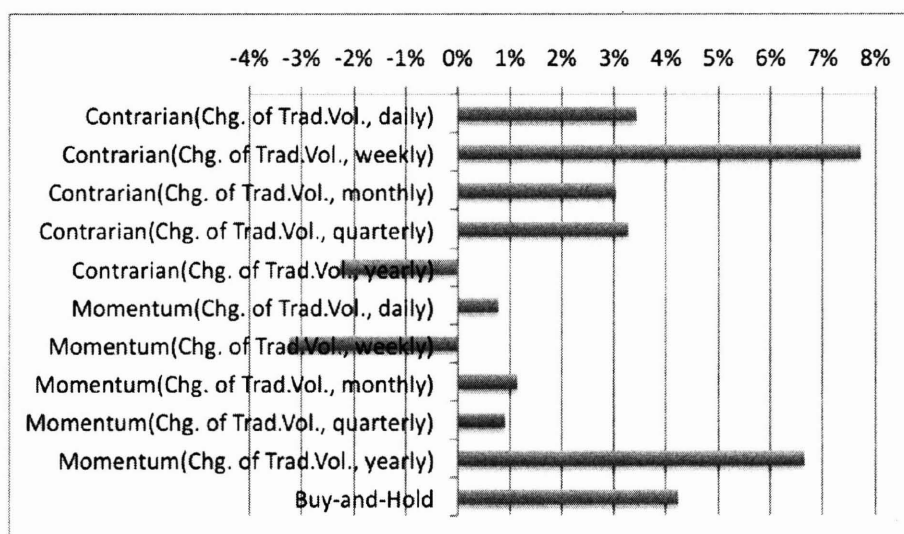


Figure 5-8: Annualized Returns of Contrarian and Momentum Strategies on Change of Trading Volume (1998-2007)

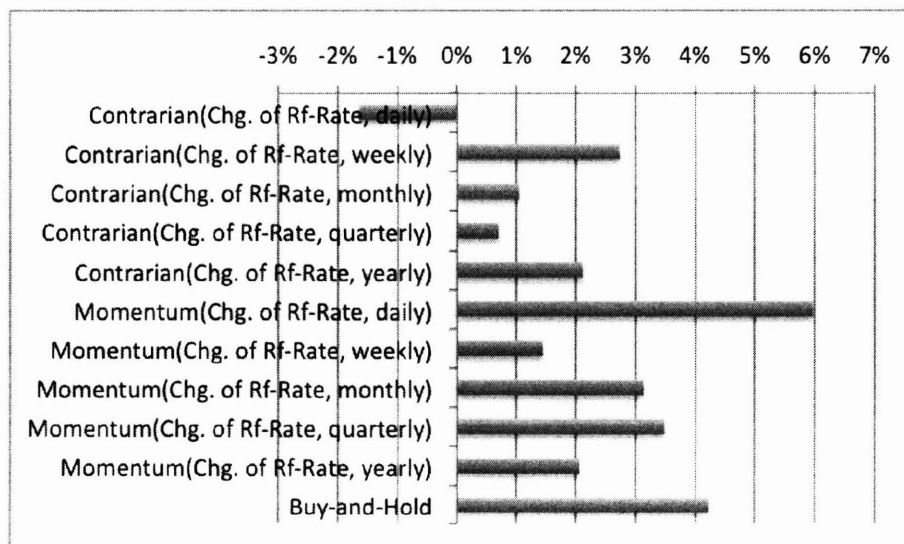


Figure 5-9: Annualized Returns of Contrarian and Momentum Strategies on Change of Risk-free Rate (1998-2007)



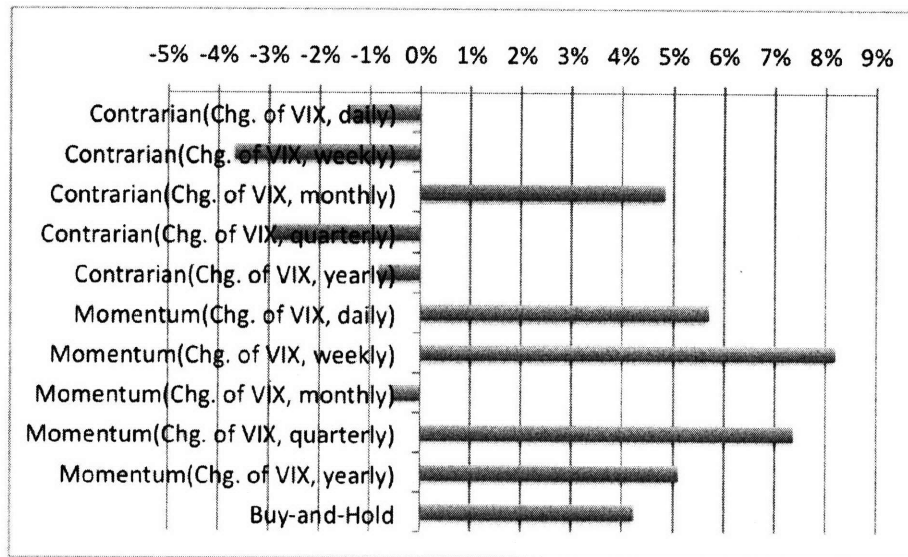


Figure 5-10: Annualized Returns of Contrarian and Momentum Strategies on Change of Volatility Index (1998-2007)

As for the strategies based on the change of the stock trading volume, weekly trading worked well for contrarian and so did yearly trading for momentum. Looking into figure A-23 and figure A-30 in appendix A to understand the reason for their successes, it is shown that there were trend changes which affected favorably to both strategies during the trading horizon.

Weekly change of the trading volume is positively correlated with the stock return with one-period lag in the long term, however the relationship reversed significantly in 2002 and that supported the contrarian strategy. In fact, this weekly contrarian on change of the trading volume outperformed the BH only during market downturn from 2000 to 2002 as indicated in its detailed performance in appendix B.

Yearly change of the trading volume had been negatively correlated with the index return. In mid 90's there was a shift toward positive correlation and it supported the yearly momentum strategy.

As for the strategies based on the change of the risk-free rate, only the daily momentum outperformed the BH. In the long run, change of risk-free rate is negatively correlated with one-period lagged stock return as we saw in section 5.2.2. However again, a trend shift can be observed to opposite direction in figure A-42 which sup-

ported the strategy.

As for the strategies based on the change of the volatility index, momentum strategies outperformed contrarian except for monthly basis. As indicated in section 5.2.2, change of the VIX has significant positive correlation with the stock return with one-period lag. That can explain the performances of the momentum strategies.

For reference, I present performances of the best strategies from the three strategy classes in comparison with the BH in figure 5-11 and in table 5.7. Also detailed annual performances of contrarian and momentum strategies based on the three market information variables are presented in appendix B.

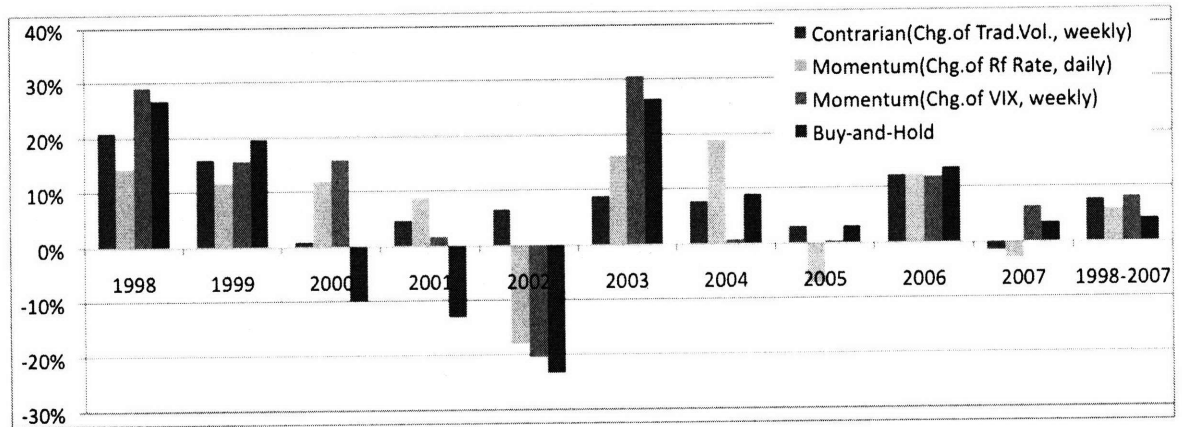


Figure 5-11: Performance Changes of the Best Contrarian and Momentum Strategies by Market Information Variable: *Contrarian(Chg. of Trad. Vol., weekly)* , *Momentum(Chg. of Rf Rate, daily)* and *Momentum(Chg. of VIX, weekly)*

1998-2007	<i>Contrarian(Chg. of Trad. Vol., weekly)</i>	<i>Momentum(Chg. of Rf Rate, daily)</i>	<i>Momentum(Chg. of VIX, weekly)</i>	Buy-and-Hold
Annualized Return	7.72%	5.97%	8.21%	4.23%
Annualized Volatility	13.26%	13.55%	13.45%	18.02%
Sharpe Ratio	0.644	0.498	0.684	0.235
Average $p_{in}$	0.49	0.61	0.48	1
Average NumOfTrade	33.2	110.9	29.6	N/A

Table 5.7: Performance Summary of the Best Contrarian and Momentum Strategies by Market Information Variable: *Contrarian(Chg. of Trad. Vol., weekly)* , *Momentum(Chg. of Rf Rate, daily)* and *Momentum(Chg. of VIX, weekly)*

### 5.3.4 Moving Average Convergence Divergence

Moving Average Convergence Divergence strategy in this study has three parameters which are size of short time window, size of long time window, and threshold. Therefore I executed grid-search based back-tests by changing short window size from 5 days to 50 days by 5 days, long window size from 100 to 300 by 20 days, and threshold from 0% to 10% by 1%. The number of total combinations of parameters is 1210.

I show returns of the top 20 strategies from 1210 in figure 5-12 and averaged returns with respect to window size parameters in 5-13. It is shown that larger size windows for both short window and long window tend to generate higher returns and that is reflected in the top 20 strategies.

It is considered that smoothing small ripples with larger time windows is assuring the performance of MACD which pursues underlying trends by its nature. Also among the top 20 strategies, there is no strategy with threshold smaller than 2% and this could be for the same reason.

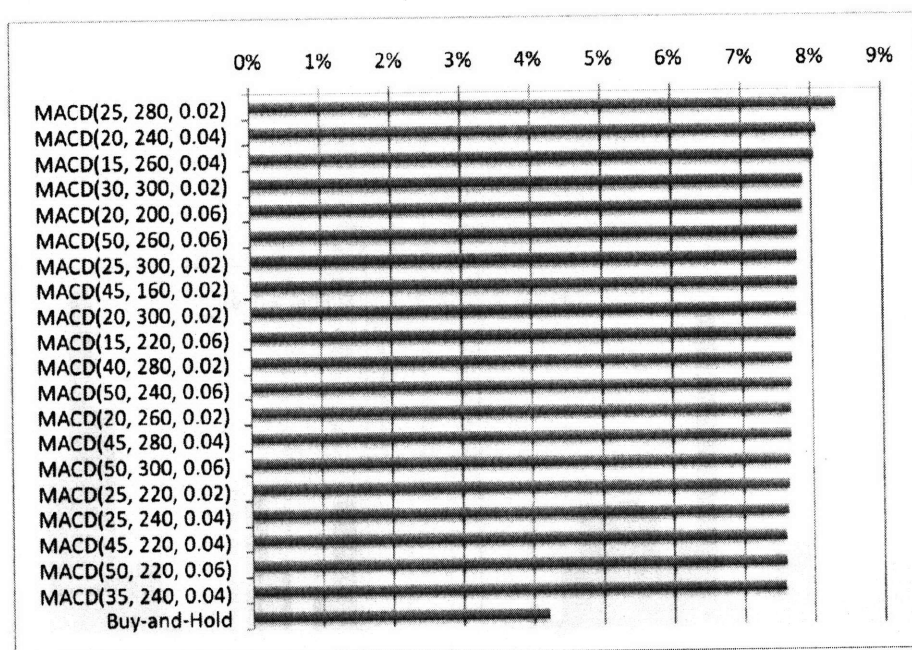


Figure 5-12: Annualized Returns of Top 20 Moving Average Convergence Divergence Strategies (1998-2007)

Secondly, to see the sensitivity of MACD, I examined the performances in a neigh-

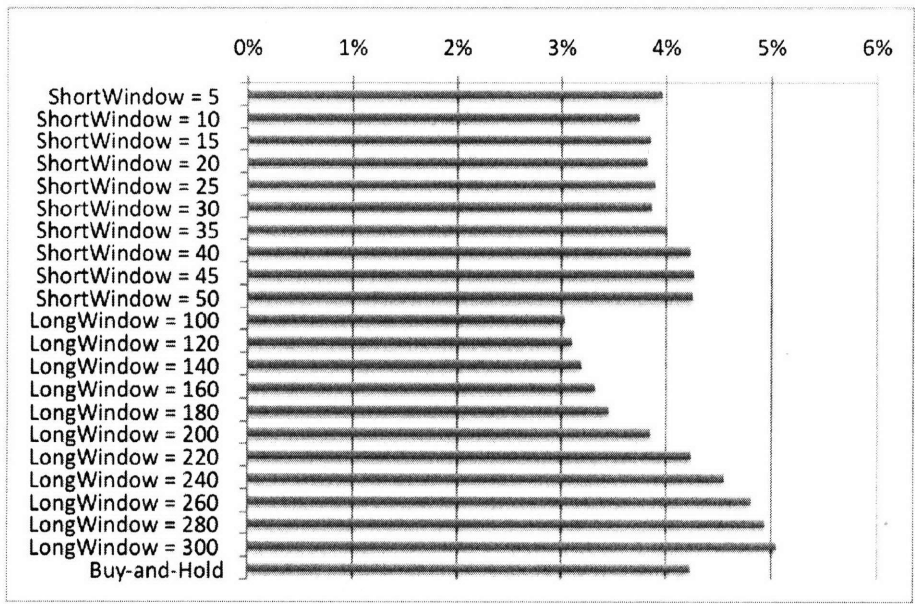


Figure 5-13: Average Annualized Returns by Parameters of Moving Average Convergence Divergence Strategies (1998-2007)

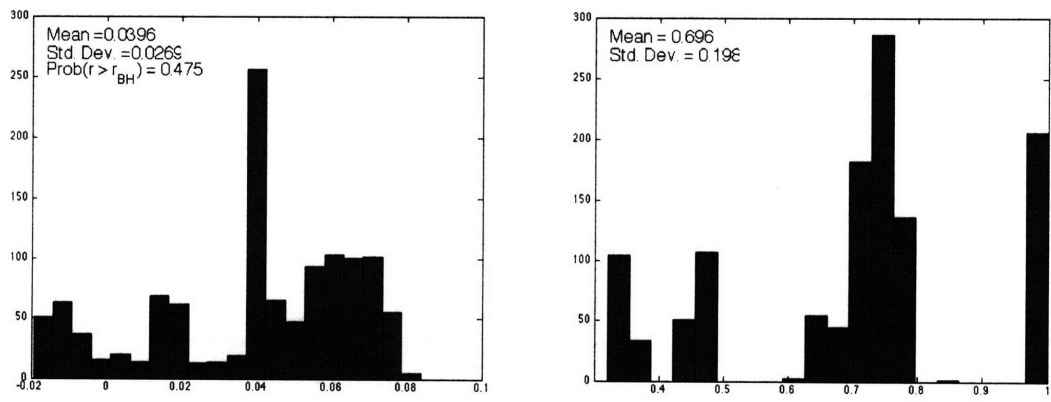


Figure 5-14: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distribution (right) of the 1210 Moving Average Convergence Divergence Strategies (1998-2007)

neighborhood of the best MACD strategy inside the grid. The result is shown in table 5.8. It is indicated that all neighbors outperformed the BH and MACD could be a robust strategy in terms of relatively small changes of parameters.

As for the properties of generated signals from MACD, I show the return distribution and the  $p_{in}$  distribution of the 1210 strategies in figure 5-14. For reference, 206 strategies out of the 1210 turned out to be the buy-and-hold. Comparing to the statistics from random signals in table 5.5, MACD has a higher  $\text{Prob}(r > r_{BH})$  in relation to its average  $p_{in}$ .

Returns in Neighborhood of MACD(25, 280, 0.02) with respect to	
Short Window Size	
<i>MACD(20, 280, 0.02)</i>	6.63%
<i>MACD(25, 280, 0.02)</i>	8.37%
<i>MACD(30, 280, 0.02)</i>	5.88%
Long Window Size	
<i>MACD(25, 260, 0.02)</i>	6.92%
<i>MACD(25, 280, 0.02)</i>	8.37%
<i>MACD(25, 300, 0.02)</i>	7.79%
Threshold	
<i>MACD(25, 280, 0.00)</i>	7.47%
<i>MACD(25, 280, 0.02)</i>	8.37%
<i>MACD(25, 280, 0.04)</i>	7.44%

Table 5.8: Average Annualized Returns in Neighborhood of the Best Moving Average Convergence Divergence Strategy: *MACD(25, 280, 0.02)*

Lastly I present the performance of the best MACD strategy *MACD(25, 280, 0.02)* in figure 5-15 and in table 5.9. The more detailed performances of MACD strategies are shown in appendix B.

Against the historical data of the S&P 500 index from 1998 to 2007, the best MACD strategy *MACD(25, 280, 0.02)* successfully sheltered from the downturn from 2000 to 2002 because of its capability to deal with longer cycle trend. This is indicated also from the small average number of trade for this strategy (0.2). It means this strategy switched its index-holding position only a few times in the 10 years.

On the other hand, by the nature of MACD, it was not so quick to respond to the beginning of the downturn in 2000 as well as the beginning of the bull market in 2003 as shown in figure 5-15.

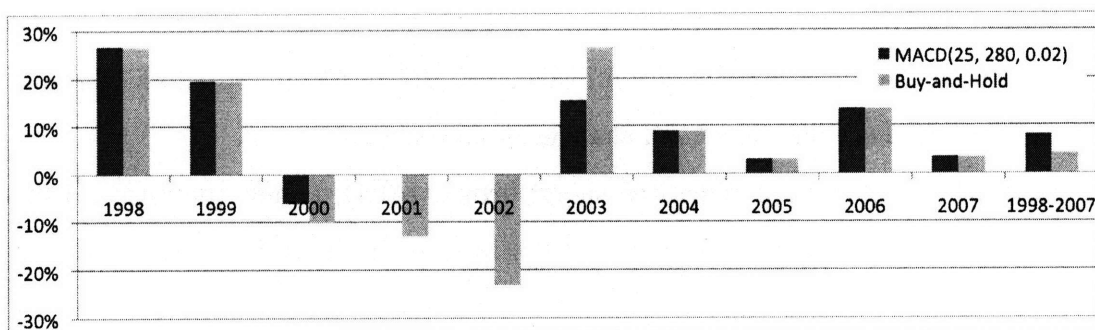


Figure 5-15: Performance Change of the Best Moving Average Convergence Divergence Strategy:  $MACD(25, 280, 0.02)$

1998-2007	$MACD(25, 280, 0.02)$	Buy-and-Hold
Annualized Return	8.37%	4.23%
Annualized Volatility	13.53%	18.02%
Sharpe Ratio	0.614	0.235
Average $p_{in}$	0.74	1
Average $NumOfTrade$	0.2	N/A

Table 5.9: Performance Summary of the Best Moving Average Convergence Divergence Strategy:  $MACD(25, 280, 0.02)$

### 5.3.5 Trend-Based Regression

As for the trend-based regression (TBR) strategy which has three parameters, I executed back-tests by grid-search method as well. The time window size was changed from 2 days to 10 days by 1 day, the number of recent trend series was changed from 10 to 100 by 10, and threshold was changed from 0 to 1 by 0.1. The total number of combinations was 990.

The top 20 returns are shown in figure 5-16 and the averaged returns with respect to the window size and the number of trend series are shown in figure 5-17. Both figures are consistent in a sense that the top 20 have combinations of better parameters indicated in the by-parameter analysis. However it is not obvious that why both smaller and larger numbers of the trend series are resulting relatively better performances in common.

Looking into a neighborhood of the best trend-based regression  $Trend-based Regression(8, 100, 0.5)$  in table 5.10, it is shown that small change of parameters affects

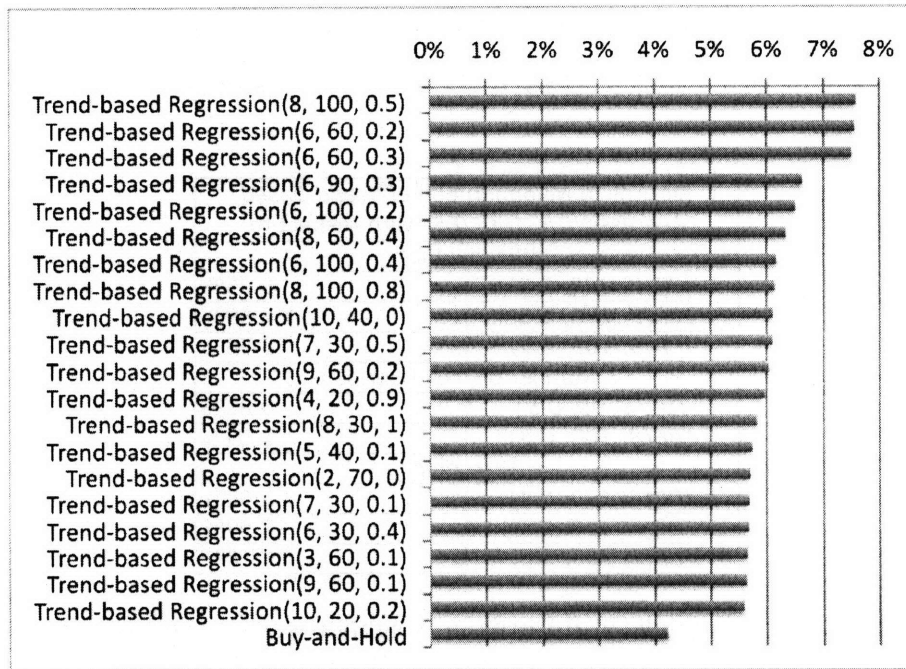


Figure 5-16: Annualized Returns of Top 20 Trend-Based Regression Strategies (1998-2007)

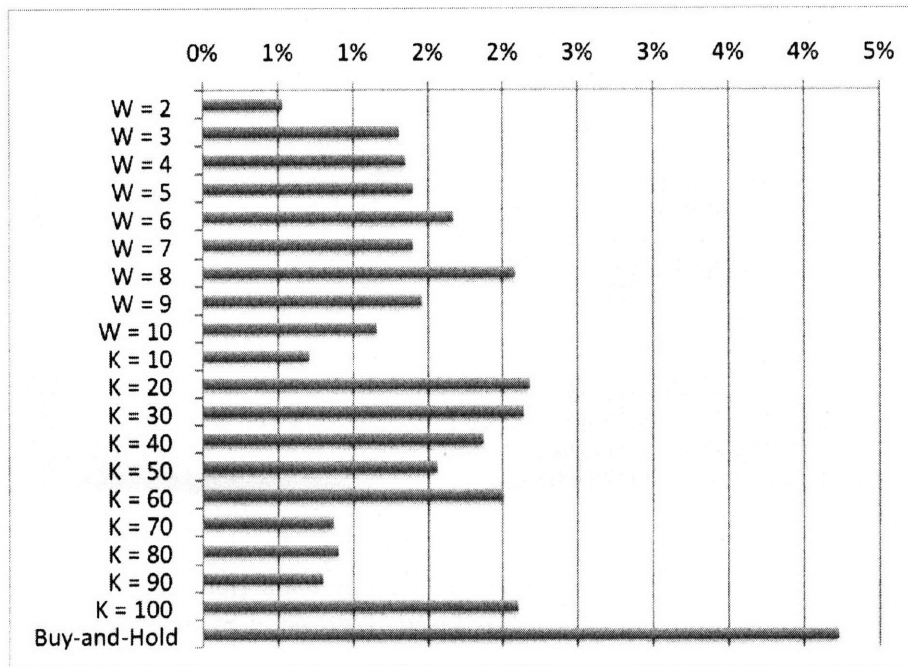


Figure 5-17: Average Annualized Returns by Parameters of Trend-Based Regression Strategies (1998-2007)

the performances tremendously. The trend-based regression strategy is utilizing a linear modeling method. Nevertheless, its behavior is not simple when applied to the real market data.

Returns in Neighborhood of <i>Trend-based Regression(8, 100, 0.5)</i> with respect to	
Window Size	
<i>TBR(7, 100, 0.5)</i>	5.25%
<i>TBR(8, 100, 0.5)</i>	7.59%
<i>TBR(9, 100, 0.5)</i>	3.56%
Number of Trend Series	
<i>TBR(8, 90, 0.5)</i>	0.81%
<i>TBR(8, 100, 0.5)</i>	7.59%
Threshold	
<i>TBR(8, 100, 0.4)</i>	3.00%
<i>TBR(8, 100, 0.5)</i>	7.59%
<i>TBR(8, 100, 0.6)</i>	1.10%

Table 5.10: Average Annualized Returns in Neighborhood of the Best Trend-Based Regression Strategy: *Trend-based Regression(8, 100, 0.5)*

Next I show the average return distribution and the  $p_{in}$  distribution of the 990 trend-based regression strategies in figure 5-18. The statistics of performances are not quite different from random signals.

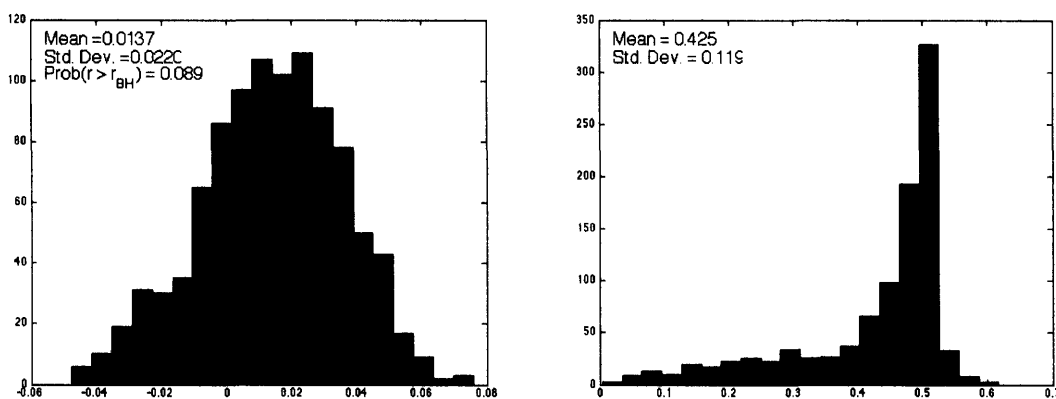


Figure 5-18: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distributions (right) of the 990 Trend-Based Regression Strategies (1998-2007)

Lastly I present the performance of the best trend-based strategy in figure 5-19 and in table 5.11. Also detailed performances of trend-based strategies are shown in appendix B.



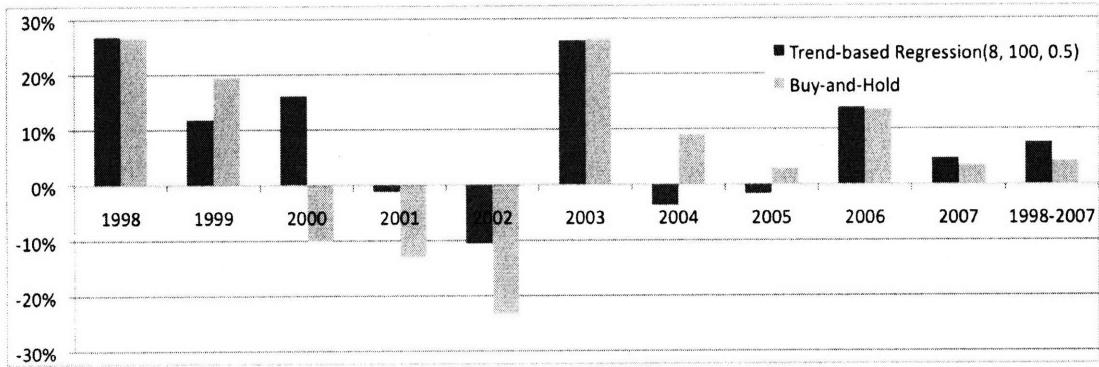


Figure 5-19: Performance Change of the Best Trend-Based Regression Strategy:  
*Trend-based Regression(8, 100, 0.5)*

1998-2007	<i>Trend-based Regression (8, 100, 0.5)</i>	Buy-and-Hold
Annualized Return	7.59%	4.23%
Annualized Volatility	12.29%	18.02%
Sharpe Ratio	0.606	0.235
Average $p_{in}$	0.45	1
Average NumOfTrade	12	N/A

Table 5.11: Performance Summary of the Best Trend-Based Regression Strategy:  
*Trend-based Regression(8, 100, 0.5)*

### 5.3.6 Trend-Based Regression with Multiple Market Information Variables

In contrast to the trend-based strategy in the previous section, I also examined the trend-based regression strategy with multiple market information variables. I tested the following three cases.

The first case is utilizing two variables, the index return and the change of the trading volume, with the window sizes of two variables equal. The second is the same as the first except that the window size of the index return is double of the change of trading volume.

The third case is studying exhaustive combinations from four variables, the index return, the change of the trading volume, the change of the risk-free rate, and the change of the volatility index, by fixing the window sizes of all variables to one period. I show the results of the three cases in the order.

As the first case, I examined the trend-based regression with two variables, the index return and the change of the trading volume by grid-search. The size of time window for the both variables was changed from 2 days to 10 days by 1 day. The number of recent trend series was changed from 10 to 100 by 10 and threshold was changed from 0 to 1 by 0.1. The total combinations are 990.

The returns of top 20 strategies and the returns by parameter (window size and number of trend series) are shown in figure 5-20 and in figure 5-21 respectively. They show that the strategies with the window size of around 6 days and the trend series number of around 20 resulted in good performances.

Comparing to the result of previous section, it seems that the adding the change of trading volume with the same window size as the index return did not contribute to performance improvement. This is indicated in the several negative returns in the by-parameter analysis which were not observed in the previous section.

Next I studied a neighborhood of the best strategy *Trend-based Regress(Index Return, 8; Chg of Trad.Vol., 8; 20, 0.5)* as shown in table 5.12. It is indicated that

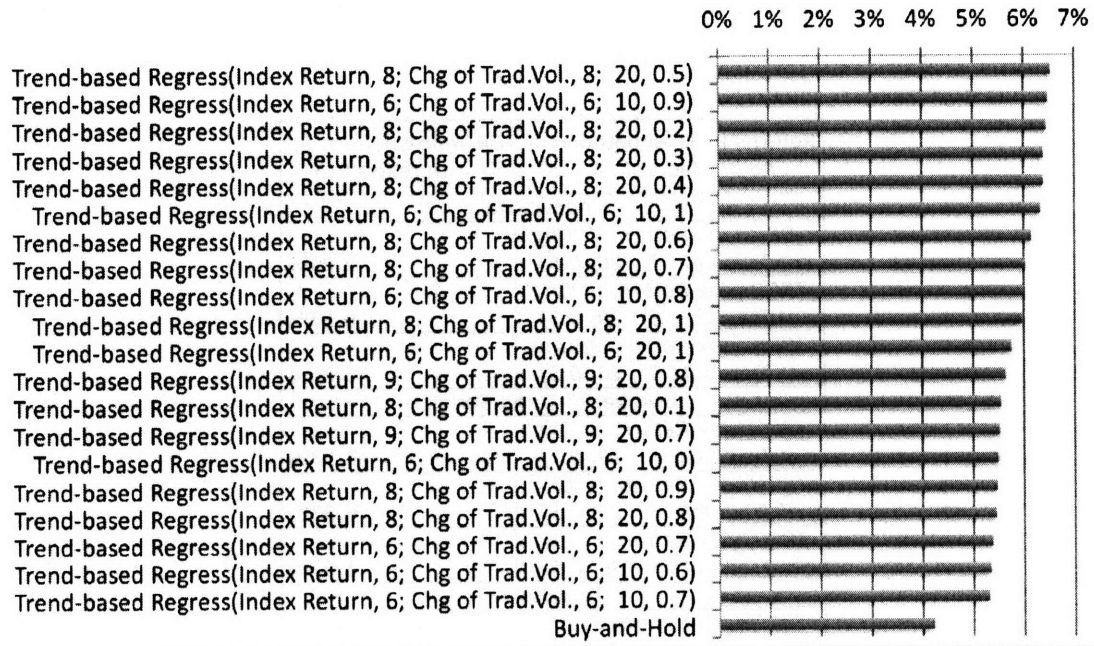


Figure 5-20: Annualized Returns of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (1998-2007)

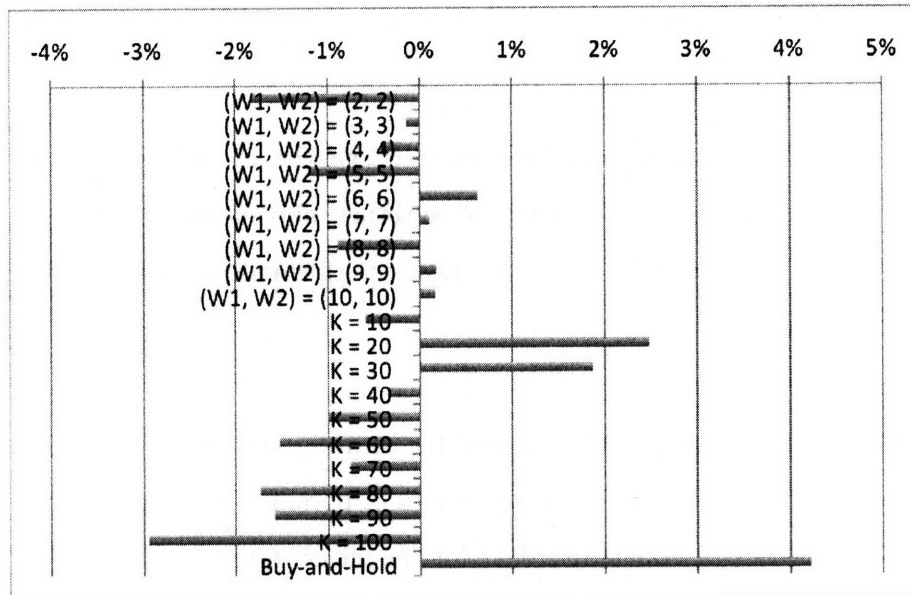


Figure 5-21: Average Annualized Returns by Parameters of Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (1998-2007)

except for the threshold, change of parameters deteriorate the performances. This instability is consistent with the result of the previous section.

Returns in Neighborhood of $TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.5)$ with respect to	
Window Size	
$TBR(\text{Index Return}, 7; \text{Chg of Trad.Vol.}, 7; 20, 0.5)$	2.89%
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.5)$	6.53%
$TBR(\text{Index Return}, 9; \text{Chg of Trad.Vol.}, 9; 20, 0.5)$	5.26%
Number of Trend Series	
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 10, 0.5)$	-3.13%
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.5)$	6.53%
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 30, 0.5)$	1.02%
Threshold	
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.4)$	6.39%
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.5)$	6.53%
$TBR(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.6)$	6.15%

Table 5.12: Average Annualized Returns in Neighborhood of the Best Trend-Based Regression Strategy with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ):  $Trend\text{-based Regress}(\text{Index Return}, 8; \text{Chg of Trad.Vol.}, 8; 20, 0.5)$

Next I show the average return distribution and the  $p_{in}$  distribution of the 990 trend-based regression strategies with index return and change of trading volume ( $W_1 : W_2 = 1 : 1$ ) in figure 5-22. The statistics of performances are not quite different from random signals.

As for the second case, I also examined the strategy with double window size for the index return by grid-search changing values of parameters. The window size was changed from 4 days to 16 days by 2 days for the index return (from 2 days to 8 days by 1 day for the change of trading volume). Number of trend series and threshold were changed from 10 to 100 by 10 and from 0 to 1 by 0.1 respectively. The total number of combinations is 770.

The result for the top 20 strategies and for by-parameter are shown in figure 5-

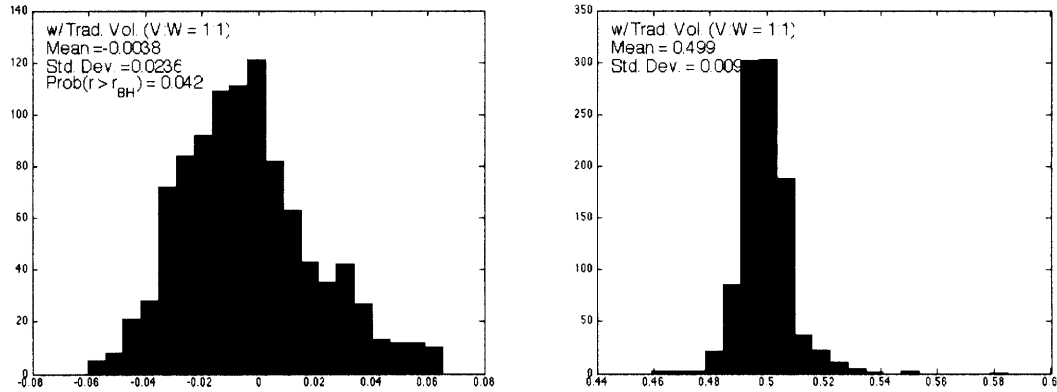


Figure 5-22: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distributions (right) of the 990 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (1998-2007)

23 and figure 5-24. It is shown that the shorter window size and larger number of trend series contributed to the better performances. The level of the top 20 returns are improved from the single variable trend-based regression in contrast to the 1 to 1 window sizes case which deteriorated the performances. It suggests that the combination of market information variables has some non-linear effects and the right mix in terms of proportion between time series sizes could improve performances.

Looking into a neighborhood of the best strategy *Trend-based Regress(Index Return, 4; Chg of Trad.Vol., 2; 80, 0.4)* in table 5.13, it is shown that the strategy is still unstable in change of parameters, even though the returns in the neighborhood are larger than the BH.

Next I show the average return distribution and the  $p_{in}$  distribution of the 770 trend-based regression strategies with index return and chg. of trading volume ( $W_1 : W_2 = 2 : 1$ ) in figure 5-22. It is shown that the statistics of performances are improved in contrast to random signals as well as to the single variable trend-based regression.

For reference of the first case and the second case, I present the performances of the best strategy in both cases in figure 5-26 and in table 5.14. On contrary to the performance from contrarian/momentum strategy and MACD strategy, the performances from the trend-based strategies with multiple variables in both cases did not align with the BH annual basis. They move up and down of the BH without any

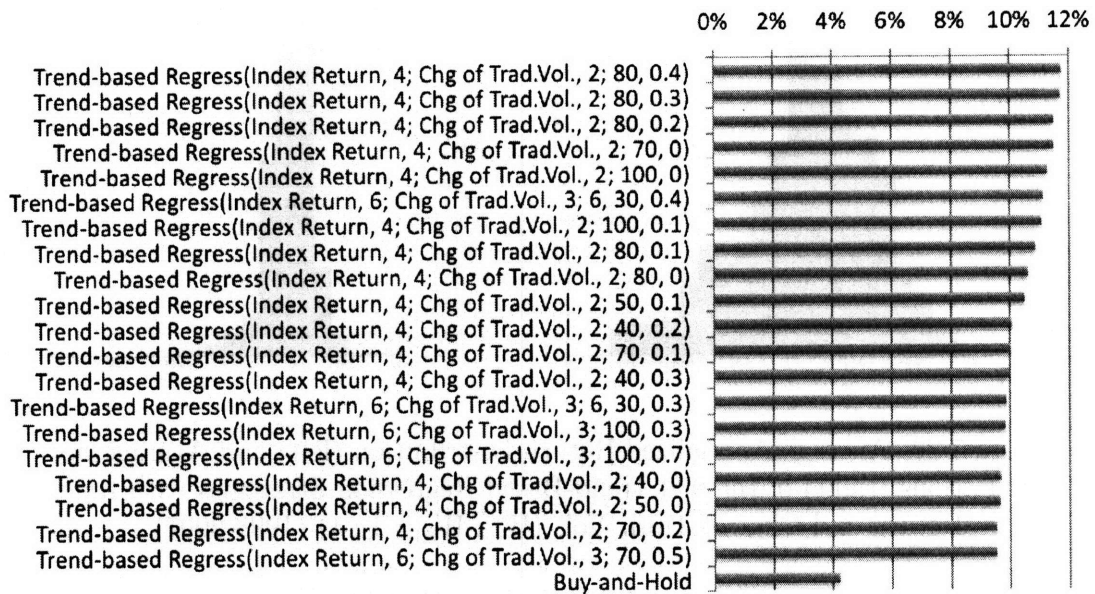


Figure 5-23: Annualized Returns of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (1998-2007)

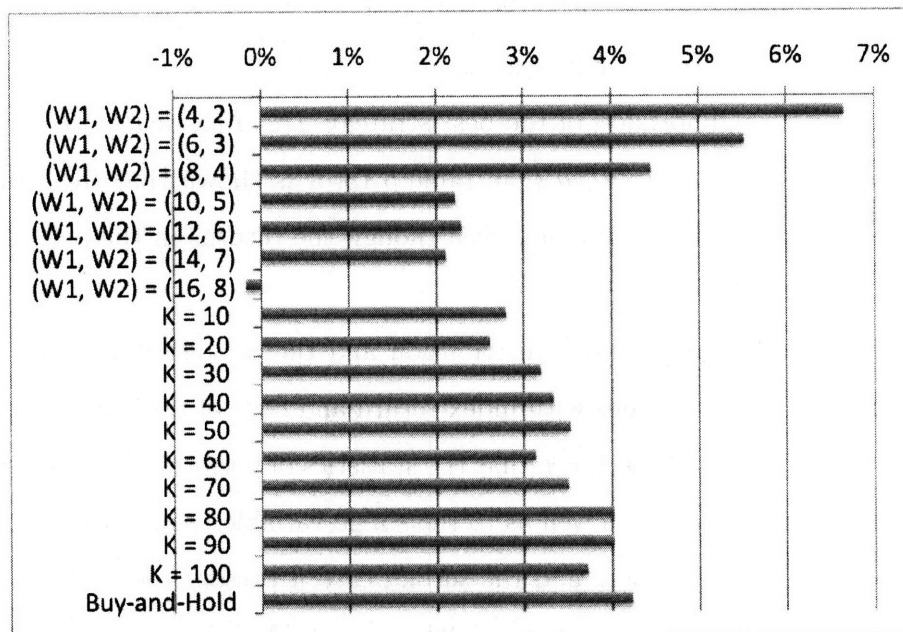


Figure 5-24: Average Annualized Returns by Parameters of Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (1998-2007)

Returns in Neighborhood of $TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 80, 0.4)$ with respect to	
Window Size	
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 80, 0.4)$	11.75%
$TBR(\text{Index Return}, 6; \text{Chg of Trad.Vol.}, 3; 80, 0.4)$	6.55%
Number of Trend Series	
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 70, 0.4)$	5.84%
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 80, 0.4)$	11.75%
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 90, 0.4)$	6.95%
Threshold	
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 80, 0.3)$	11.72%
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 80, 0.4)$	11.75%
$TBR(\text{Index Return}, 4; \text{Chg of Trad.Vol.}, 2; 80, 0.5)$	9.26%

Table 5.13: Average Annualized Returns in Neighborhood of the Best Trend-Based Regression Strategy with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ):  
*Trend-based Regress(Index Return, 4; Chg of Trad.Vol., 2; 80, 0.4)*

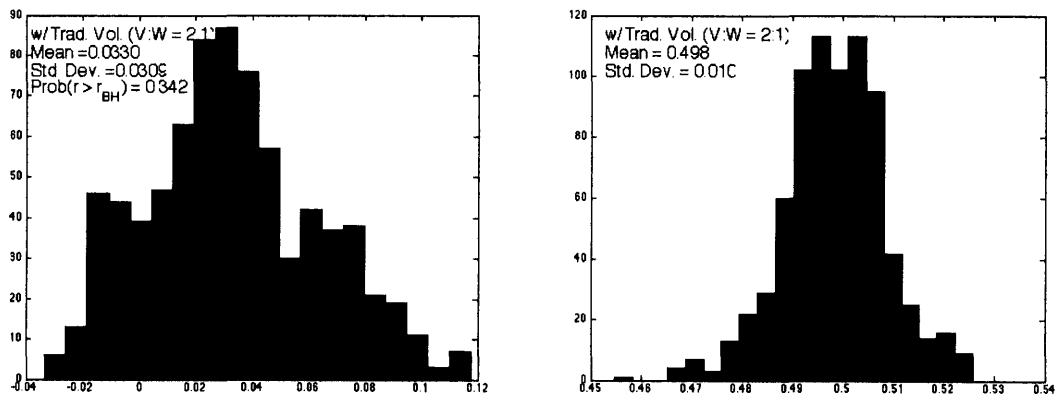


Figure 5-25: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distributions (right) of the 770 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (1998-2007)

apparent relationship with the BH. The detailed performances of the strategy classes for the first and the second case are presented in appendix B.

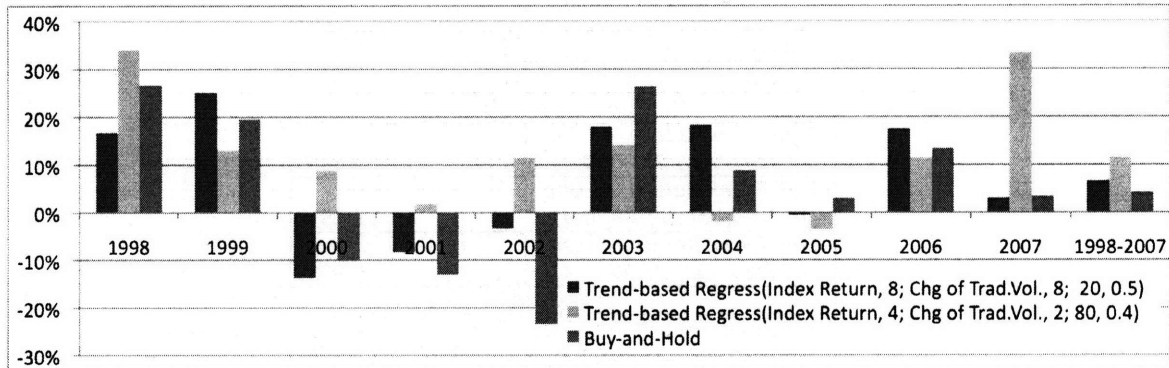


Figure 5-26: Performance Changes of the Best Trend-Based Regression Strategy with Index Return and Chg. of Trad. Vol.: *Trend-based Regress(Index Return, 8; Chg of Trad. Vol., 8; 20, 0.5)* for ( $W_1 : W_2 = 1 : 1$ ) and *Trend-based Regress(Index Return, 4; Chg of Trad. Vol., 2; 80, 0.4)* for ( $W_1 : W_2 = 2 : 1$ )

1998-2007	<i>TBR(Index Return, 8; Chg of Trad. Vol., 8; 20, 0.5)</i>	<i>TBR(Index Return, 4; Chg of Trad. Vol., 2; 80, 0.4)</i>	Buy-and-Hold
Annualized Return	6.53%	11.75%	4.23%
Annualized Volatility	12.57%	11.90%	18.02%
Sharpe Ratio	0.498	0.921	0.235
Average $p_{in}$	0.51	0.48	1
Average NumOfTrade	132.5	110.2	N/A

Table 5.14: Performance Summary of the Best Trend-Based Regression Strategy with Index Return and Chg. of Trad. Vol.: *Trend-based Regress(Index Return, 8; Chg of Trad. Vol., 8; 20, 0.5)* for ( $W_1 : W_2 = 1 : 1$ ) and *Trend-based Regress(Index Return, 4; Chg of Trad. Vol., 2; 80, 0.4)* for ( $W_1 : W_2 = 2 : 1$ )



As the third case, I examined various combination of the market information variables by fixing their time window size and threshold to one period ( 1 day or 1 week) and zero in order to explore the effects of variable combination. The exhaustive combinations from four variables: the index return, the change of the trading volume, the change of the risk-free rate, and the change of the volatility index, were tested changing the trend series numbers from 42 days to 126 days by 21 days and from 52 weeks to 156 weeks by 26 weeks. The number of total combinations examined is 110.

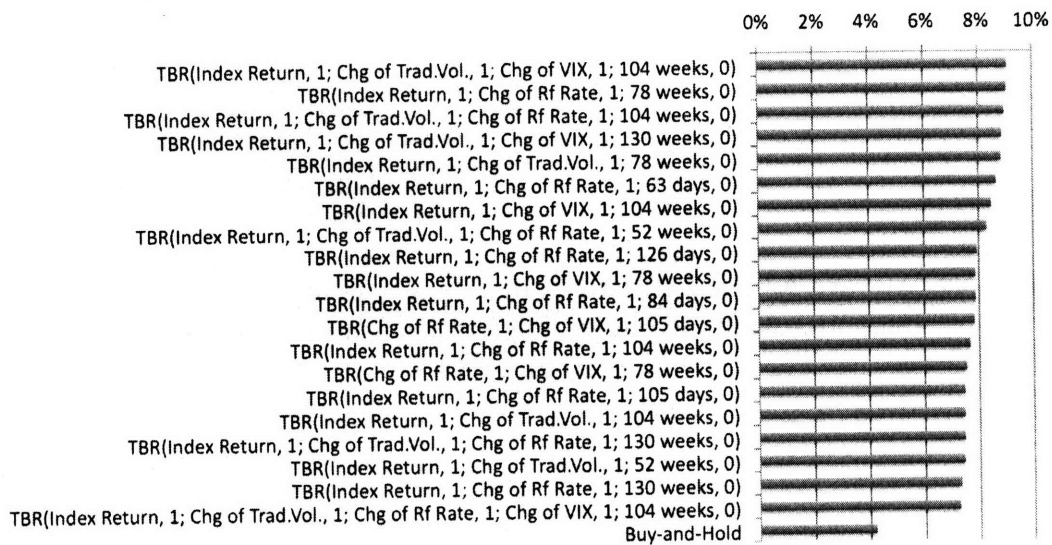


Figure 5-27: Annualized Returns of Top 20 Trend-Based Regression Strategies with Multiple Market Information Variables (1998-2007)

The performance of the top 20 strategies and the performance by parameters (combination of variables and number of trend series) are presented in figure 5-27 and in figure 5-28. The strategies utilizing index return and change of risk-free rate in weekly basis tend to perform relatively well. This observation is also supported by a tabulation on the used variables in the top 20 strategies in table 5.15. The number of variables used itself does not necessarily improve the performance.

Lastly I show the summary performance of the best strategy in the third strategy class of trend-based regression with multiple variables, *TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)*, in figure 5-29 and in table 5.16.

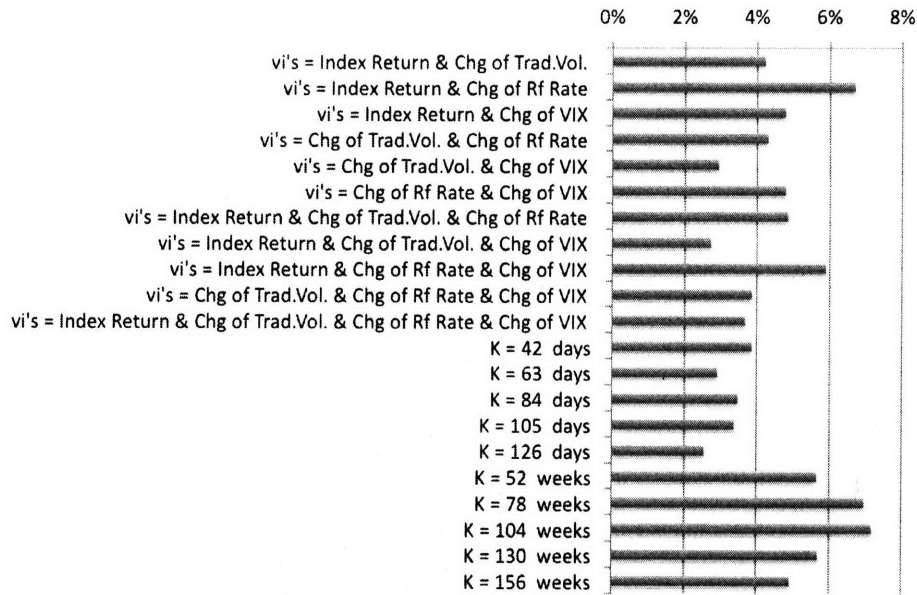


Figure 5-28: Average Annualized Returns by Parameters of Trend-Based Regression Strategy with Multiple Market Information Variables (1998-2007)

Use of Market Information Variables in Top 20 Trend-based Regression with Multiple Variables Strategies				
	Index Return	Chg. of Trad.Vol.	Chg. of Rf Rate	Chg. of VIX
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	1	1		1
TBR(Index Return, 1; Chg of Rf Rate, 1; 78 weeks, 0)	1		1	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 104 weeks, 0)	1	1	1	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 130 weeks, 0)	1	1		1
TBR(Index Return, 1; Chg of Trad.Vol., 1; 78 weeks, 0)	1	1		
TBR(Index Return, 1; Chg of Rf Rate, 1; 63 days, 0)	1		1	
TBR(Index Return, 1; Chg of VIX, 1; 104 weeks, 0)	1			1
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 52 weeks, 0)	1	1	1	
TBR(Index Return, 1; Chg of Rf Rate, 1; 126 days, 0)	1		1	
TBR(Index Return, 1; Chg of VIX, 1; 78 weeks, 0)	1			1
TBR(Index Return, 1; Chg of Rf Rate, 1; 84 days, 0)	1		1	
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 105 days, 0)			1	1
TBR(Index Return, 1; Chg of Rf Rate, 1; 104 weeks, 0)	1		1	
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 78 weeks, 0)			1	1
TBR(Index Return, 1; Chg of Rf Rate, 1; 105 days, 0)	1		1	
TBR(Index Return, 1; Chg of Trad.Vol., 1; 104 weeks, 0)	1	1		
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 130 weeks, 0)	1	1	1	
TBR(Index Return, 1; Chg of Trad.Vol., 1; 52 weeks, 0)	1	1		
TBR(Index Return, 1; Chg of Rf Rate, 1; 130 weeks, 0)	1		1	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; Chg of VIX, 1; 104 weeks, 0)	1	1	1	1
Total	18	9	13	7

Table 5.15: Use of Market Information Variables in Top 20 Trend-Based Regression Strategies with Multiple Market Information Variables (1998-2007)

The detailed performances of the trend-based regression strategies with multiple variables are presented in appendix B.

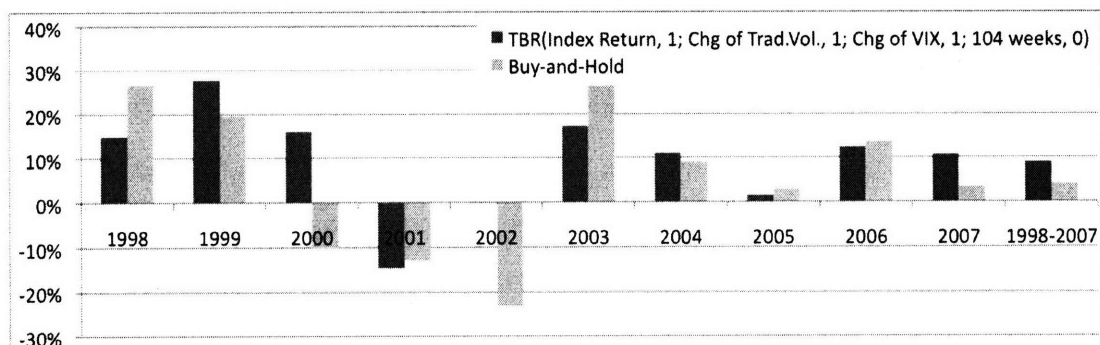


Figure 5-29: Performance Change of the Best Trend-Based Regression Strategy with Multiple Market Information Variables:  $TBR(Index\ Return, 1; Chg\ of\ Trad.Vol., 1; Chg\ of\ VIX, 1; 104\ weeks, 0)$

1998-2007	$TBR(Index\ Return, 1; Chg\ of\ Trad.Vol., 1; Chg\ of\ VIX, 1; 104\ weeks, 0)$	Buy-and-Hold
Annualized Return	9.09%	4.23%
Annualized Volatility	13.13%	18.02%
Sharpe Ratio	0.748	0.235
Average $p_{in}$	0.58	1
Average NumOfTrade	22.5	N/A

Table 5.16: Performance Summary of the Best Trend-Based Regression Strategy with Multiple Market Information Variables:  $TBR(Index\ Return, 1; Chg\ of\ Trad.Vol., 1; Chg\ of\ VIX, 1; 104\ weeks, 0)$

### 5.3.7 Conditional Probability Table

Regarding the conditional probability table (CPT) strategy, I examined exhaustive combination of the four variables changing the number of trend series in the same way of the trend-based regression with multi-variables. The four variables are the index return, the change of the trading volume, the change of the risk-free rate, and the change of the volatility index. The trend series number was changed from 42 days to 126 days by 21 days and from 52 weeks to 156 weeks by 26 weeks. The number of total combinations is 110.

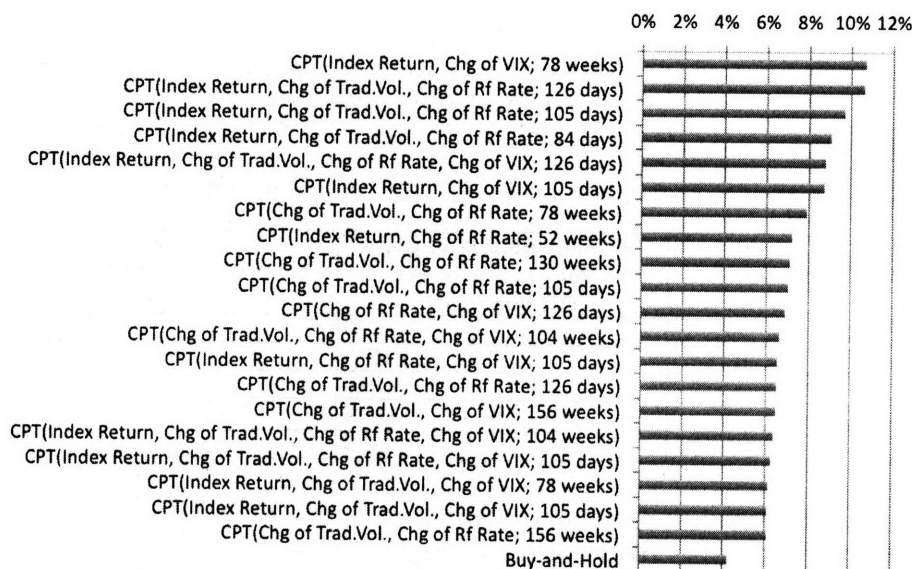


Figure 5-30: Annualized Returns of Top 20 Conditional Probability Table Strategies (1998-2007)

The performance of the top 20 strategies and the performance by parameters are shown in figure 5-30 and in figure 5-31. Also the tabulation of variables used in the top 20 strategies is presented in table 5.17. It is indicated from these figures that various combination among variables and trading period (day or week) are effective in the back-tests not having any significantly dominant variable.

The important characteristic of the CPT is that it can capture the non-linear relationship between multiple variables, because it is based on the conditional probabilities estimated from the market history. The results suggest that CPT could

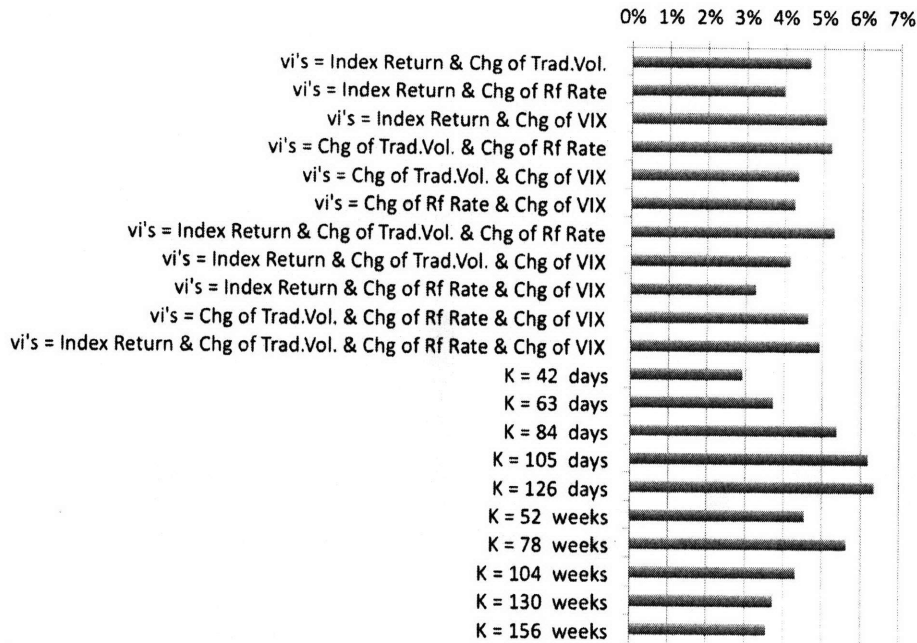


Figure 5-31: Average Annualized Returns by Parameters of Conditional Probability Table Strategies (1998-2007)

Use of Market Information Variables in Top 20 Conditional Probability Table Strategies				
	Index Return	Chg.of Trad.Vol.	Chg.of Rf Rate	Chg.of VIX
CPT(Index Return, Chg of VIX; 78 weeks)	1			1
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 126 days)	1	1	1	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 105 days)	1	1	1	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 84 days)	1	1	1	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 126 days)	1	1	1	1
CPT(Index Return, Chg of VIX; 105 days)	1			1
CPT(Chg of Trad.Vol., Chg of Rf Rate; 78 weeks)		1	1	
CPT(Index Return, Chg of Rf Rate; 52 weeks)	1		1	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 130 weeks)		1	1	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 105 days)		1	1	
CPT(Chg of Rf Rate, Chg of VIX; 126 days)			1	1
CPT(Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)		1	1	1
CPT(Index Return, Chg of Rf Rate, Chg of VIX; 105 days)	1		1	1
CPT(Chg of Trad.Vol., Chg of Rf Rate; 126 days)		1	1	
CPT(Chg of Trad.Vol., Chg of VIX; 156 weeks)		1		1
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	1	1	1	1
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 105 days)	1	1	1	1
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 78 weeks)	1	1		1
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 105 days)	1	1		1
CPT(Chg of Trad.Vol., Chg of Rf Rate; 156 weeks)		1	1	
Total	12	15	15	11

Table 5.17: Use of Market Information Variables in Top 20 Conditional Probability Table Strategies (1998-2007)

capture the various trends which the market information variables have in different time frames.

Lastly I show the performance summary of the best CPT strategy  $CPT(Index\ Return, Chg.\ of\ VIX; 78\ weeks, 0)$  in figure 5-32 and in table 5.18. The detailed performances of the CPT strategies are presented in appendix B.

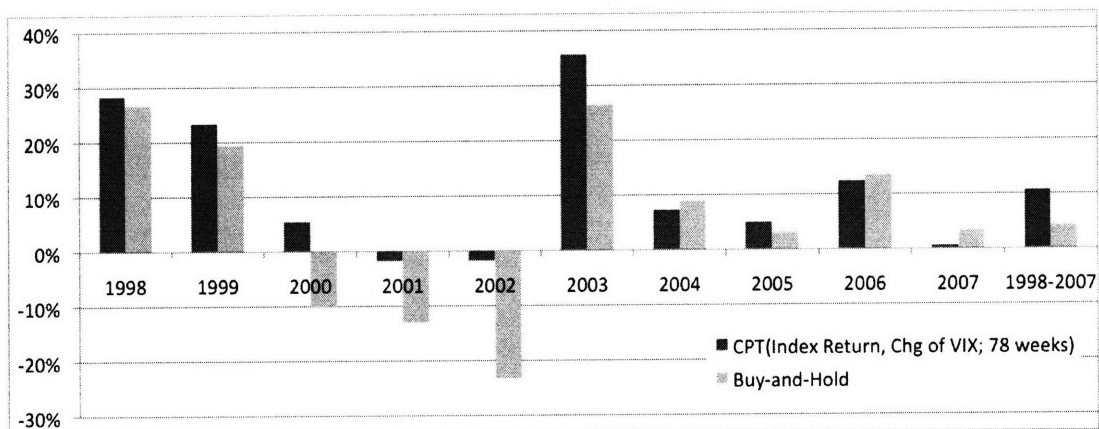


Figure 5-32: Performance Change of the Best Conditional Probability Table Strategies:  $CPT(Index\ Return, Chg.\ of\ VIX; 78\ weeks, 0)$

1998-2007	$CPT(Index\ Return, Chg\ of\ VIX; 78\ weeks)$	Buy-and-Hold
Annualized Return	10.71%	4.23%
Annualized Volatility	14.19%	18.02%
Sharpe Ratio	0.861	0.235
Average $p_n$	0.69	1
Average NumOfTrade	12.7	N/A

Table 5.18: Performance Summary of the Best Conditional Probability Table Strategies:  $CPT(Index\ Return, Chg.\ of\ VIX; 78\ weeks, 0)$

### 5.3.8 Nearest Neighbors Algorithm

I examined the nearest neighbors algorithm (NN) strategy by grid-search. The time window size parameter was changed from 2 days to 14 days by 2 days. The number of nearest neighbors was changed from 10 to 50 to 500 by 50. Both regression method and average method to forecast the next period return were tested. The number of total combinations of parameters was 1694.

The performance of the top 20 NN strategies and the performance by parameters are shown in figure 5-33 and in figure 5-34. From the figure 5-34 it is indicated that strategies with the shorter time windows, the mid-size number of nearest neighbors, and the average method performed relatively well. However majority of the top 20 strategies do not hold those properties. It is considered that non-linear nature of the NN is affecting on good combinations of parameters.

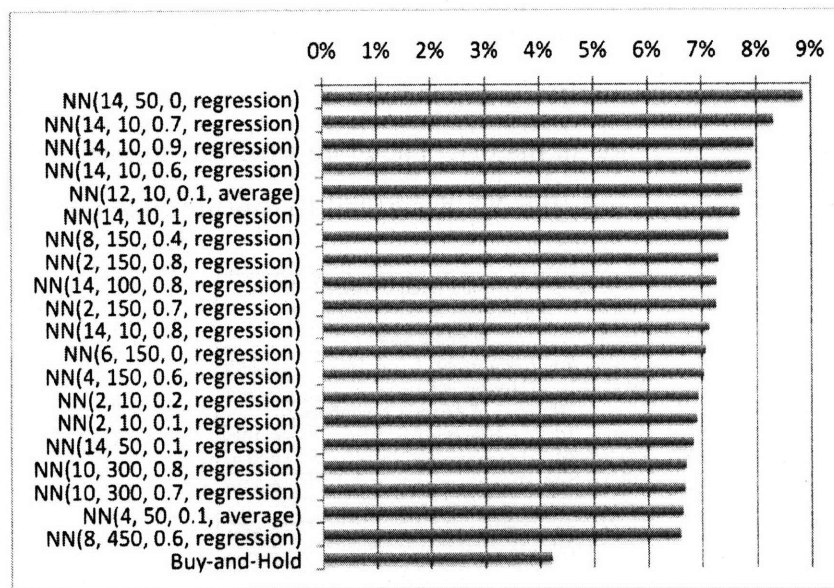


Figure 5-33: Annualized Returns of Top 20 Nearest Neighbors Algorithm Strategies (1998-2007)

In order to see the stability of the NN strategy, I examined the performances in neighborhood of the best NN strategy  $NN(14, 50, 0, regression)$  as shown in table 5.22. The result indicates that the NN strategy would be unstable as in the case of the trend-based regression.

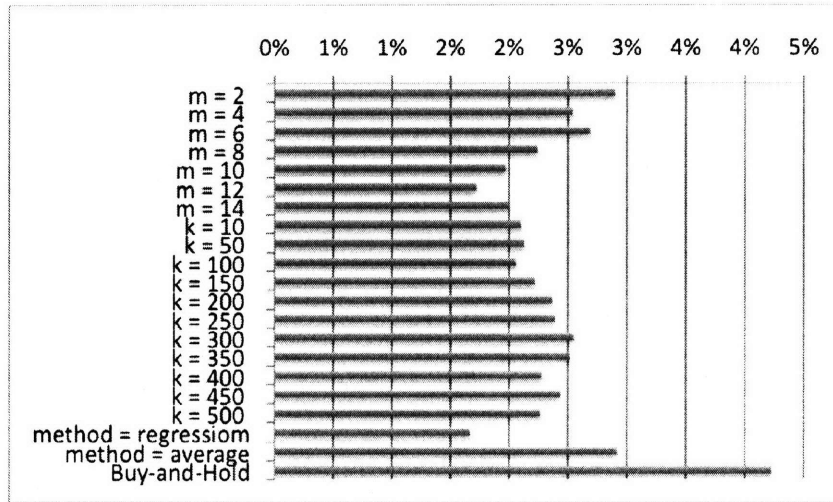


Figure 5-34: Average Annualized Returns by Parameters of Nearest Neighbors Algorithm Strategies (1998-2007)

The NN strategy searches the similar patterns to the recent path from historical data indifferent of time proximity or recency. It is considered that the NN tends to average all the relevant trends in history. Therefore when the market moves shifting its short-run or mid-run trends, the NN would fail to capture those patterns.

Returns in Neighborhood of $NN(14, 50, 0, regression)$ with respect to	
Window Size	
$NN(12, 50, 0, regression)$	2.90%
$NN(14, 50, 0, regression)$	8.86%
Number of Nearest Neighbors	
$NN(14, 10, 0, regression)$	6.13%
$NN(14, 50, 0, regression)$	8.86%
$NN(14, 100, 0, regression)$	4.21%
Threshold	
$NN(14, 50, 0, regression)$	8.86%
$NN(14, 50, 0.1, regression)$	6.83%
Method	
$NN(14, 50, 0, regression)$	8.86%
$NN(14, 50, 0, average)$	2.79%

Table 5.19: Average Annualized Returns in Neighborhood of the Best Nearest Neighbors Strategies:  $NN(14, 50, 0, regression)$

Next I present the average return distribution and the  $p_{in}$  distribution of the 1694 NN strategies in figure 5-35. It is shown that the statistics of performances are not quite different from the random signals except that the NN generated 484 BH signals



out of 1694 (for the BH signal,  $p_{in} = 1$ ).

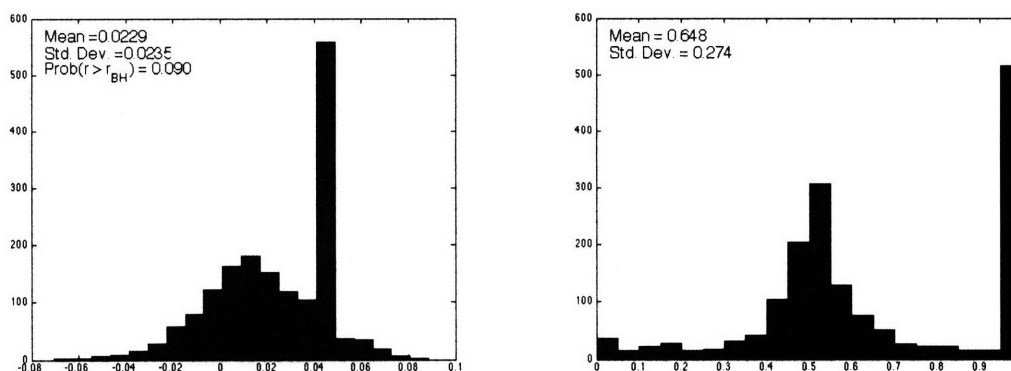


Figure 5-35: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distributions (right) of the 1452 Nearest Neighbors Strategies (1998-2007)

Lastly I show the performance summary of the best NN strategy  $NN(14, 50, 0, regression)$  in figure 5-36 and in table 5.20. The detailed results of the NN strategies are shown in appendix B.

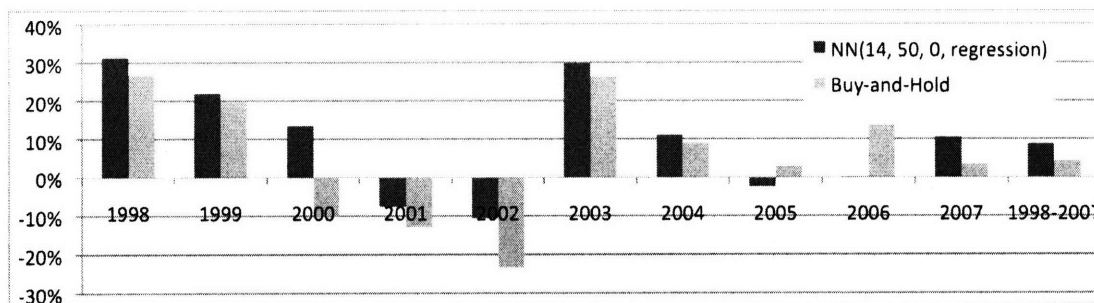


Figure 5-36: Performance Change of the Best Nearest Neighbors Strategies:  $NN(14, 50, 0, regression)$

1998-2007	$NN(14, 50, 0, regression)$	Buy-and-Hold
Annualized Return	8.86%	4.23%
Annualized Volatility	12.73%	18.02%
Sharpe Ratio	0.533	0.235
Average $p_{in}$	0.51	1
Average NumOfTrade	128.1	N/A

Table 5.20: Performance Summary of the Best Nearest Neighbors Strategies:  $NN(14, 50, 0, regression)$

### 5.3.9 Nearest Neighbors Algorithm with Multiple Market Information Variables

The NN strategy with multiple variables are examined in two ways. One is utilizing two variables, the index return and the change of the trading volume, with the window sizes of two variables equal. The other is also utilizing the same two variables except that the window size of the index return is double of the change of trading volume. I show the results in this order.

Regarding the first case, I examined the NN with two variables, the index return and the change of the trading volume by grid-search. The size of time window for the both variables was changed from 2 days to 7 days by 1 day. The number of nearest neighbors was changed from 10 to 50 to 500 by 50 and threshold was changed from 0 to 1 by 0.1. The total combinations are 1452.

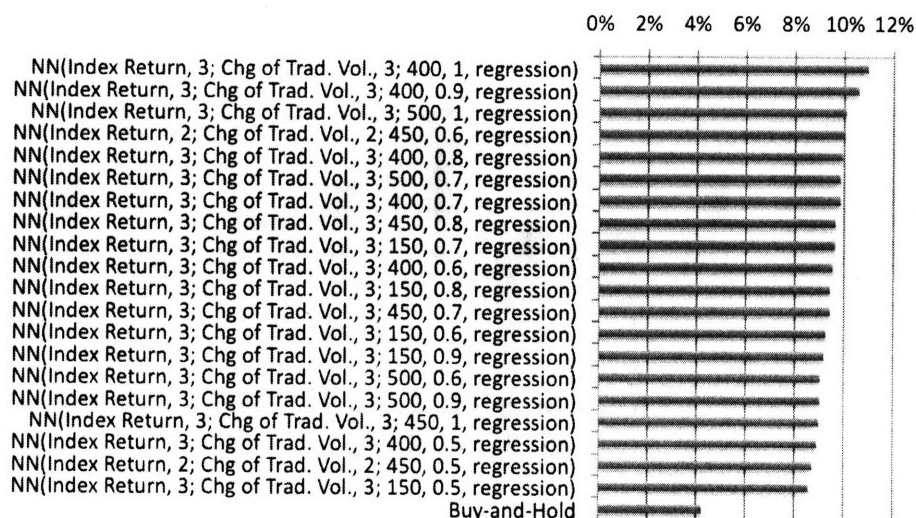


Figure 5-37: Annualized Returns of Top 20 Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (1998-2007)

The returns of top 20 strategies and the returns by parameter (window size and number of nearest neighbors) are shown in figure 5-37 and in figure 5-38 respectively. They show that the strategies with the window size of 2 or 3 days for both variables and the larger number of nearest neighbors performed relatively well. On the

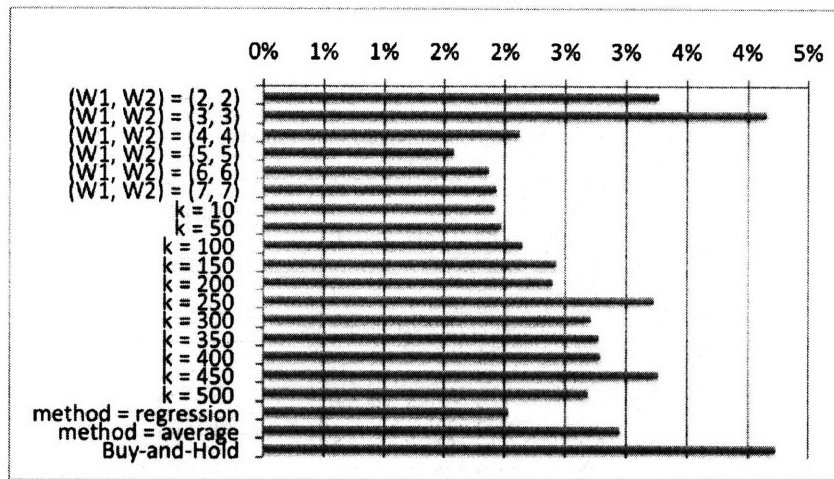


Figure 5-38: Average Annualized Returns by Parameters of Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (1998-2007)

other hand, the average method is better than the regression method in by-parameter averaged performance. However, no average method is ranked in the top 20.

Next I examined the performances in a neighborhood of the best strategy in the class of strategy *NN(Index Return, 3; Chg of Trad. Vol., 3; 400, 1, regression)*. The results are shown in table 5.21. It seems that the stability increased in comparison to the NN strategy with single variable, however it is less stable than MACD strategy.

In figure 5-39, I present the average return distribution and the  $p_{in}$  distribution of the 1452 NN strategies of the two variables with the same widow sizes. The distributions are similar to the NN with single variable. In this time 406 BH signals were generated out of 1452.

As for the other trial, I examined the strategy with double window size for the index return by grid-search changing values of parameters. The window size was changed from 4 days to 16 days by 2 days for the index return (from 2 days to 8 days by 1 day for the change of trading volume). Number of nearest neighbors and threshold were changed from 10 to 50 to 500 by 50 and from 0 to 1 by 0.1 respectively. The total number of combinations is 1694.

The result for the top 20 strategies and for by-parameter are shown in figure 5-40

Returns in Neighborhood of $NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$ with respect to	
Window Size	
$NN(\text{Index Return}, 2; \text{Chg of Trad. Vol.}, 2; 400, 1, \text{regression})$	5.84%
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$	10.97%
$NN(\text{Index Return}, 4; \text{Chg of Trad. Vol.}, 4; 400, 1, \text{regression})$	2.92%
Number of Nearest Neighbors	
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 350, 1, \text{regression})$	8.47%
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$	10.97%
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 450, 1, \text{regression})$	9.00%
Threshold	
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 0.9, \text{regression})$	10.60%
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$	10.97%
Method	
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$	10.97%
$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{average})$	4.23%

Table 5.21: Average Annualized Returns in Neighborhood of the Best Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ):  $NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$

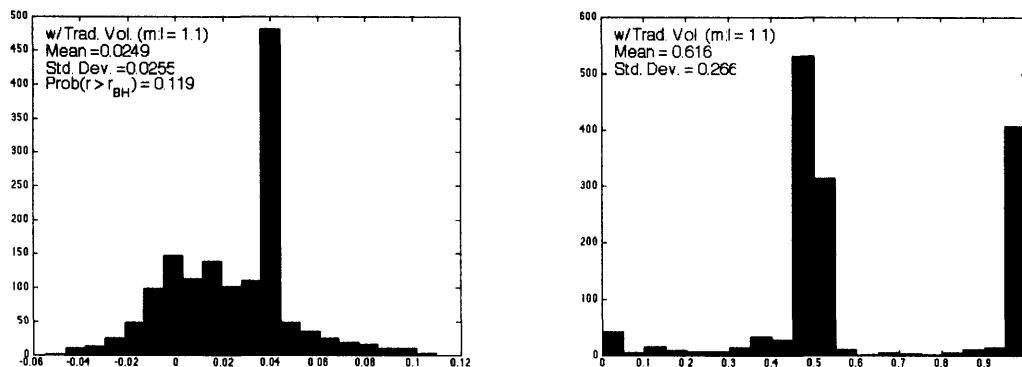


Figure 5-39: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distributions (right) of the 1452 Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (1998-2007)

and figure 5-41. It is shown that the longest window size and moderate number for nearest neighbors resulted in better performances. The level of the top 20 returns are not improved from the first trial. As seen in the first case, the average method performed better than the regression method on average, even though only one average method is observed in the top 20.

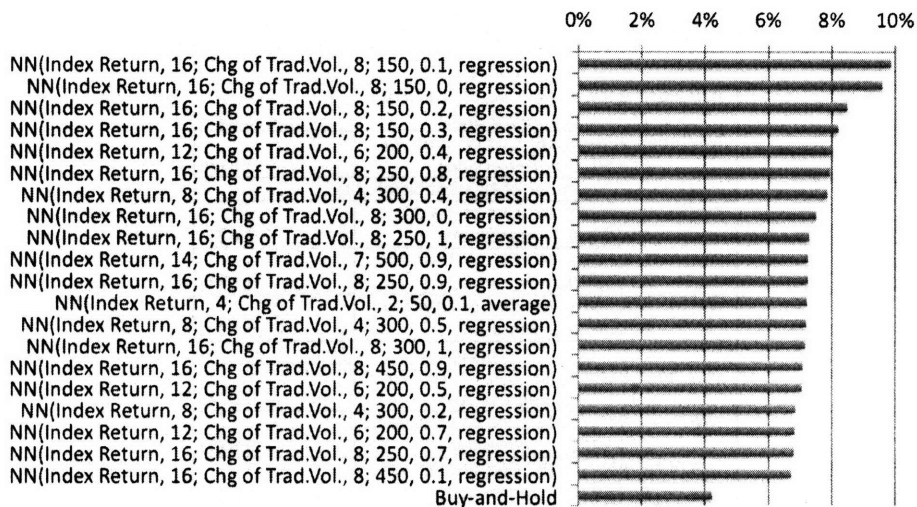


Figure 5-40: Annualized Returns of Top 20 Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (1998-2007)

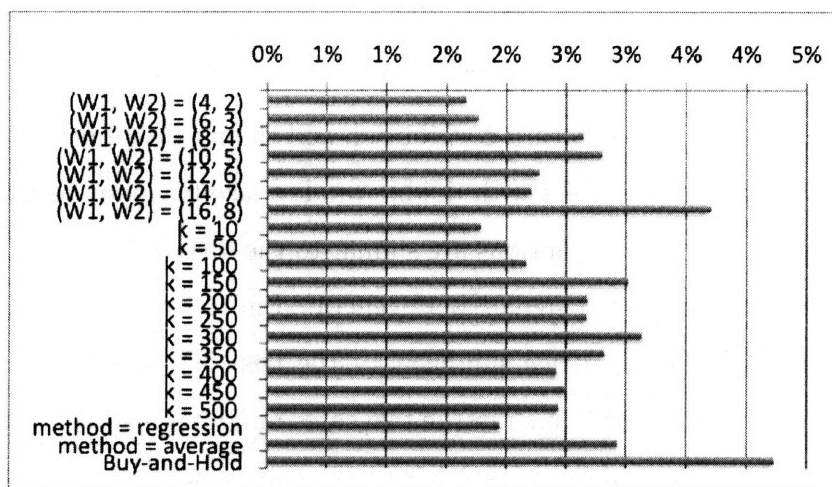


Figure 5-41: Average Annualized Returns by Parameters of Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (1998-2007)

In terms of stability in a neighborhood of the best strategy  $NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$  in this second strategy class, it is unstable against the changes in parameters except for the threshold parameter as indicated in table 5.22. It seems that the relatively unstable tendency is in common for the all three NN strategy classes examined in this study.

Returns in Neighborhood of $NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$ with respect to	
Window Size	
$NN(\text{Index Return}, 14; \text{Chg of Trad. Vol.}, 7; 150, 0.1, \text{regression})$	3.29%
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$	9.87%
Number of Nearest Neighbors	
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 100, 0.1, \text{regression})$	2.62%
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$	9.87%
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 200, 0.1, \text{regression})$	5.63%
Threshold	
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0, \text{regression})$	9.59%
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$	9.87%
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.2, \text{regression})$	8.49%
Method	
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$	9.87%
$NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{average})$	-0.30%

Table 5.22: Average Annualized Returns in Neighborhood of the Best Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ):  $NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$

Next I present the average return distribution and the  $p_{in}$  distribution of the 1694 NN strategies of the two variables with double window size for index return in figure 5-42. It is shown that the distributions are similar to the former NN strategy classes. Out of 1694 strategies, 406 BH signals were generated in this case.

Lastly I show the performance summary of the best NN strategies with index return and change of trading volume in the two cases in figure 5-43 and in table 5.23. The detailed performances of the both NN strategy classes are shown in appendix B.

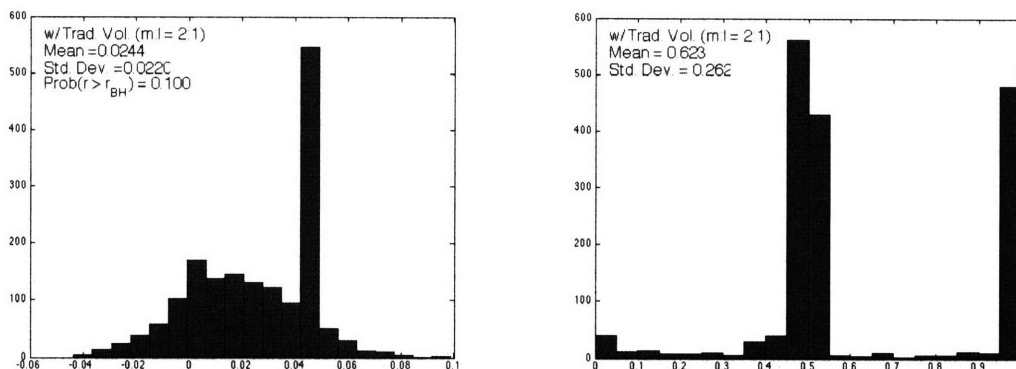


Figure 5-42: Average Annualized Return Distribution (left) and Average  $p_{in}$  Distributions (right) of the 1694 Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (1998-2007)

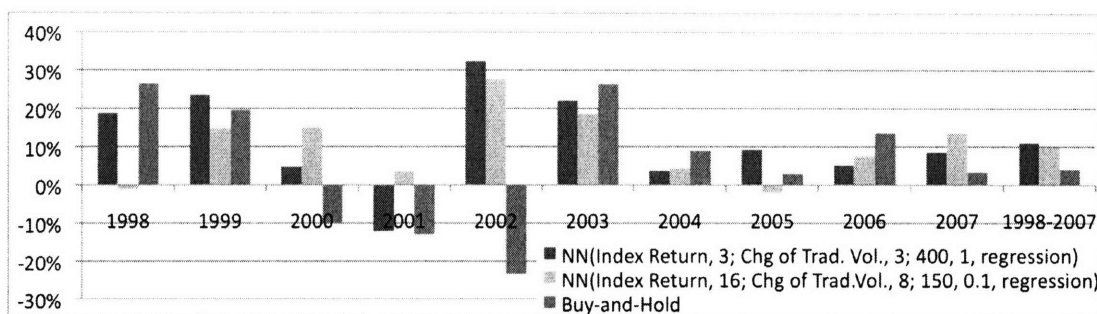


Figure 5-43: Performance Change of the Best Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol.:  $NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$  for ( $W_1 : W_2 = 1 : 1$ ) and  $NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$  for ( $W_1 : W_2 = 2 : 1$ )

1998-2007	$NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$	$NN(\text{Index Return}, 16; \text{Chg of Trad.Vol.}, 8; 150, 0.1, \text{regression})$	Buy-and-Hold
Annualized Return	10.97%	9.87%	4.23%
Annualized Volatility	13.02%	13.32%	18.02%
Sharpe Ratio	0.884	0.737	0.235
Average $p_{in}$	0.52	0.52	1
Average NumOfTrade	79.4	121.5	N/A

Table 5.23: Performance Summary of the Best Nearest Neighbors Strategies with Index Return and Chg. of Trad. Vol.:  $NN(\text{Index Return}, 3; \text{Chg of Trad. Vol.}, 3; 400, 1, \text{regression})$  for ( $W_1 : W_2 = 1 : 1$ ) and  $NN(\text{Index Return}, 16; \text{Chg of Trad. Vol.}, 8; 150, 0.1, \text{regression})$  for ( $W_1 : W_2 = 2 : 1$ )

### 5.3.10 Best Performer Selection in Combination with Individual Strategies

The individual strategies examined so far have a serious problem in practice as I mentioned in section 3.4, that is how to select the right strategy from a number of strategies with different parameter values. The best performer selection strategy and the voting strategy try to cope with this problem.

In order to evaluate the effectiveness of best performer selection, I examined the strategy in combination with individual strategies. The detailed performances of each best performer selection strategy with individual strategy are shown in appendix B. Also particular strategies which were selected in each trading period are shown in appendix B.

To provide a bird's-eye view, I show the result from the best selection strategy in combination with the aggregated strategies. Specifically, the eight of previous strategy classes (contrarian/momentun, MACD, TBR, two classes of TBR with index return and change of trading volume, NN, and two classes of NN with index return and change of trading volume) were aggregated to be utilized for the best performer selection strategy. The number of aggregated strategies is 8808. Also the selection of the best performer was executed both in monthly basis and in annual basis.

In table 5.24, I show the five-period ranking transition of the top 10 performers in one period before the start of the trading horizon from 1998 to 2007. The best performing strategy was selected as the candidate for the first period of the horizon. As we can see, the higher ranking in the current period does not necessarily guarantee the equally higher performance in the subsequent period. This simple rule was not able to effectively switch the strategies along with the evolving market situation.

For reference, I show the performance summary of the best selection strategy in monthly basis and in yearly basis in figure 5-44 and in table 5.25.



Eight Strategy Classes (Number of Strategies = 8808)						
Best Perf. Select.(monthly)						
	Dec97	Jan98	Feb98	Mar98	Apr98	May98
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.1)	1	7192	4518	4705	7444	8569
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.4)	2	5478	4520	4302	1046	8778
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.3)	3	5480	4519	4736	1041	8779
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.2)	4	7193	4517	4735	1045	8568
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.9)	5	5897	5483	5213	1586	7888
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0)	6	7188	4516	4704	7443	7886
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.8)	7	5896	5484	4195	1685	7889
TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.5)	8	5476	5480	4376	1042	8777
TBR(Index Return, 6; Chg of Trad.Vol., 6; 80, 0.3)	9	5793	5139	6072	1661	7641
TBR(Index Return, 6; Chg of Trad.Vol., 6; 80, 0.6)	10	1530	4486	6312	1662	8237
Best Perf. Select.(yearly)						
	1997	1998	1999	2000	2001	2002
TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0)	1	3506	8479	8104	4198	5313
TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.3)	2	3229	8774	7784	4057	3342
TBR(Index Return, 12; Chg of Trad.Vol., 6; 80, 0)	3	3587	8708	8348	3755	2559
TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.1)	4	3513	8381	8499	4374	4651
TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.4)	5	3238	7995	8268	2920	4324
TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.3)	6	3733	6874	8415	2790	5135
TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.2)	7	3537	6761	8502	3086	5658
TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.2)	8	3334	8796	8225	3957	4908
TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.4)	9	3534	8762	7871	3917	3651
TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.5)	10	3777	8788	7737	3641	4037

Table 5.24: Ranking Transition of Top 10 Strategies in Five Subsequent Periods

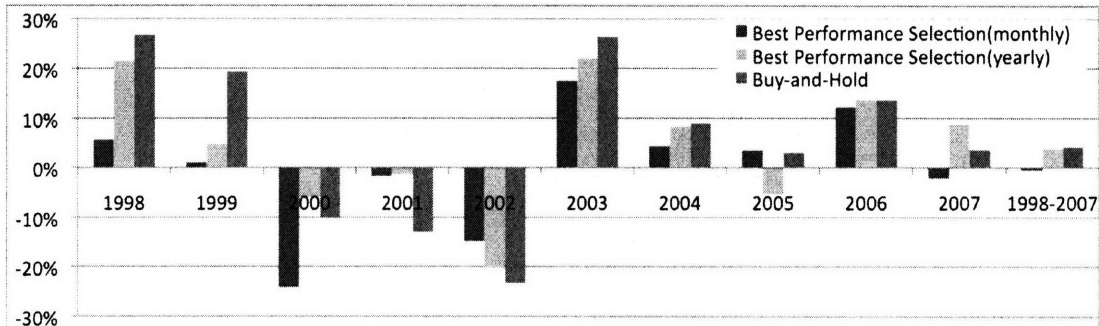


Figure 5-44: Performance Change of Best Performer Selection Strategy in Combination with Eight Strategy Classes (1998-2007)

1998-2007	Best Performance Selection(monthly)	Best Performance Selection(yearly)	Buy-and-Hold
Annualized Return	-0.57%	3.80%	4.23%
Annualized Volatility	12.39%	12.66%	18.02%
Sharpe Ratio	-0.046	0.301	0.235
Average $p_{in}$	0.49	0.53	1
Average NumOfTrade	105.8	90.4	N/A

Table 5.25: Performance Summary of Best Performer Selection Strategy in Combination with Eight Strategy Classes (1998-2007)

### 5.3.11 Voting in Combination with Individual Strategies

The voting strategy has the same motivation as the best performer selection strategy to automate the selection of a strategy for next period. I examined the voting strategy in combination with individual strategies. The detailed performances of each voting strategy with individual strategy are shown in appendix B.

To illustrate the big picture of the back-test results on the voting strategy, I show the performance of the voting strategy applied for the same aggregation of eight strategy classes as used for the best performer selection.

Even though it is self-contradictory to explore parameter values for the voting strategy which tries to become automatic, I examined several cases with voting members from 5 to 50 by 5 and monthly/yearly voting for the purpose of reference. The results are shown in figure 5-45.

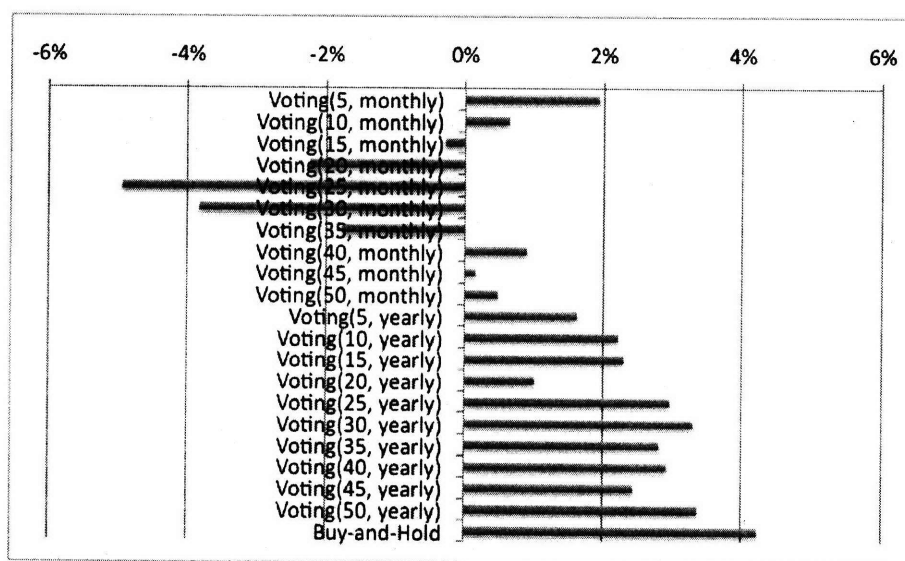


Figure 5-45: Annualized Returns of Voting among Eight Strategy Classes by Parameters (1998-2007)

As indicated, no single case outperformed the BH unfortunately. It suggests that voting process causes some sort of compromise with respect to prediction or detection of market trends and turns out to be lower performances.

For reference, I show the performance summary of the best voting strategy *Voting(50, yearly)* in figure 5-46 and in table 5.26.

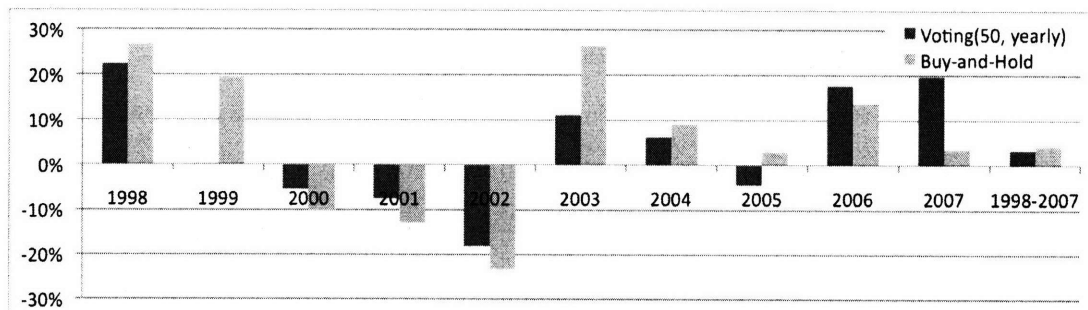


Figure 5-46: Performance Change of the Best Voting Strategy in Combination with Eight Strategy Classes: *Voting(50, yearly)*

1998-2007	<i>Voting(50, yearly)</i>	Buy-and-Hold
Annualized Return	3.37%	4.23%
Annualized Volatility	12.38%	18.02%
Sharpe Ratio	0.272	0.235
Average $p_{in}$	0.5	1
Average <i>NumOfTrade</i>	106.7	N/A

Table 5.26: Performance Summary of the Best Voting Strategy in Combination with Eight Strategy Classes: *Voting(50, yearly)*

## 5.4 Summary of Empirical Analysis

In this research, as shown until now, I executed the back-testing on 15 classes of strategies. I present the summary performances of the best strategies in each class in table 5.27. For reference, the betas are calculated based on monthly rate of returns against those of the BH, i.e. S&P 500 stock index returns.

1998-2007	Annualized Return	Annualized Volatility	Sharpe Ratio	Average $\rho_m$	Average NumOfTrade	beta
<i>Contrarian(weekly)</i>	7.53%	13.76%	0.63	0.47	26.5	0.50
<i>Contrarian(Chg.of Trad.Vol., weekly)</i>	7.72%	13.26%	0.64	0.49	33.2	0.62
<i>Momentum(Chg.of Rf Rate, daily)</i>	5.97%	13.55%	0.50	0.61	110.9	0.65
<i>Momentum(Chg.of VIX, weekly)</i>	8.21%	13.45%	0.68	0.48	29.6	0.54
<i>MACD(25, 280, 0.02)</i>	8.37%	13.53%	0.61	0.74	0.2	0.59
<i>Trend-based Regression(8, 100, 0.5)</i>	7.59%	12.29%	0.61	0.45	12	0.40
<i>TBR(Index Return, 8; Chg of Trad.Vol., 8; 20, 0.5)</i>	6.53%	12.57%	0.50	0.51	132.5	0.47
<i>TBR(Index Return, 4; Chg of Trad.Vol., 2; 80, 0.4)</i>	11.75%	11.90%	0.92	0.48	110.2	0.42
<i>TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)</i>	9.09%	13.13%	0.75	0.58	22.5	0.73
<i>CPT(Index Return, Chg of VIX; 78 weeks)</i>	10.71%	14.19%	0.86	0.69	12.7	0.68
<i>NN(14, 50, 0, regression)</i>	8.86%	12.73%	0.53	0.51	128.1	0.35
<i>NN(Index Return, 3; Chg of Trad. Vol., 3; 400, 1, regression)</i>	10.97%	13.02%	0.88	0.52	79.4	0.85
<i>NN(Index Return, 16; Chg of Trad.Vol., 8; 150, 0.1, regression)</i>	9.87%	13.32%	0.74	0.52	121.5	0.47
<i>Voting(50, yearly)</i>	3.37%	12.38%	0.27	0.5	106.7	0.39
<i>Best Performance Selection(yearly)</i>	3.80%	12.66%	0.30	0.53	90.4	0.51
Credit Suisse/Tremont Hedge Fund Index	9.46%	6.68%	0.90	N/A	N/A	0.16
Buy-and-Hold	4.23%	18.02%	0.23	1	N/A	1

Table 5.27: Performance Summary of the Best Strategies by Strategy Classes Examined in the Study

To provide graphical overview, I present a plot in terms of return and risk in figure 5-47. It is shown that all the best strategies have lower risks than the BH and higher risks than the hedge fund index. Regarding the Sharpe ratio which is a slope of a line from the origin to a strategy, the Sharpe ratios of the best strategies are in between those of the BH and the hedge fund index similarly to the case of risk.

The two meta-level strategies, best performer selection and voting, have lower performances than the BH. However their SR's are slightly larger than the BH. On

the other hand, the strategies which utilized change of trading volume and/or change of VIX in addition to the stock index return as the information to predict future return demonstrate higher performances except for  $TBR(Index\ Return, 8; Chg\ of\ Trad.\ Vol., 8; 20, 0.5)$ . The strategies which used only one source of market information have lower performances than the strategies with two or three market information sources.

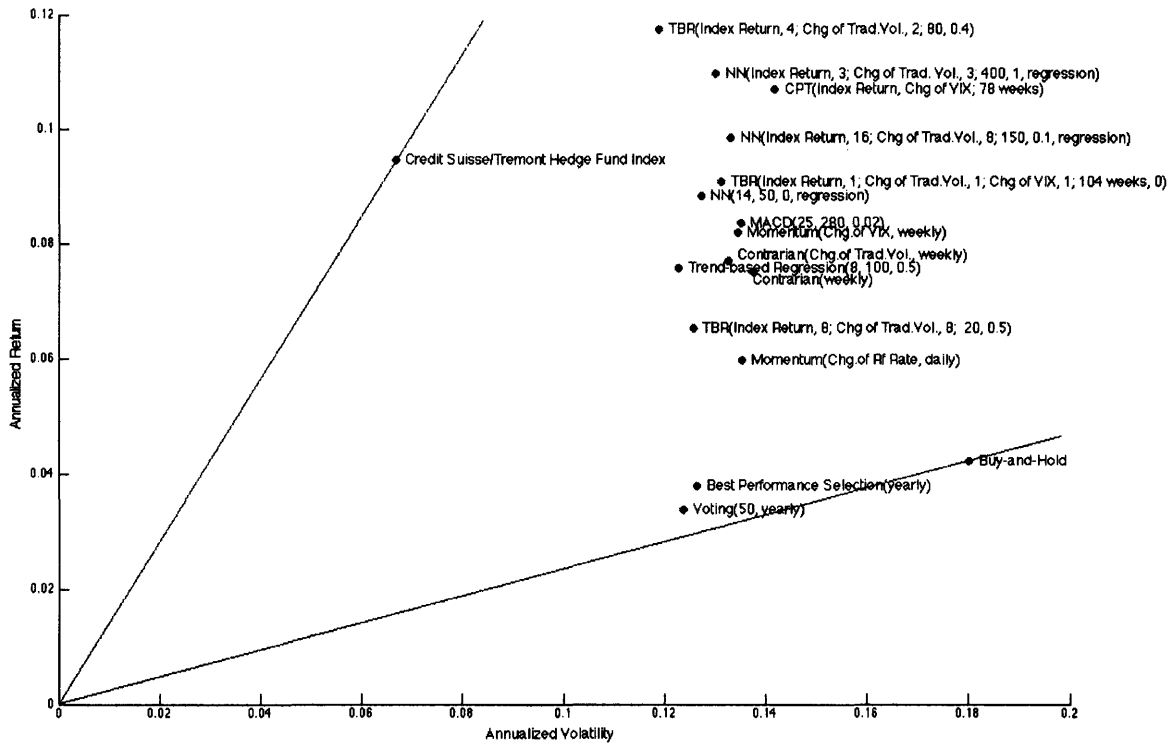


Figure 5-47: Annualized Return-Annualized Volatility Plot of the Best Strategies by Strategy Classes Examined in the Study (1998-2007)

Next I show a plot of the strategies in terms of return and  $p_{in}$ , a proportion of in-the-market periods to the entire periods of trading horizon. Figure 5-48 shows positions of the best strategies in relation to the upper boundary and the boundary of the 5 % level significance as introduced in section 4.2 and section 4.3. The enlarged figure regarding the plots of strategies is figure 5-49.

The upper boundary are calculated based on both lognormal distribution assumption and historical data of the realized index returns. As for the lognormal assumption

case, average rate of return and volatility were estimated by the daily index returns from 1997 to 2007, the trading horizon of the back-tests. The upper boundary based on the historical data is calculated using realized daily returns from 1997 to 2008 and picking up the  $N p_{in}$  highest returns from them.

Comparing the two upper boundaries, the boundary estimated by lognormal distribution is above the historical data-based around  $p_{in} = 0.5$ . This is thought to be due to the negative skewness of the historical returns. In contrast, in the area in which  $p_{in}$  is close to 0 or 1, the boundary based on historical data is above the lognormal-based because of the fat tails in the historical data. Looking into the figures, all the best

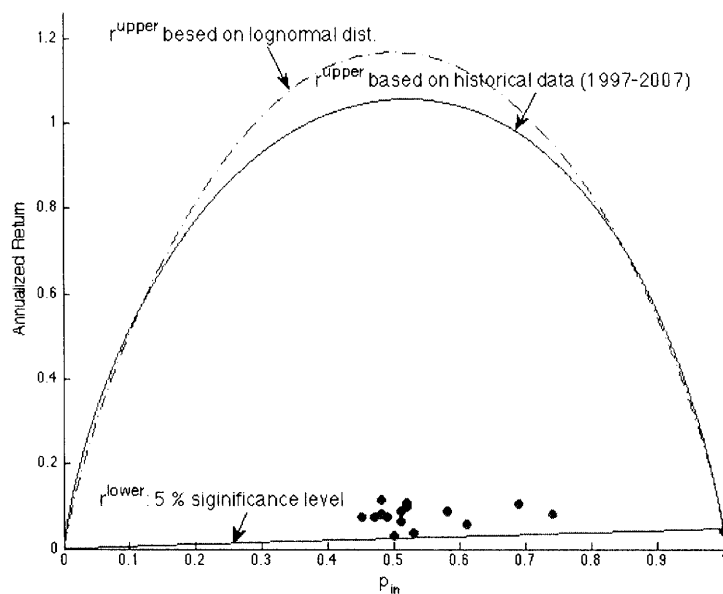


Figure 5-48: Annualized Return-Average  $p_{in}$  Plot of the Best Strategies by Strategy Classes Examined in the Study (1998-2007)

strategies are located above the 5 percent significance level boundary, however there is a large room to the upper boundary. It is indicated that despite the possibility of tremendous performance in appearance, the market is so efficient that approaching to the upper boundary in significant amount is quite difficult. Even a modest shift toward the upper boundary can make significant difference with respect to trading performance.

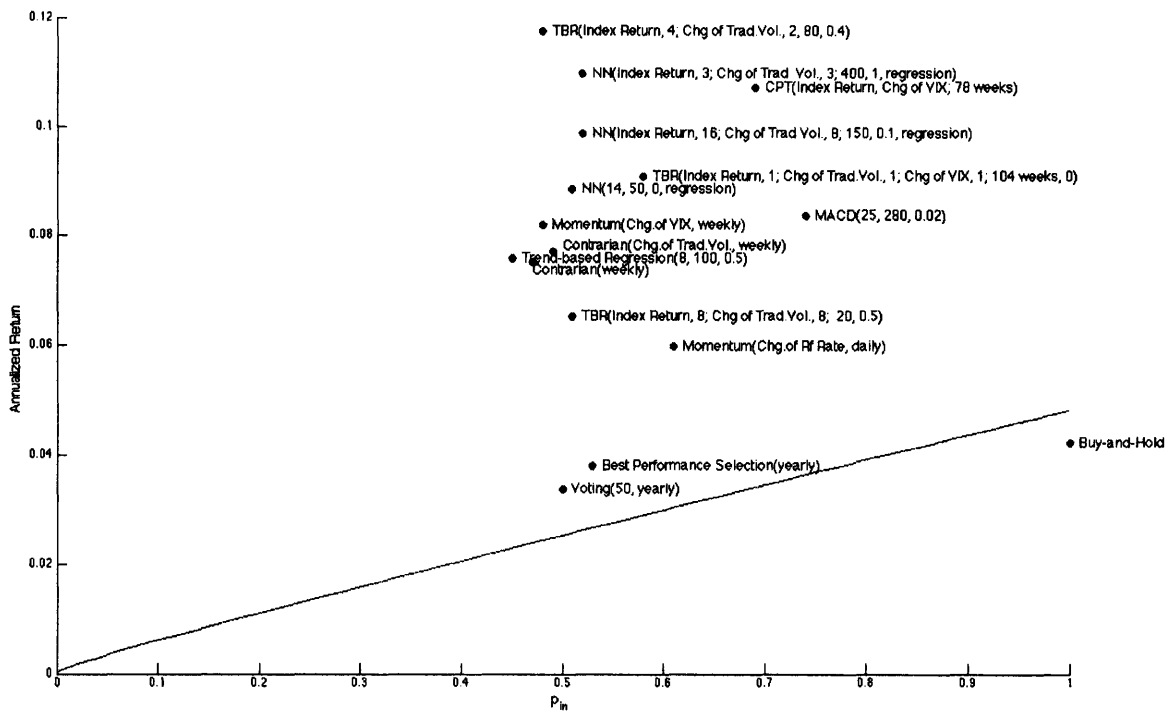


Figure 5-49: Enlarged Annualized Return-Average  $p_{in}$  Plot of the Best Strategies by Strategy Classes Examined in the Study (1998-2007)

About the value of  $p_{in}$ , *Trend-based Regression(8, 100, 0.5)* has the smallest value and *MACD(25, 280, 0.02)* has the largest value. As discussed in chapter 4, it could be suggested that strategies with lower  $p_{in}$  such as *Trend-based Regression(8, 100, 0.5)* are safer regarding jump events because of their shorter total time in the market.

Finally, I studied the correlation between monthly returns of the strategies during the 10-year horizon to find any relationship among them. The result is presented in table 5.28. Correlation coefficients greater than 0.6 are shadowed and average correlation coefficients are put in the last column.

It is indicated that two-thirds of the strategies have relatively larger correlation with the buy-and-hold. Interestingly the strategies which use the same market information don't necessarily have larger correlations. Also NN strategies and TBR strategies have lower correlations with others even though there are a few exceptions.

Table 5.28: Correlation Relationships among the Best Strategies by Strategy Classes Examined in the Study

	Contrarian(weekly)	Contrarian(Chg.of Trad.Vol., weekly)	Momentum(Chg.of Rf Rate, daily)	Momentum(Chg.of VIX, weekly)	MACD(25, 280, 0.02)	Trend-based Regression(8, 100, 0.5)	TBR(Index Return, 8; Chg of Trad.Vol., 8; 20, 0.5)	TBR(Index Return, 4; Chg of Trad.Vol., 2; 80, 0.4)	TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	CPT(Index Return, Chg of VIX; 78 weeks)	NN(14, 50, 0, regression)	NN(Index Return, 3; Chg of Trad. Vol., 3; 400, 1, regression)	NN(Index Return, 16; Chg of Trad.Vol., 8; 150, 0.1, regression)	Voting(50, yearly)	Best Performance Selection(yearly)	Credit Suisse/Tremont Hedge Fund Index	Buy-and-Hold	Average Correlation Coefficient
Contrarian(weekly)	1.00																	0.45
Contrarian(Chg.of Trad.Vol., weekly)	0.52	1.00																0.41
Momentum(Chg.of Rf Rate, daily)	0.35	0.51	1.00															0.43
Momentum(Chg.of VIX, weekly)	<b>0.71</b>	0.35	0.49	1.00														0.44
MACD(25, 280, 0.02)	0.43	0.52	0.60	0.45	1.00													0.47
Trend-based Regression(8, 100, 0.5)	0.34	0.35	0.42	0.29	0.44	1.00												0.37
TBR(Index Return, 8; Chg of Trad.Vol., 8; 20, 0.5)	0.35	0.30	0.41	0.25	0.54	0.40	1.00											0.39
TBR(Index Return, 4; Chg of Trad.Vol., 2; 80, 0.4)	0.40	0.38	0.23	0.25	0.34	0.49	0.44	1.00										0.33
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	<b>0.67</b>	0.59	0.48	<b>0.74</b>	0.47	0.38	0.30	0.26	1.00									0.47
CPT(Index Return, Chg of VIX; 78 weeks)	<b>0.61</b>	<b>0.61</b>	<b>0.63</b>	<b>0.64</b>	<b>0.80</b>	0.45	0.54	0.34	<b>0.64</b>	1.00								0.53
NN(14, 50, 0, regression)	0.31	0.29	0.19	0.19	0.33	0.35	0.26	0.41	0.21	0.32	1.00							0.29
NN(Index Return, 3; Chg of Trad. Vol., 3; 400, 1, regression)	0.58	<b>0.72</b>	<b>0.62</b>	0.51	0.48	0.39	0.33	0.32	<b>0.64</b>	0.59	0.26	1.00						0.46
NN(Index Return, 16; Chg of Trad.Vol., 8; 150, 0.1, regression)	0.34	0.30	0.38	0.41	0.30	0.19	0.45	0.26	0.44	0.47	0.24	0.45	1.00					0.36
Voting(50, yearly)	0.32	0.13	0.31	0.42	0.31	0.31	0.42	0.34	0.32	0.24	0.25	0.38	1.00					0.34
Best Performance Selection(yearly)	0.46	0.31	0.49	0.51	0.37	0.43	0.36	0.29	0.49	0.43	0.31	0.41	0.40	<b>0.64</b>	1.00			0.42
Credit Suisse/Tremont Hedge Fund Index	0.14	0.02	0.16	0.18	0.34	0.08	0.30	0.06	0.19	0.28	0.17	0.07	0.24	0.21	0.20	1.00		0.19
Buy-and-Hold	<b>0.62</b>	<b>0.61</b>	<b>0.69</b>	<b>0.64</b>	<b>0.76</b>	0.55	<b>0.65</b>	0.53	<b>0.68</b>	<b>0.78</b>	0.48	<b>0.68</b>	0.57	0.55	<b>0.70</b>	0.32	1.00	0.61



# Chapter 6

## Conclusion

In this study, I examined empirically the performances of quantitative trading strategies by back-tests assuming that we traded S&P 500 stock index from 1998 to 2007. Then I also examined the possible sources of profitability for successful strategies.

I introduced various quantitative trading strategies to examine from simple rules to data-mining algorithms, from linear models to non-linear models, and from recency-based approaches to pattern-based approaches. Also market information used to generate trading signals had a wide variety of variables such as stock index itself, trading volume, risk-free rate and implied volatility of stock index.

Some strategies recorded superior performances to the benchmark. It was suggested that the sources of the high performances could be attributed to several very small but statistically significant relationships which we could observe in the historical data of market information in the short-run, in the mid-run, and in the long-run.

However the practical problem is how we can select these winners beforehand from all candidates of quantitative strategies including losers in the beginning of our investment horizon. The two meta-level strategies were tested to cope with this issue but turned out to be unsuccessful. This issue is still open for future study.

Also it was shown that even the best strategy had a large distance to the possibility boundary of returns, and that supports the market efficiency to some extent. Quantitative trading is thought to be a kind of game to quickly adapt to a temporal market inefficiency, resulting in the more efficient market as a consequence.

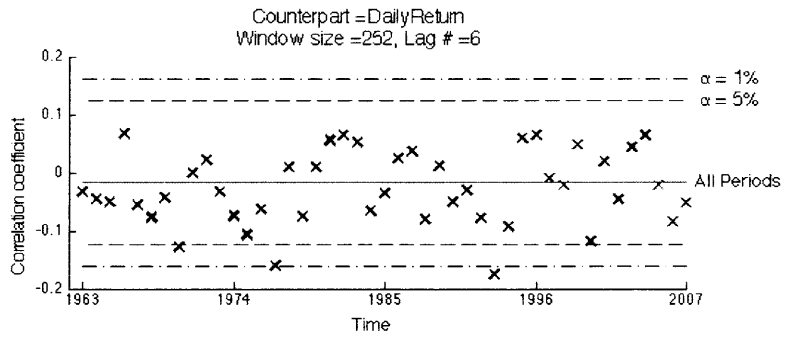
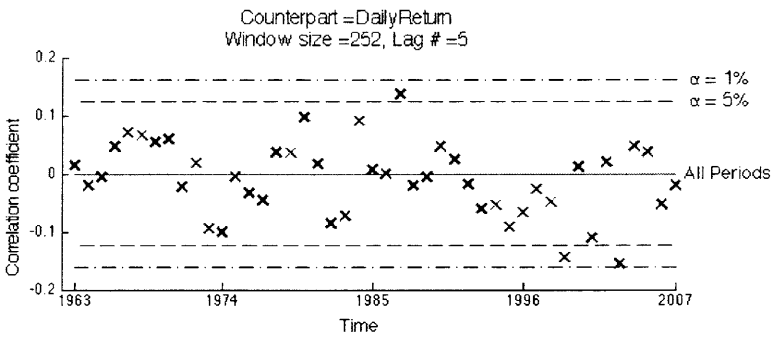
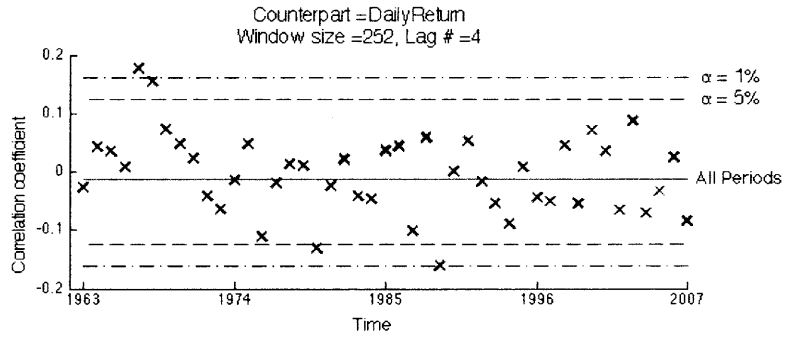
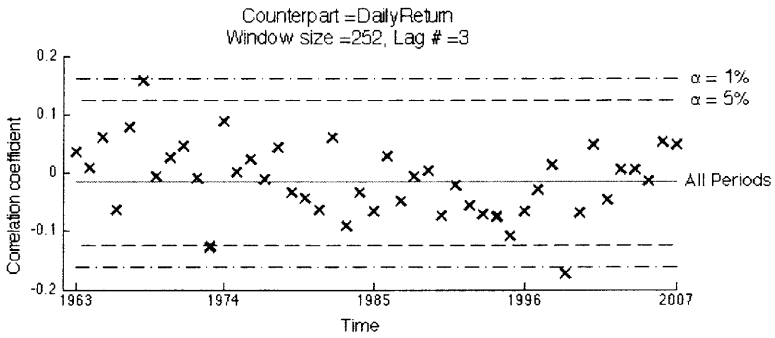
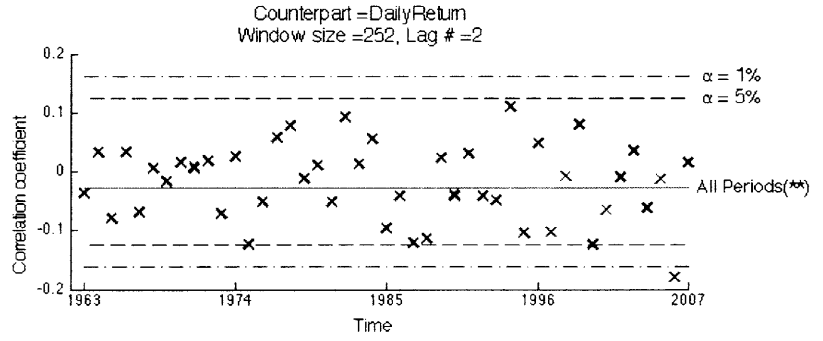
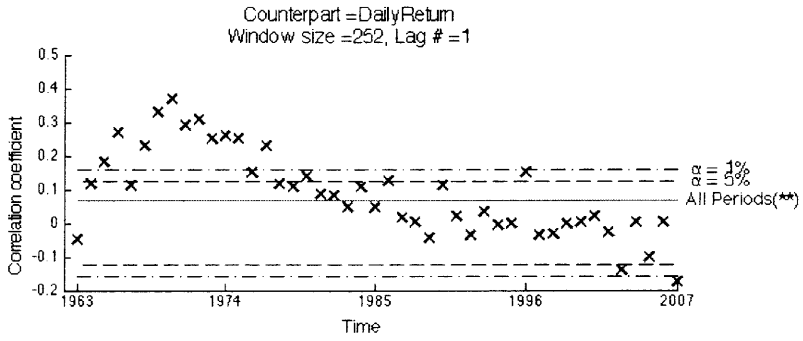
In conclusion, it is considered that human discretion such as macro view on the future market trend still plays a quite important role for quantitative trading to be successful in the long-run. Therefore, successful quantitative trading is considered to be a product of integration between human decision to select a right strategy along the current market context and the capability/efficiency of the selected strategy to exploit the market context to the full.

# Appendix A

## Detailed Correlation Analysis between Market Information Variables

### A.1 Auto-Correlation Analysis of the S&P 500 Stock Index Returns

Figure A-1: Change of Index Return Auto-Correlation  
(Period = Daily, Time Window = 1 year)



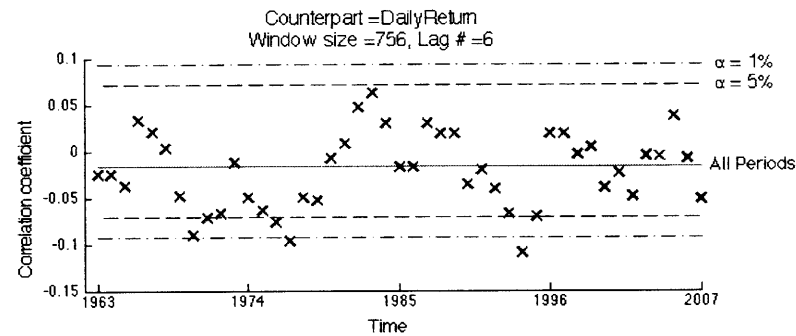
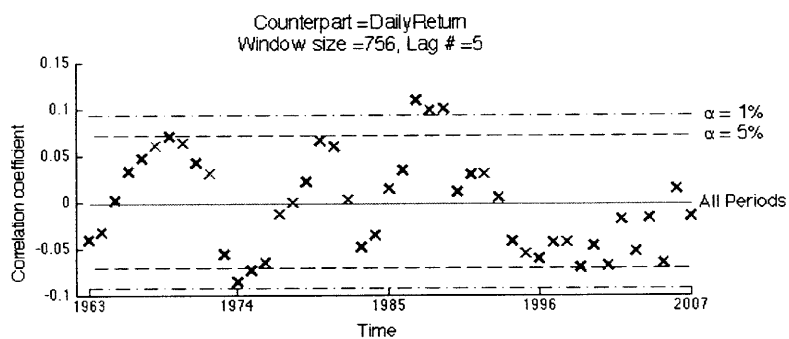
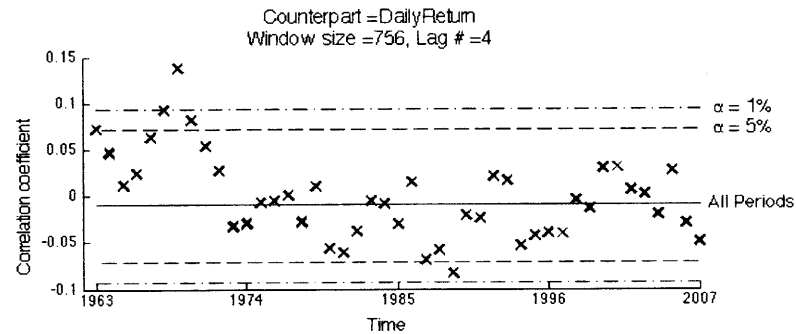
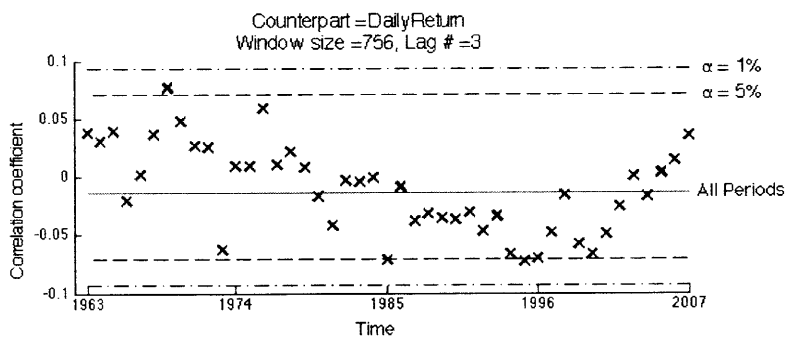
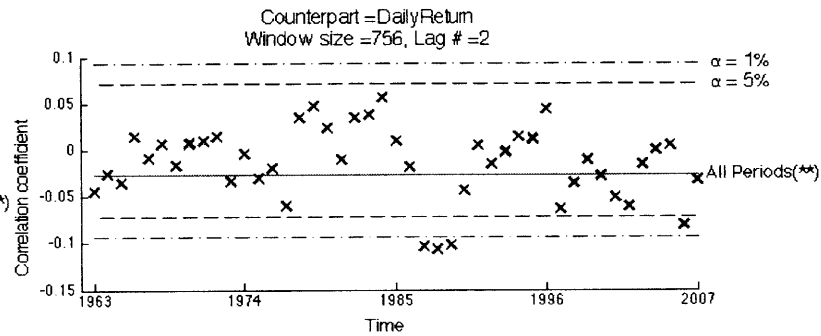
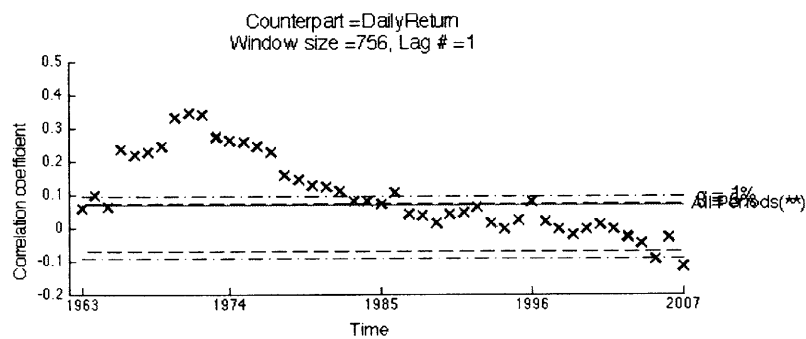


Figure A-2: Change of Index Return Auto-Correlation  
(Period = Daily, Time Window = 3 years)

Figure A-3: Change of Index Return Auto-Correlation  
 (Period = Weekly, Time Window = 1 year)

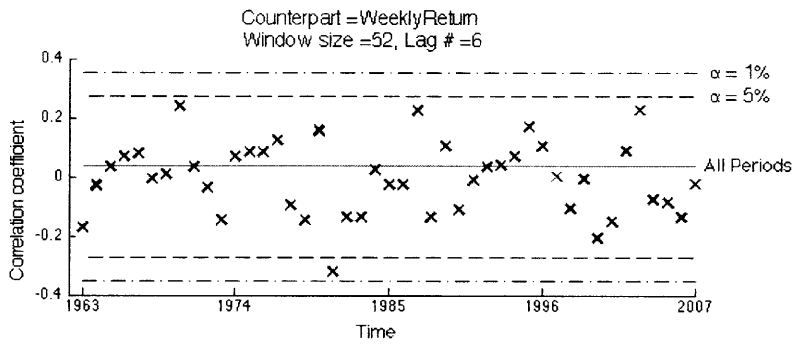
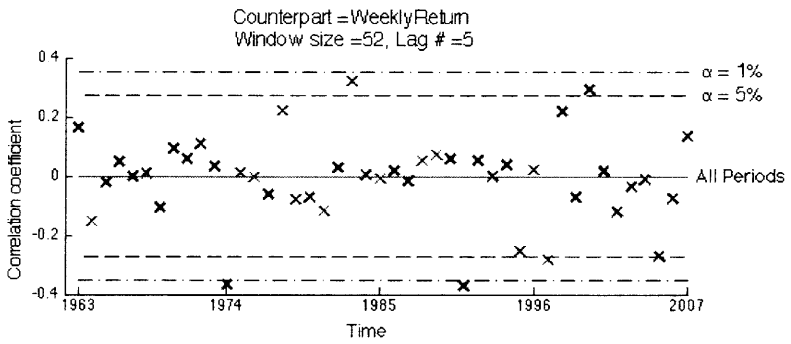
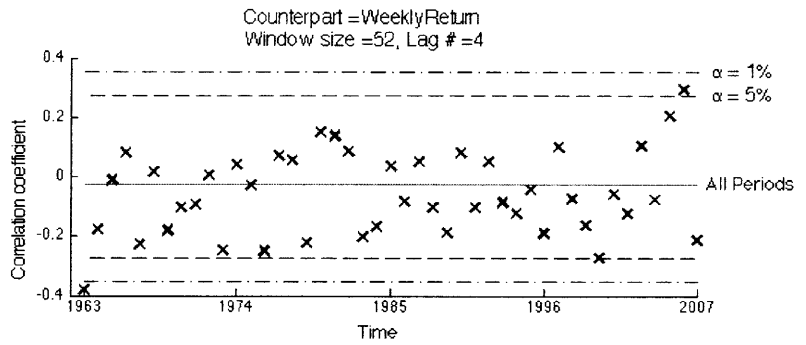
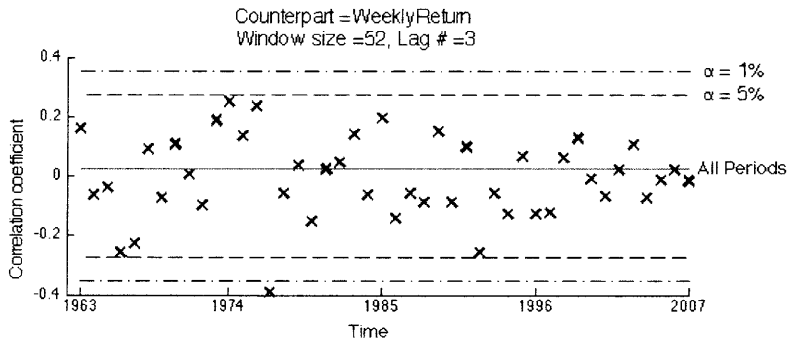
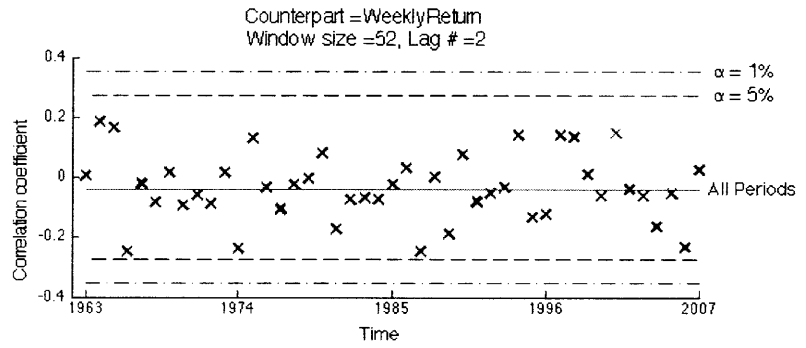
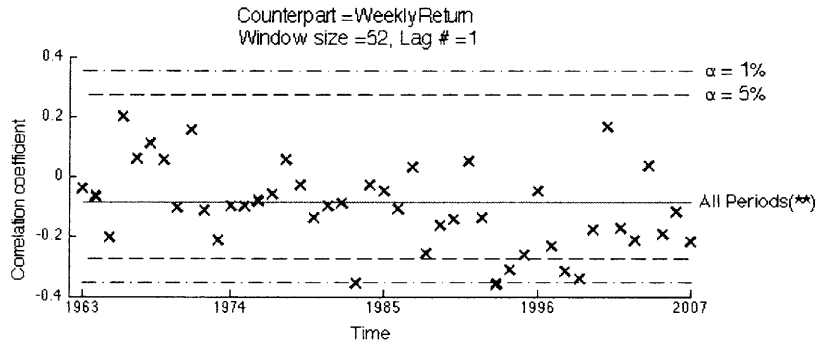


Figure A-4: Change of Index Return Auto-Correlation  
 (Period = Weekly, Time Window = 3 years)

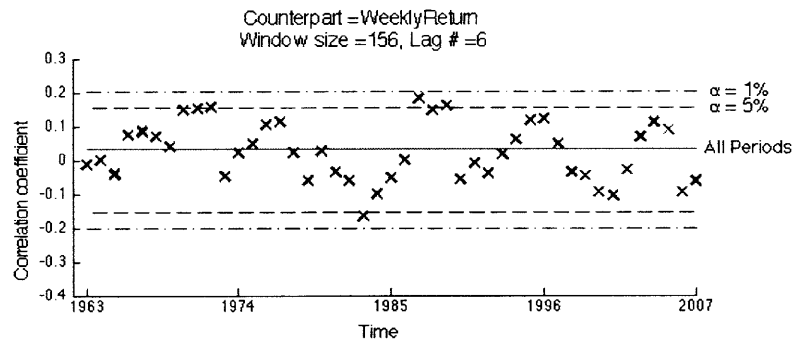
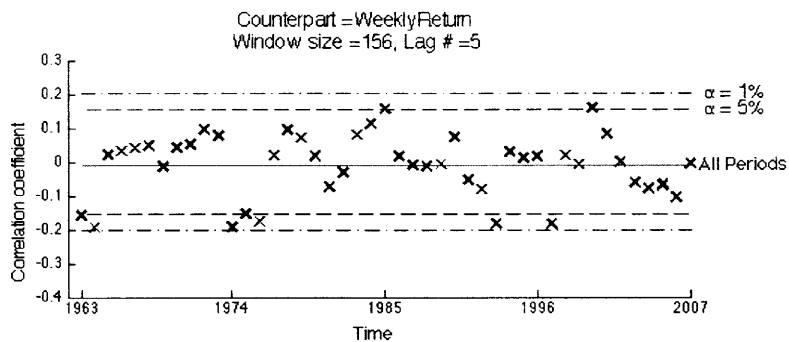
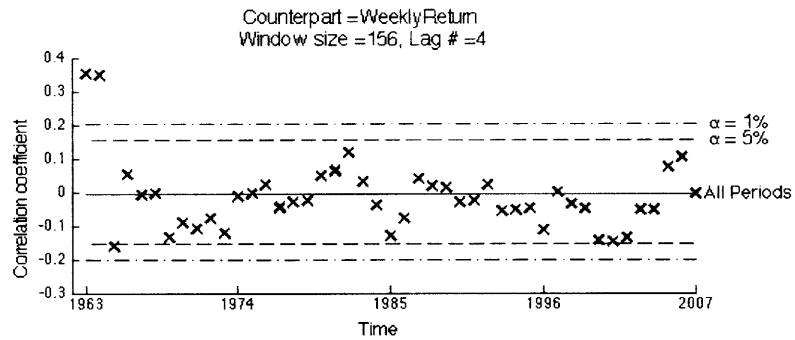
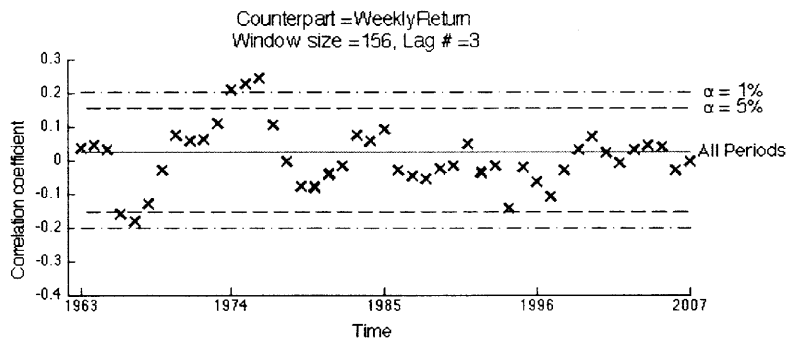
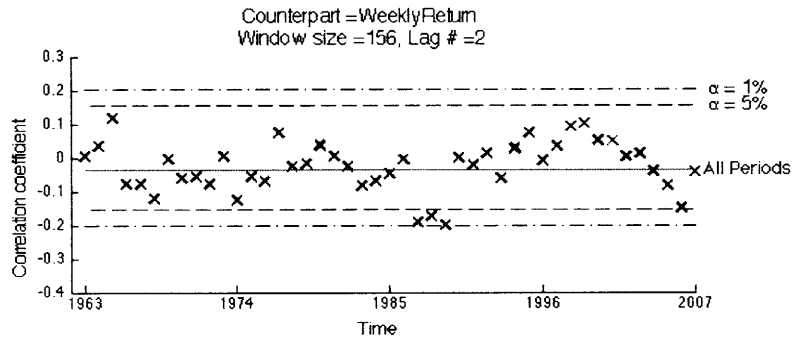
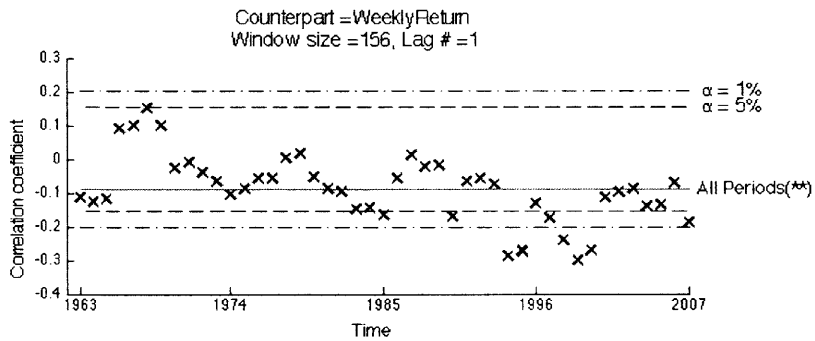
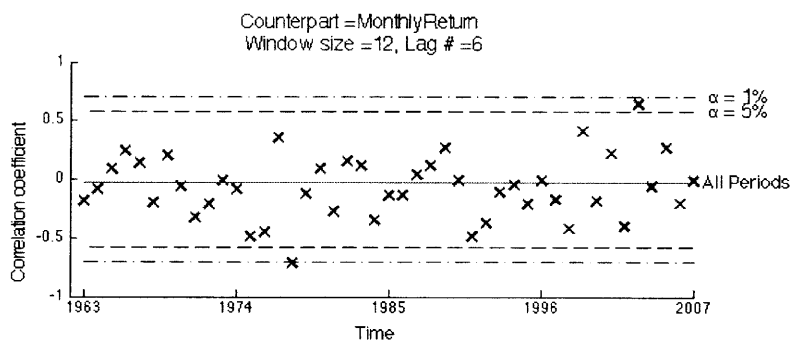
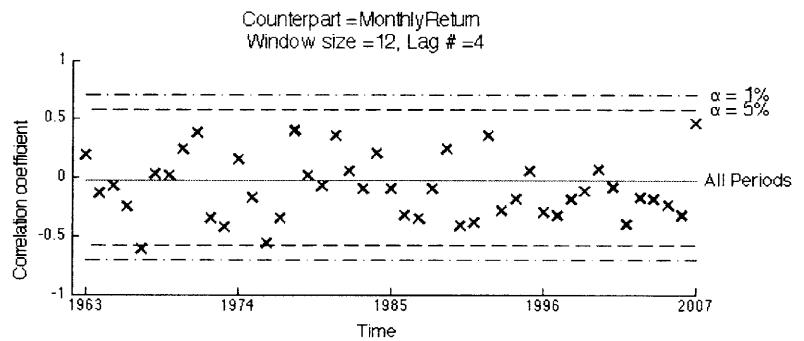
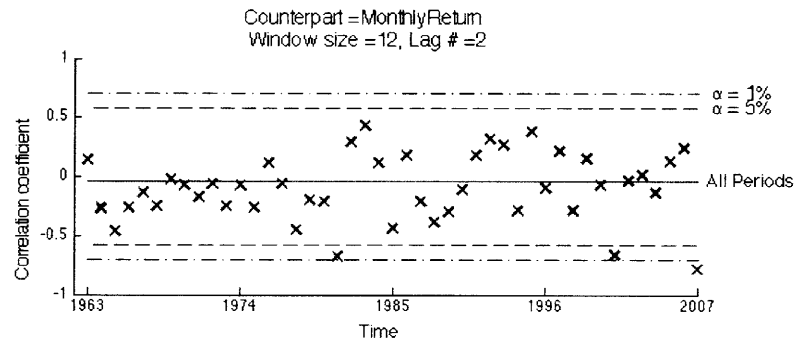
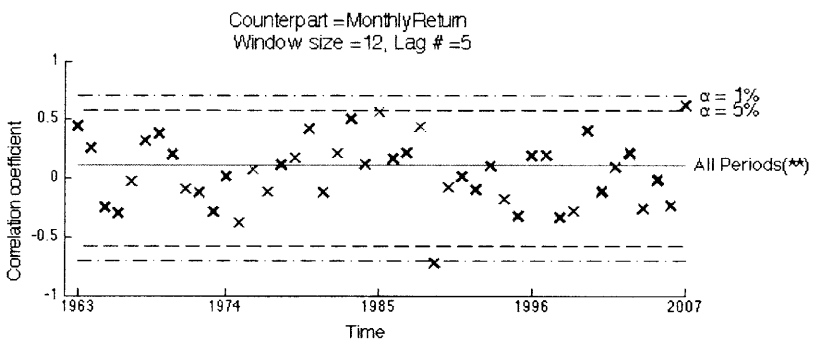
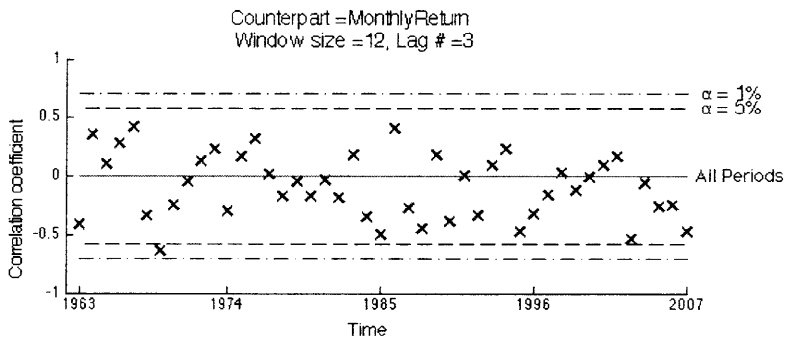
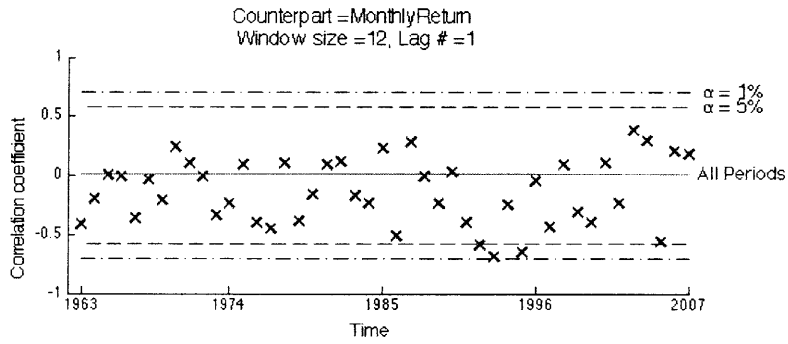


Figure A-5: Change of Index Return Auto-Correlation  
 (Period = Monthly, Time Window = 1 year)





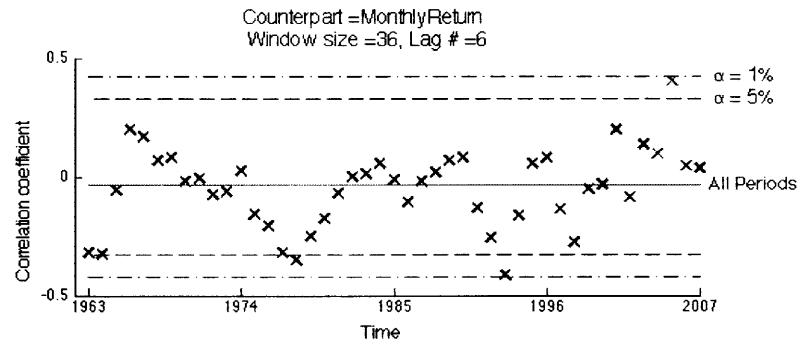
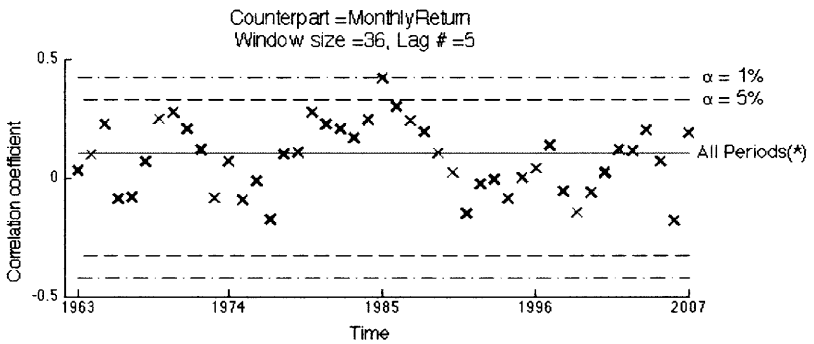
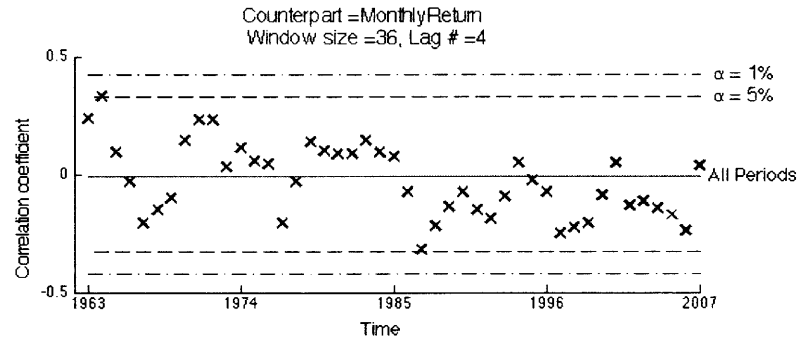
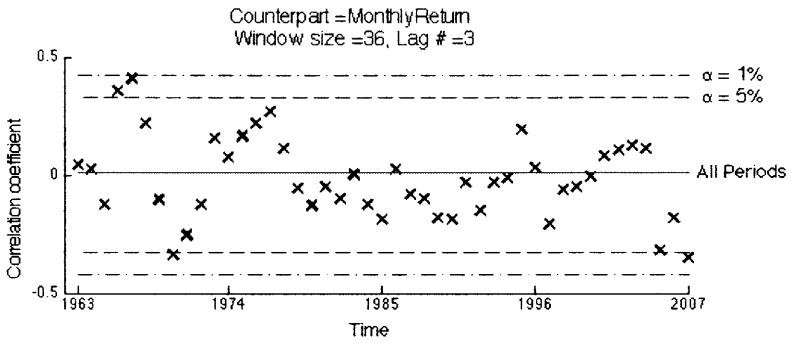
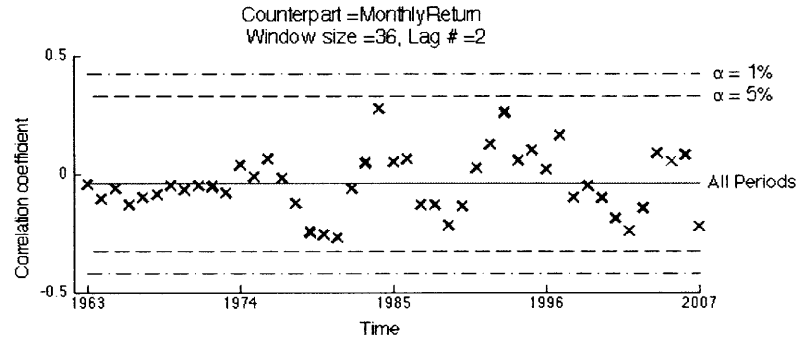
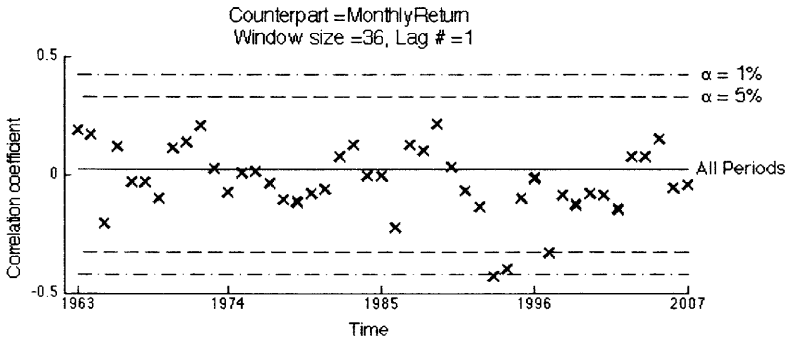
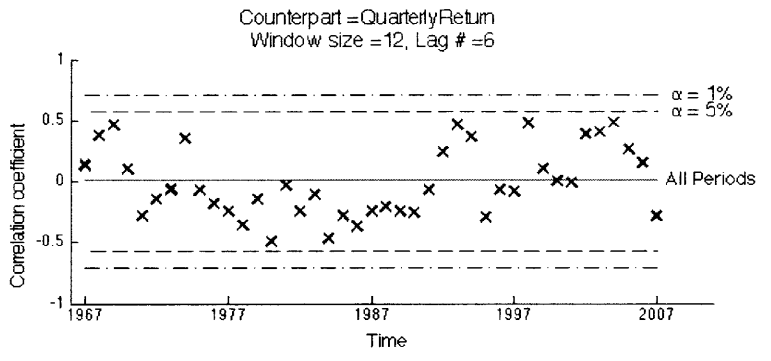
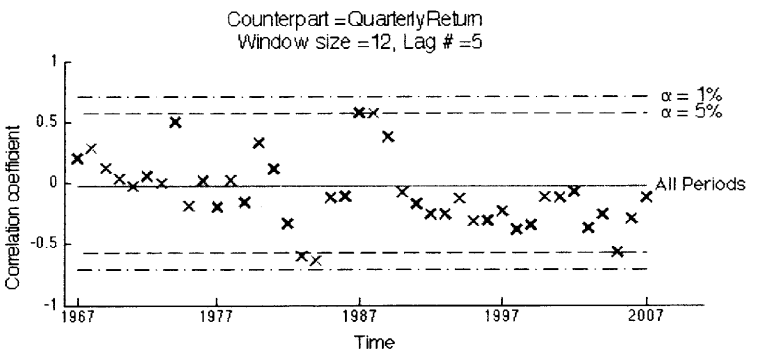
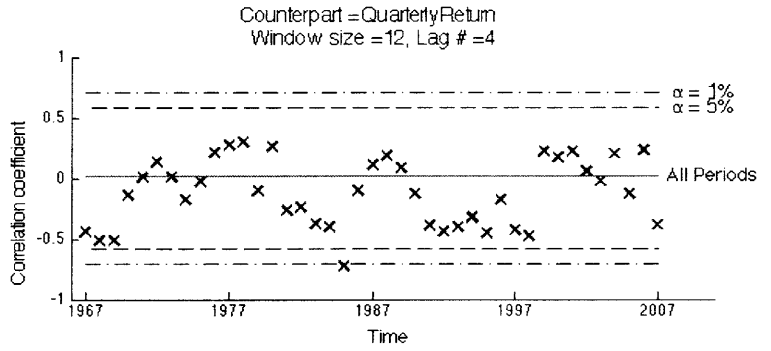
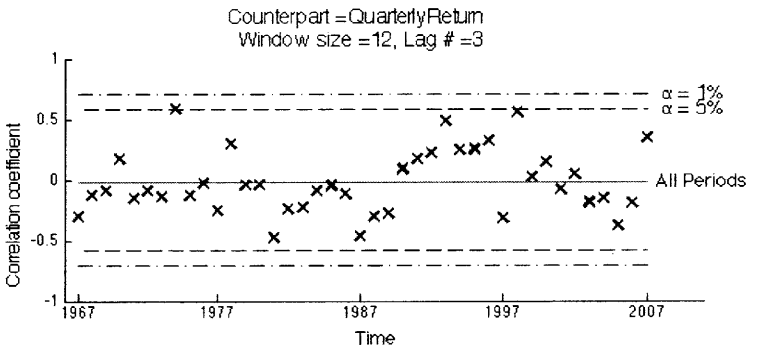
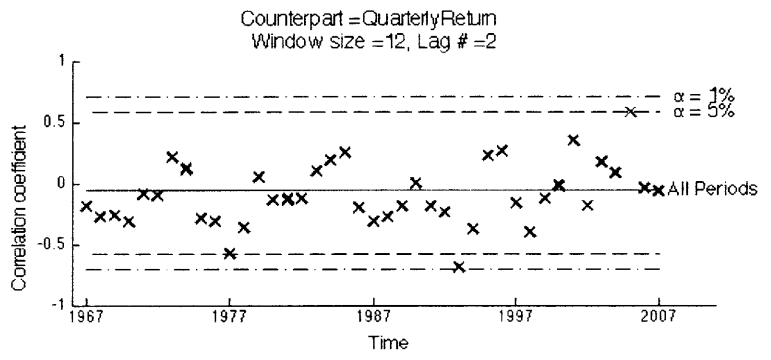
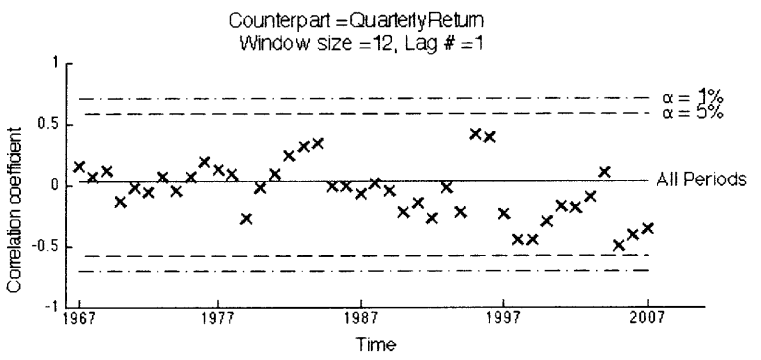


Figure A-6: Change of Index Return Auto-Correlation  
(Period = Monthly, Time Window = 3 years)  
129

Figure A-7: Change of Index Return Auto-Correlation  
 (Period = Quarterly, Time Window = 3 years)



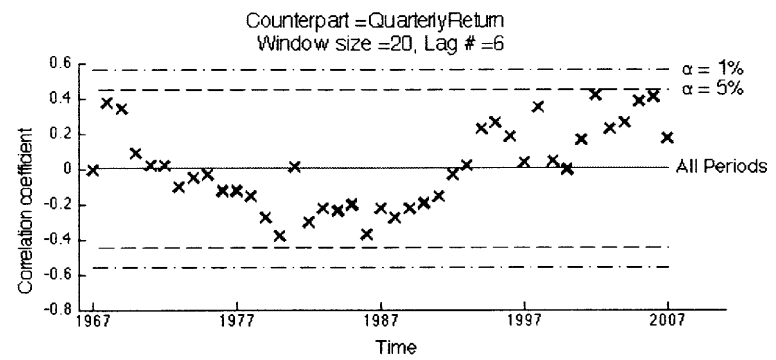
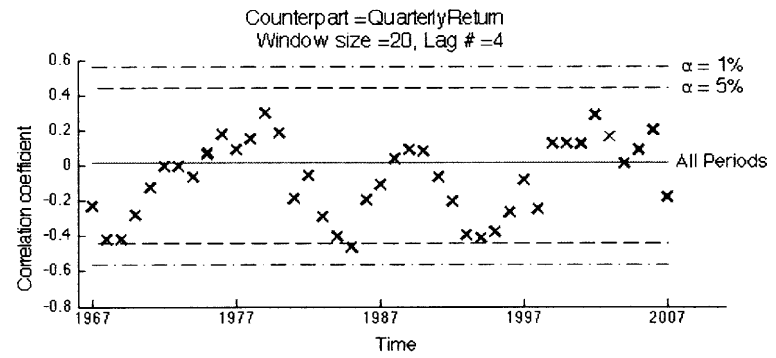
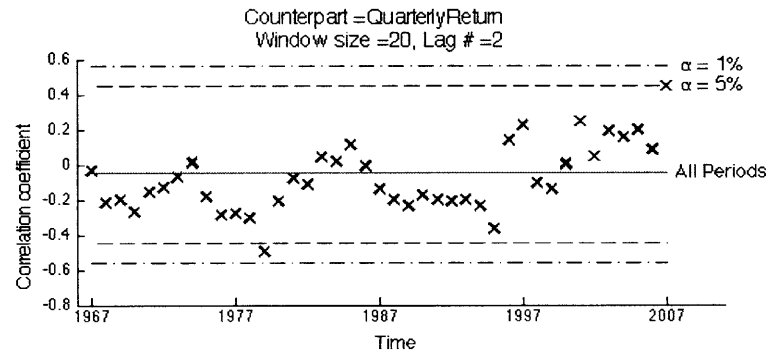
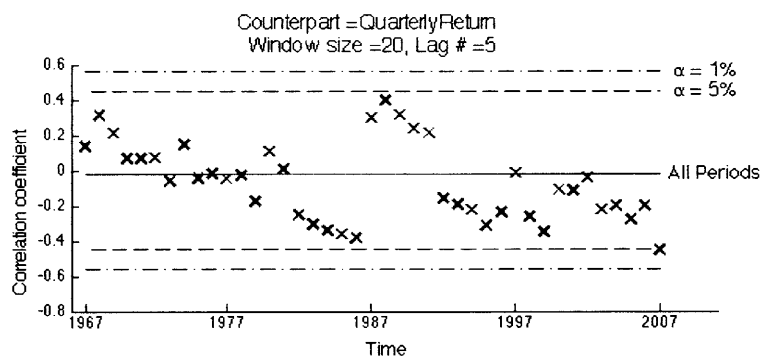
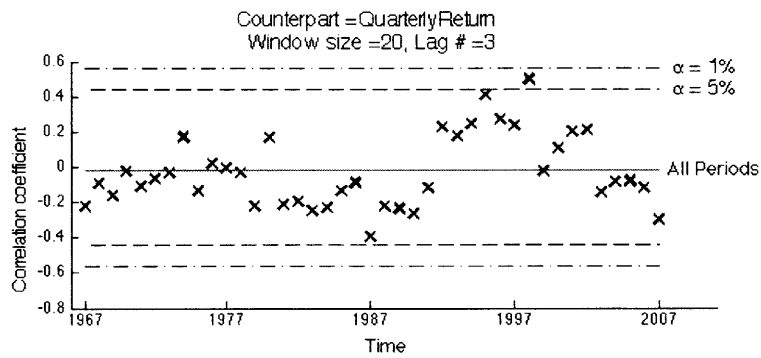
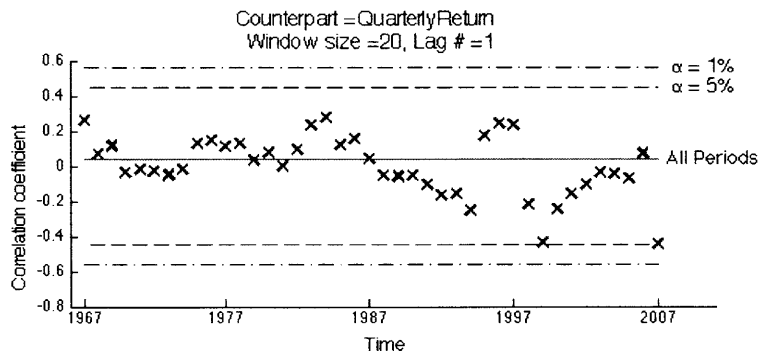


Figure A-8: Change of Index Return Auto-Correlation  
(Period = Quarterly, Time Window = 5 years)

Figure A-9: Change of Index Return Auto-Correlation  
 (Period = Yearly, Time Window = 5 years)

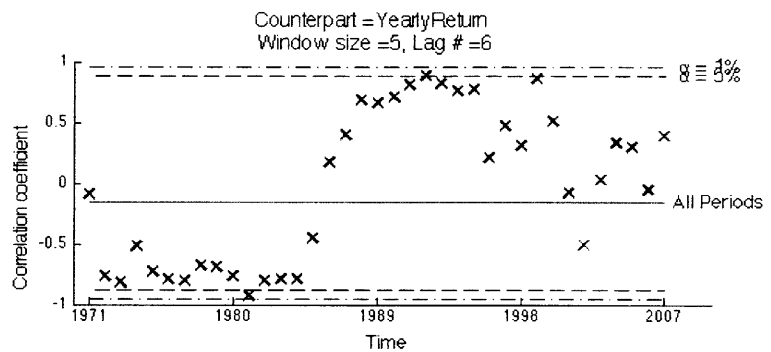
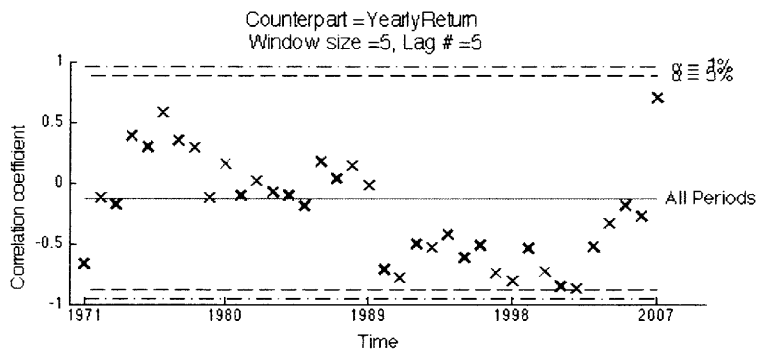
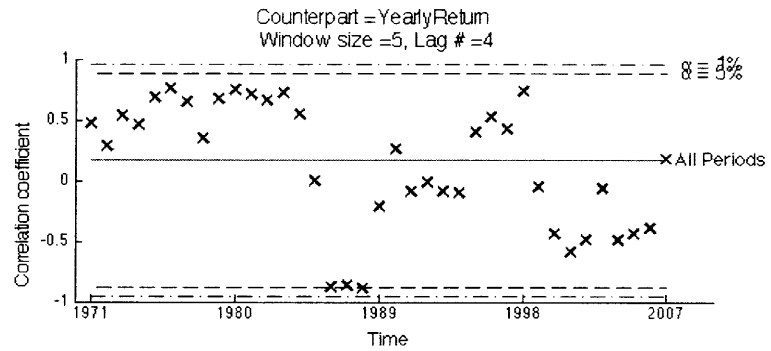
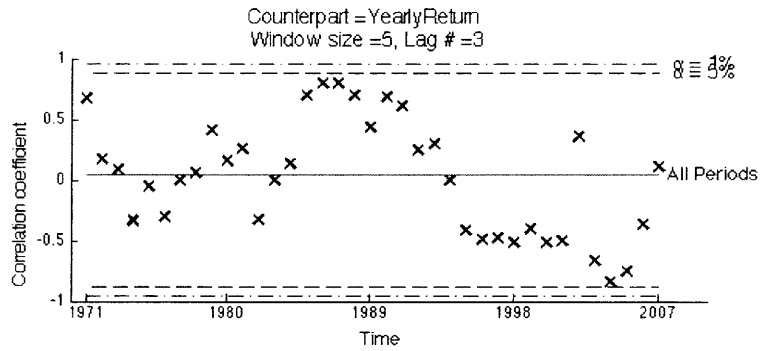
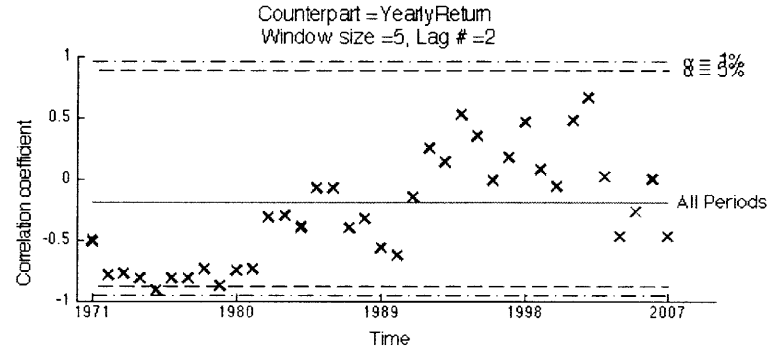
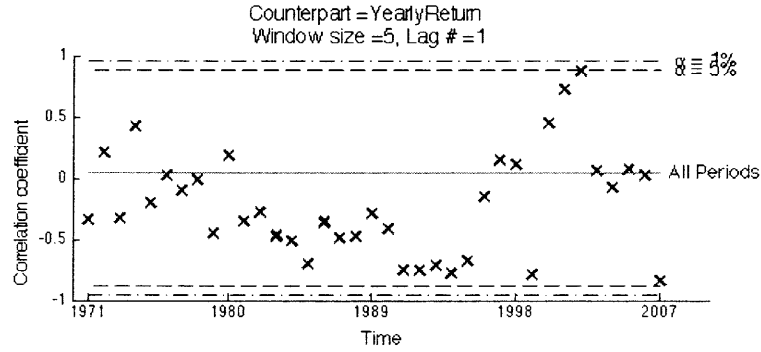
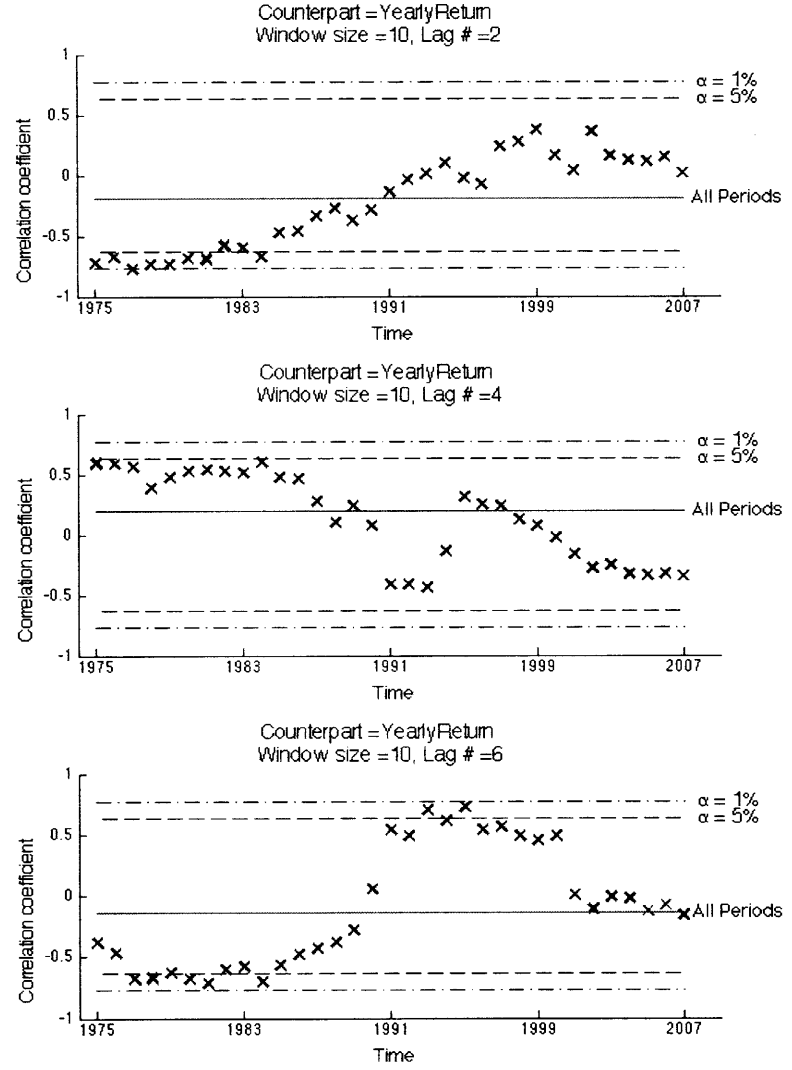
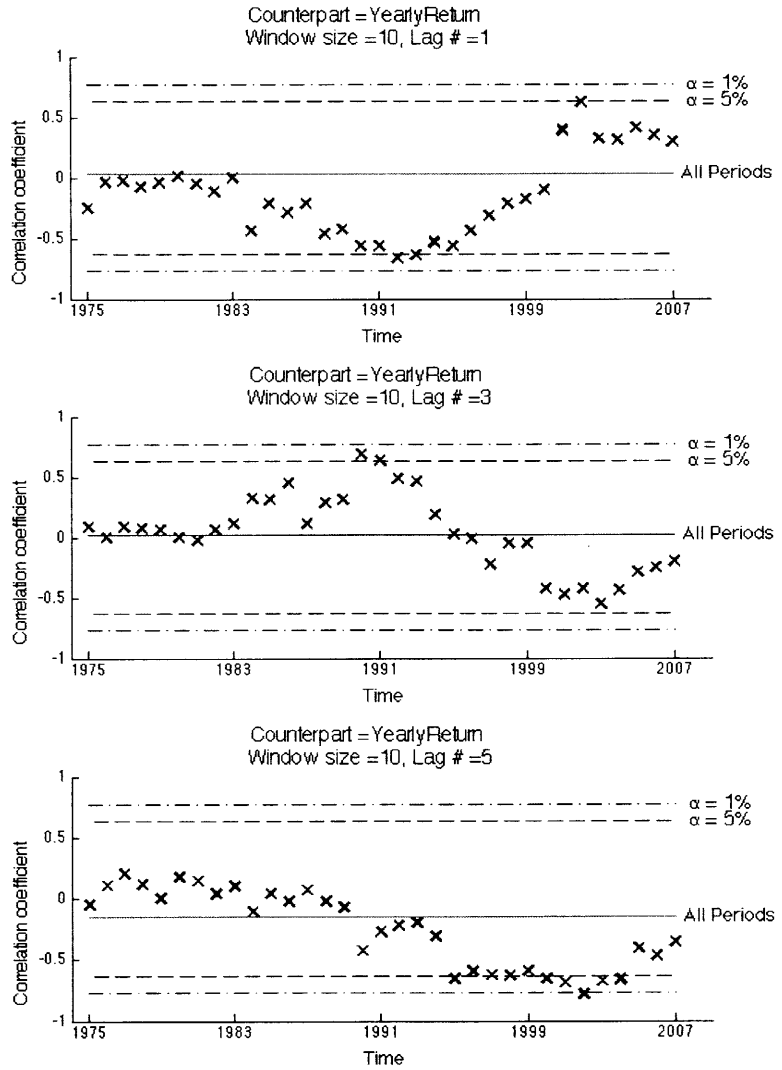


Figure A-10: Change of Index Return Auto-Correlation  
 (Period = Yearly, Time Window = 10 years)



## A.2 Correlation Analysis between the S&P 500 Stock Index Returns and its Trading Volumes

Figure A-11: Change of Correlation with Trading Volume  
 (Period = Daily, Time Window = 1 year)  
 135

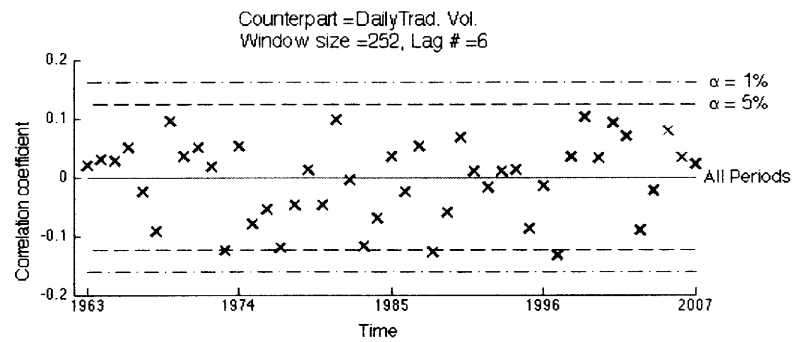
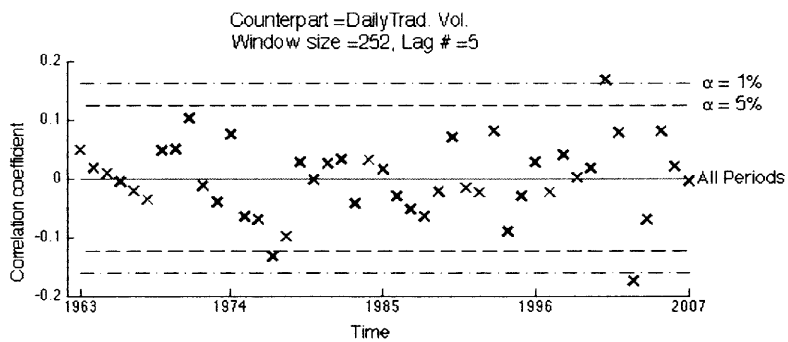
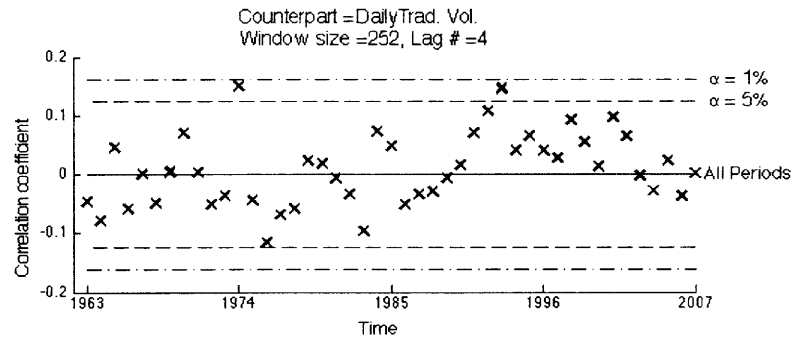
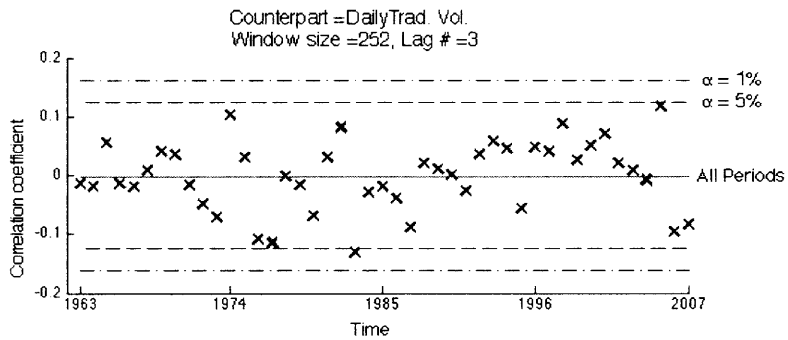
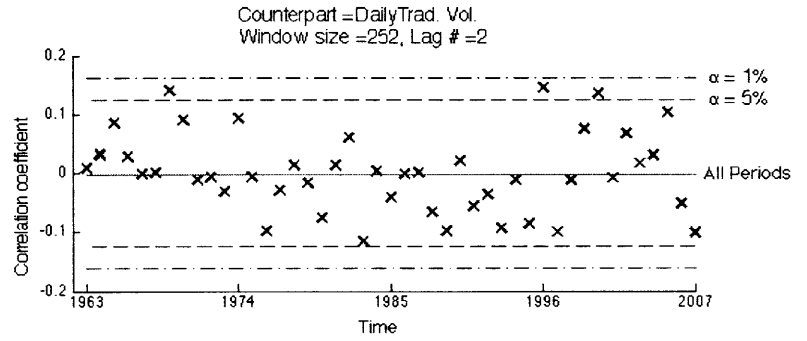
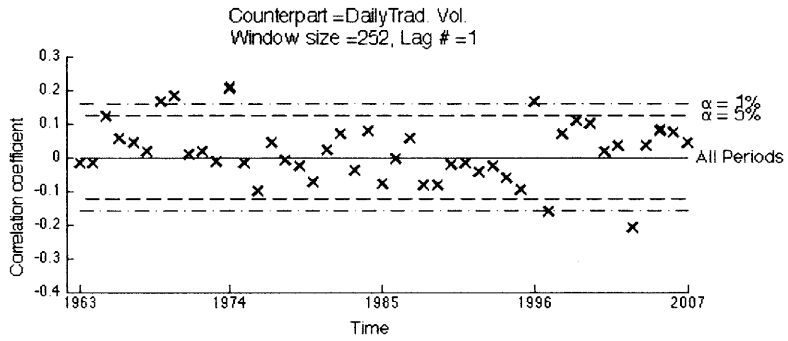
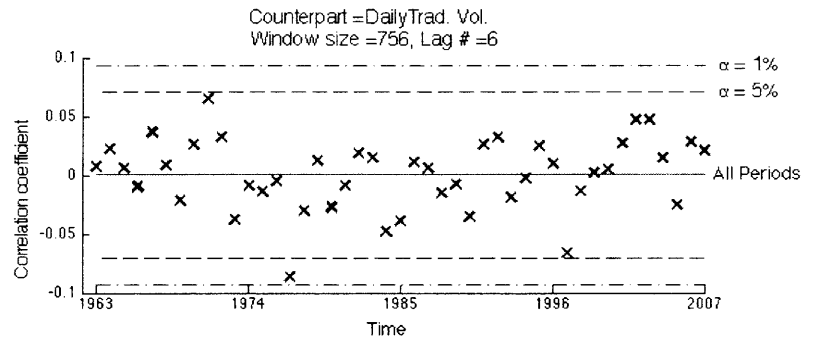
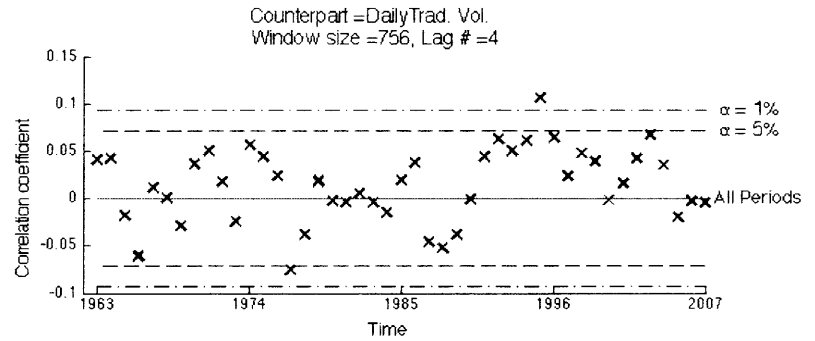
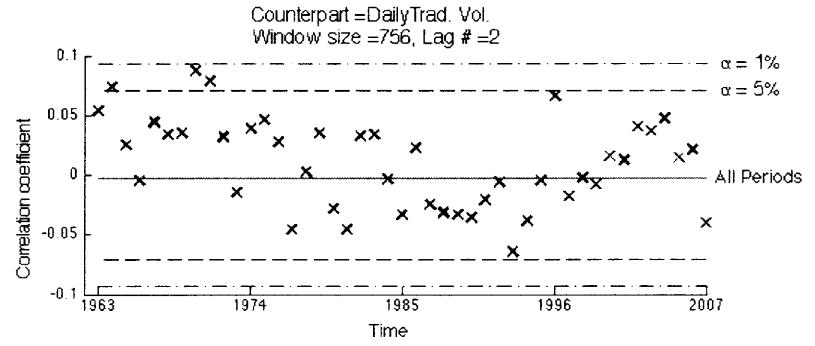
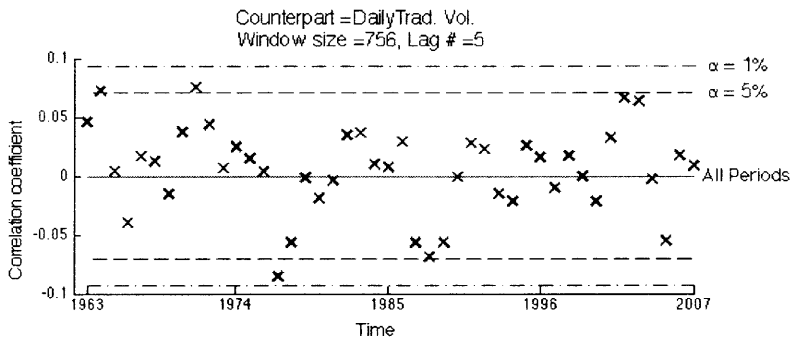
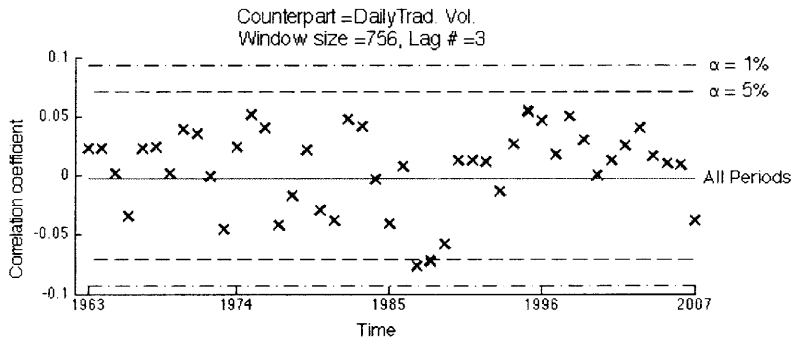
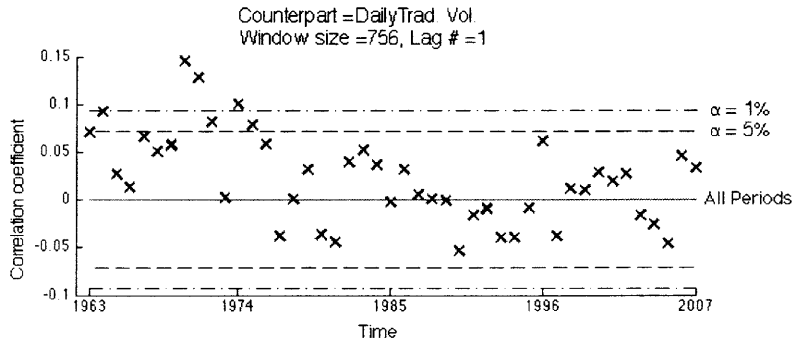


Figure A-12: Change of Correlation with Trading Volume  
 (Period = Daily, Time Window = 3 years)





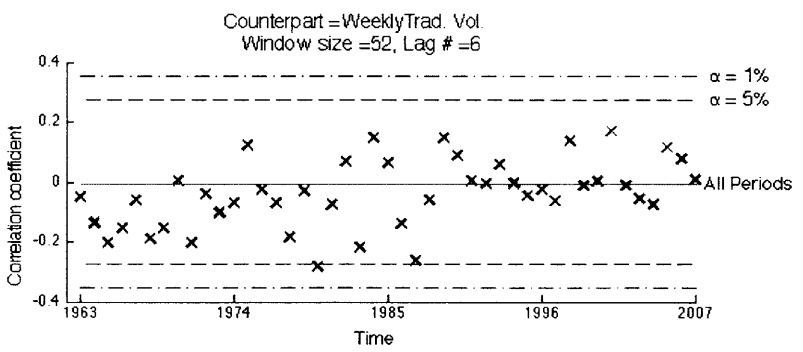
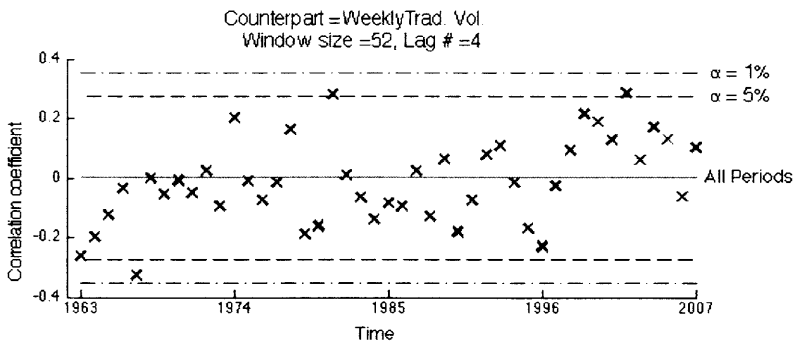
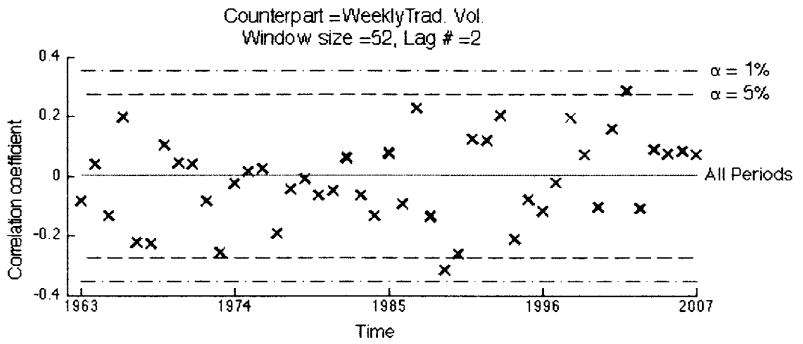
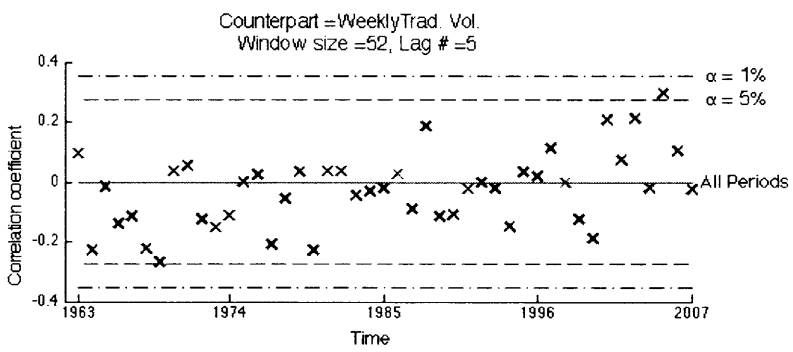
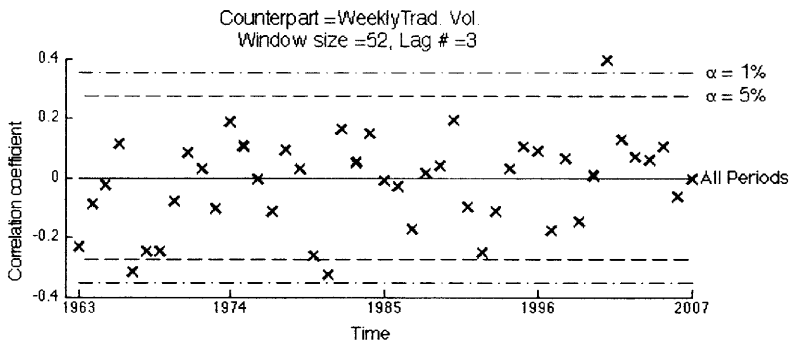
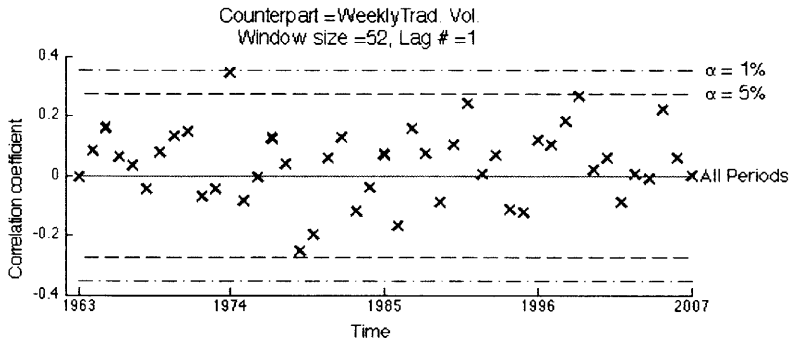


Figure A-13: Change of Correlation with Trading Volume  
(Period = Weekly, Time Window = 1 year)

Figure A-14: Change of Correlation with Trading Volume  
 (Period = Weekly, Time Window = 3 years)

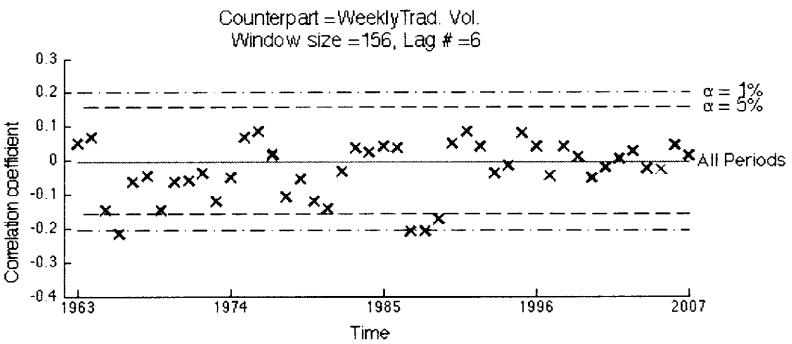
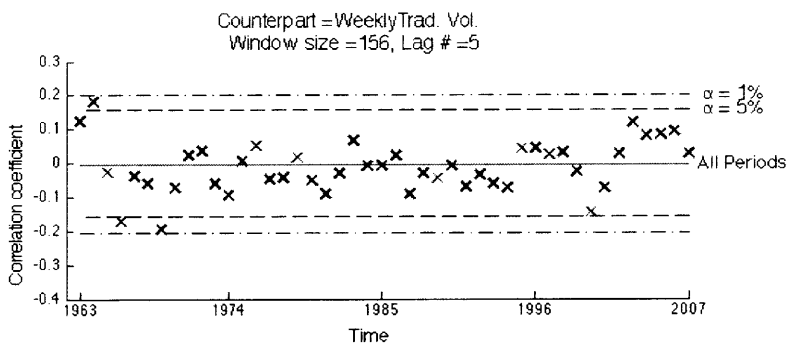
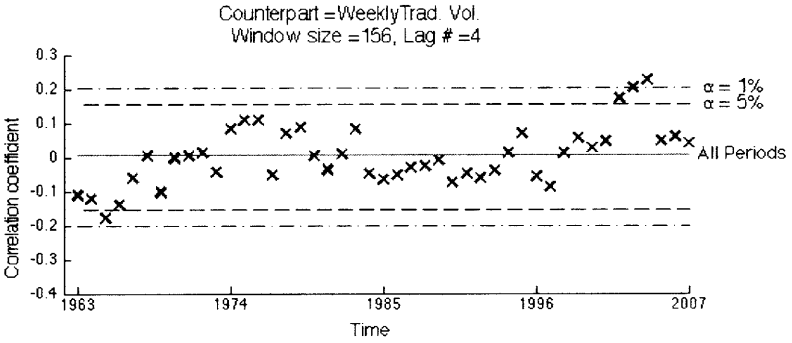
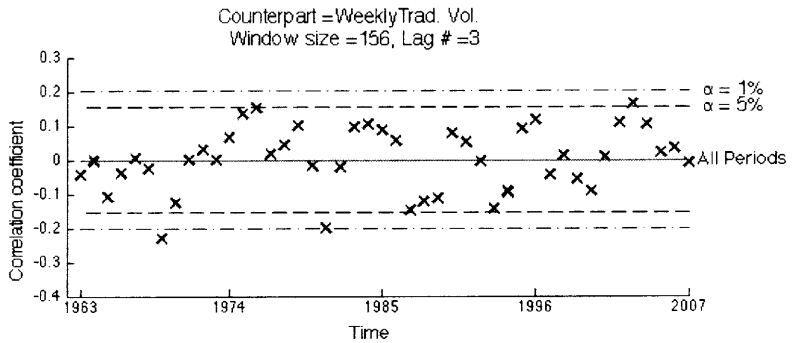
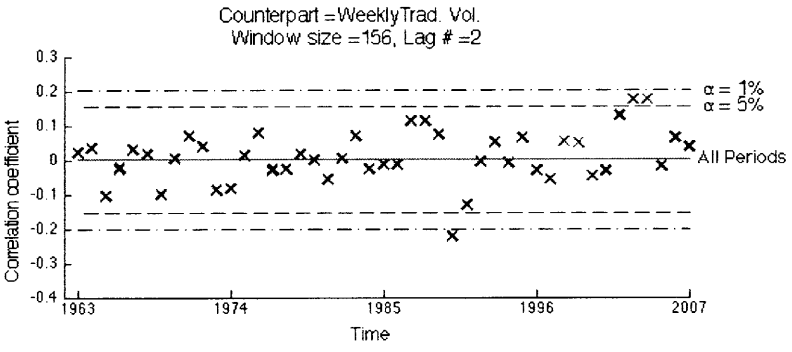
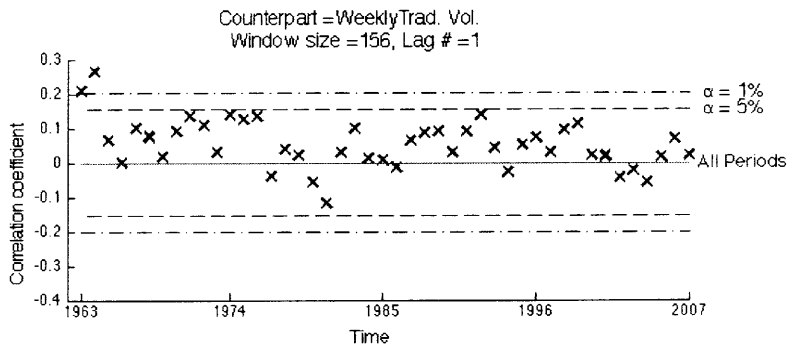
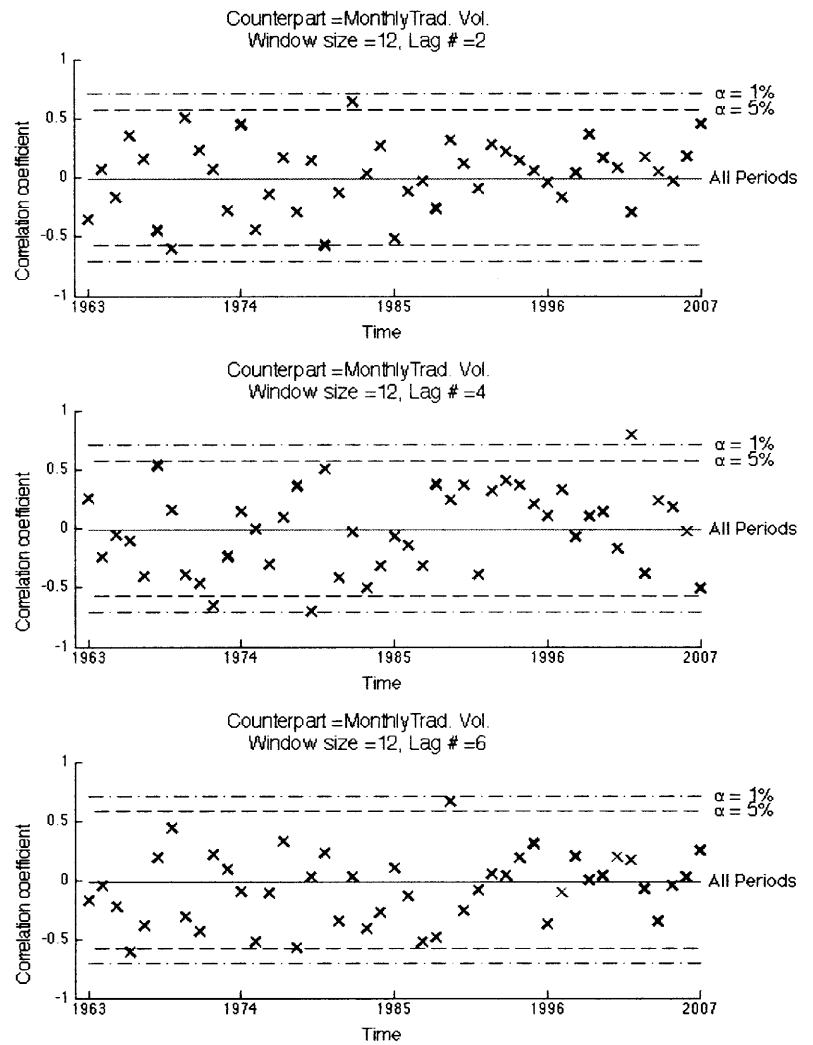
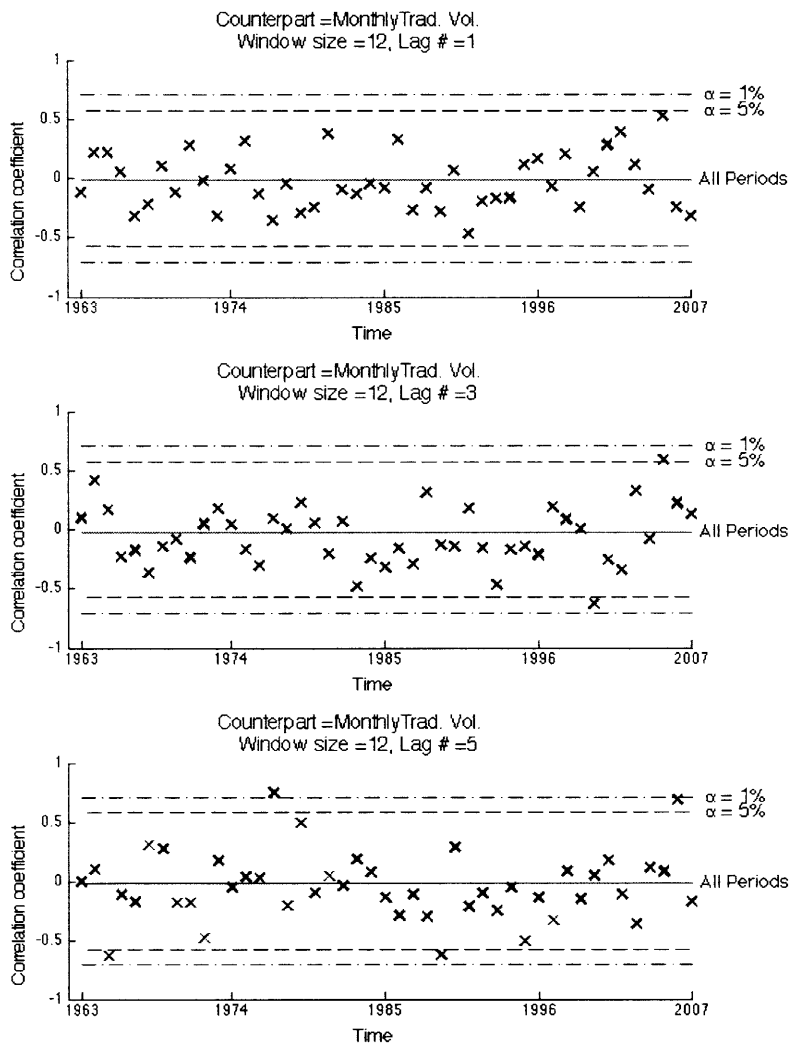


Figure A-15: Change of Correlation with Trading Volume  
 (Period = Monthly, Time Window = 1 year)



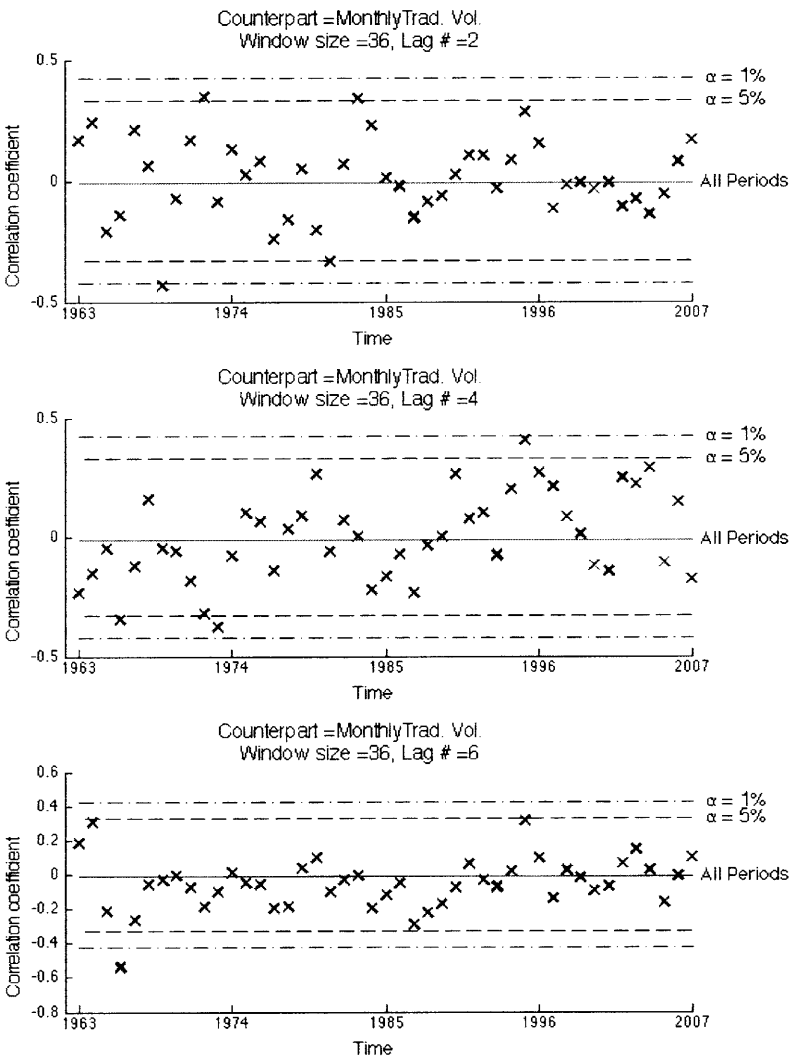


Figure A-16: Change of Correlation with Trading Volume  
(Period = Monthly, Time Window = 3 years)

Figure A-17: Change of Correlation with Trading Volume  
 (Period = Quarterly, Time Window = 3 years)  
 141

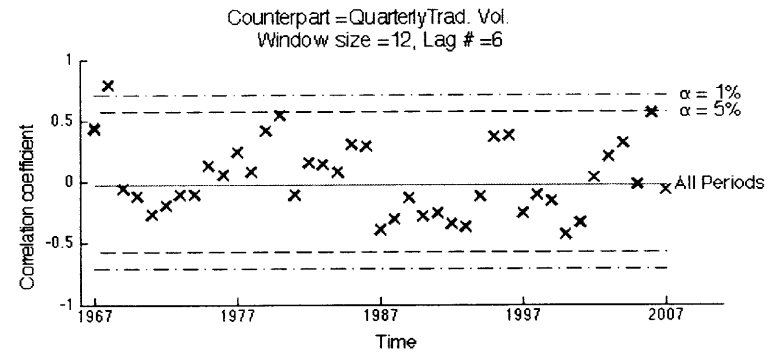
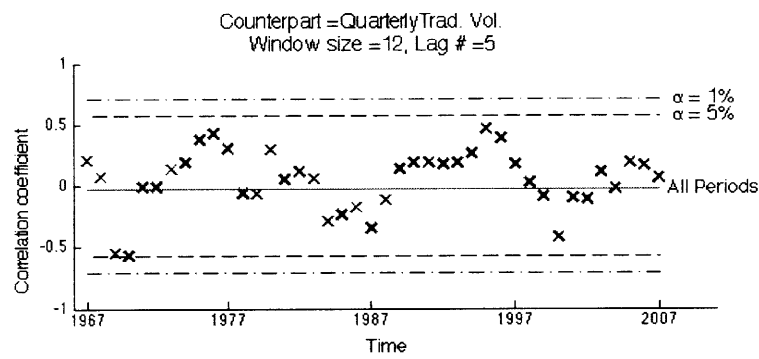
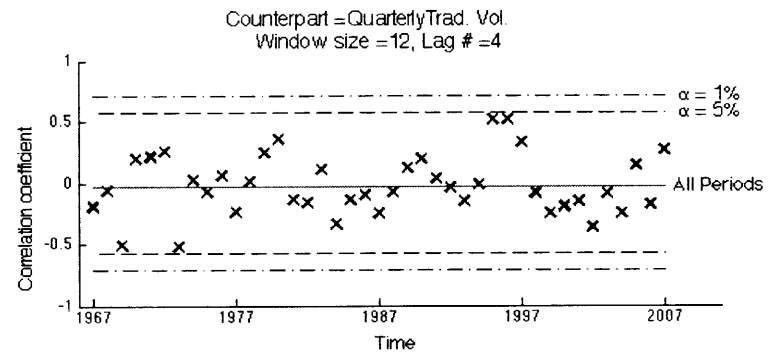
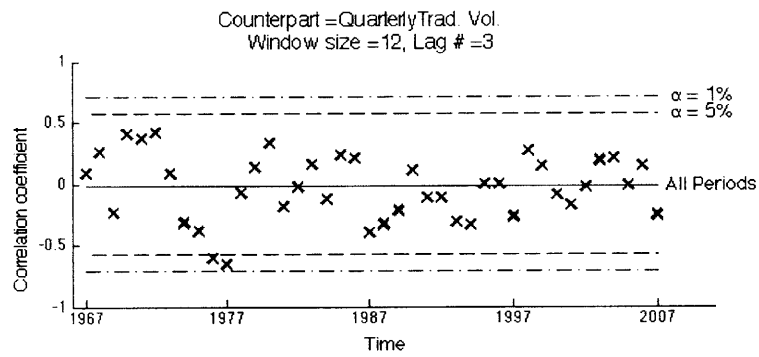
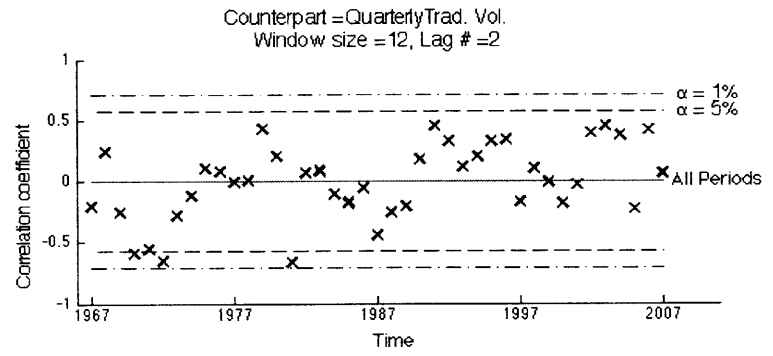
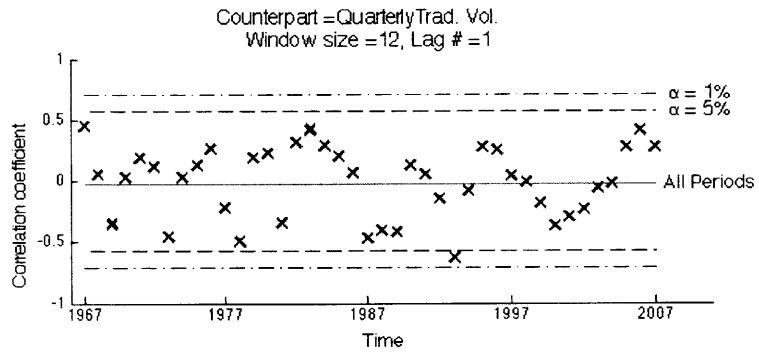
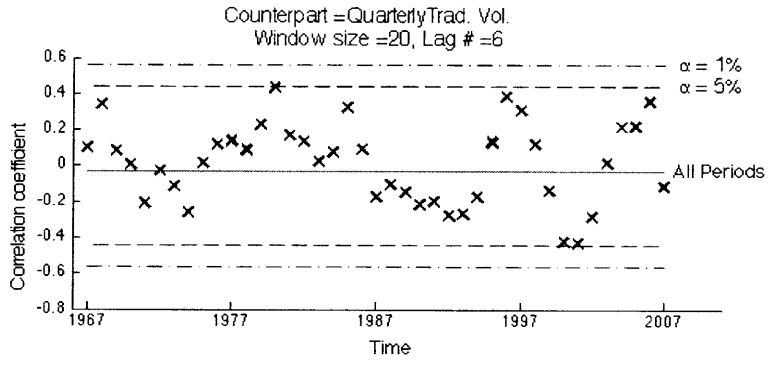
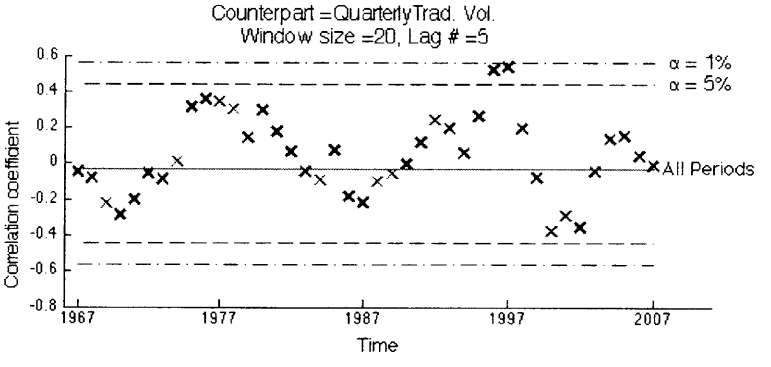
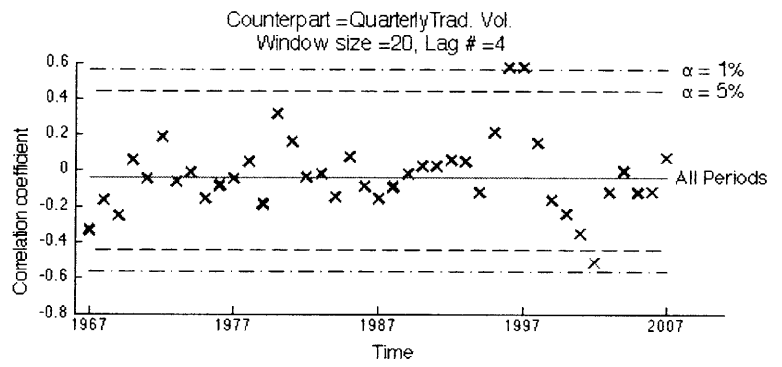
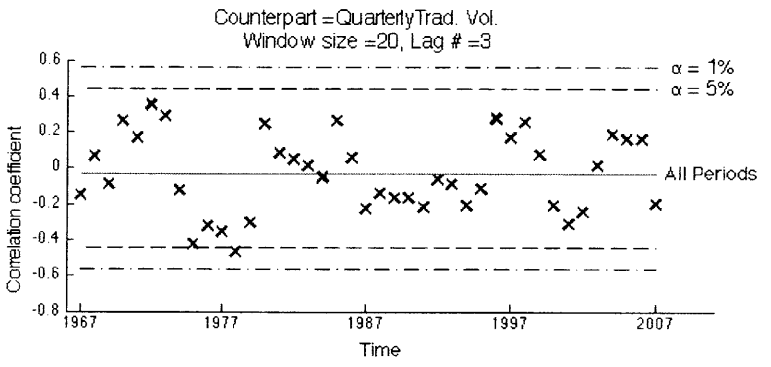
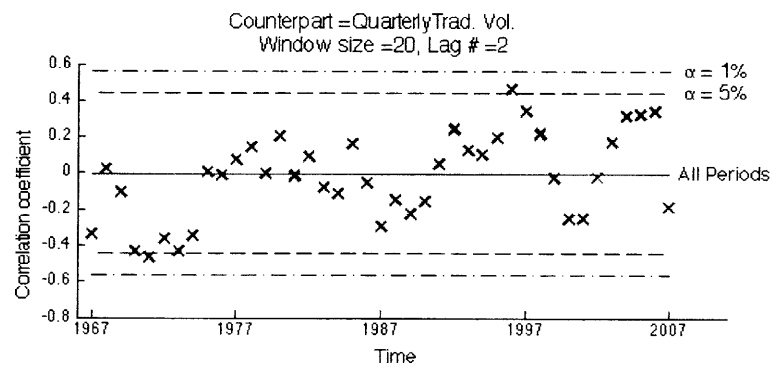
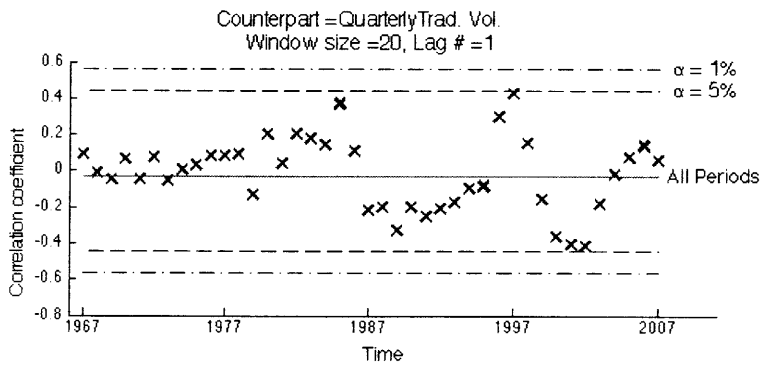


Figure A-18: Change of Correlation with Trading Volume  
 (Period = Quarterly, Time Window = 5 years)



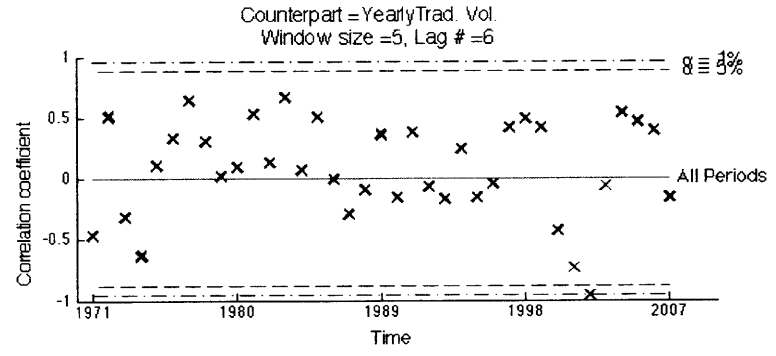
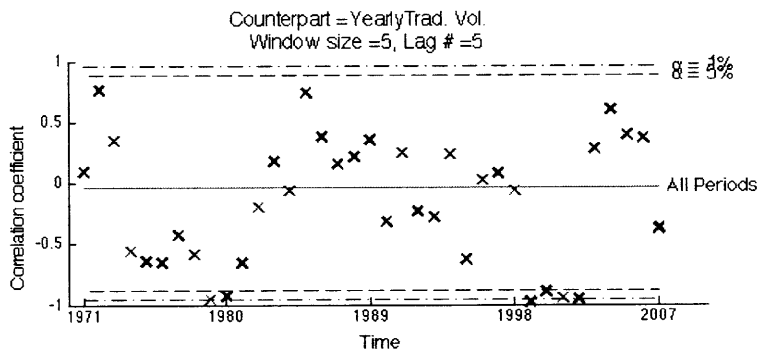
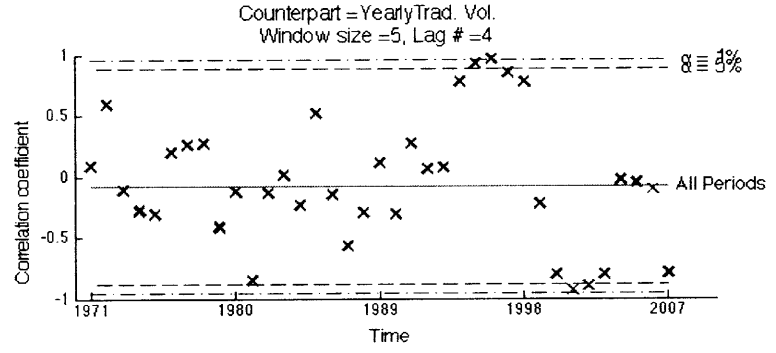
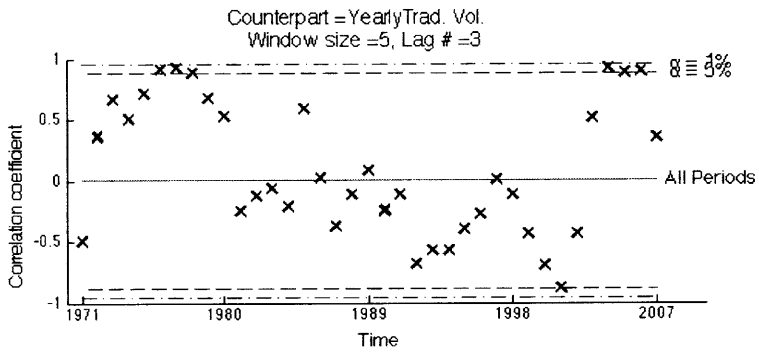
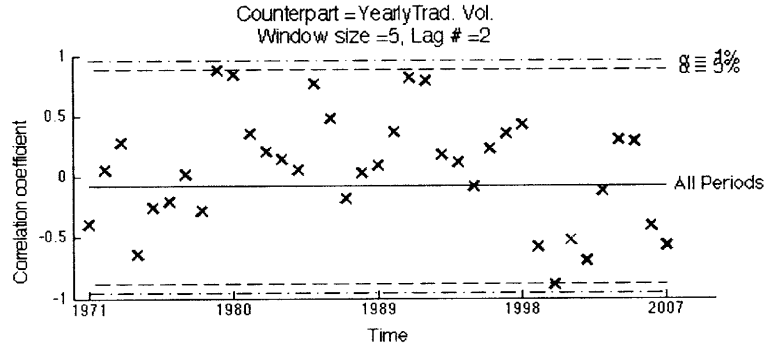
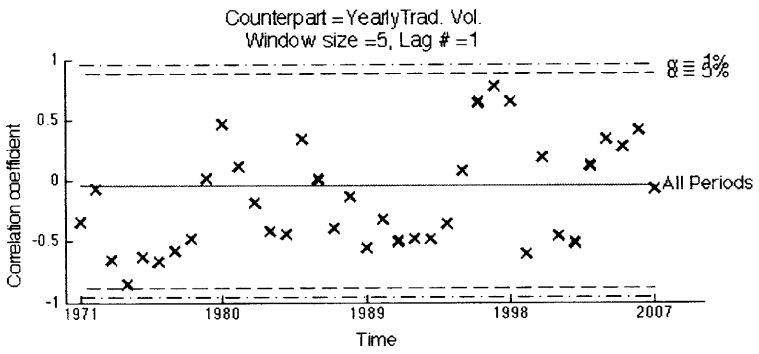
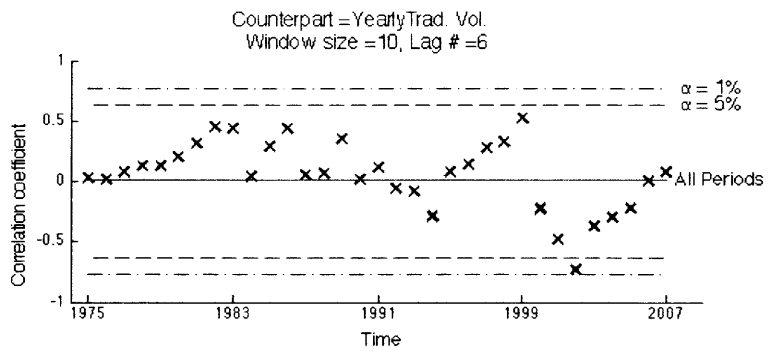
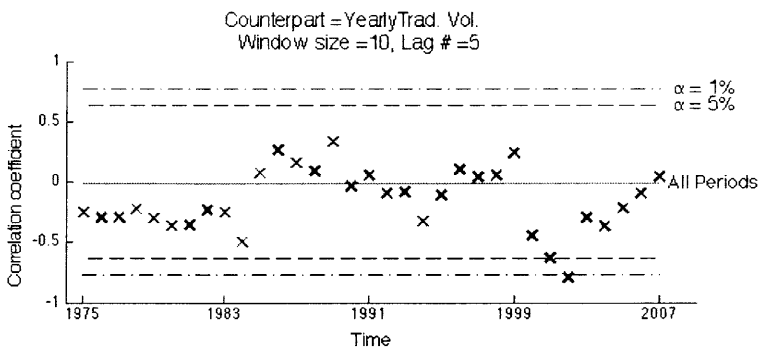
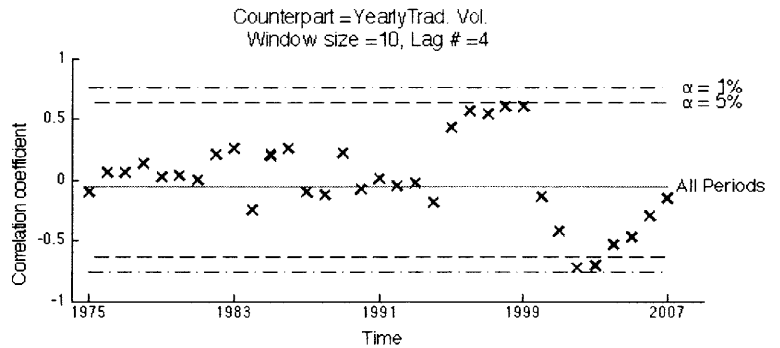
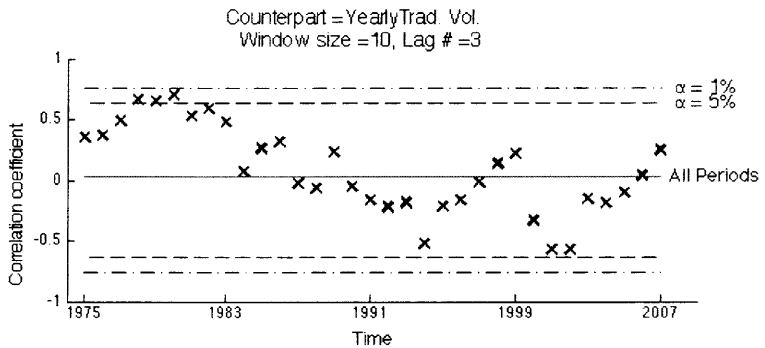
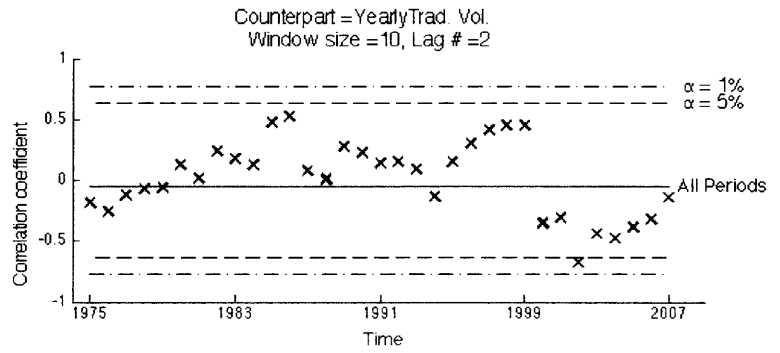
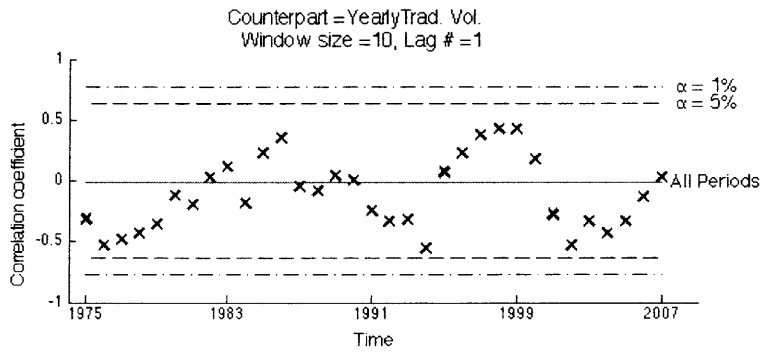


Figure A-19: Change of Correlation with Trading Volume  
(Period = Yearly, Time Window = 5 years)

Figure A-20: Change of Correlation with Trading Volume  
 (Period = Yearly, Time Window = 10 years)





### A.3 Correlation Analysis between the S&P 500 Stock Index Returns and the Change of its Trading Volumes

Figure A-21: Change of Correlation with Change of Trading Volume  
 (Period = Daily, Time Window = 1 year)

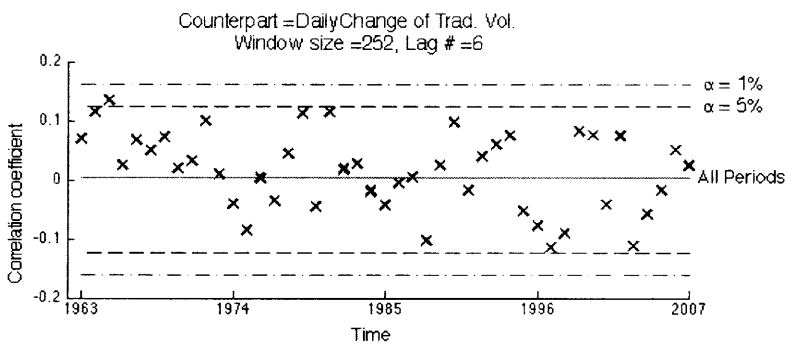
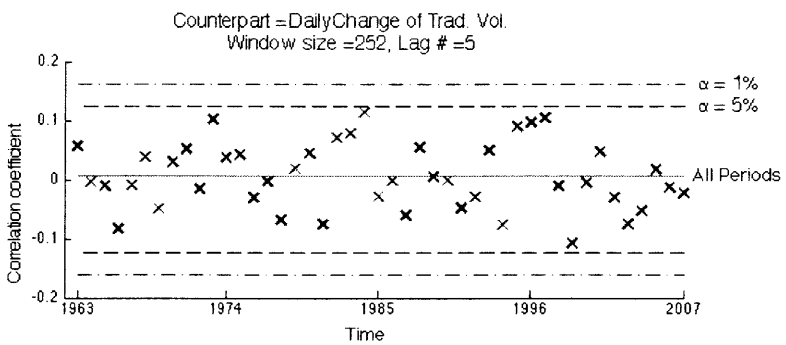
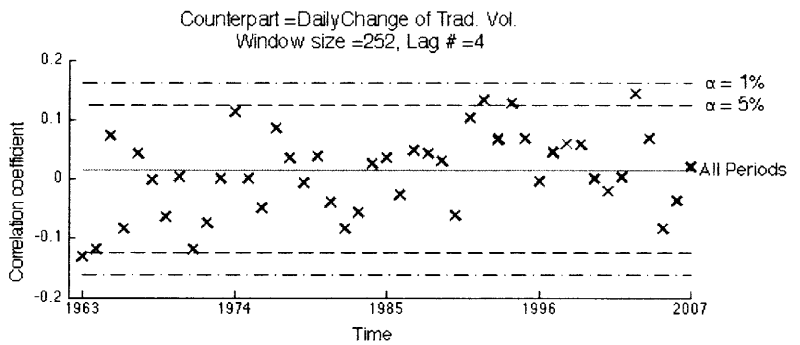
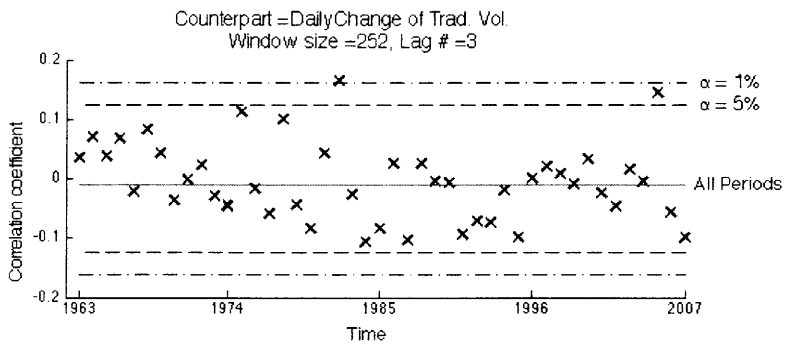
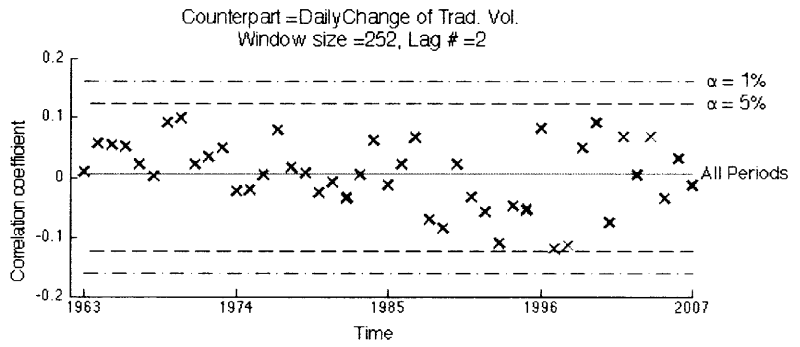
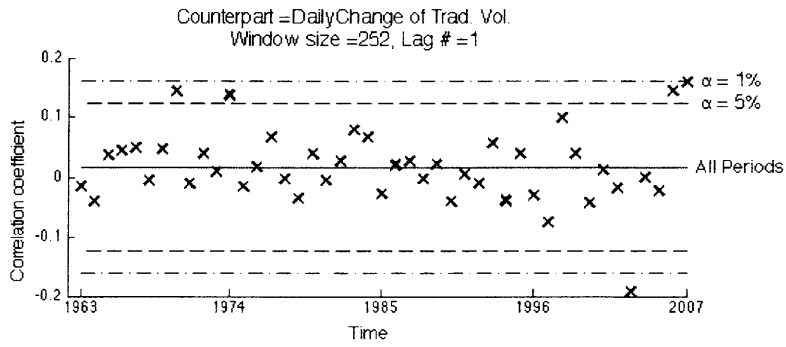


Figure A-22: Change of Correlation with Change of Trading Volume  
 (Period = Daily, Time Window = 3 years)

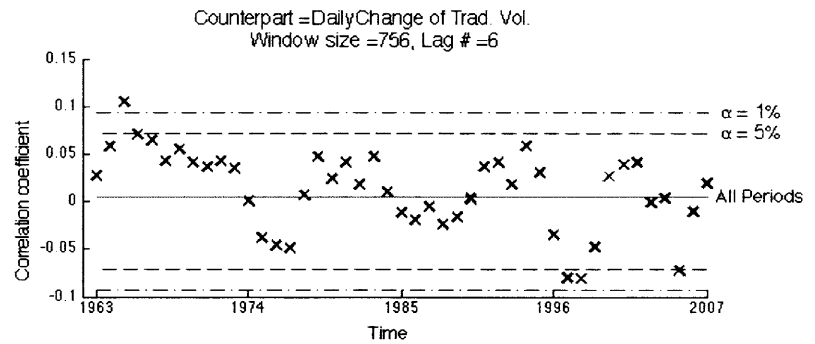
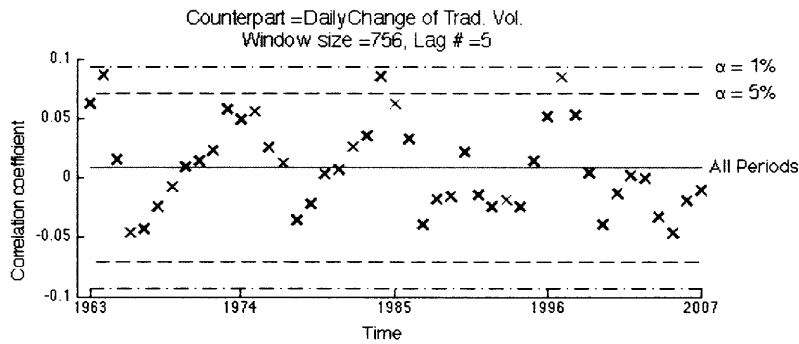
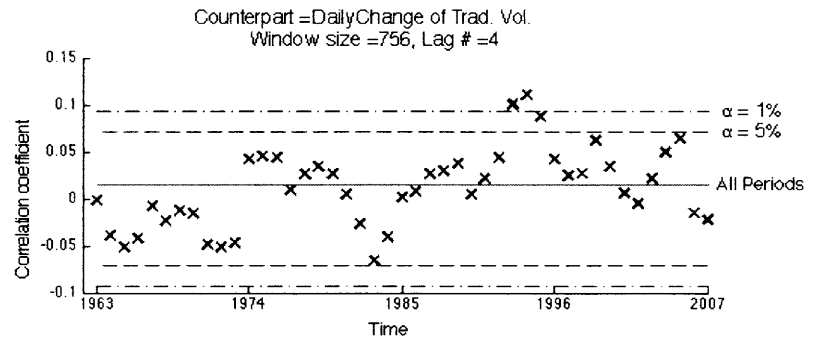
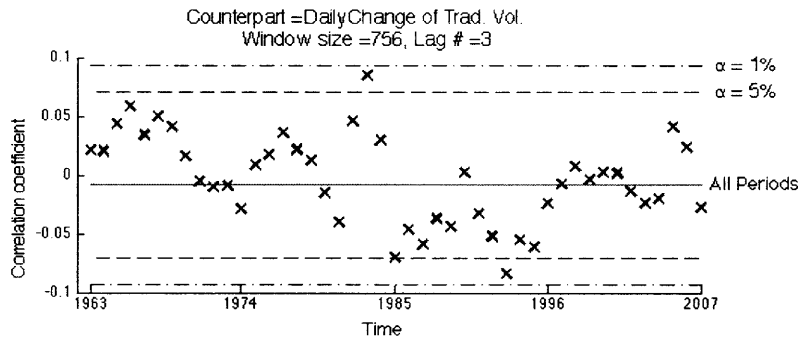
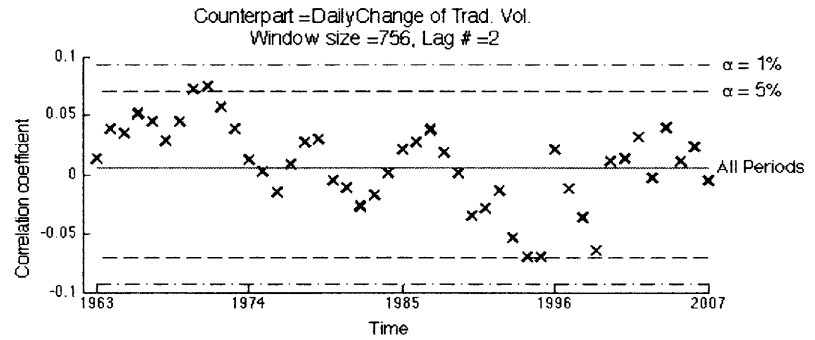
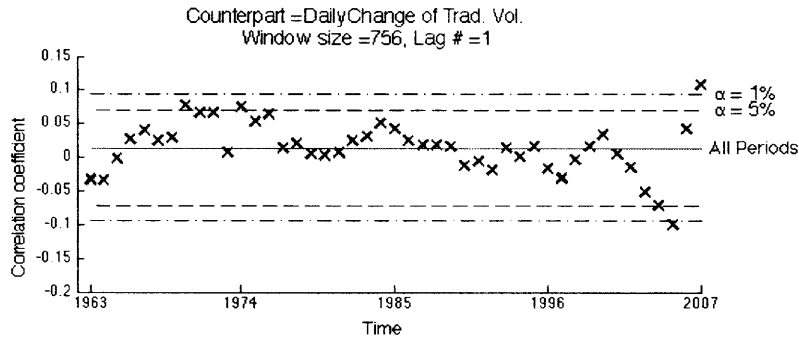
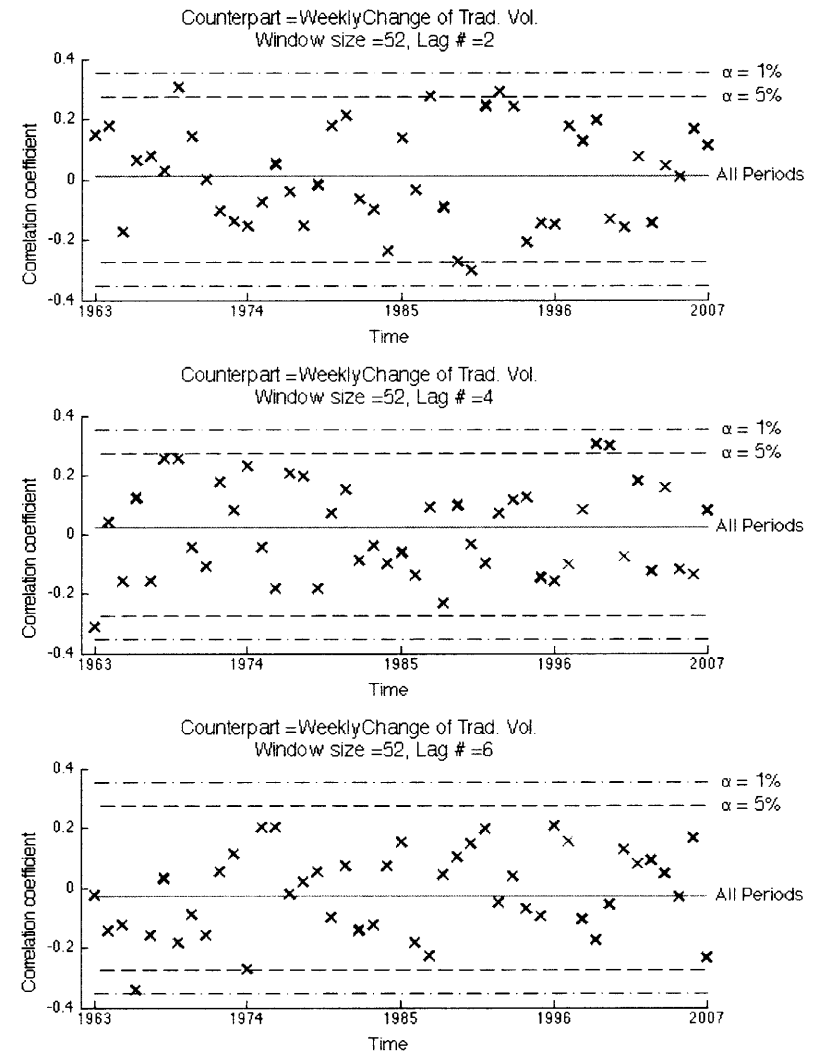
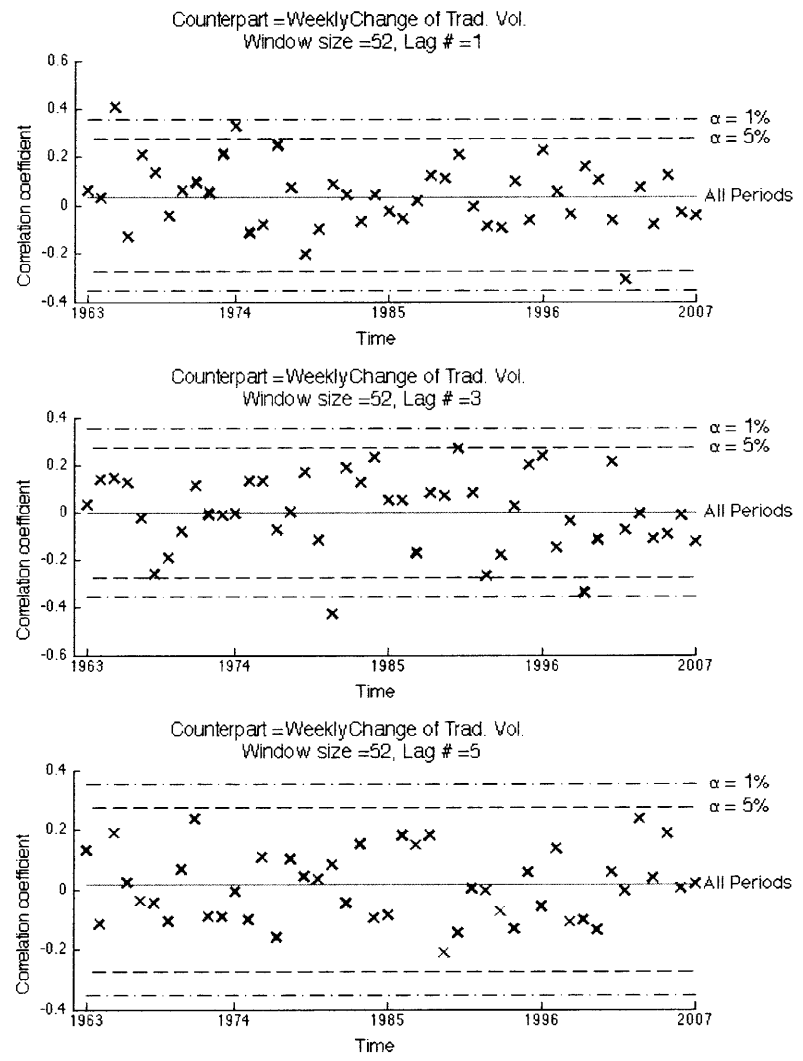


Figure A-23: Change of Correlation with Change of Trading Volume  
 (Period = Weekly, Time Window = 1 year)



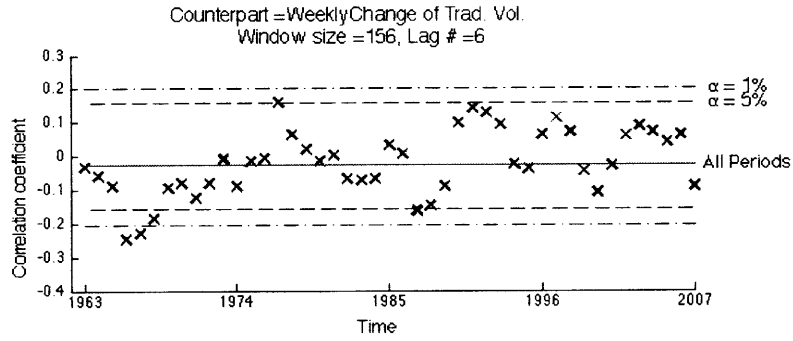
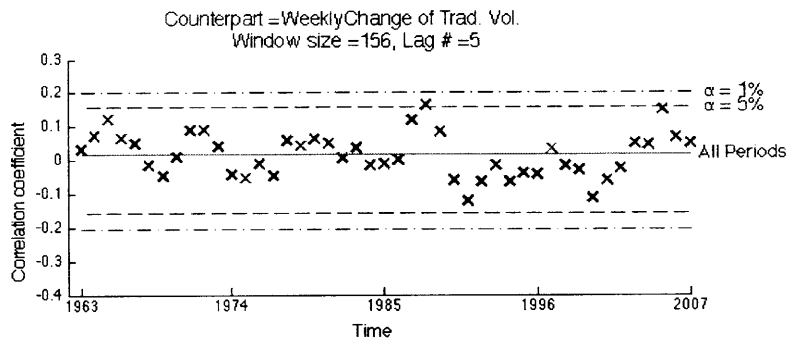
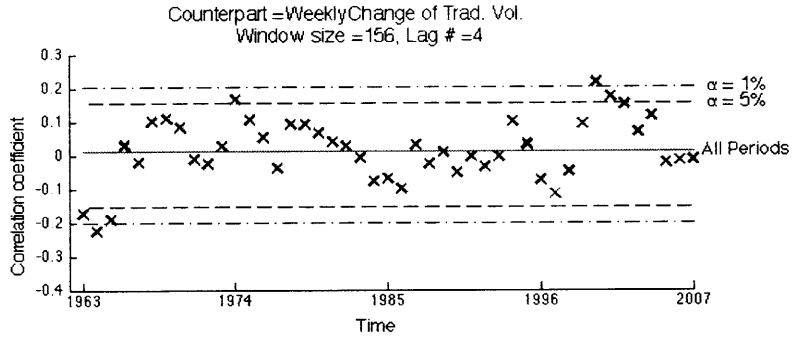
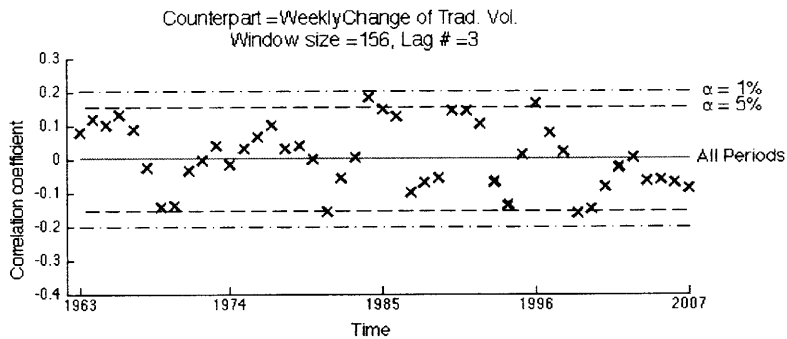
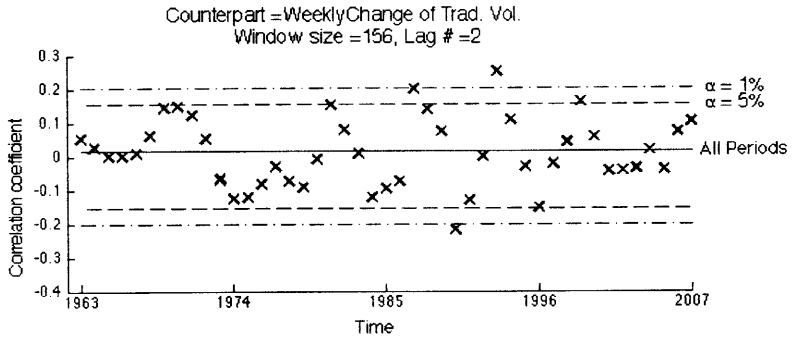
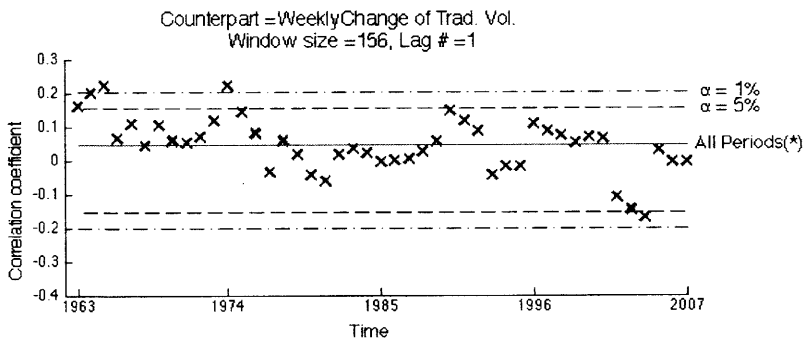


Figure A-24: Change of Correlation with Change of Trading Volume  
(Period = Weekly, Time Window = 3 years)

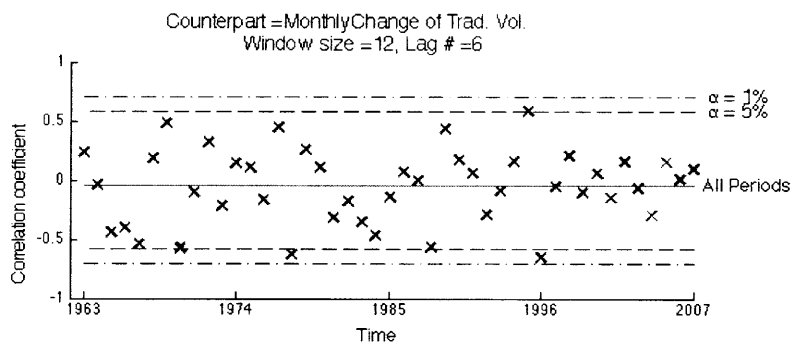
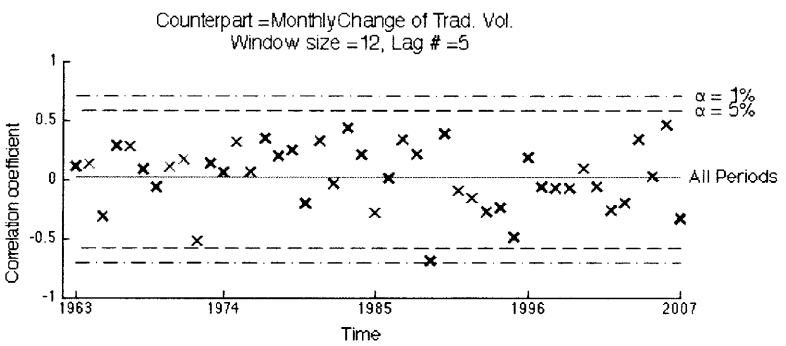
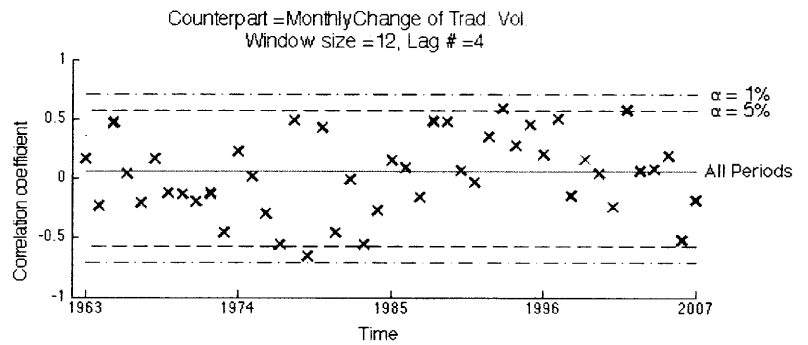
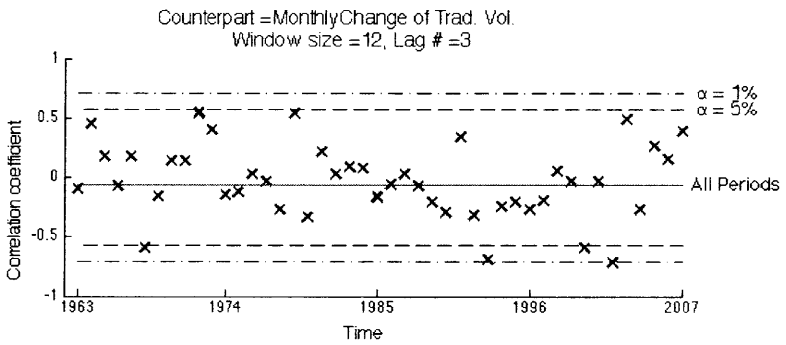
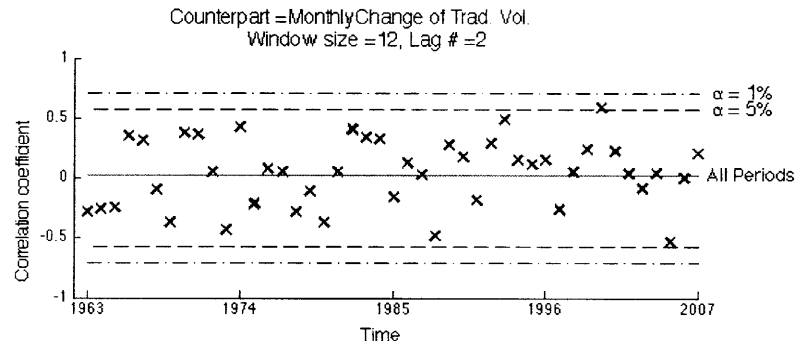
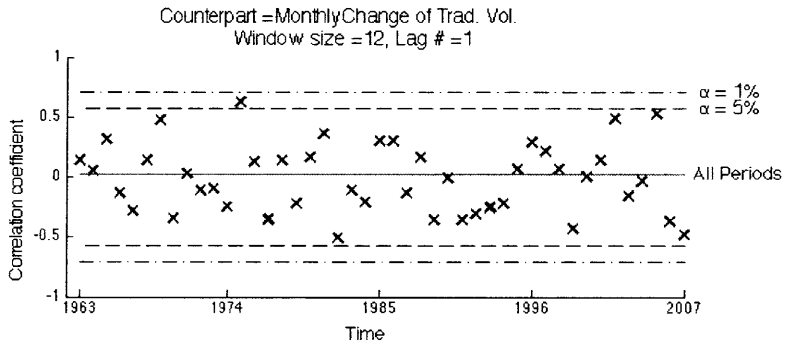


Figure A-25: Change of Correlation with Change of Trading Volume  
(Period = Monthly, Time Window = 1 year)

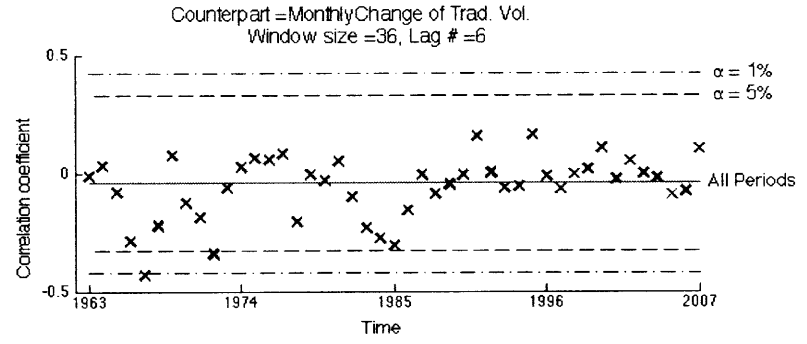
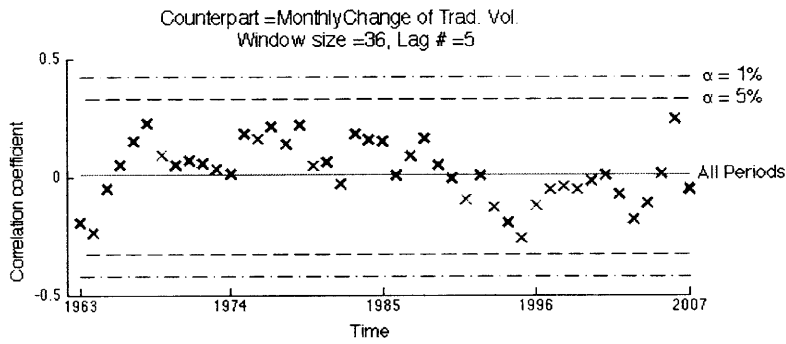
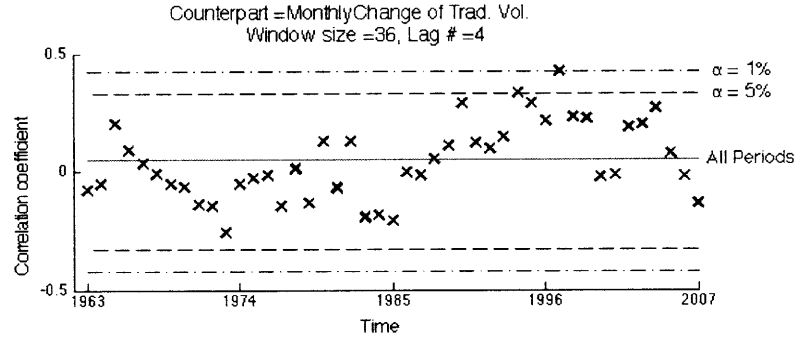
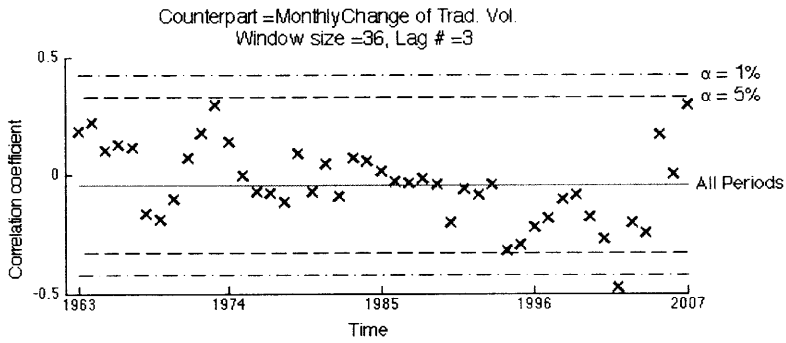
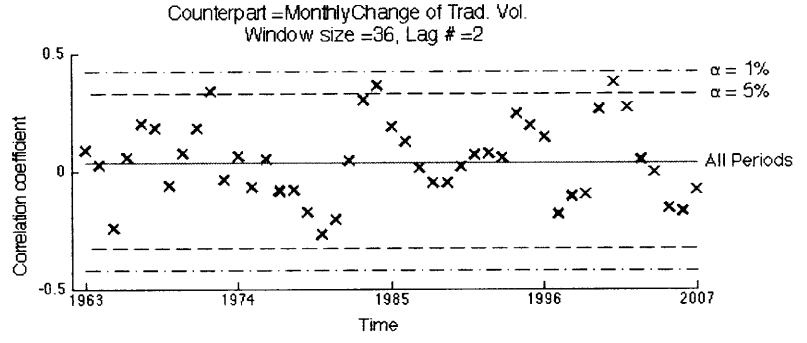
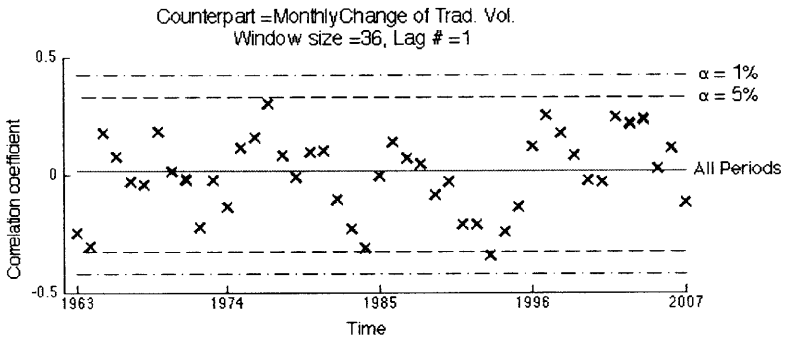


Figure A-26: Change of Correlation with Change of Trading Volume  
(Period = Monthly, Time Window = 3 years)

Figure A-27: Change of Correlation with Change of Trading Volume  
 (Period = Quarterly, Time Window = 3 years)

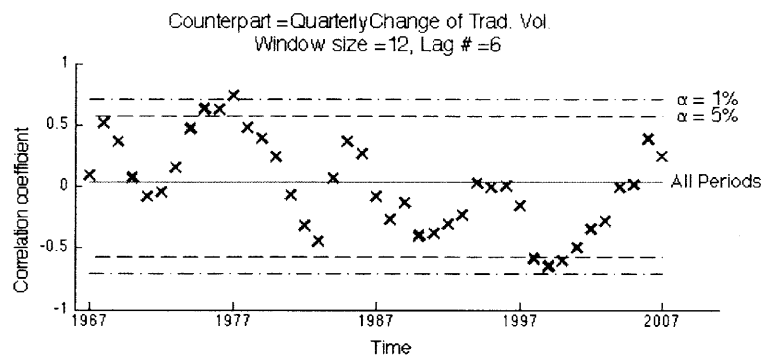
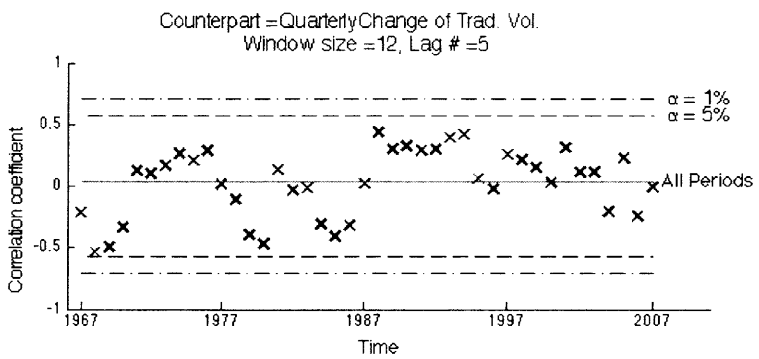
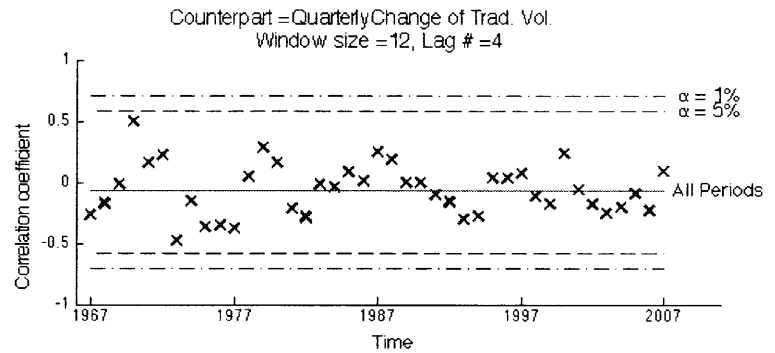
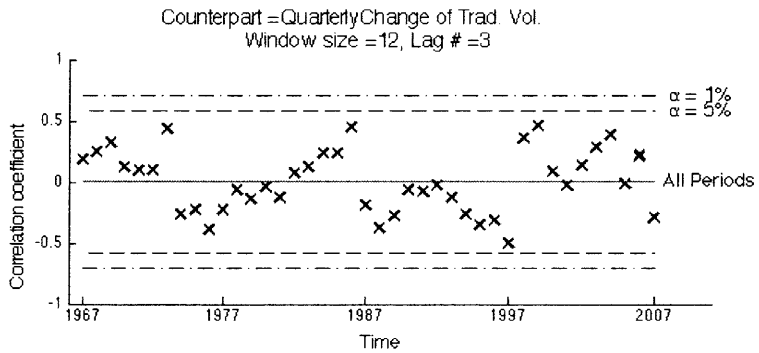
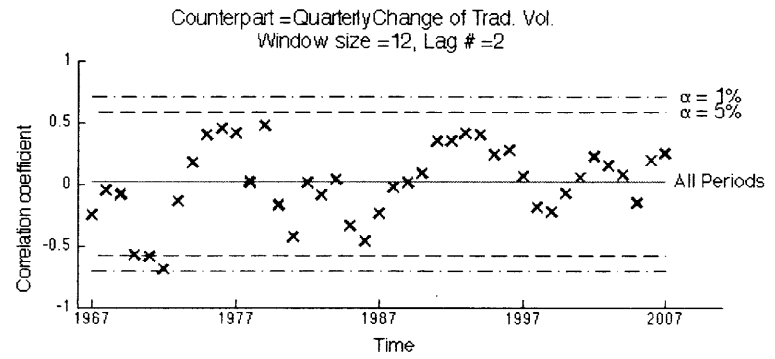
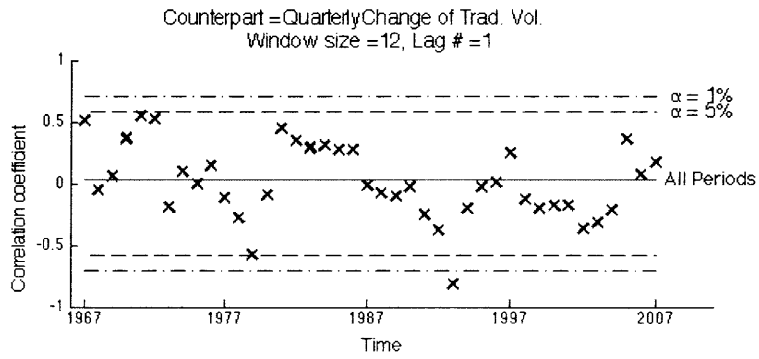




Figure A-28: Change of Correlation with Change of Trading Volume  
 (Period = Quarterly, Time Window = 5 years)  
 153

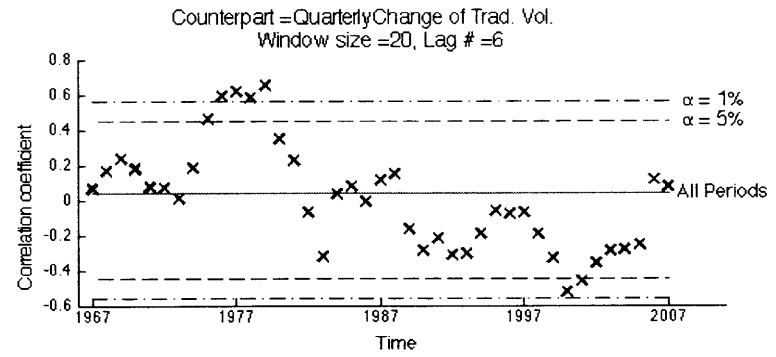
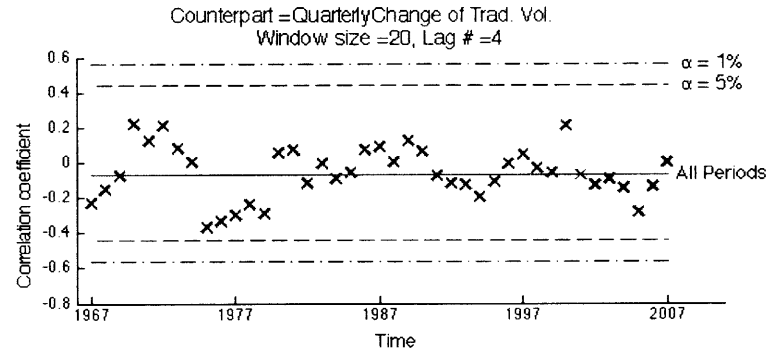
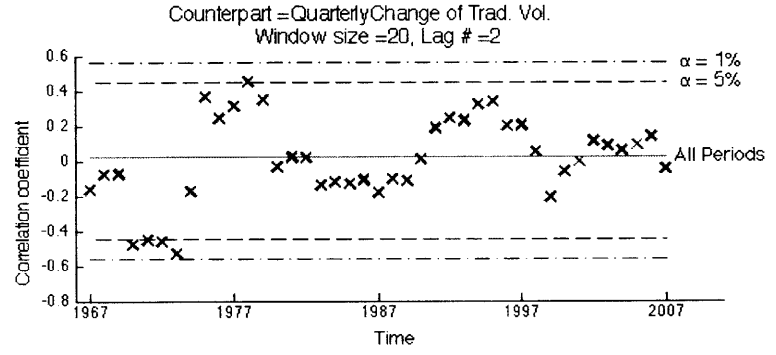
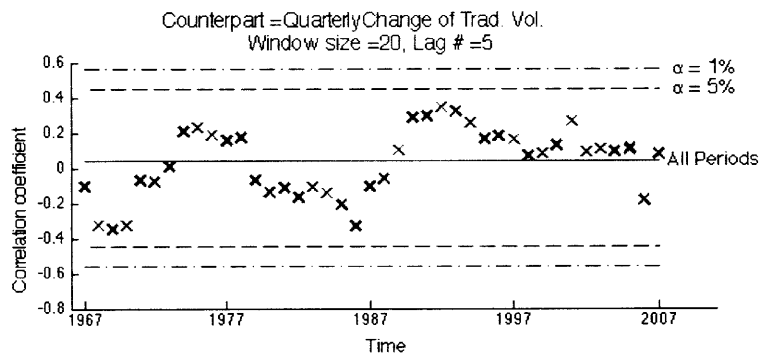
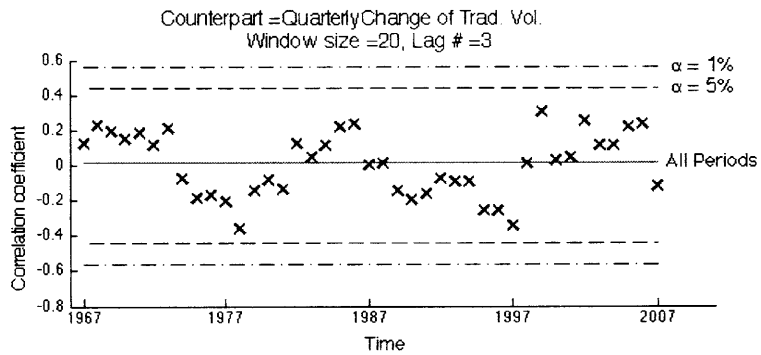
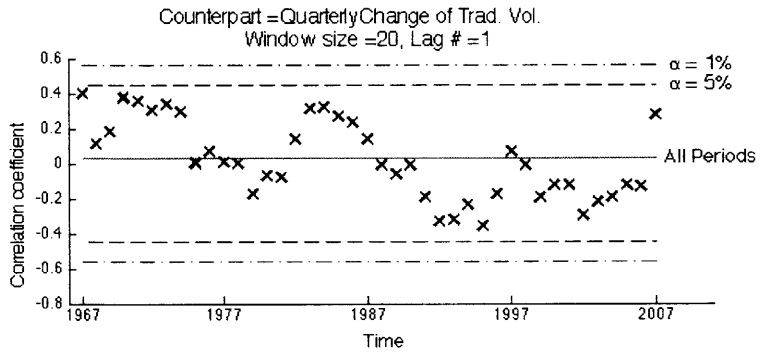
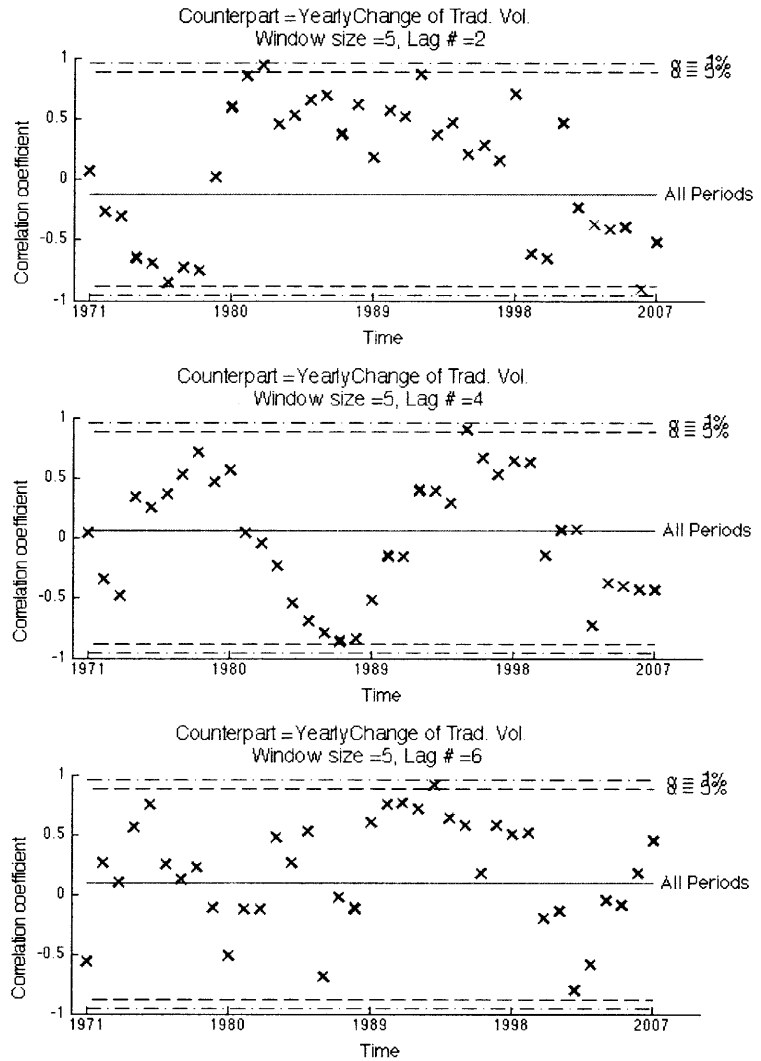
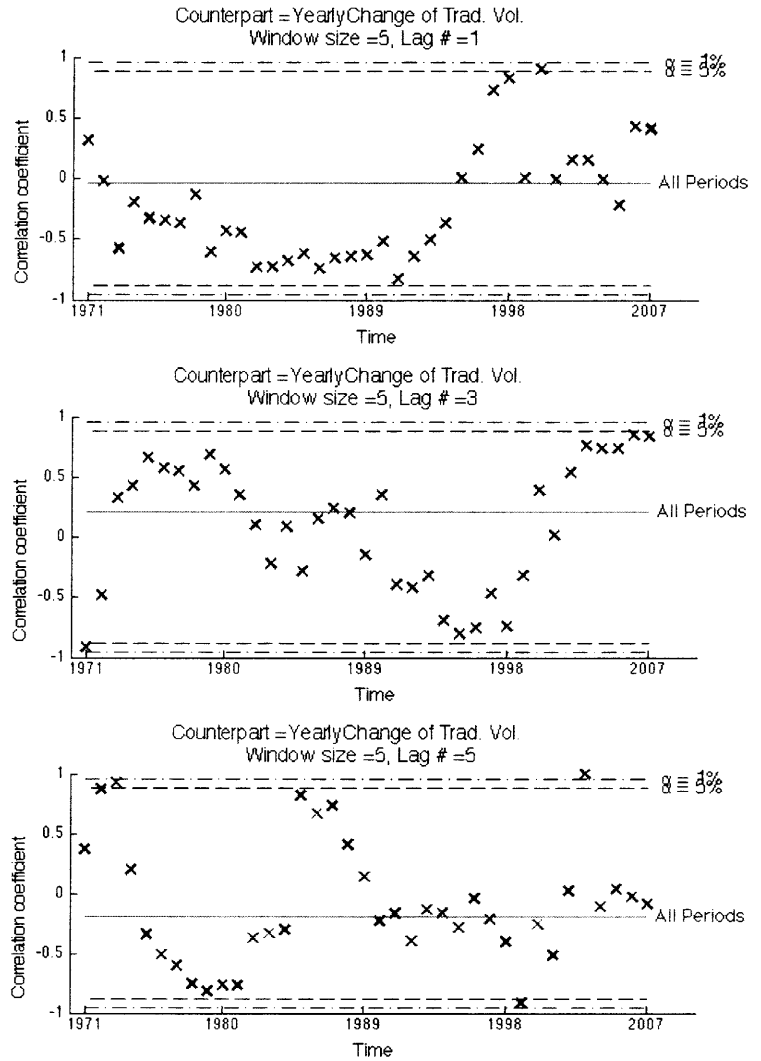


Figure A-29: Change of Correlation with Change of Trading Volume  
 (Period = Yearly, Time Window = 5 years)



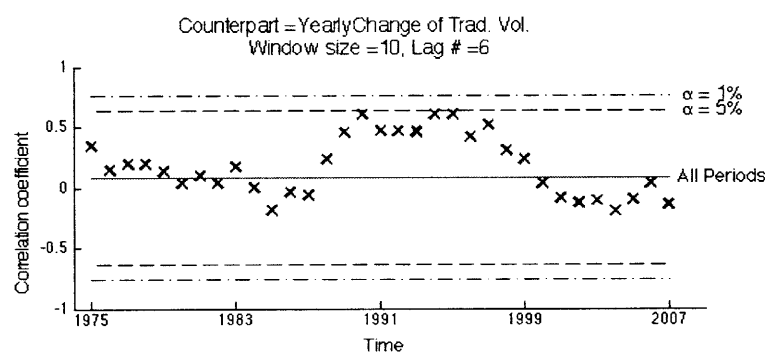
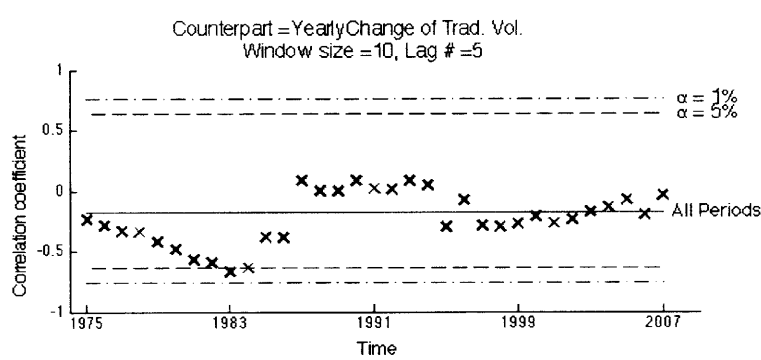
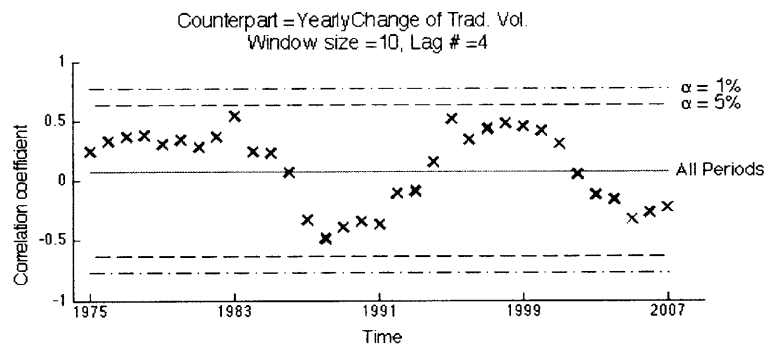
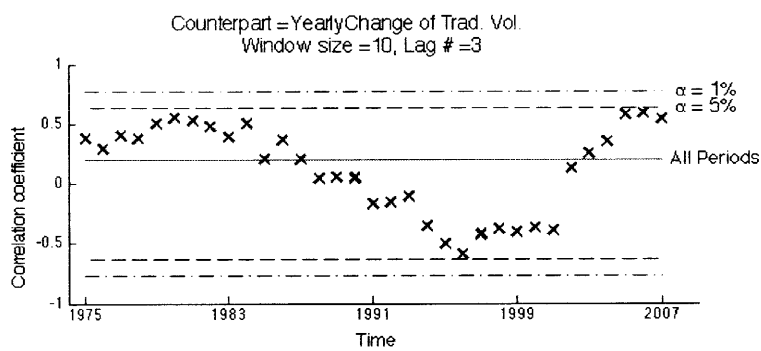
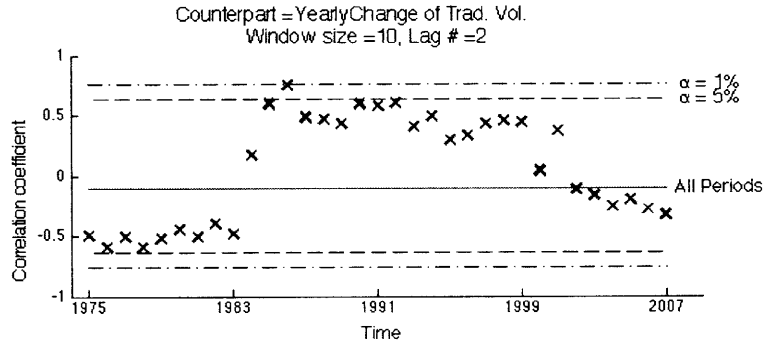
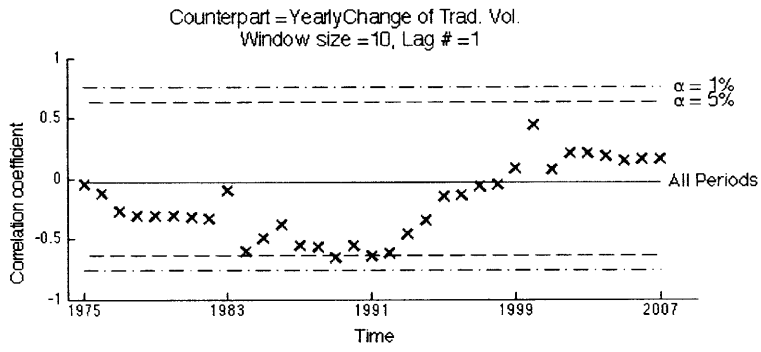


Figure A-30: Change of Correlation with Change of Trading Volume  
(Period = Yearly, Time Window = 10 years)

## A.4 Correlation Analysis between the S&P 500 Stock Index Returns and the 13-Week Treas- ury Bill Rates

Figure A-31: Change of Correlation with Risk-free Rate  
 (Period = Daily, Time Window = 1 year)  
 157

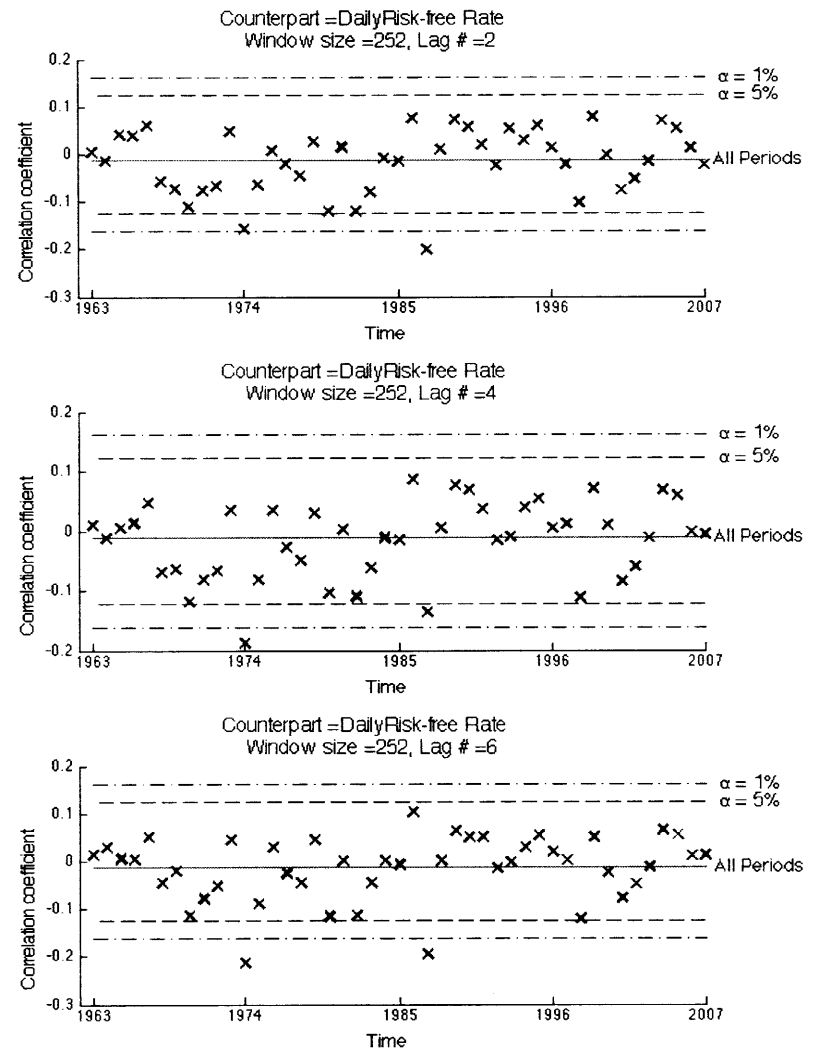
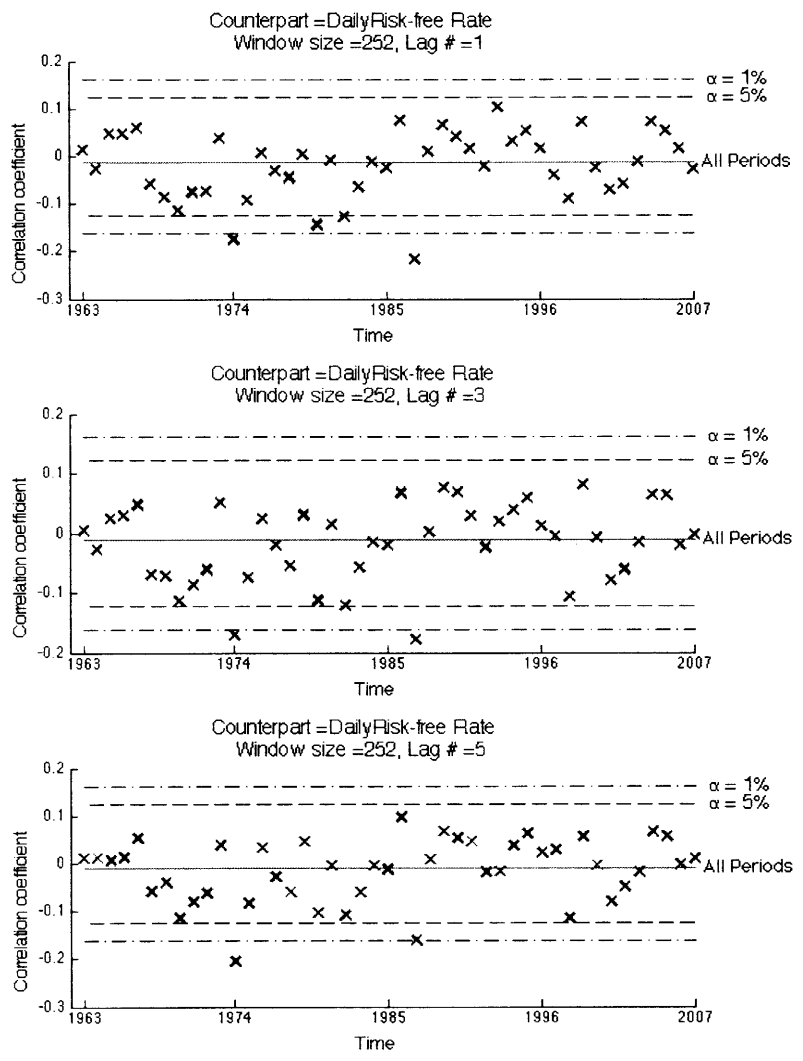


Figure A-32: Change of Correlation with Risk-free Rate  
 (Period = Daily, Time Window = 3 years)

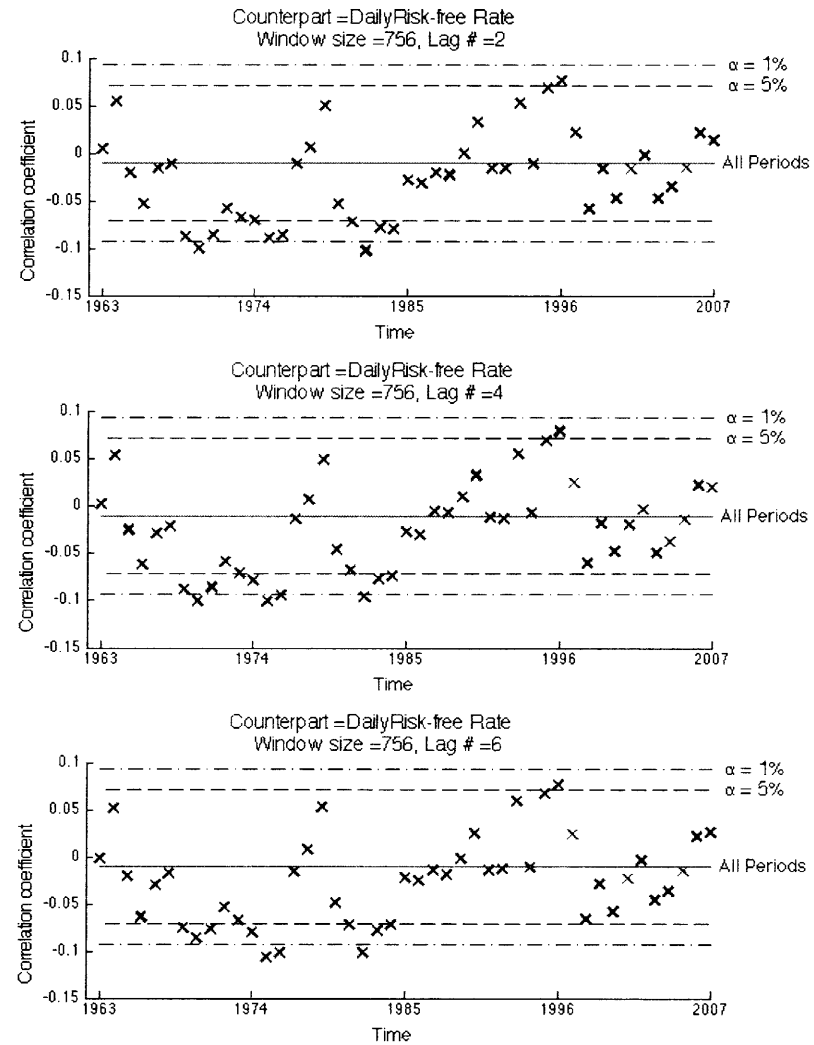
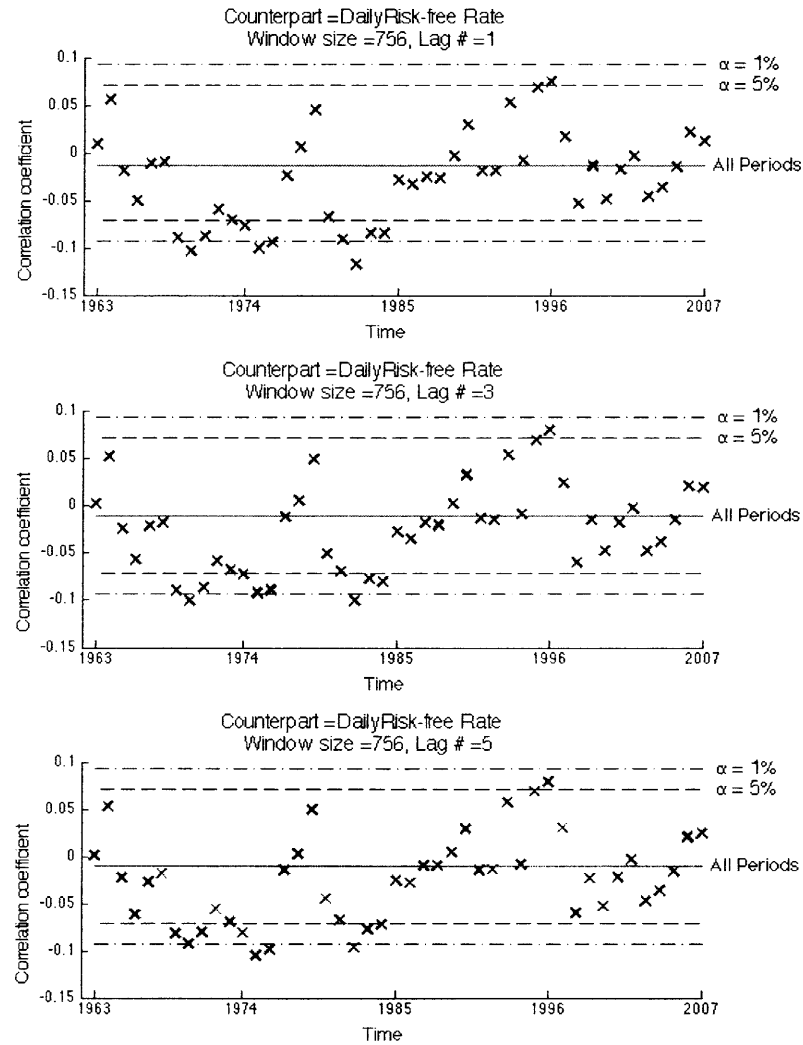


Figure A-33: Change of Correlation with Risk-free Rate  
 (Period = Weekly, Time Window = 1 year)  
 159

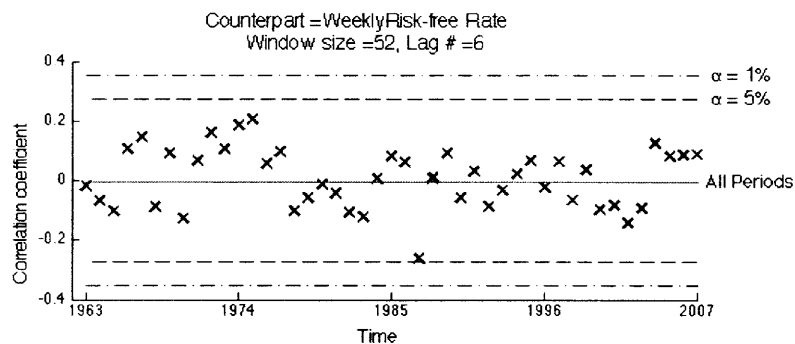
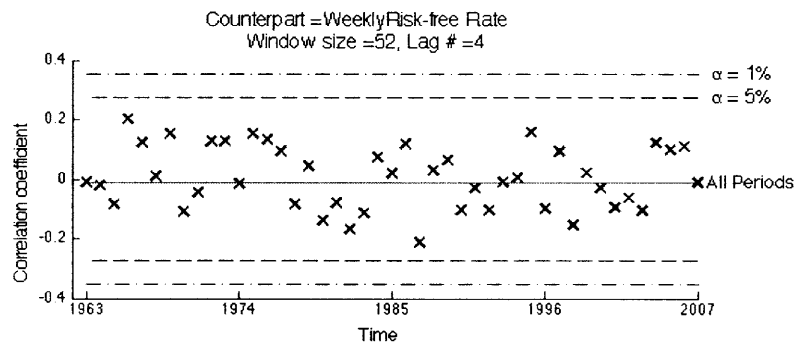
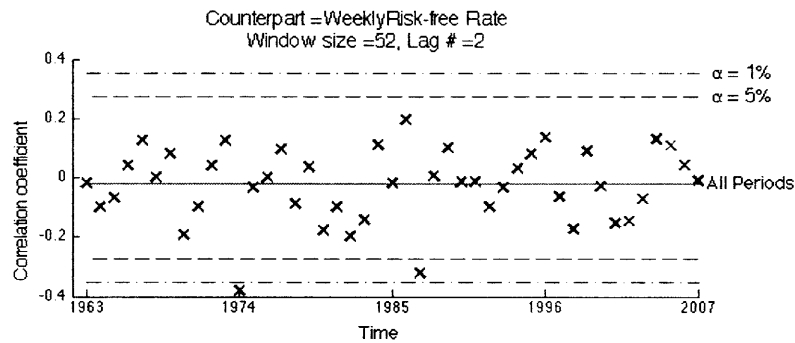
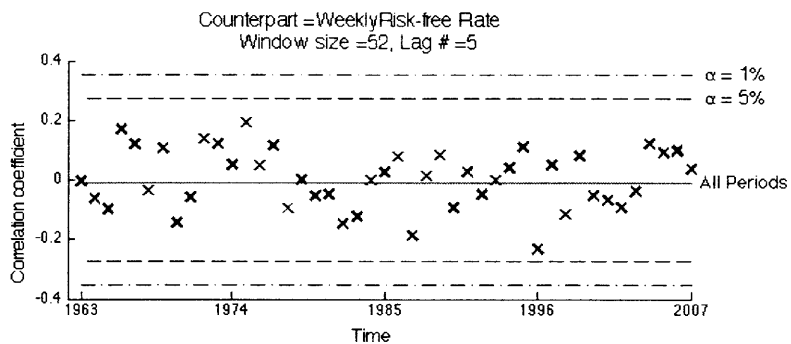
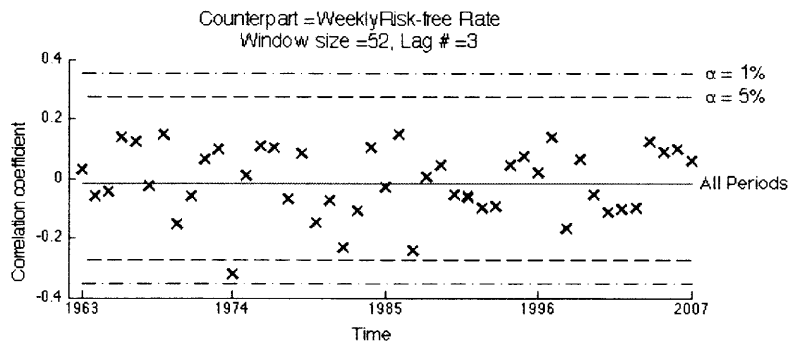
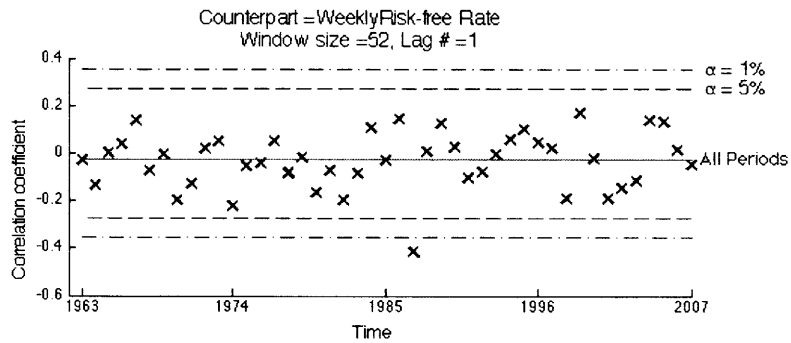
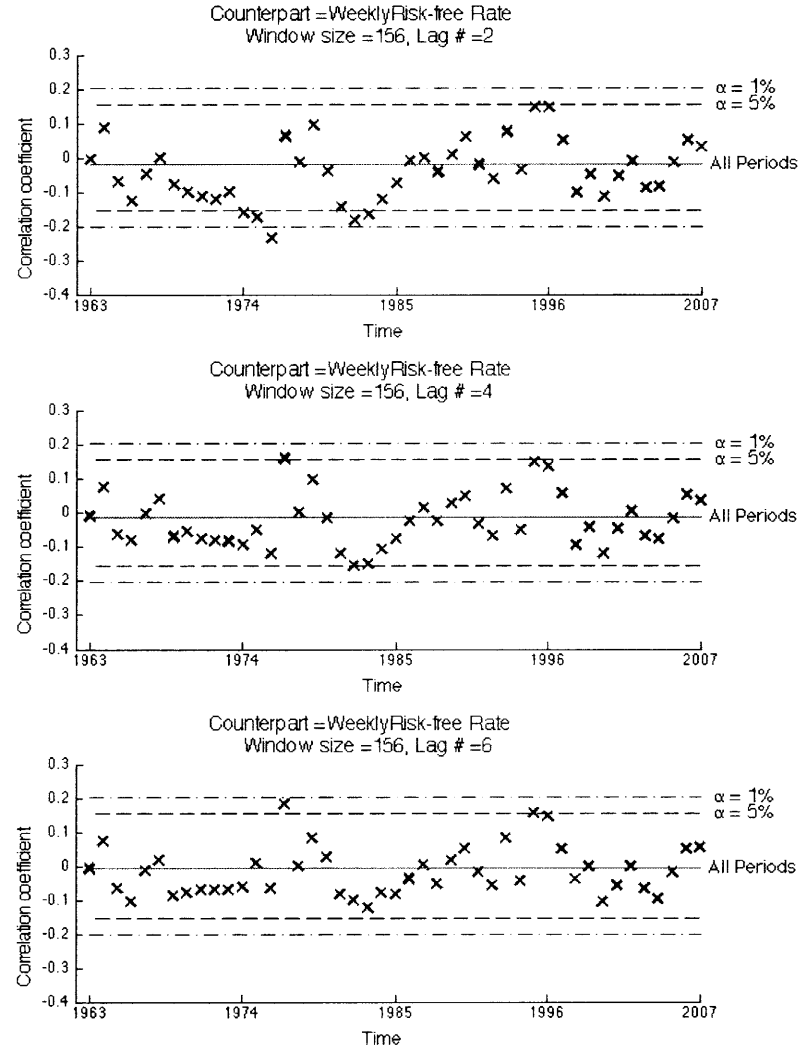
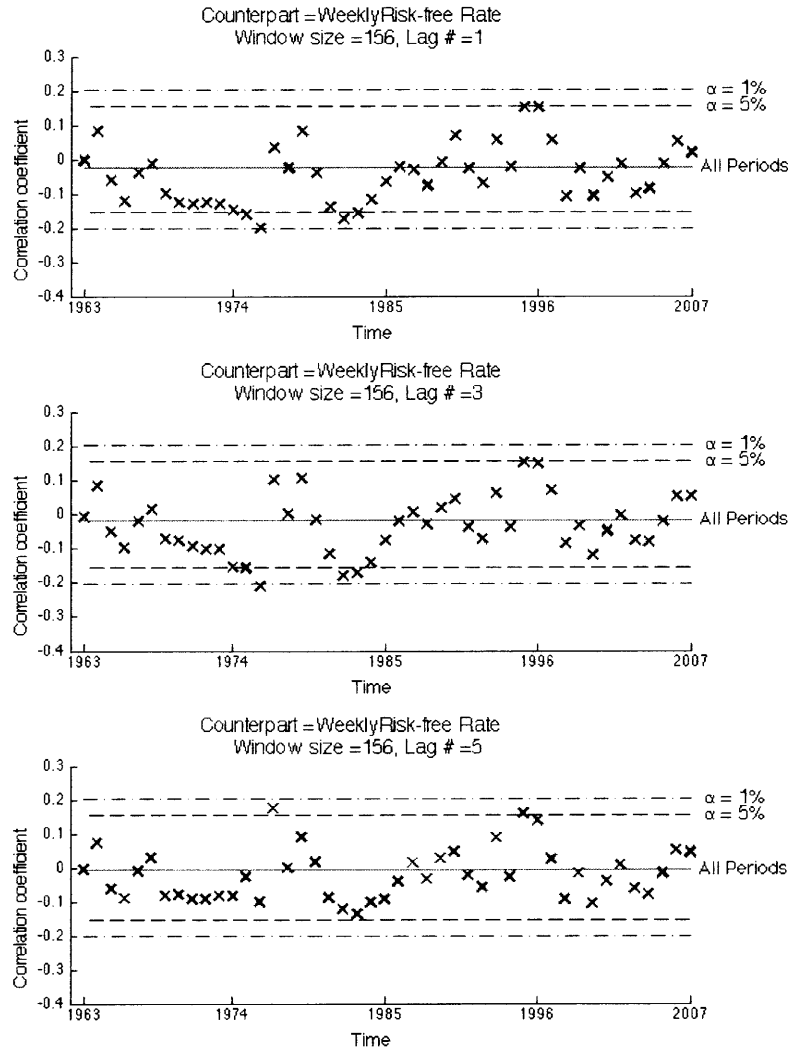


Figure A-34: Change of Correlation with Risk-free Rate  
 (Period = Weekly, Time Window = 3 years)





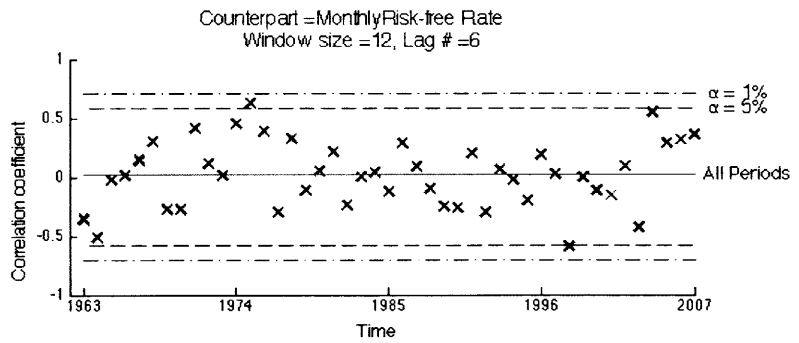
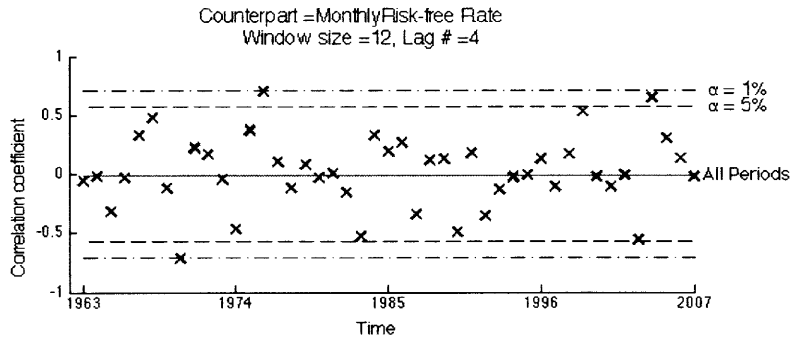
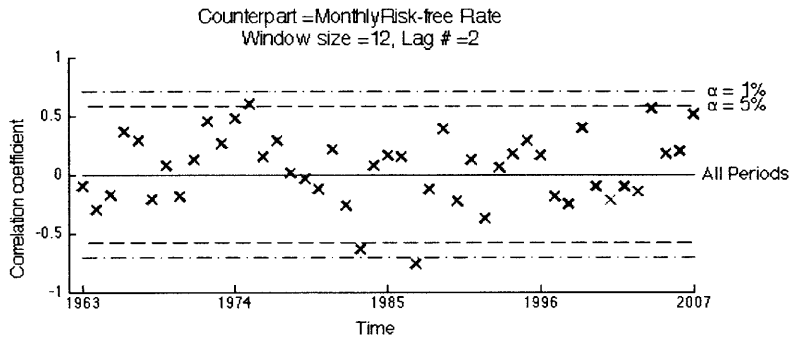
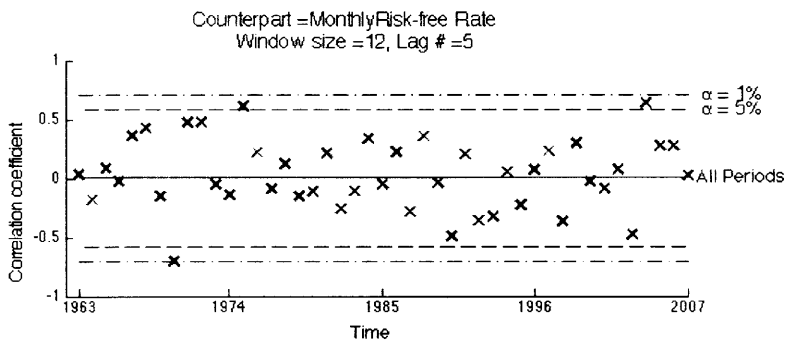
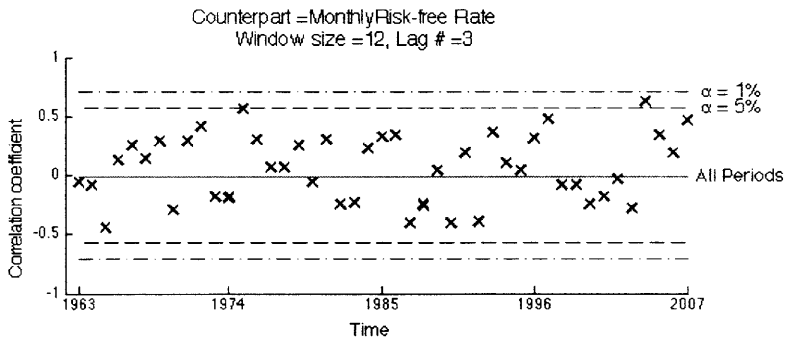
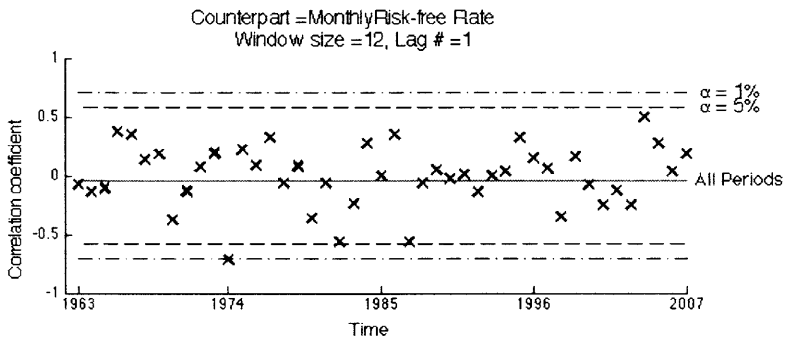


Figure A-35: Change of Correlation with Risk-free Rate  
(Period = Monthly, Time Window = 1 year)

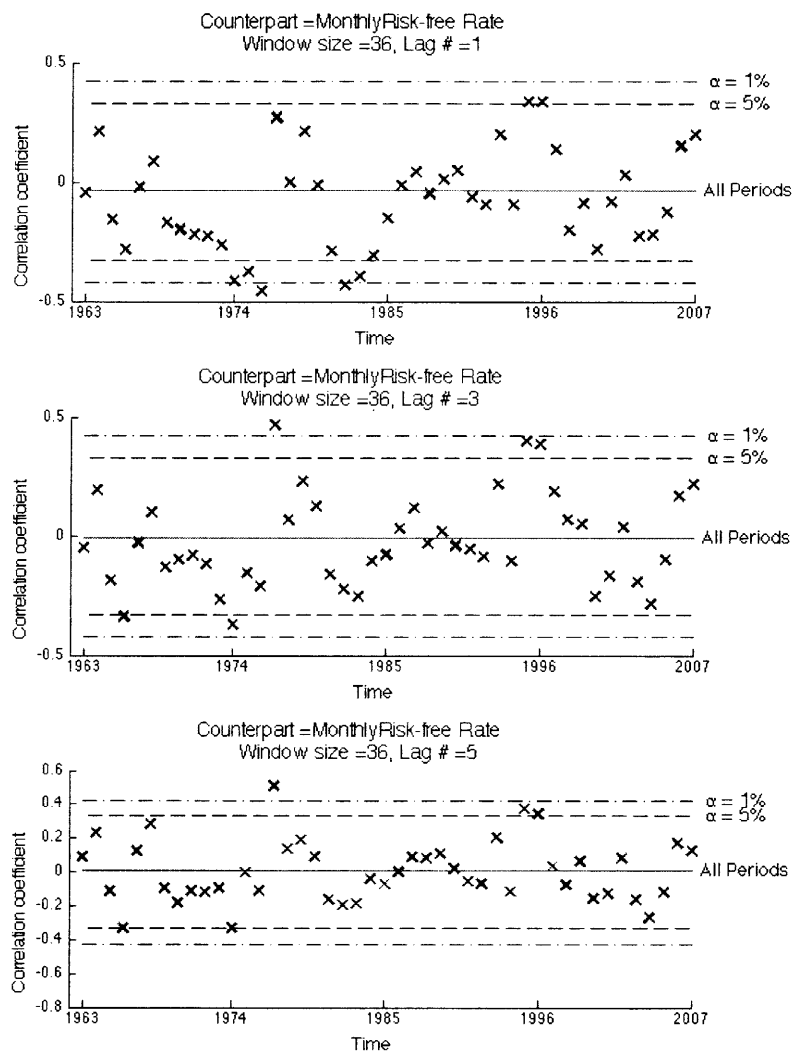
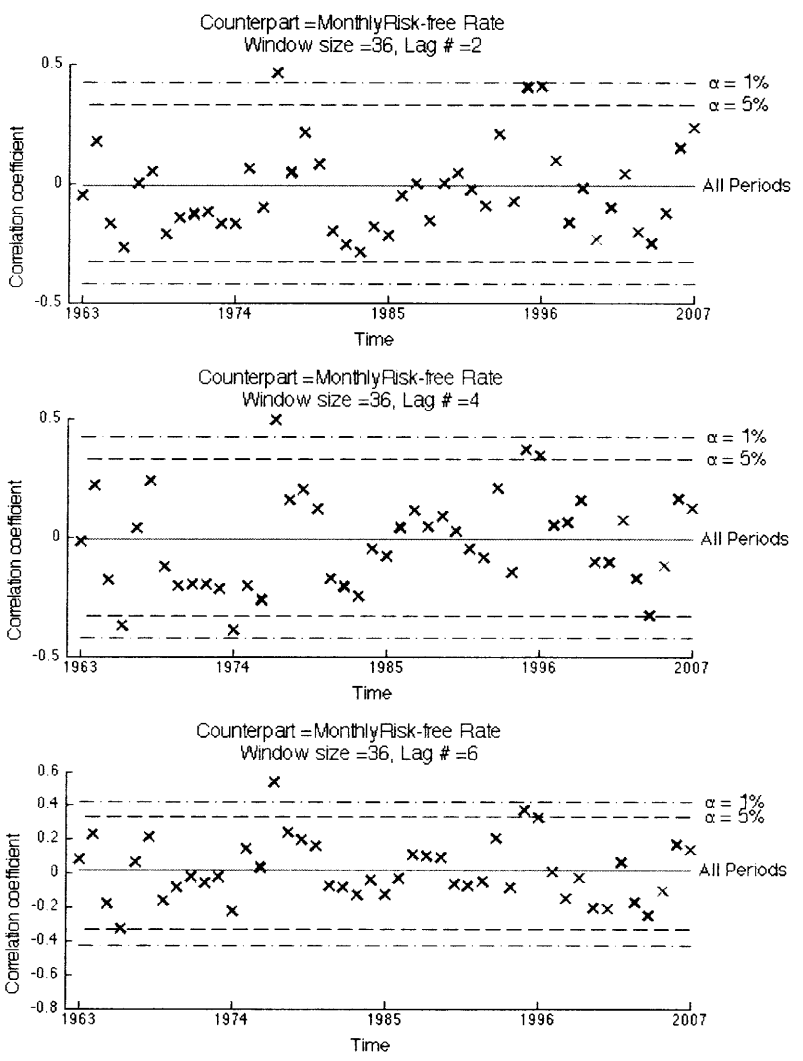


Figure A-36: Change of Correlation with Risk-free Rate  
(Period = Monthly, Time Window = 3 years)

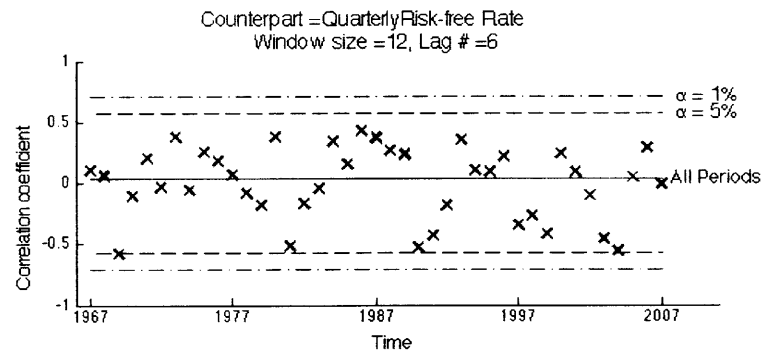
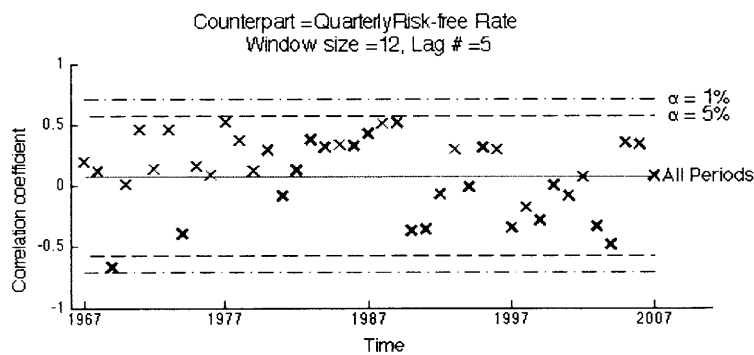
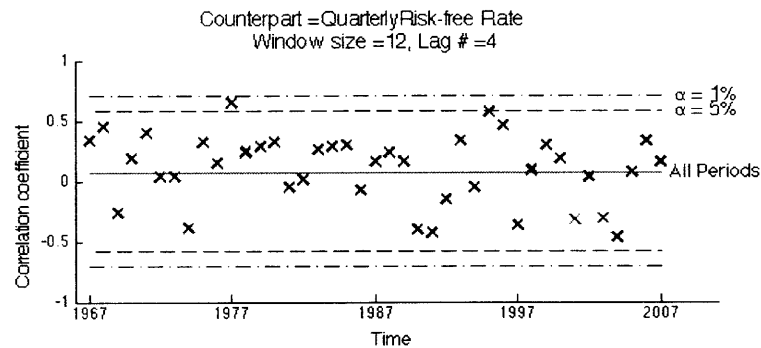
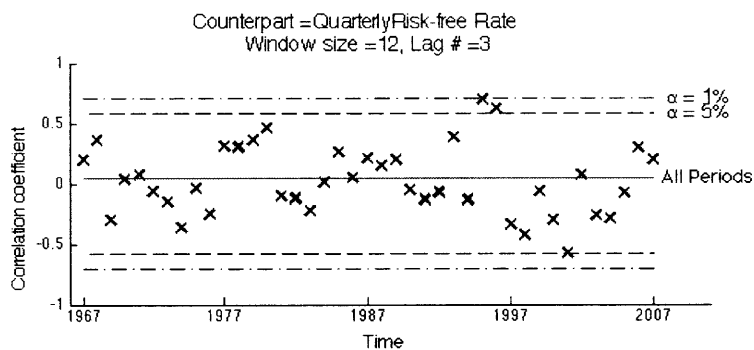
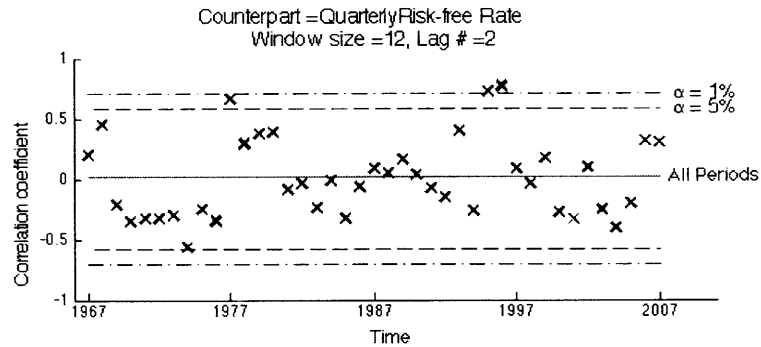
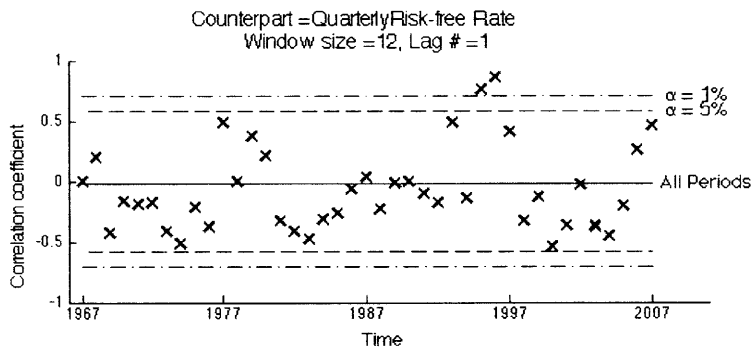


Figure A-37: Change of Correlation with Risk-free Rate  
(Period = Quarterly, Time Window = 3 years)

Figure A-38: Change of Correlation with Risk-free Rate  
 (Period = Quarterly, Time Window = 5 years)

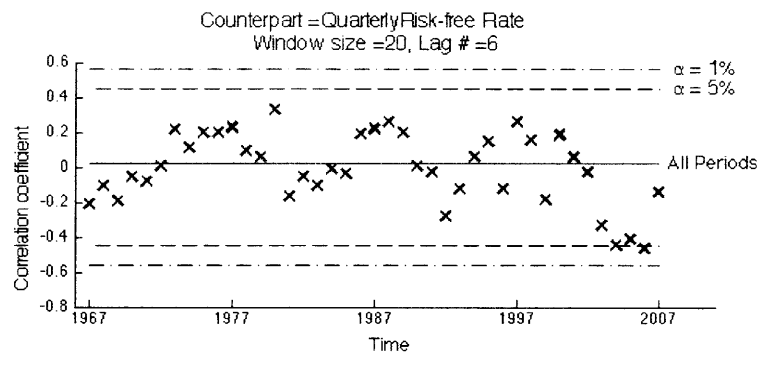
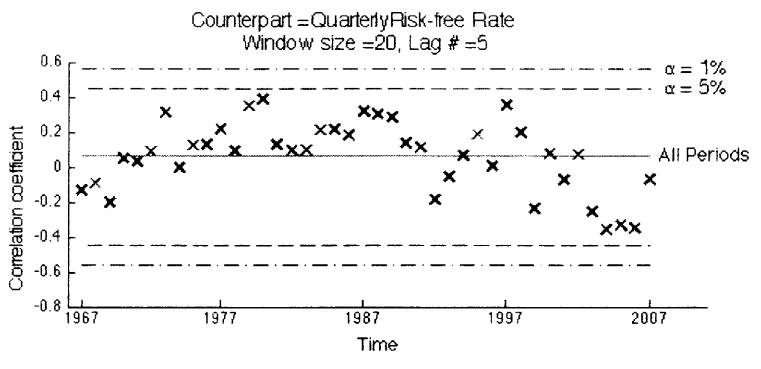
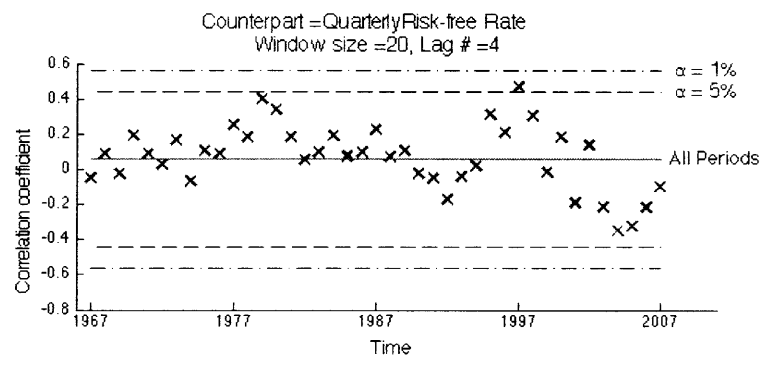
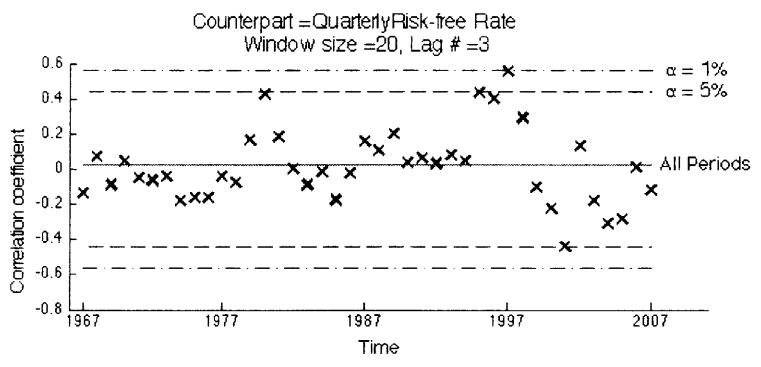
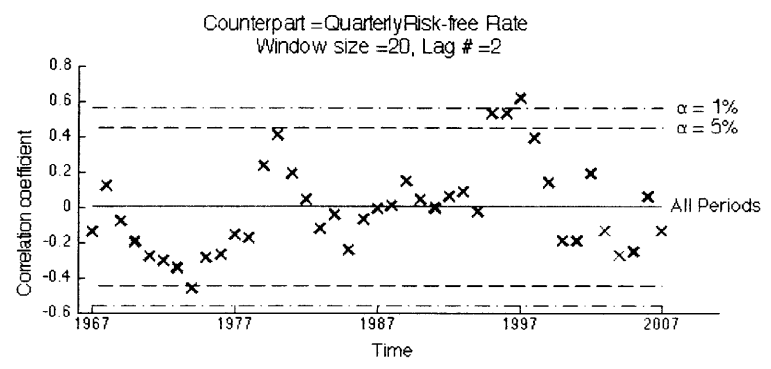
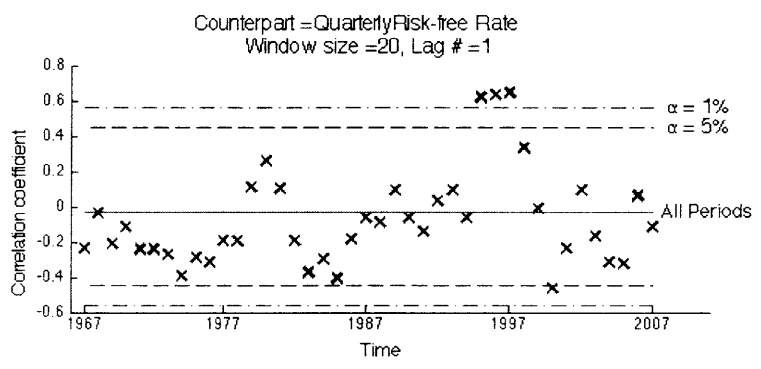
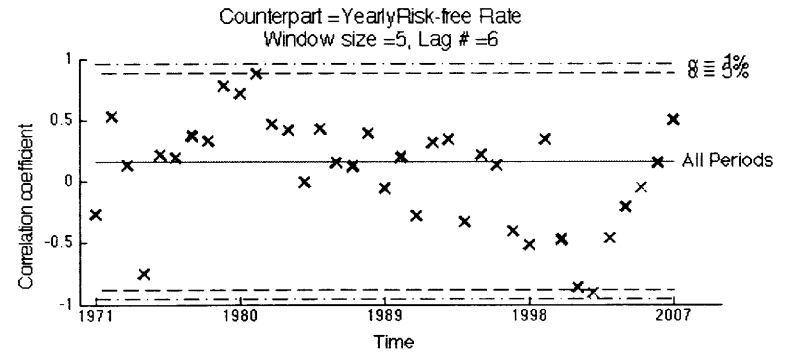
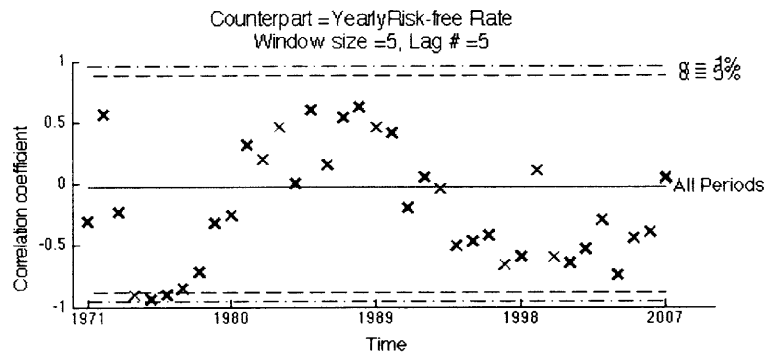
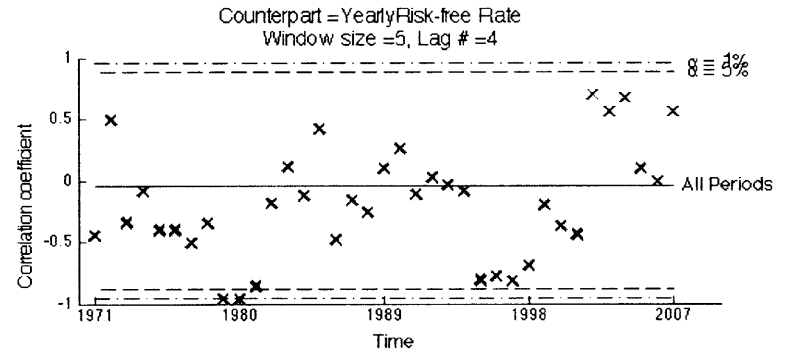
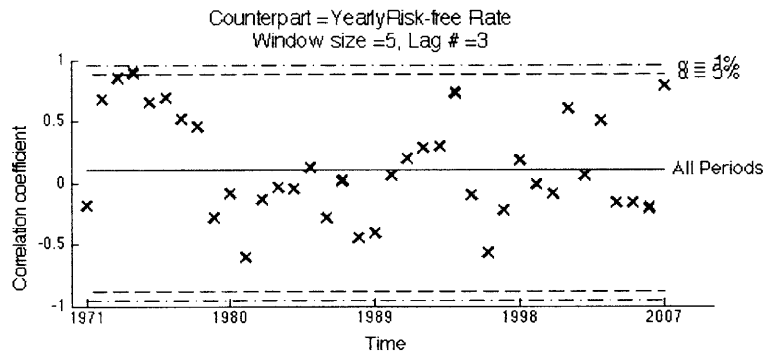
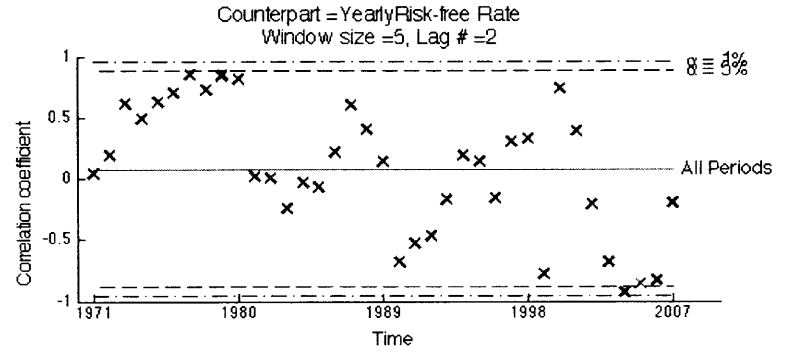
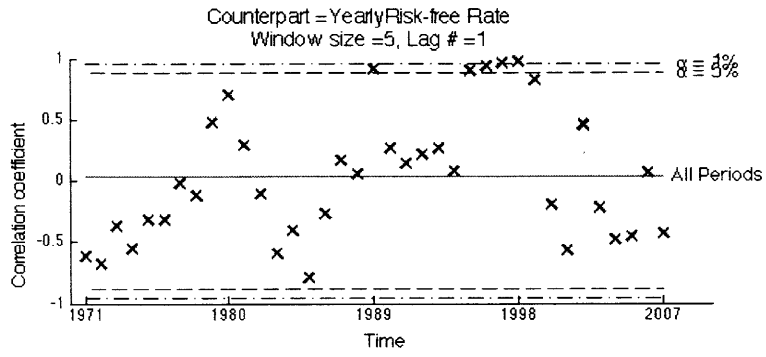


Figure A-39: Change of Correlation with Risk-free Rate  
 (Period = Yearly, Time Window = 5 years)  
 165



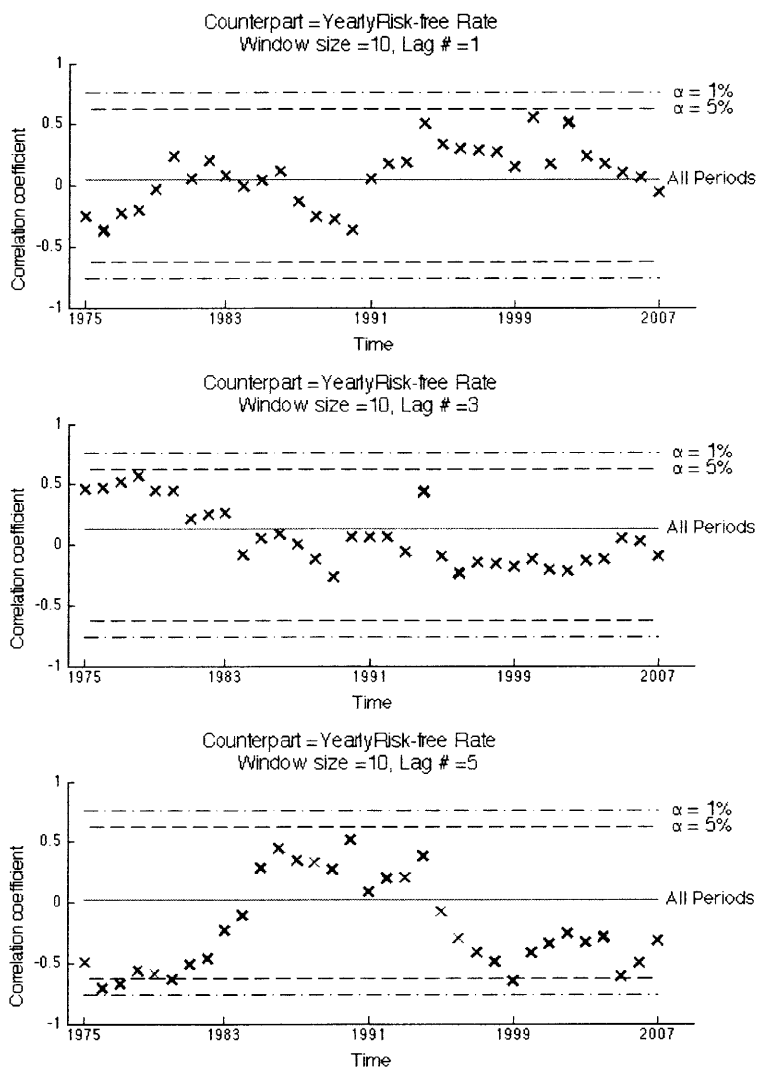
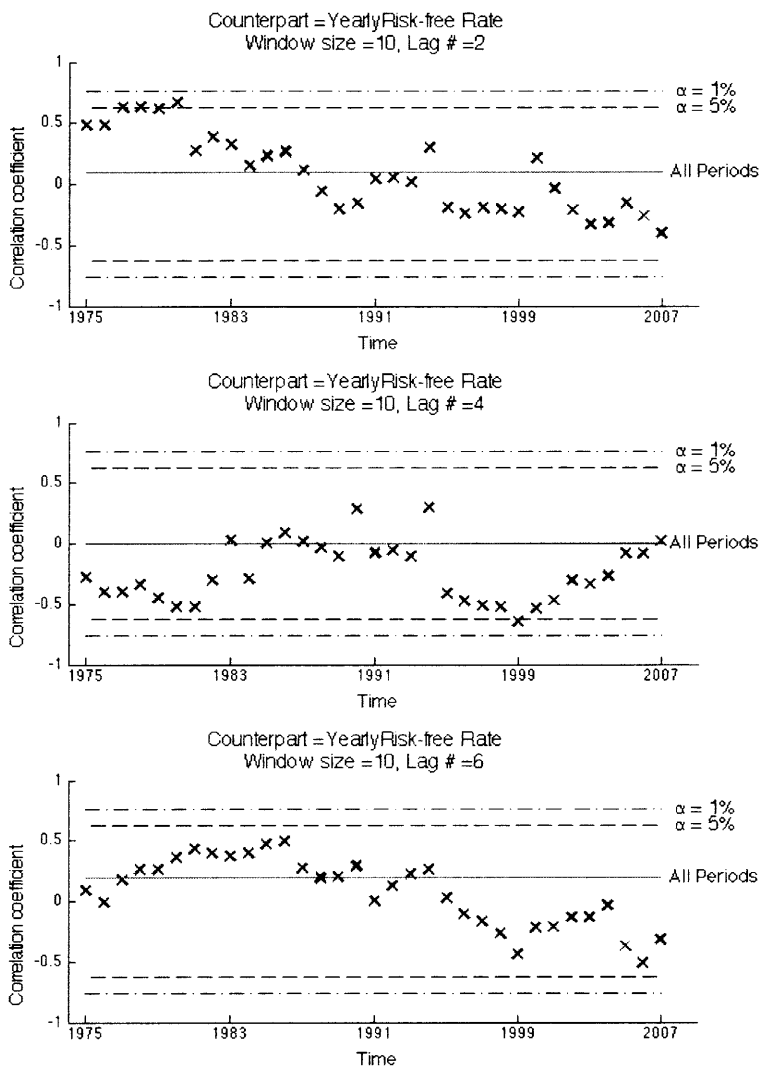


Figure A-40: Change of Correlation with Risk-free Rate  
(Period = Yearly, Time Window = 10 years)

## **A.5 Correlation Analysis between the S&P 500 Stock Index Returns and the Change of the 13-Week Treasury Bill Rates**

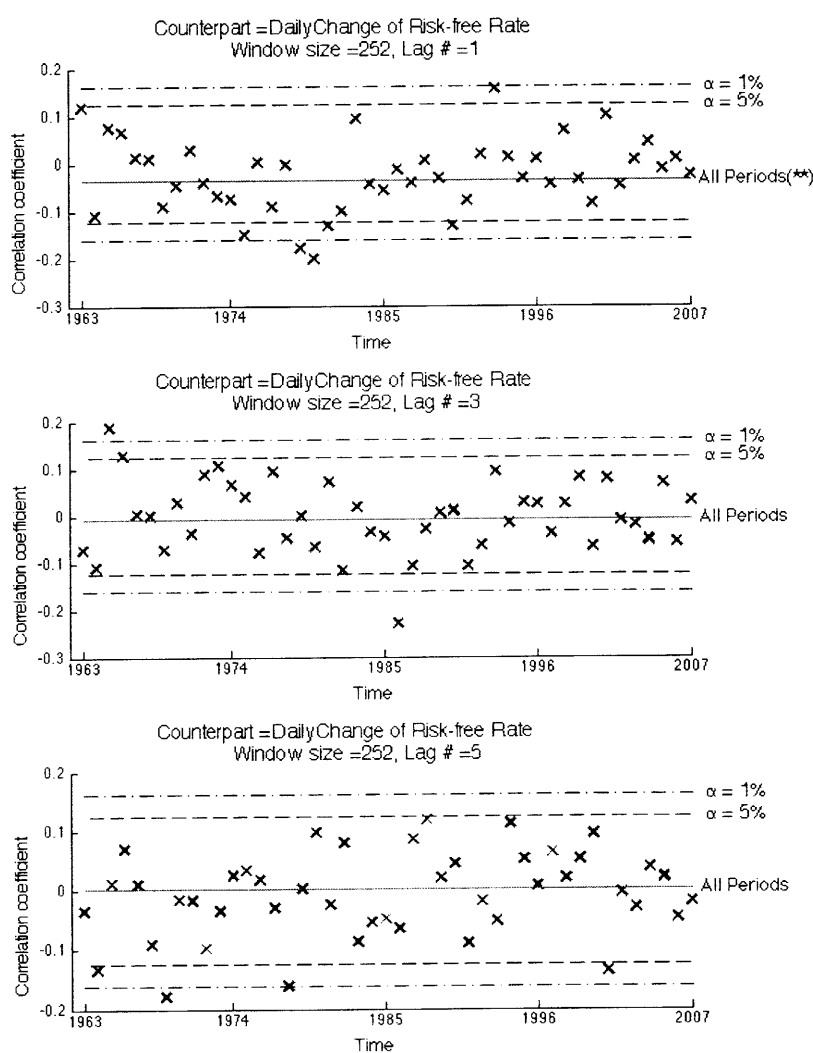
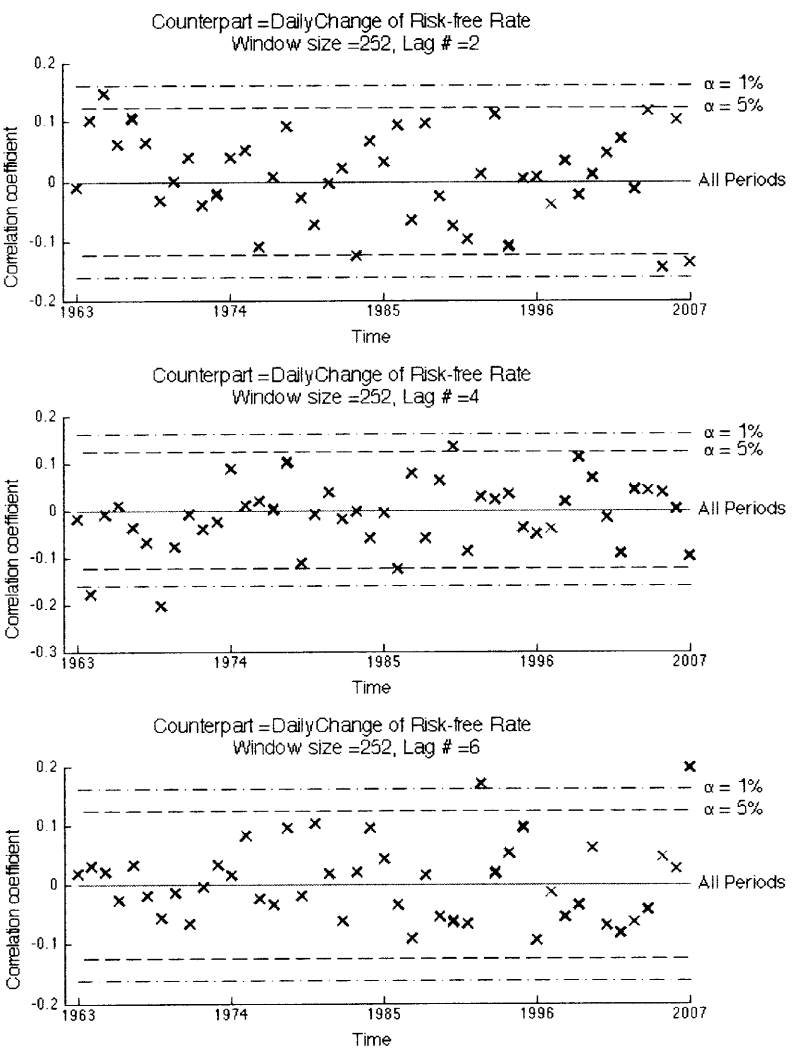
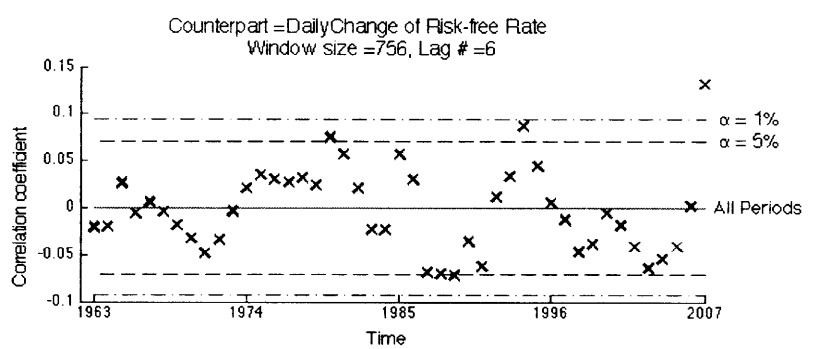
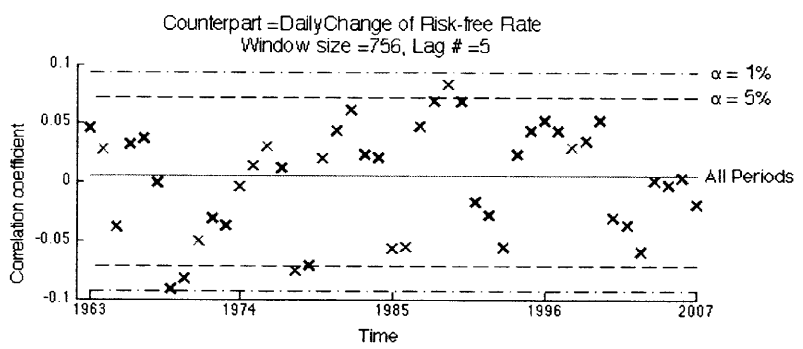
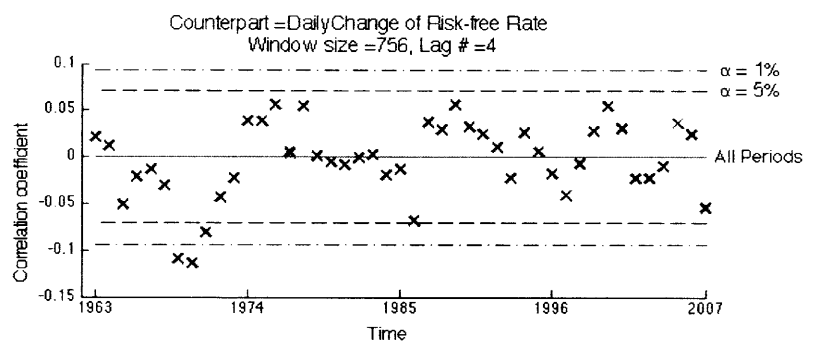
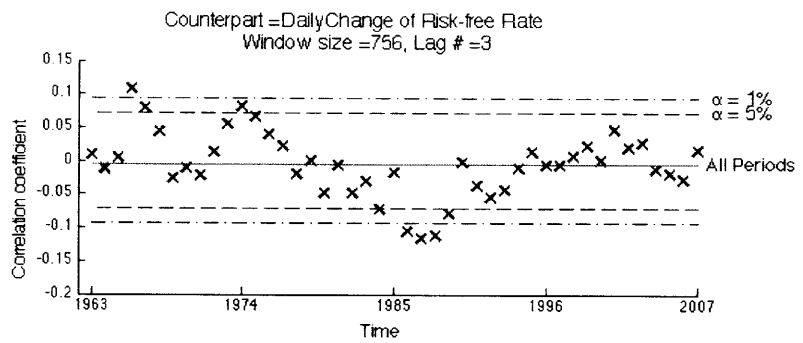
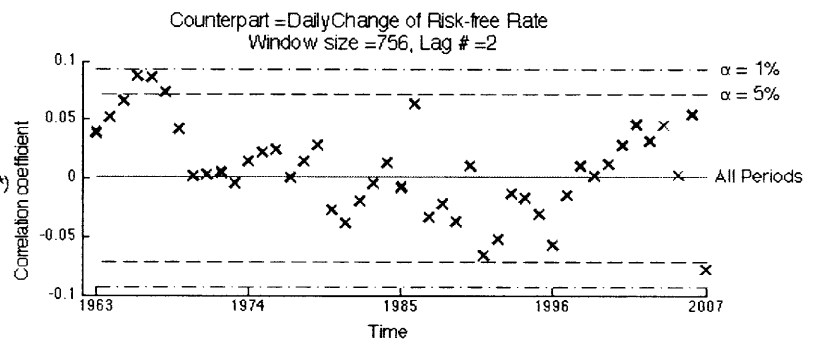
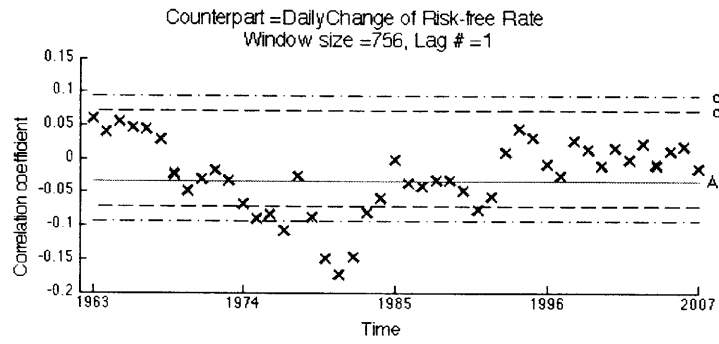


Figure A-41: Change of Correlation with Change of Risk-free Rate  
(Period = Daily, Time Window = 1 year)



Figure A-42: Change of Correlation with Change of Risk-free Rate  
 (Period = Daily, Time Window = 3 years)  
 169



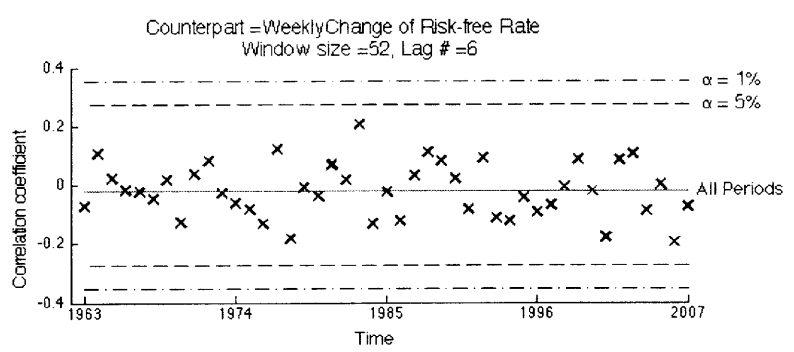
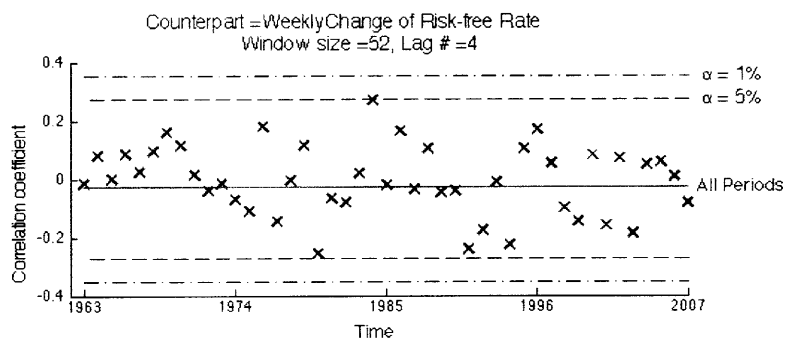
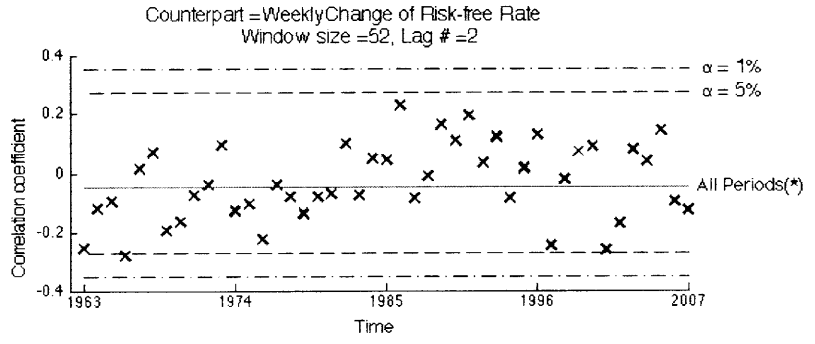
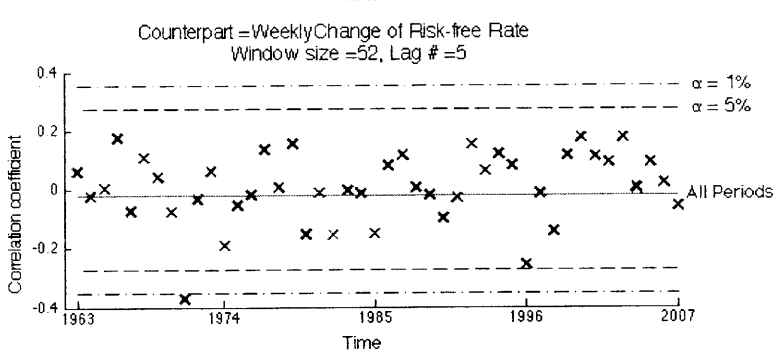
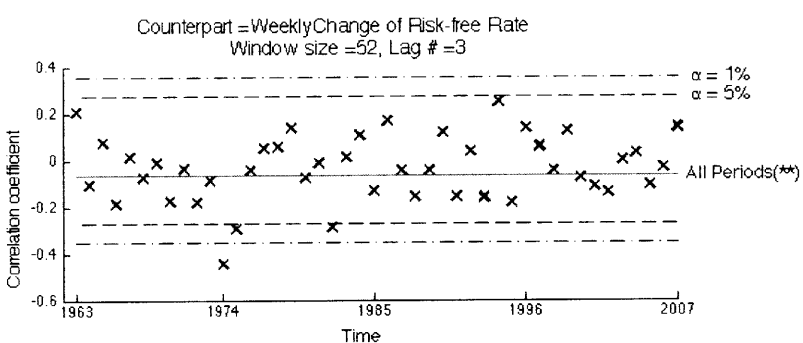
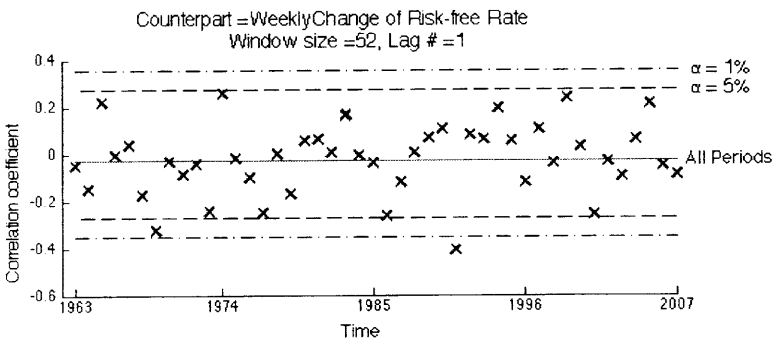


Figure A-43: Change of Correlation with Change of Risk-free Rate  
(Period = Weekly, Time Window = 1 year)

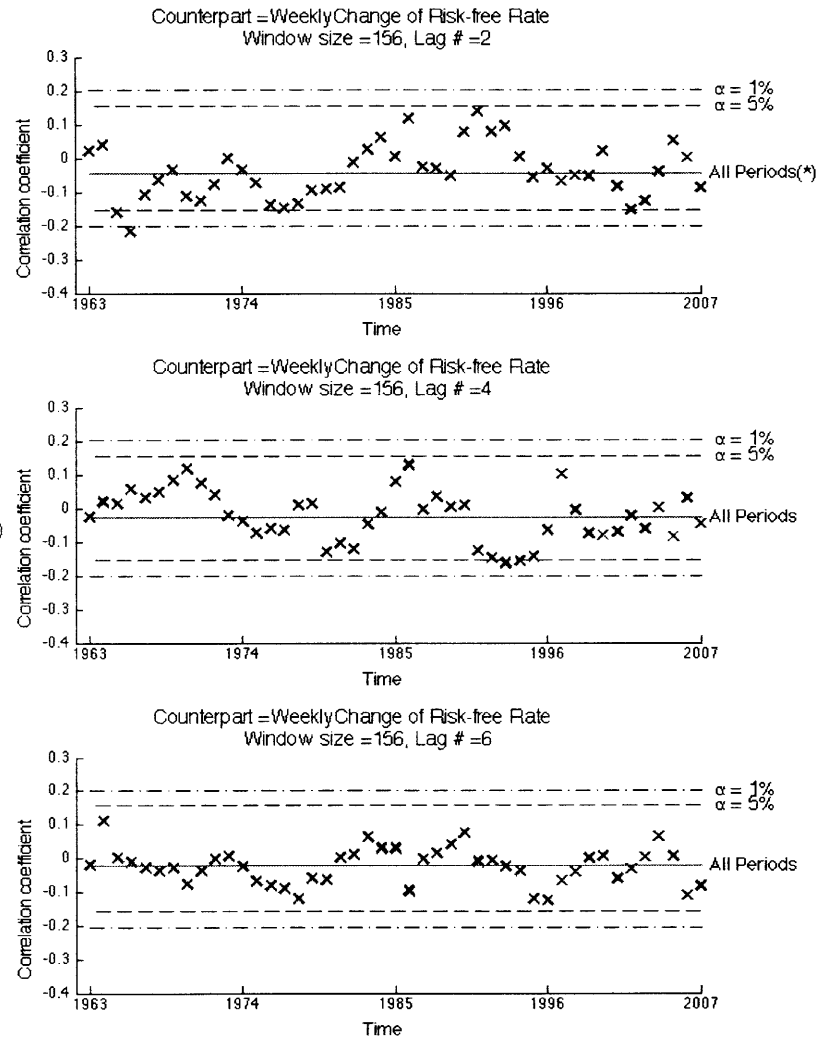
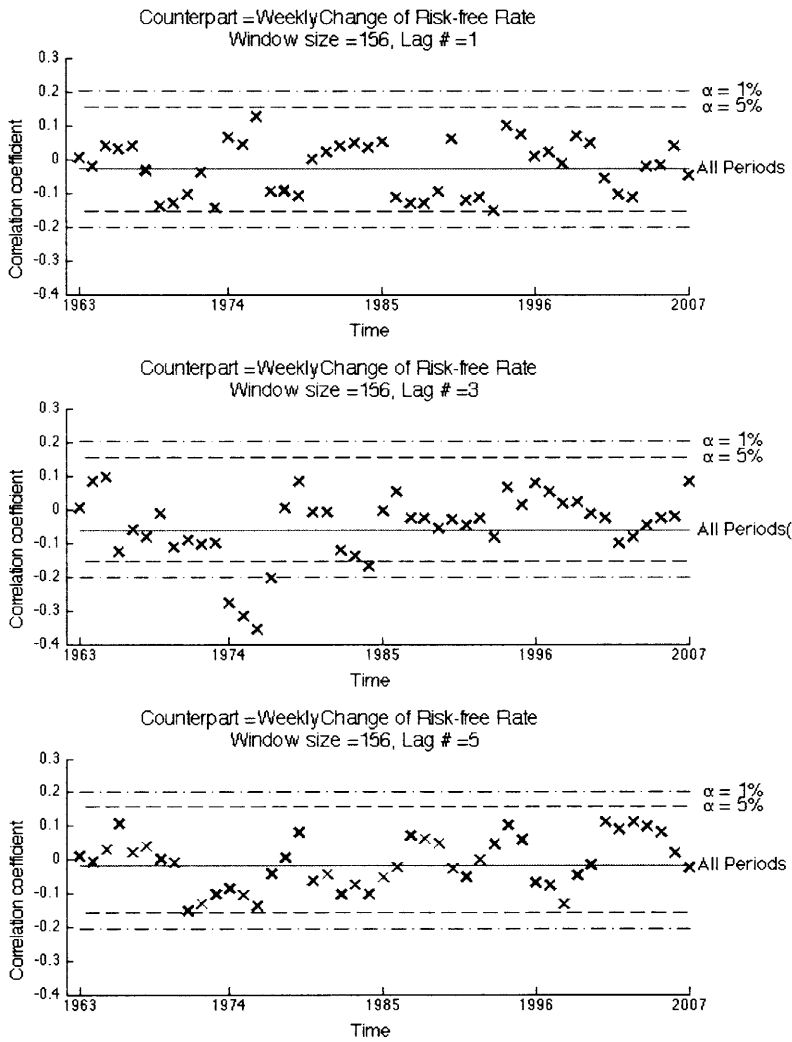


Figure A-44: Change of Correlation with Change of Risk-free Rate  
(Period = Weekly, Time Window = 3 years)

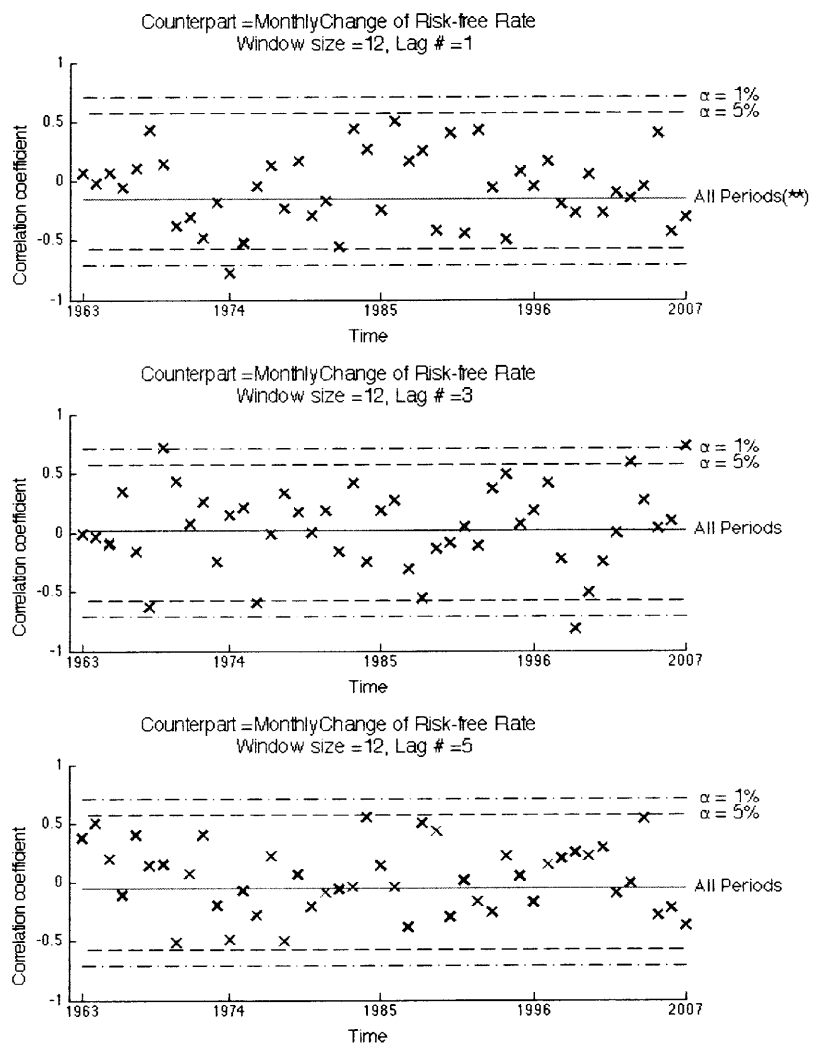
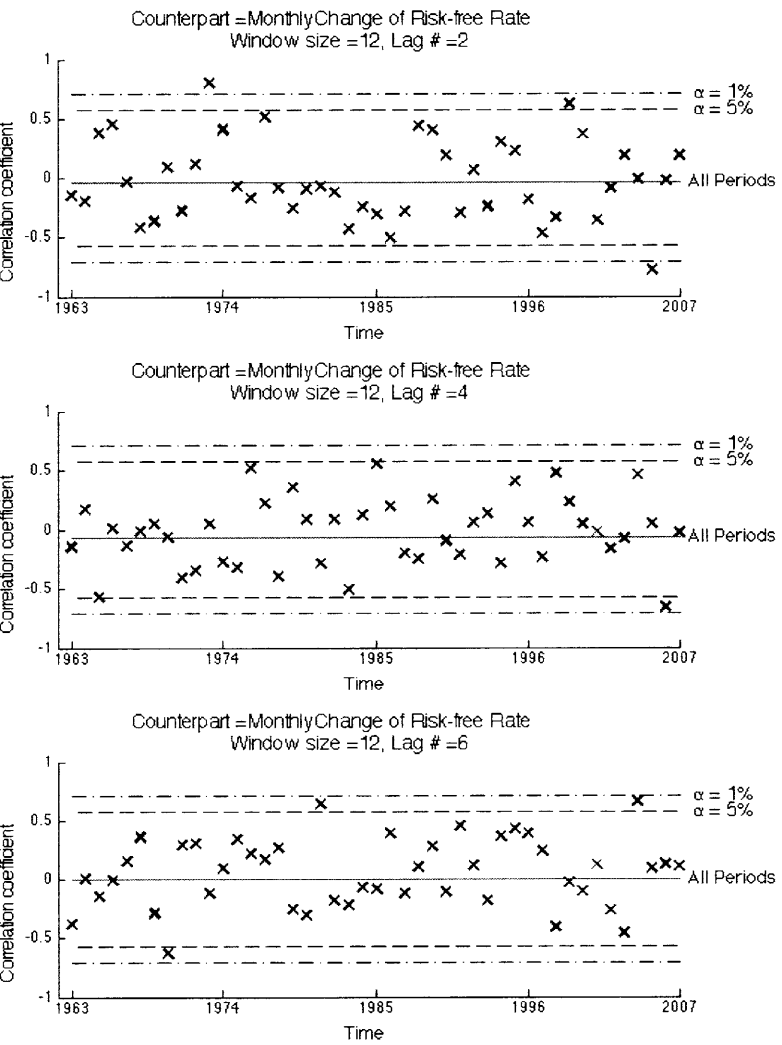
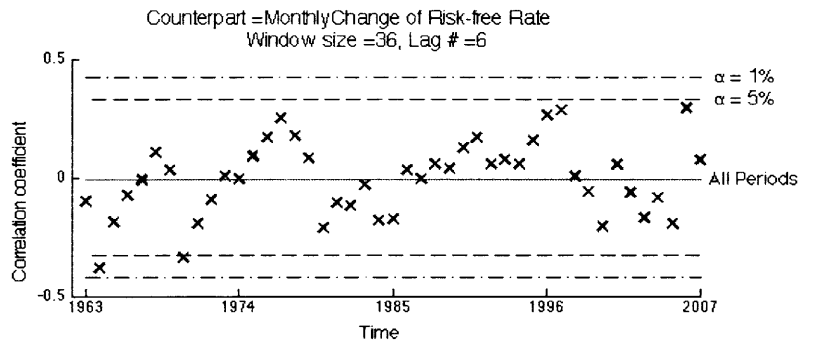
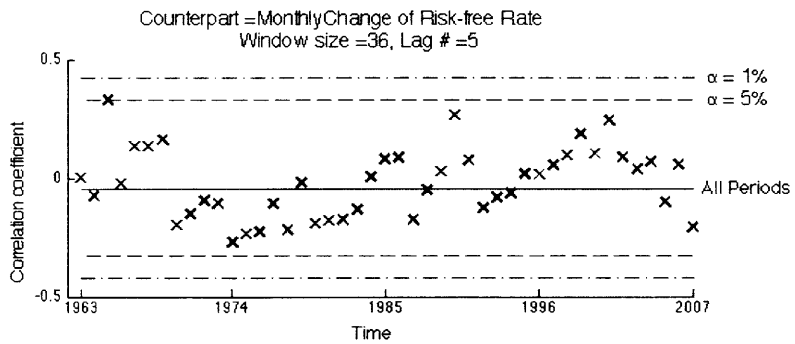
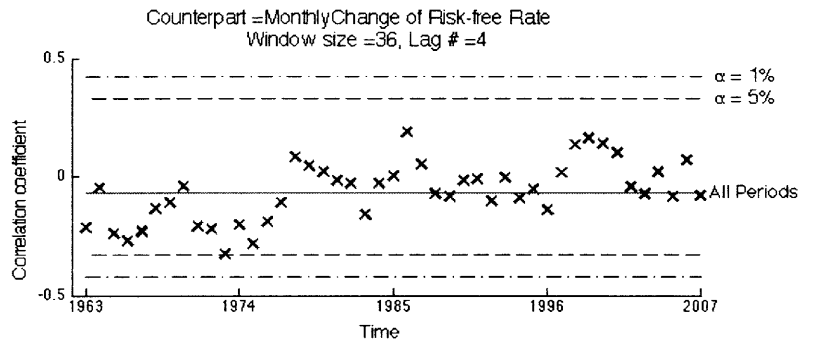
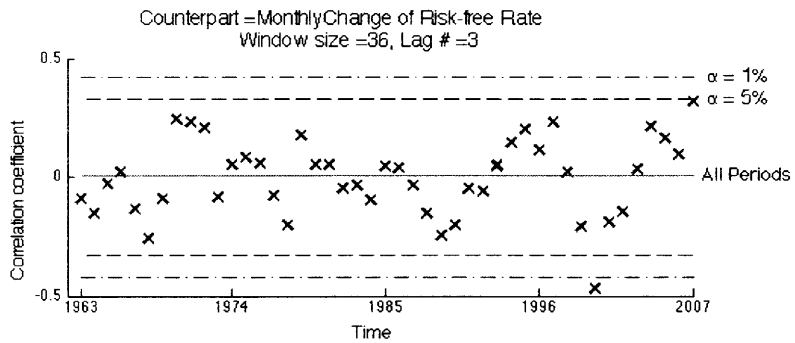
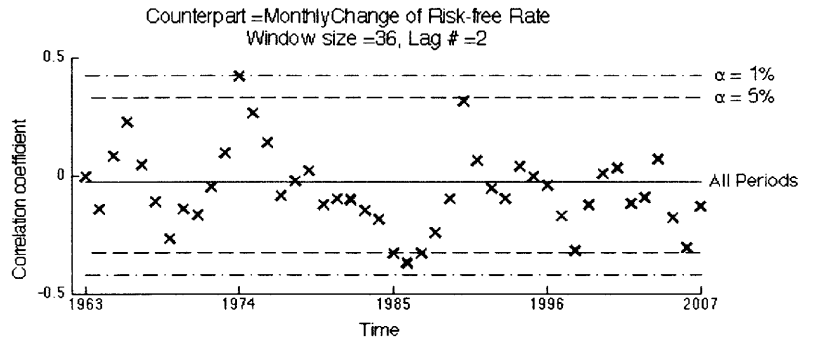
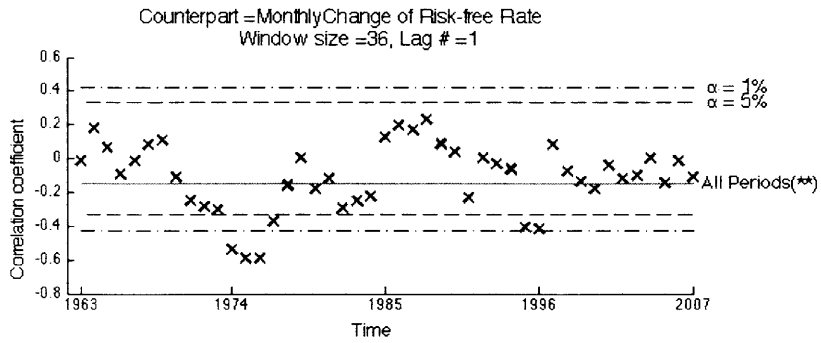


Figure A-45: Change of Correlation with Change of Risk-free Rate  
(Period = Monthly, Time Window = 1 year)

Figure A-46: Change of Correlation with Change of Risk-free Rate  
 (Period = Monthly, Time Window = 3 years)



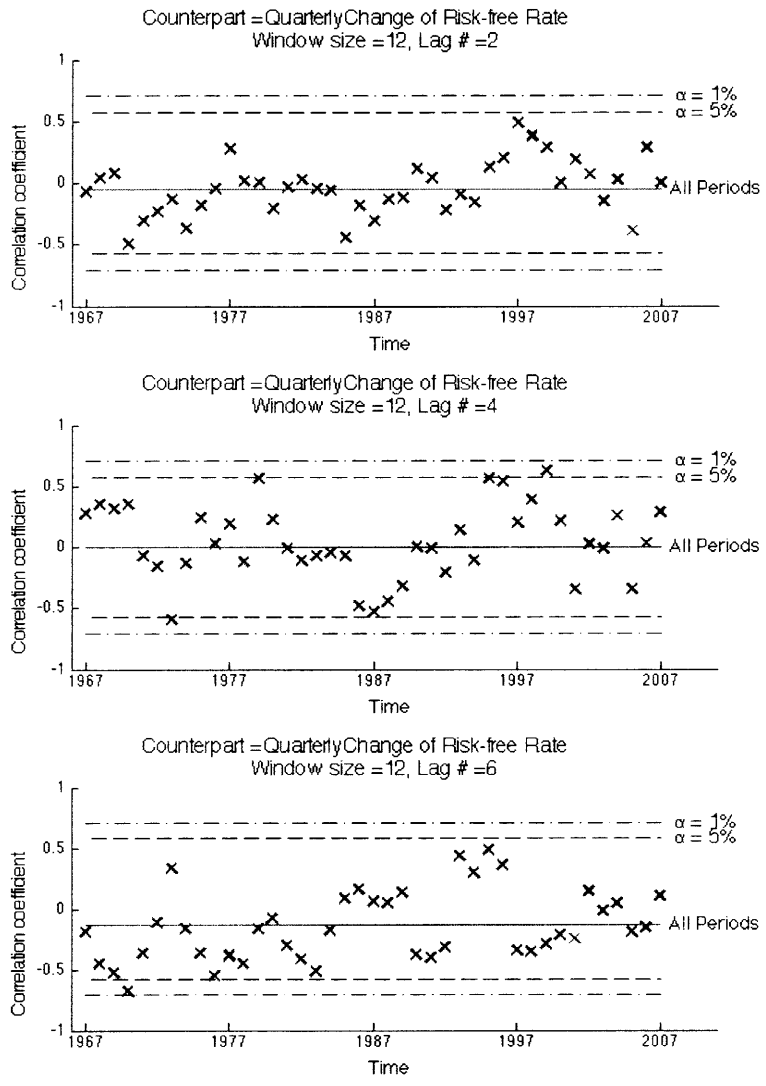


Figure A-47: Change of Correlation with Change of Risk-free Rate  
(Period = Quarterly, Time Window = 3 years)

Figure A-48: Change of Correlation with Change of Risk-free Rate  
 (Period = Quarterly, Time Window = 5 years)  
 175

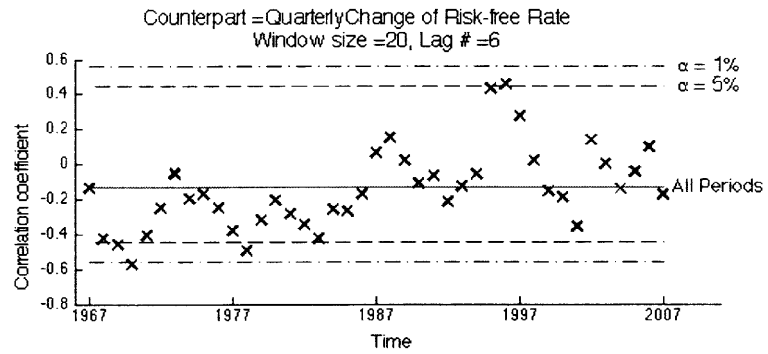
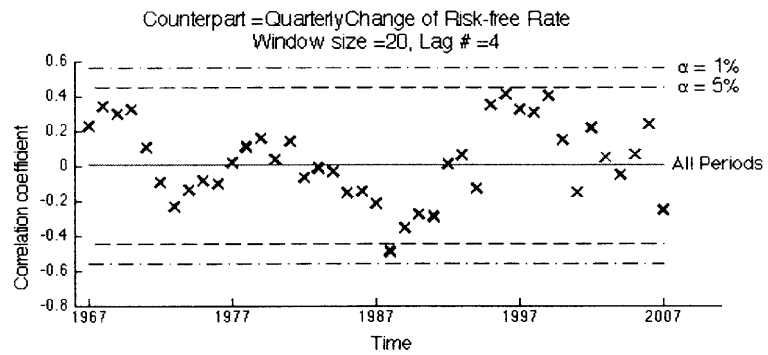
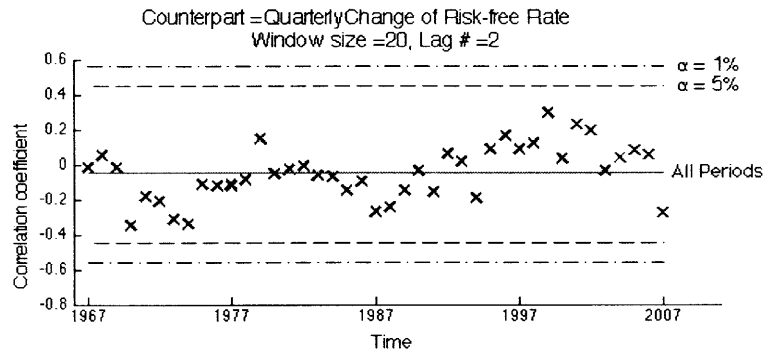
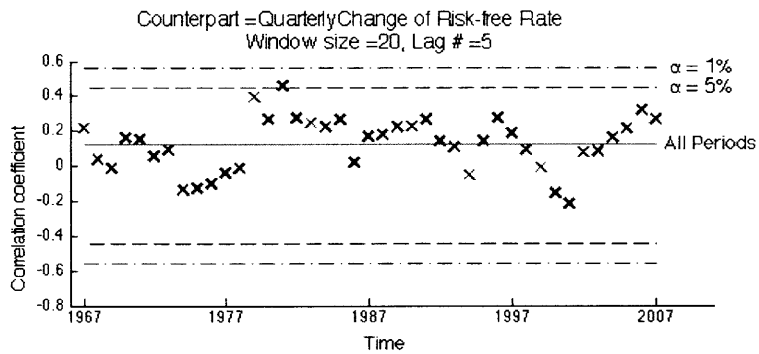
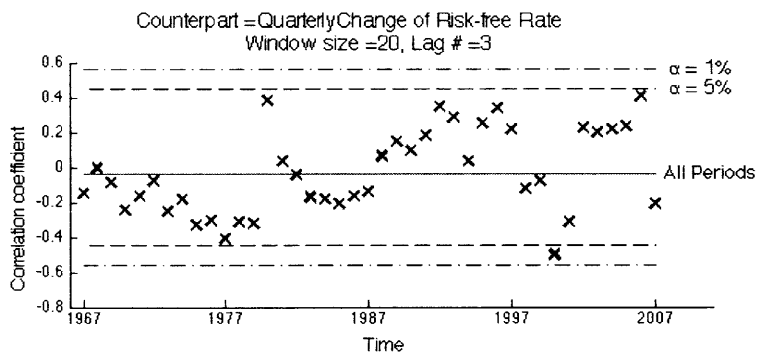
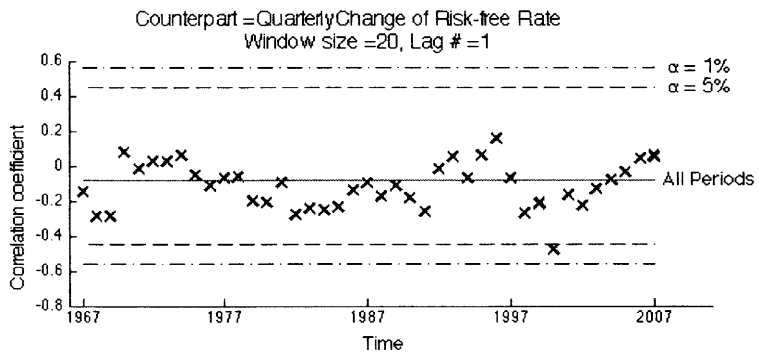


Figure A-49: Change of Correlation with Change of Risk-free Rate  
 (Period = Yearly, Time Window = 5 years)

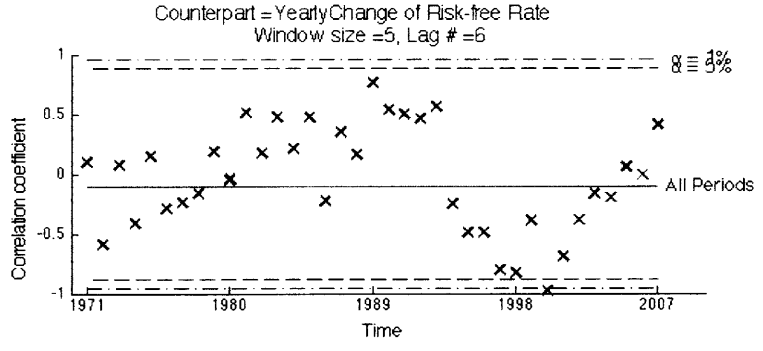
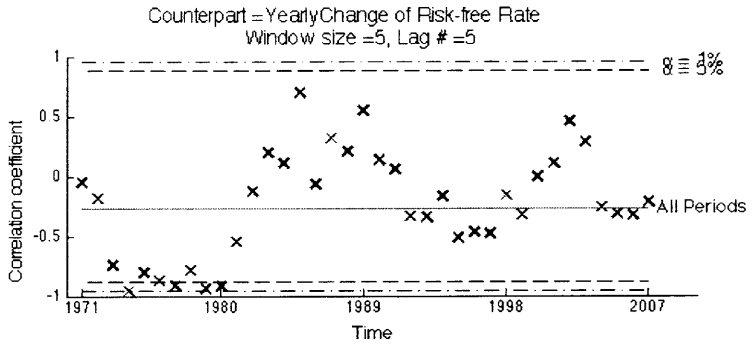
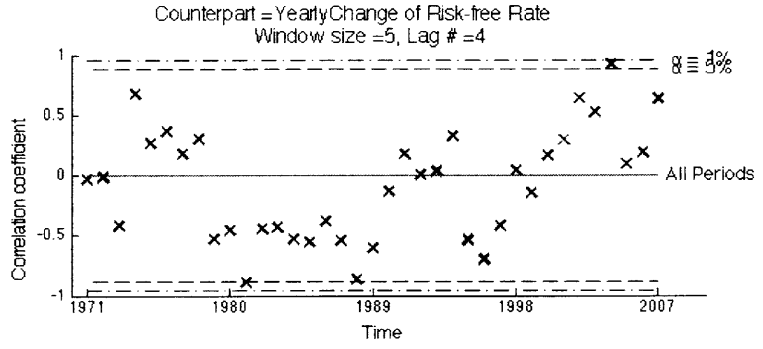
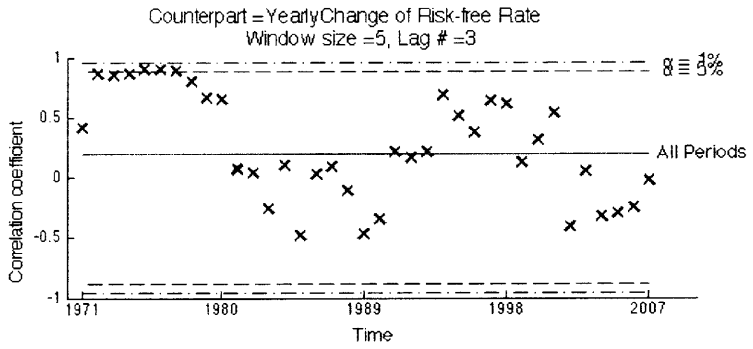
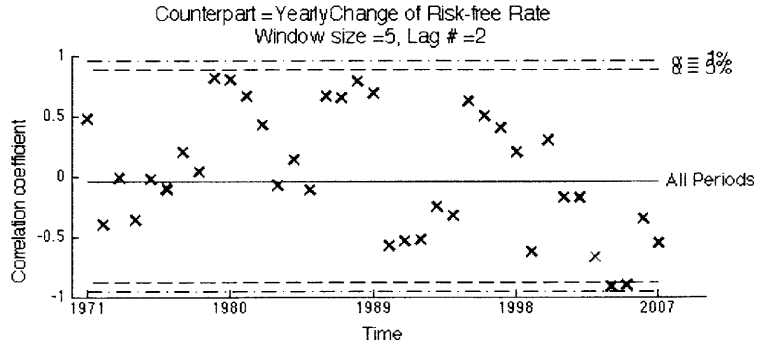
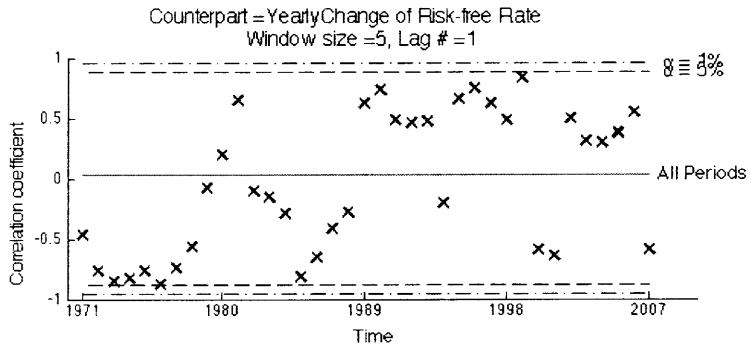
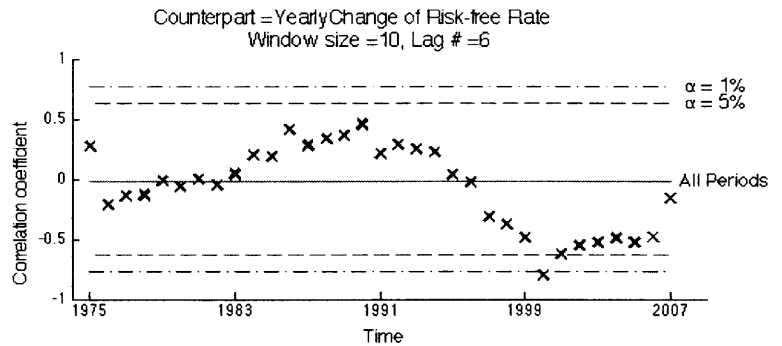
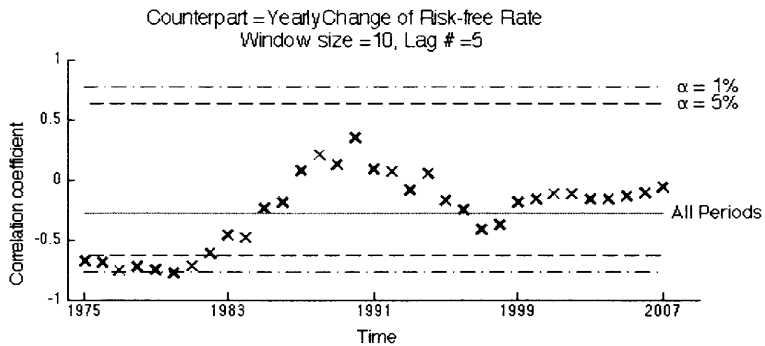
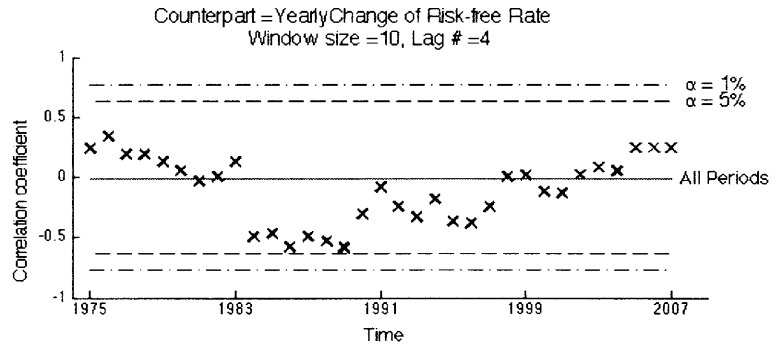
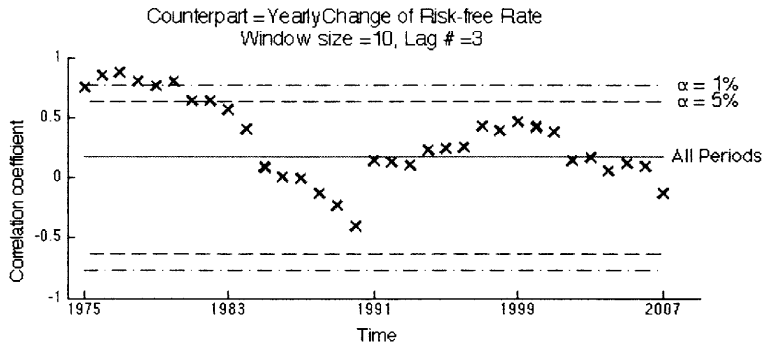
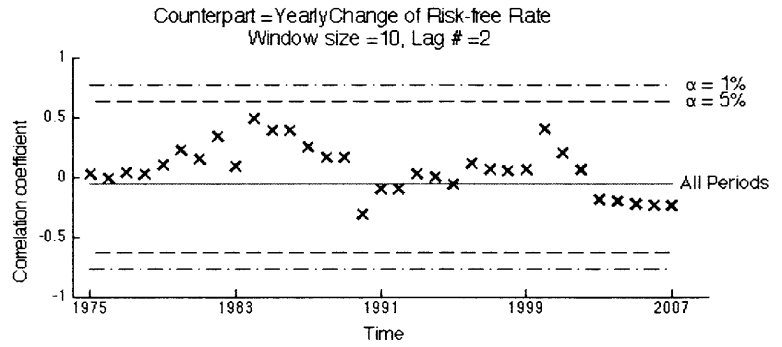
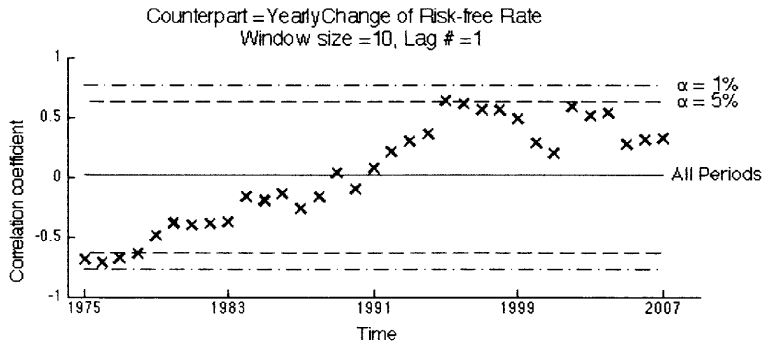


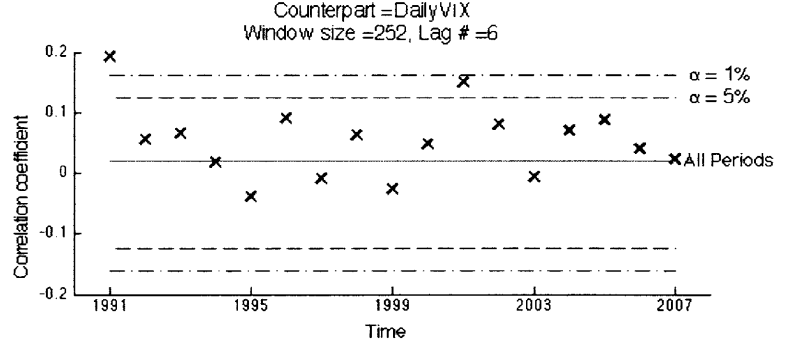
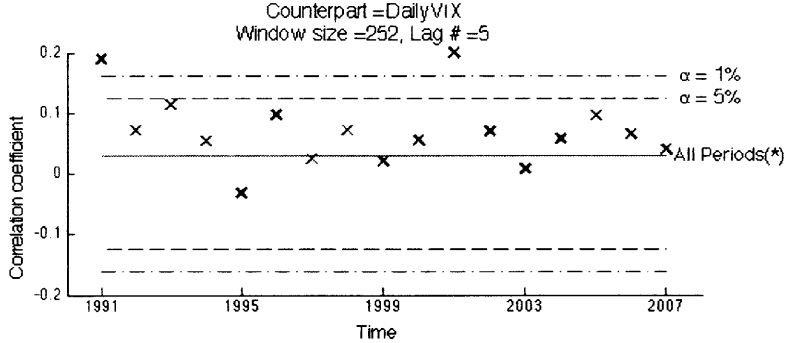
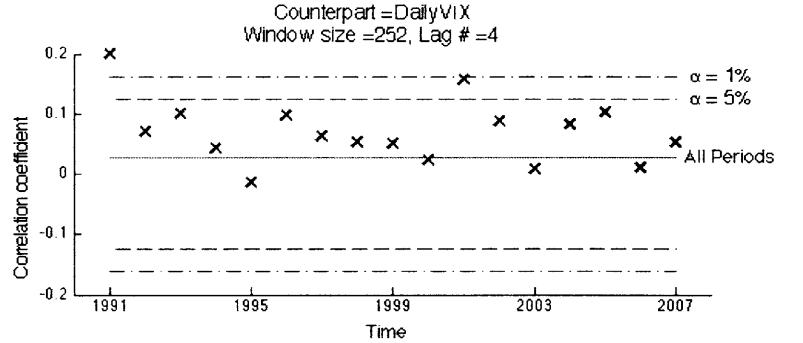
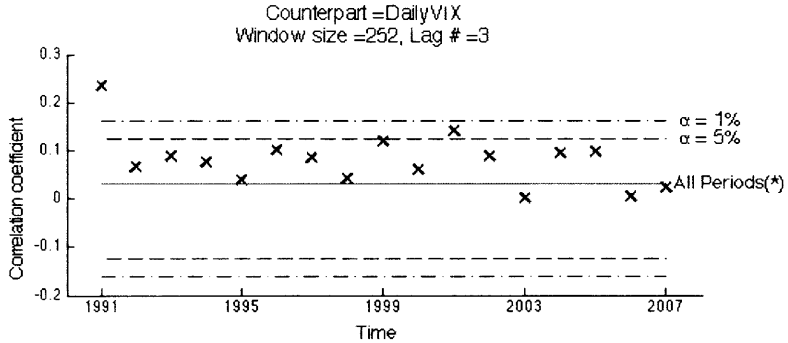
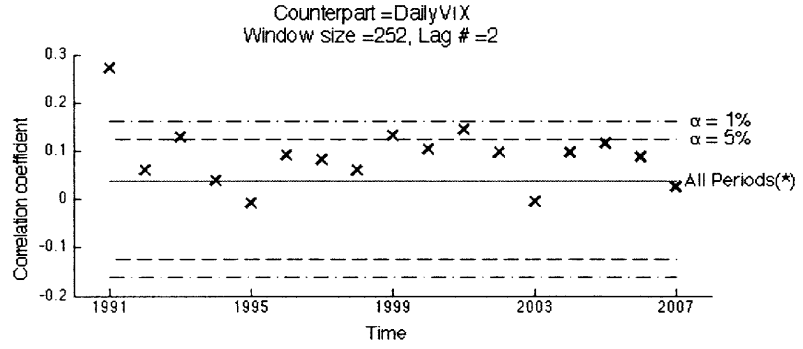
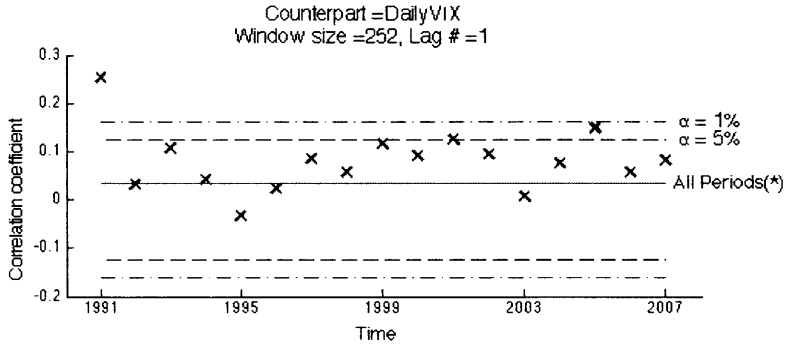


Figure A-50: Change of Correlation with Change of Risk-free Rate  
 (Period = Yearly, Time Window = 10 years)  
 177



## A.6 Correlation Analysis between the S&P 500 Stock Index Returns and the CBOE Volatility Index

Figure A-51: Change of Correlation with Volatility Index  
 (Period = Daily, Time Window = 1 year)



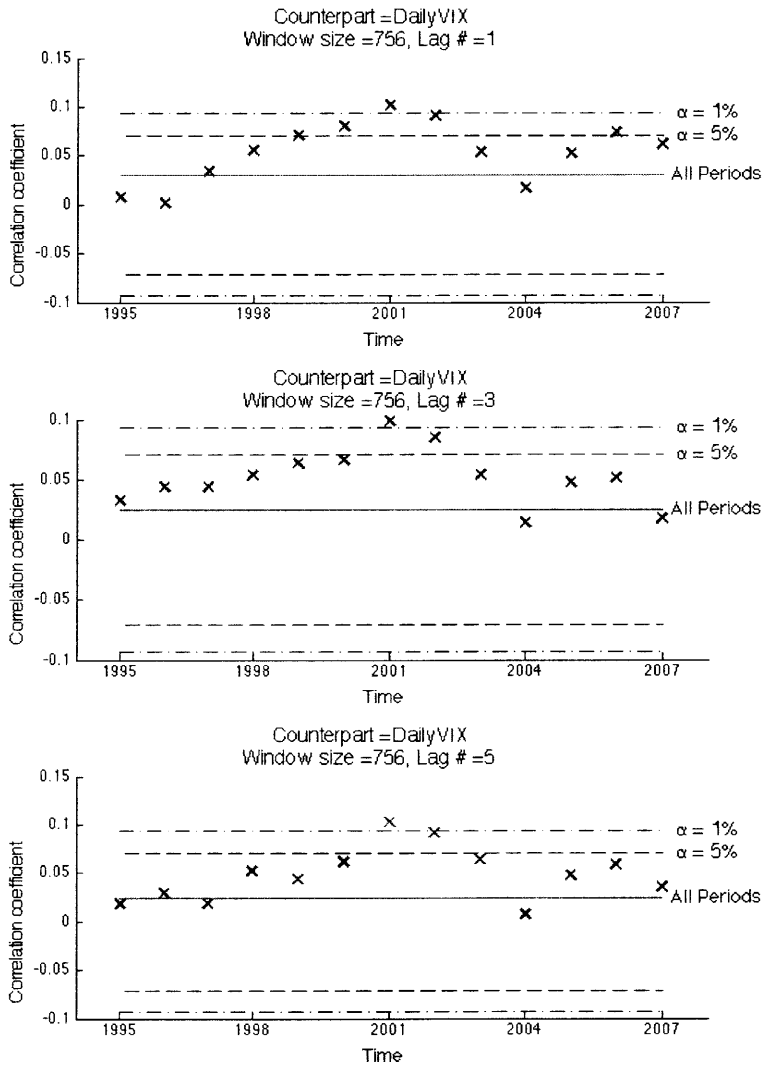
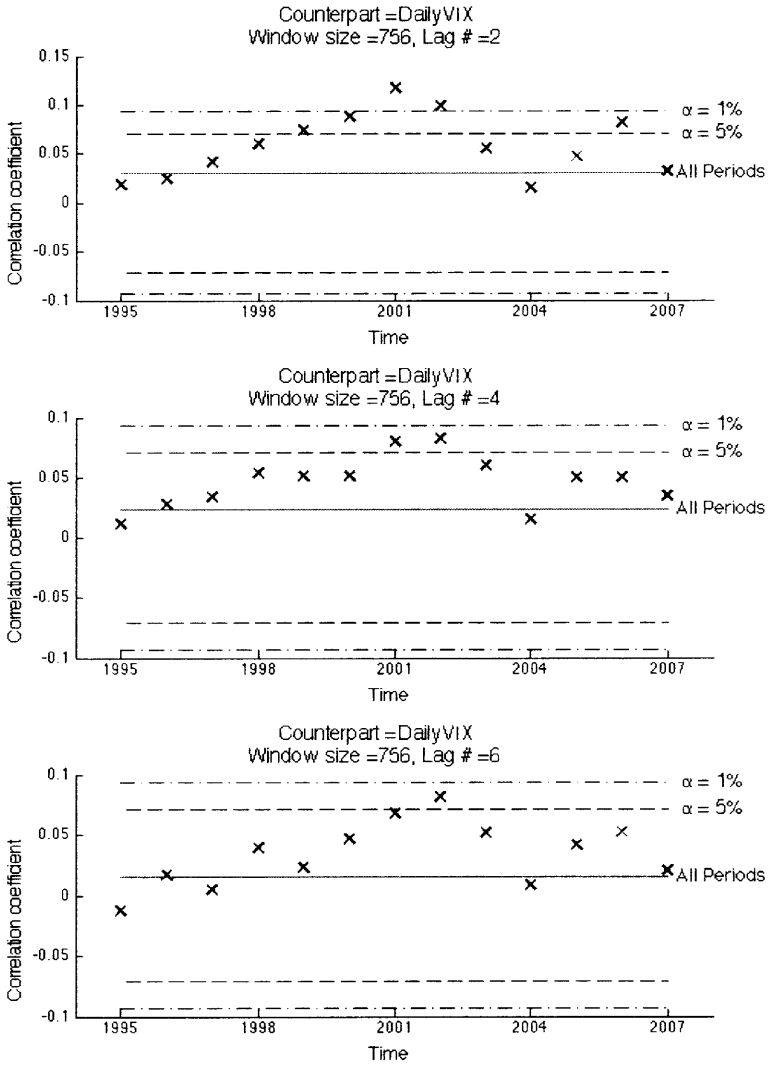
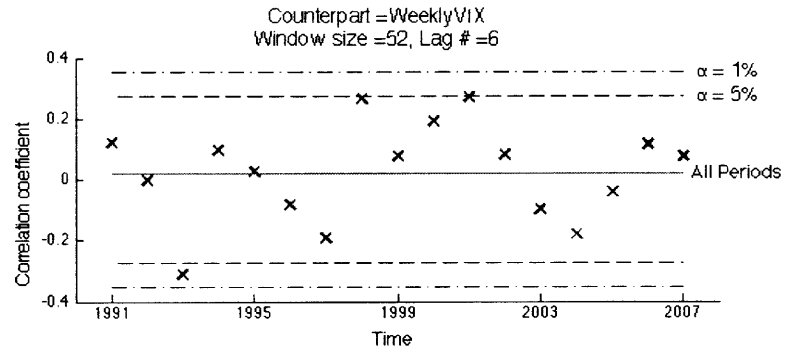
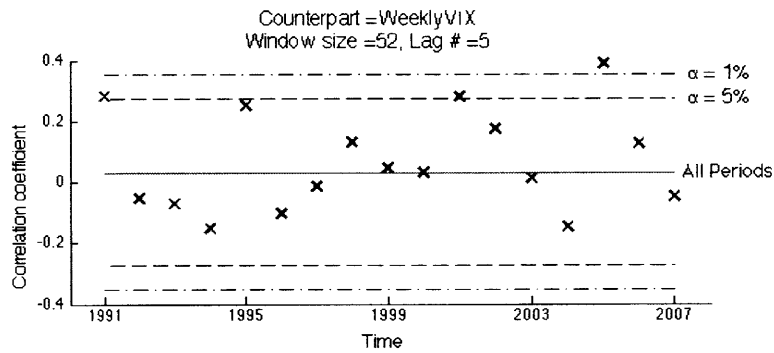
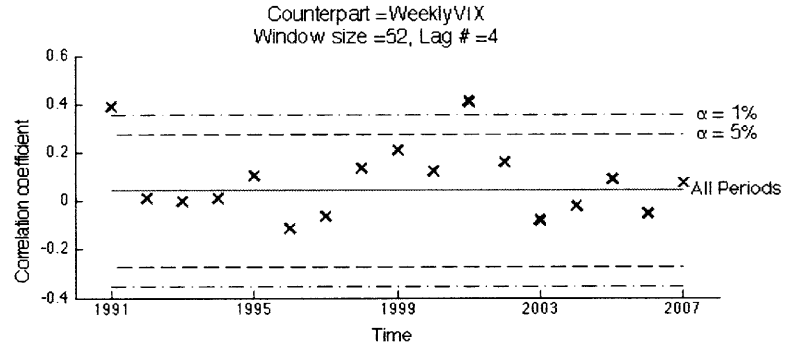
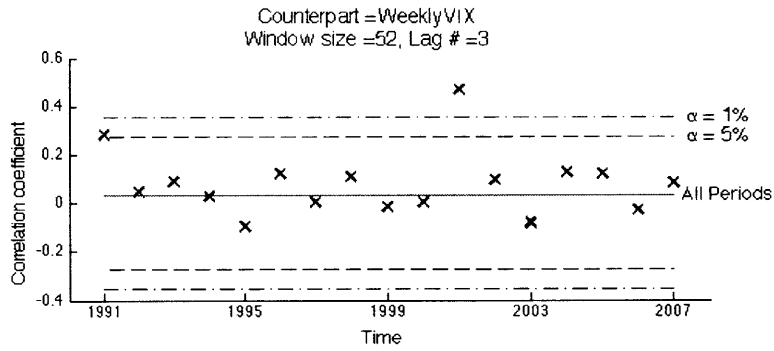
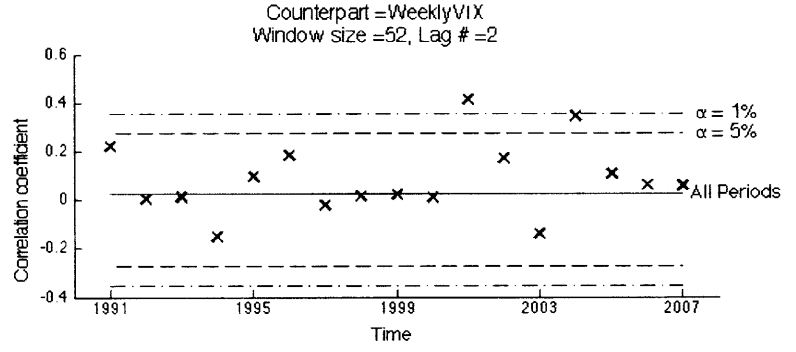
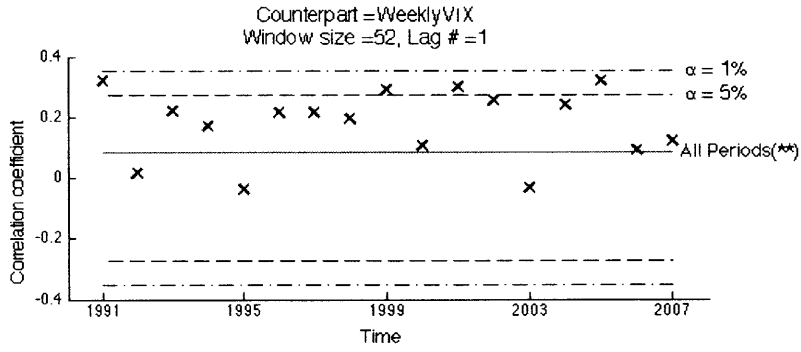


Figure A-52: Change of Correlation with Volatility Index  
(Period = Daily, Time Window = 3 years)

Figure A-53: Change of Correlation with Volatility Index  
 (Period = Weekly, Time Window = 1 year)



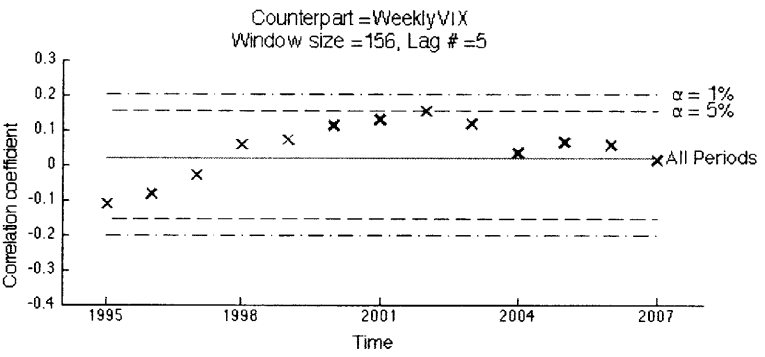
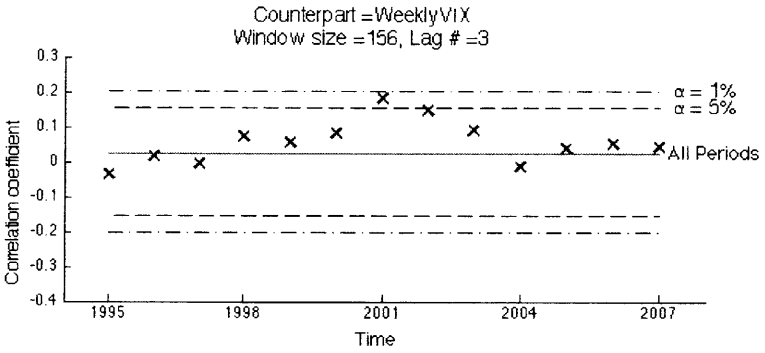
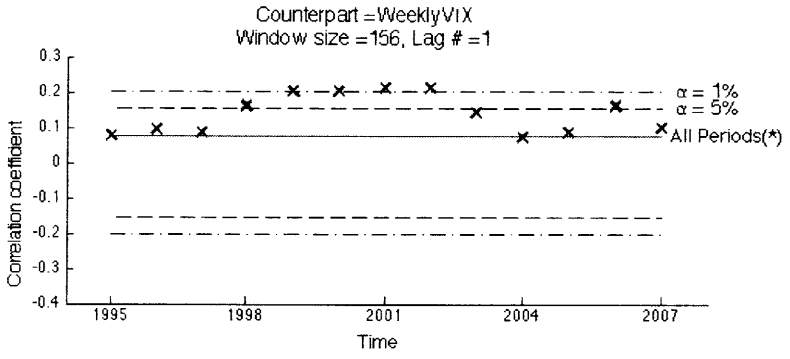
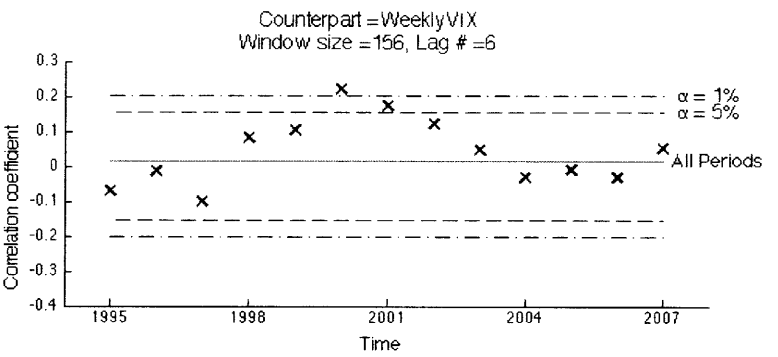
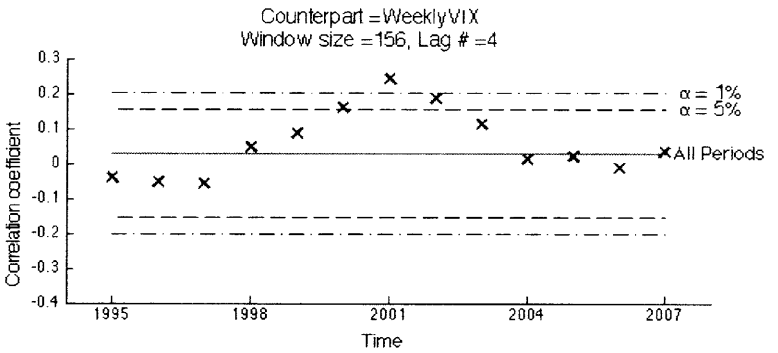
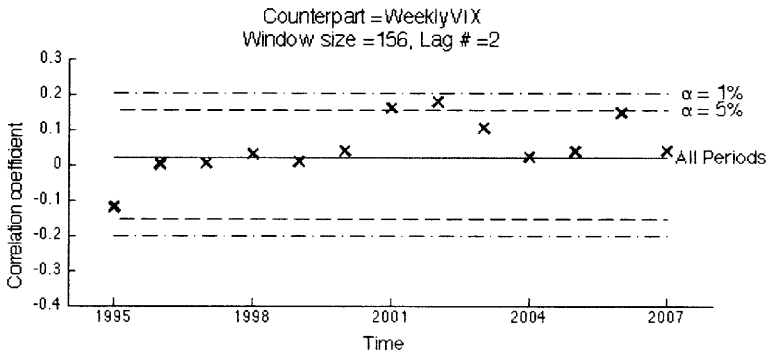


Figure A-54: Change of Correlation with Volatility Index  
(Period = Weekly, Time Window = 3 years)

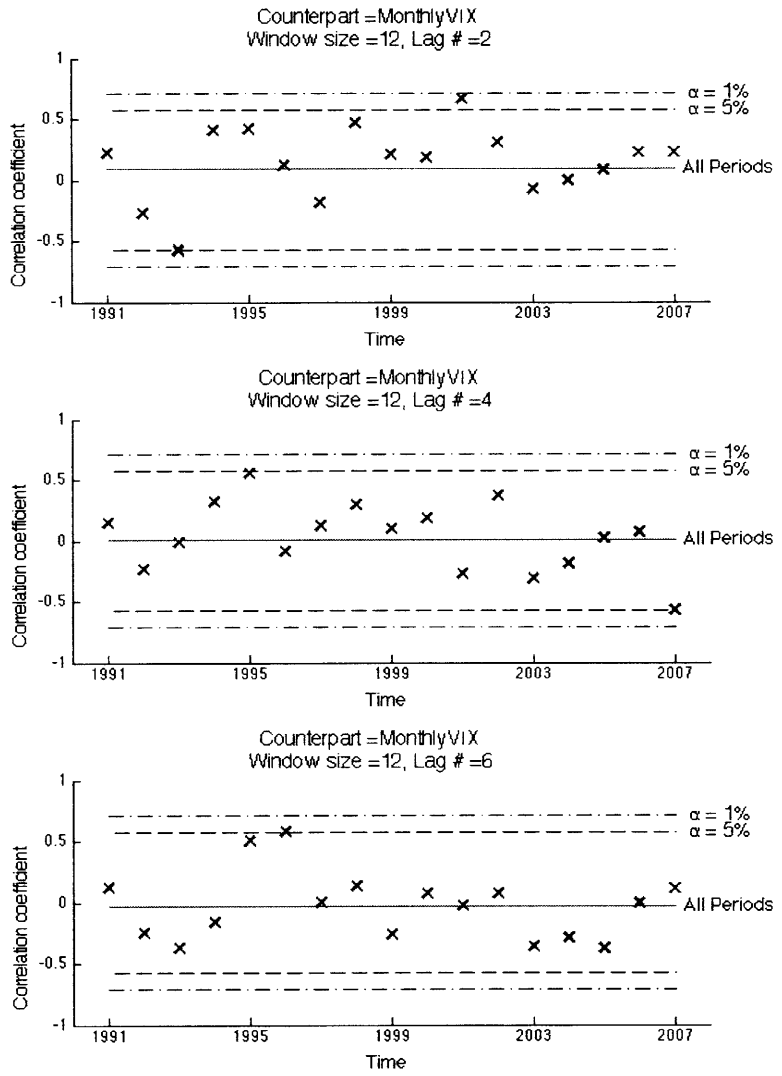


Figure A-55: Change of Correlation with Volatility Index  
(Period = Monthly, Time Window = 1 year)

Figure A-56: Change of Correlation with Volatility Index  
 (Period = Monthly, Time Window = 3 years)

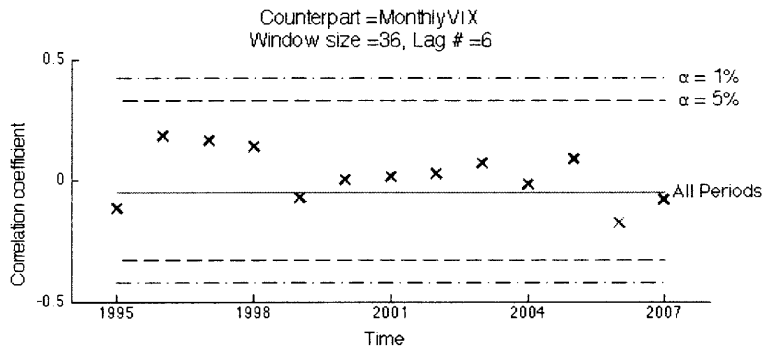
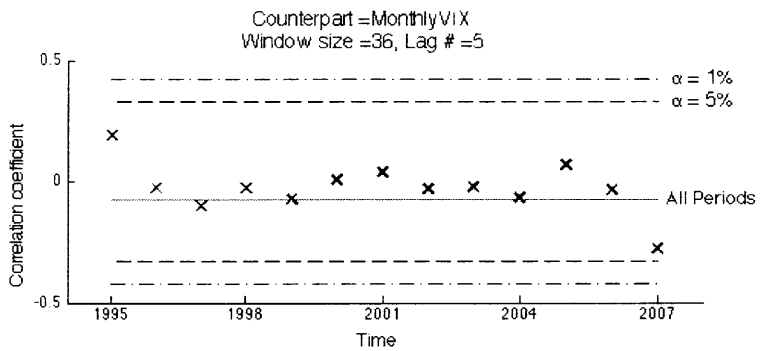
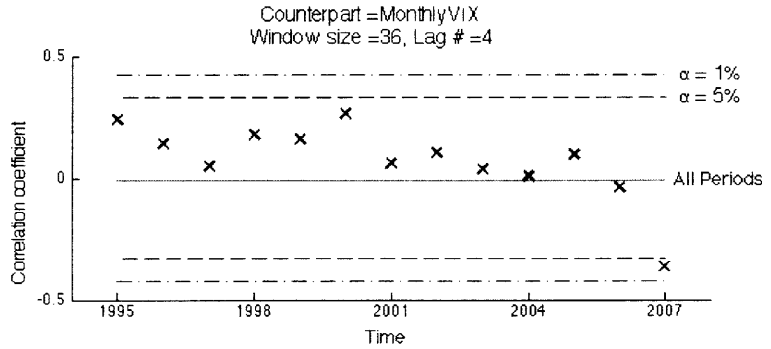
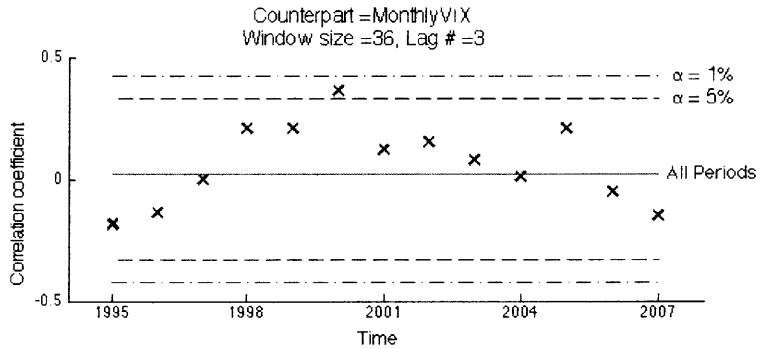
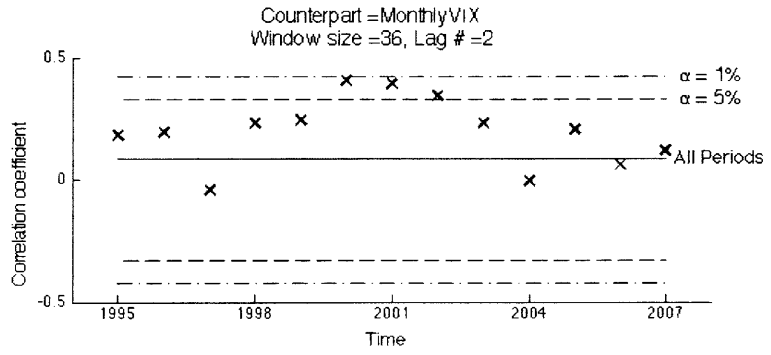
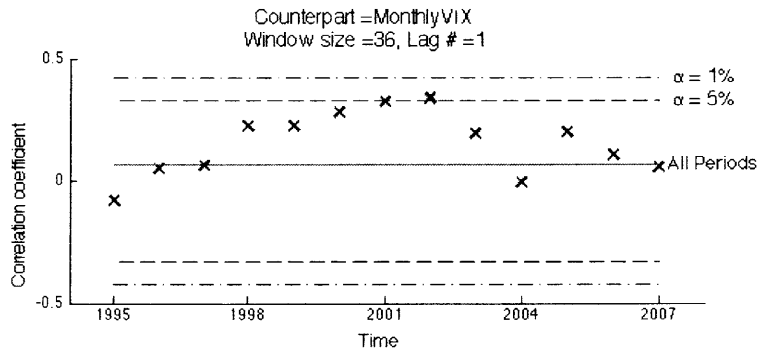




Figure A-57: Change of Correlation with Volatility Index  
 (Period = Quarterly, Time Window = 3 years)  
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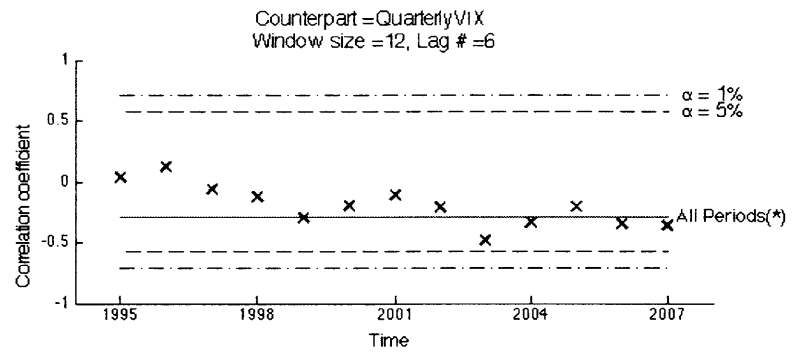
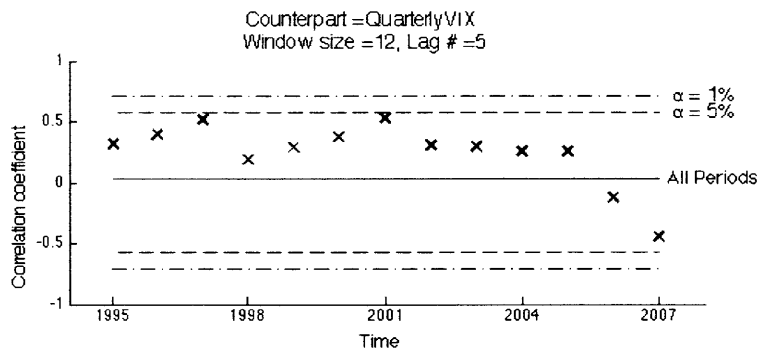
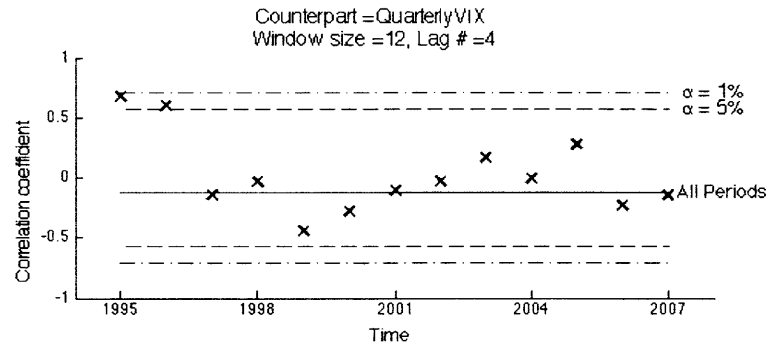
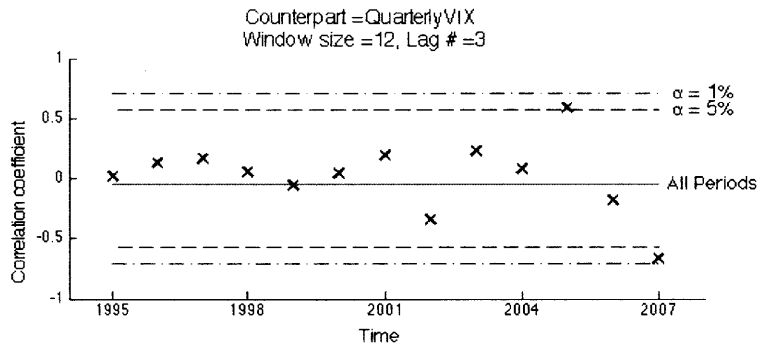
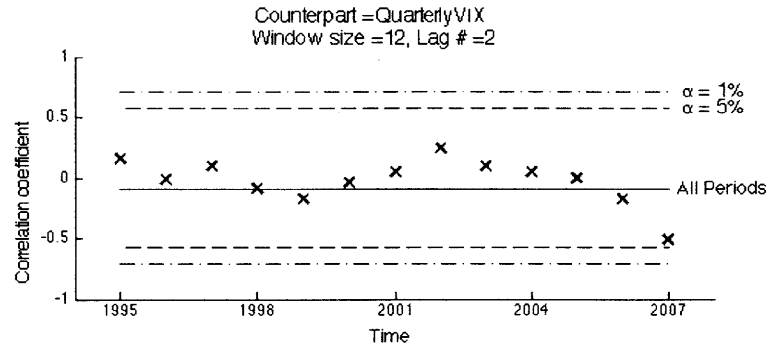
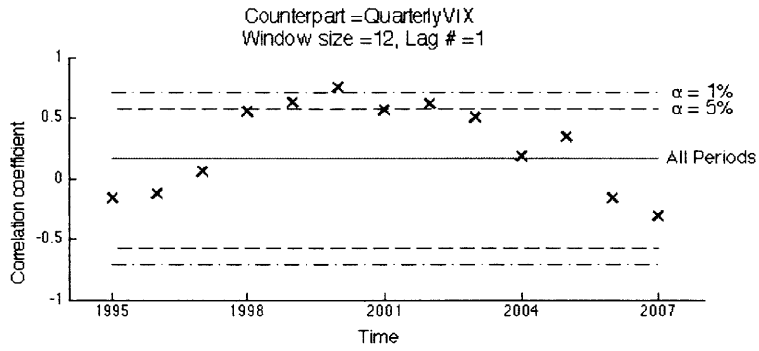
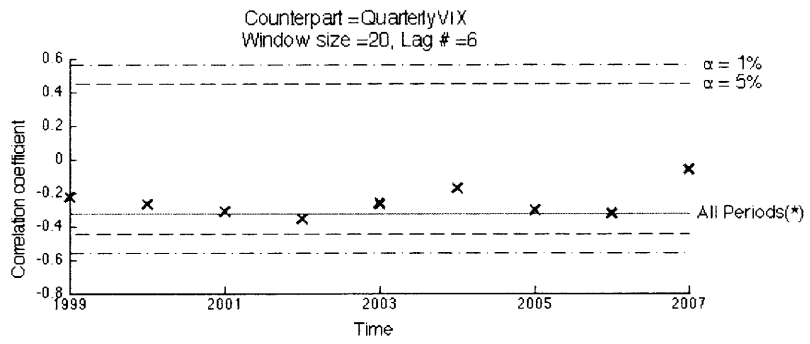
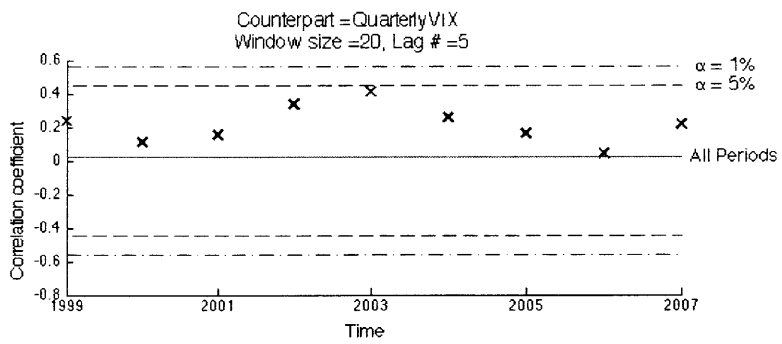
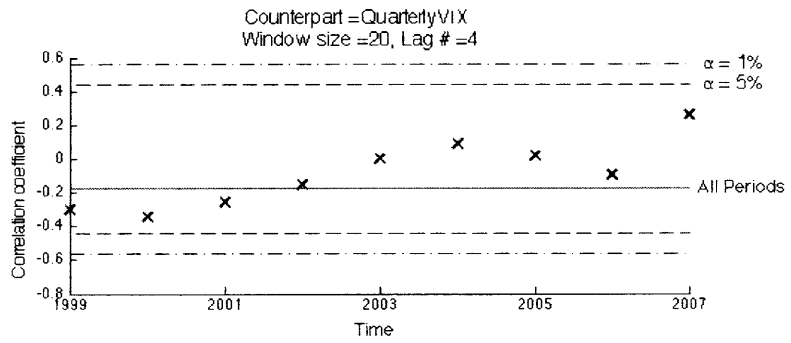
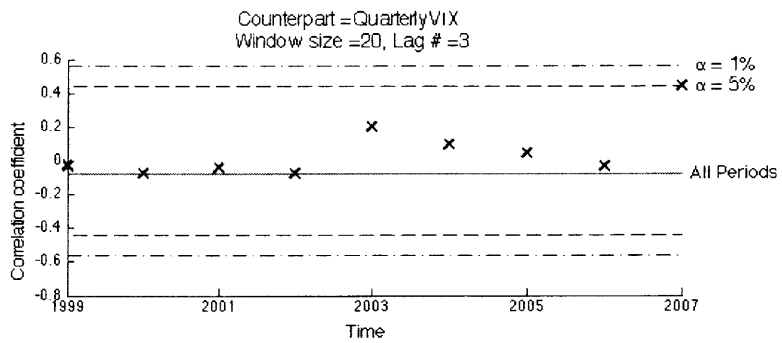
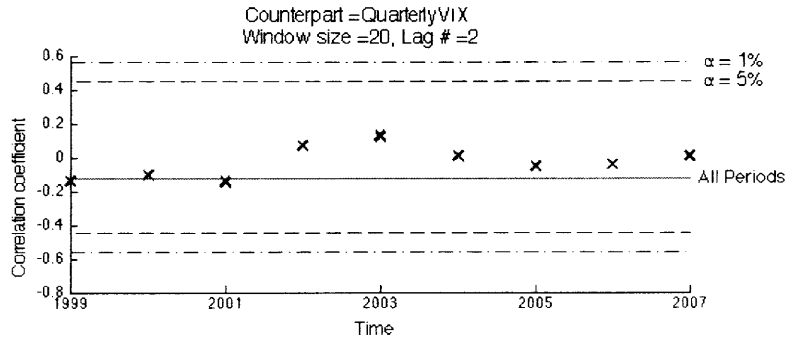
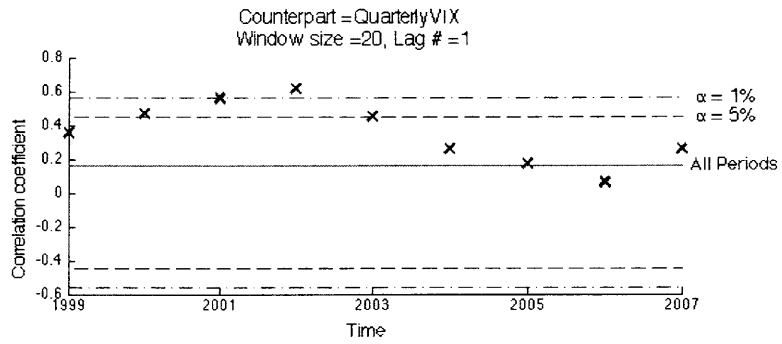


Figure A-58: Change of Correlation with Volatility Index  
 (Period = Quarterly, Time Window = 5 years)



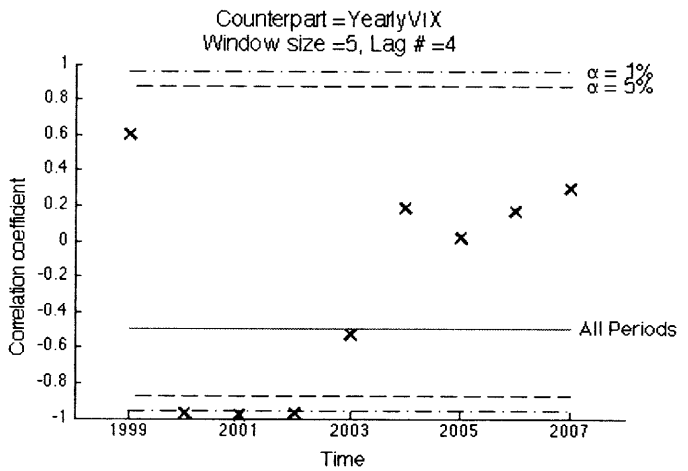
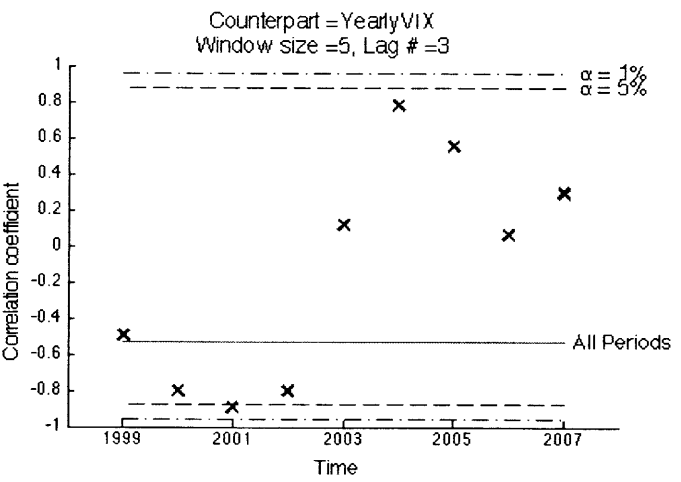
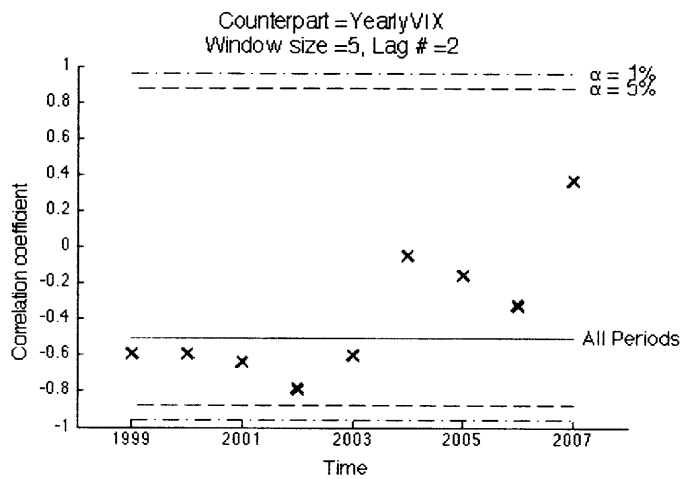
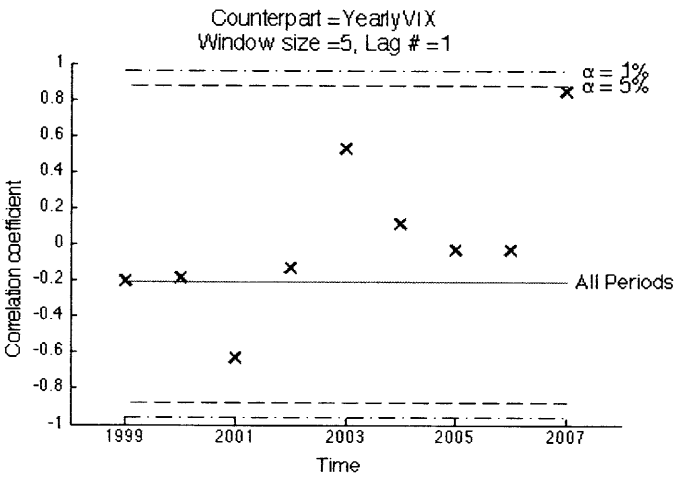


Figure A-59: Change of Correlation with Volatility Index  
(Period = Yearly, Time Window = 5 years)  
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## A.7 Correlation Analysis between the S&P 500 Stock Index Returns and the Change of the CBOE Volatility Index

Figure A-60: Change of Correlation with Change of Volatility Index  
 (Period = Daily, Time Window = 1 year)

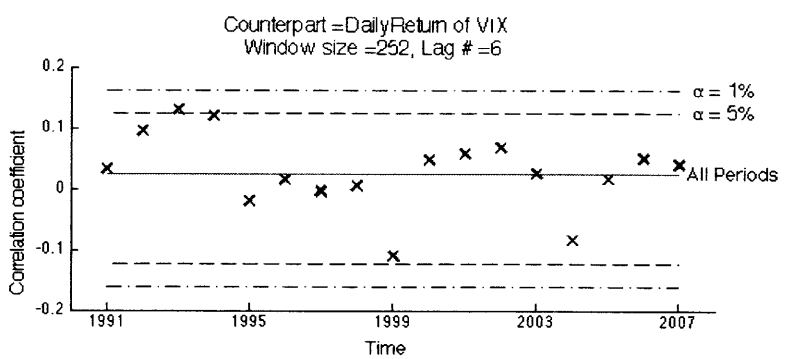
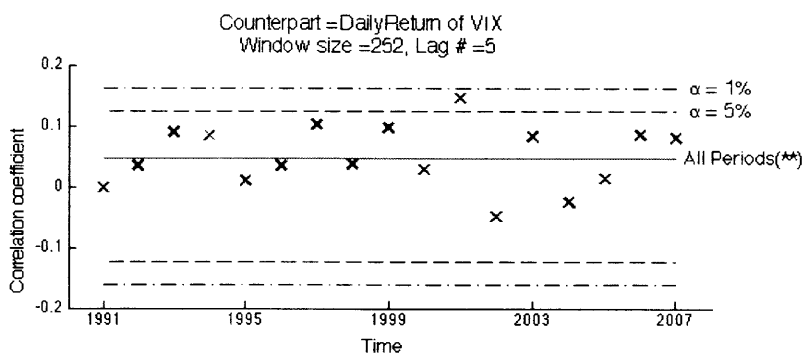
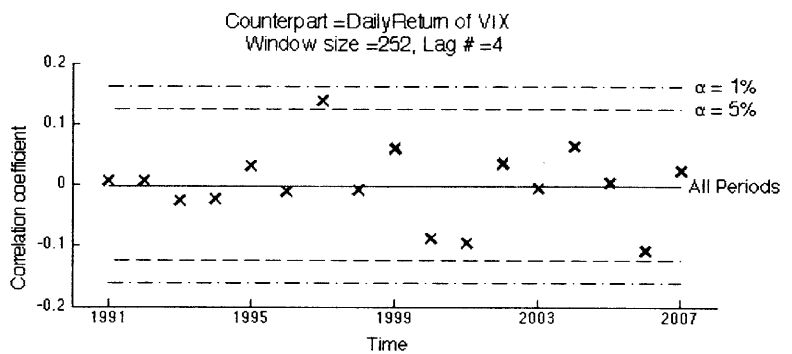
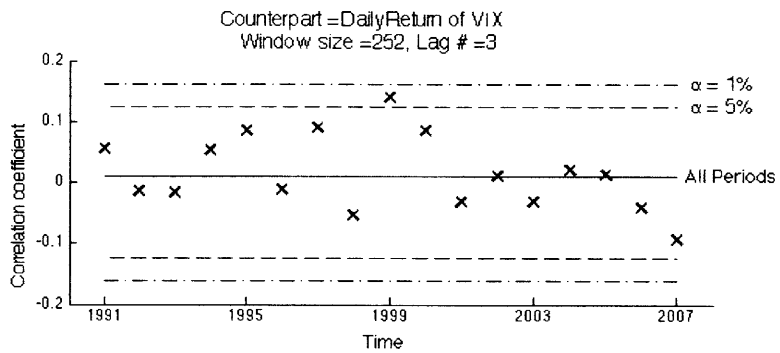
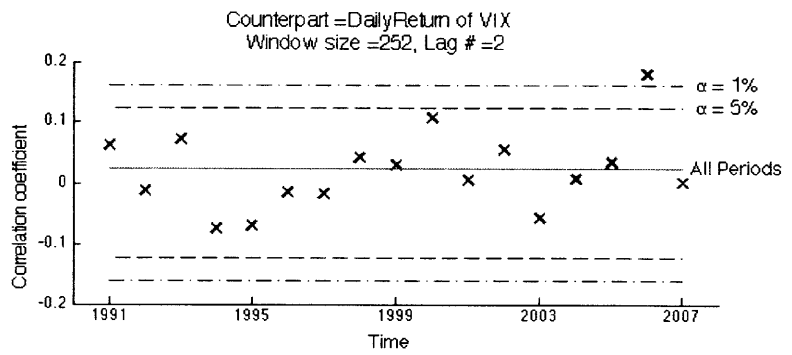
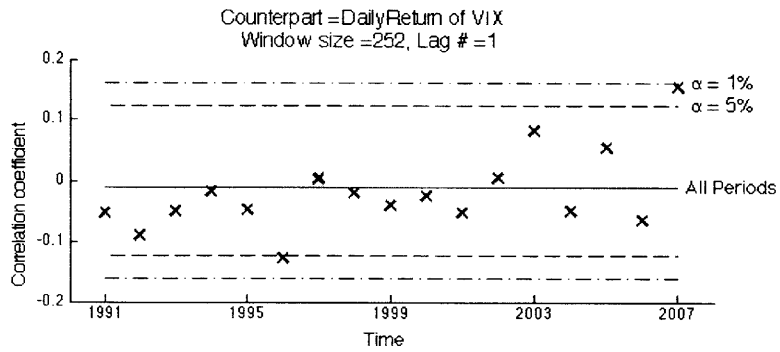


Figure A-61: Change of Correlation with Change of Volatility Index  
 (Period = Daily, Time Window = 3 years)

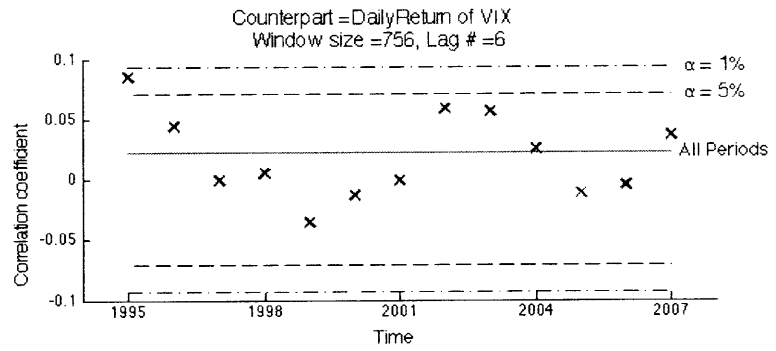
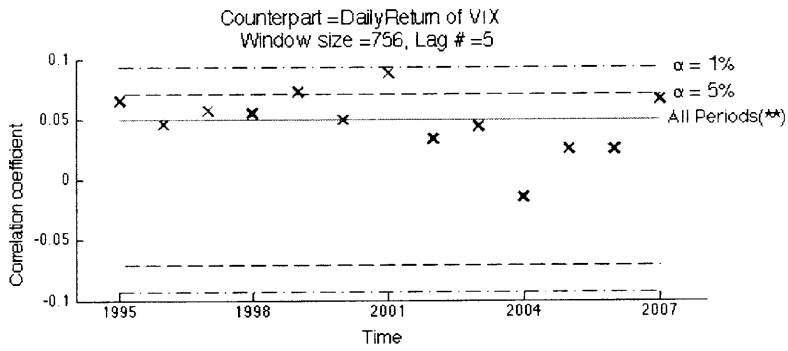
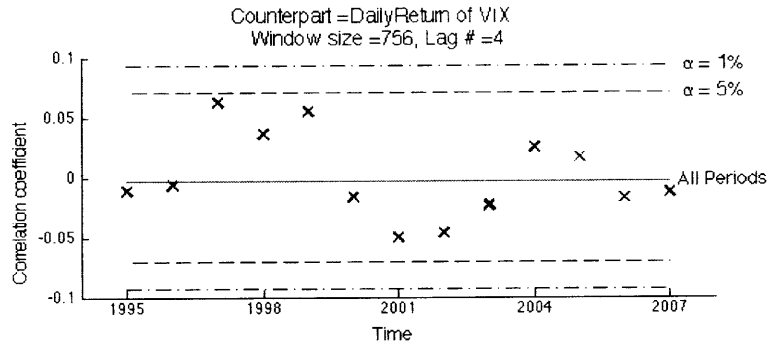
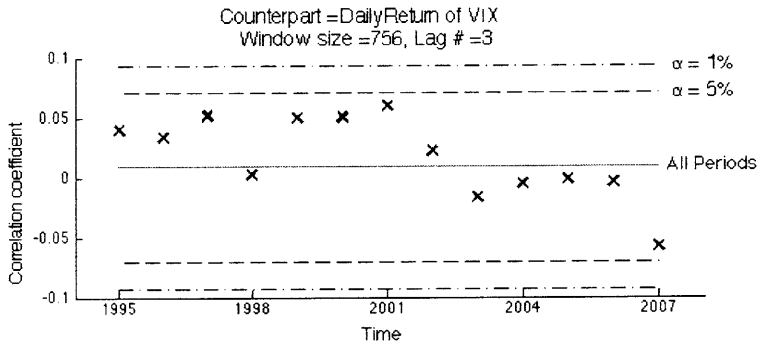
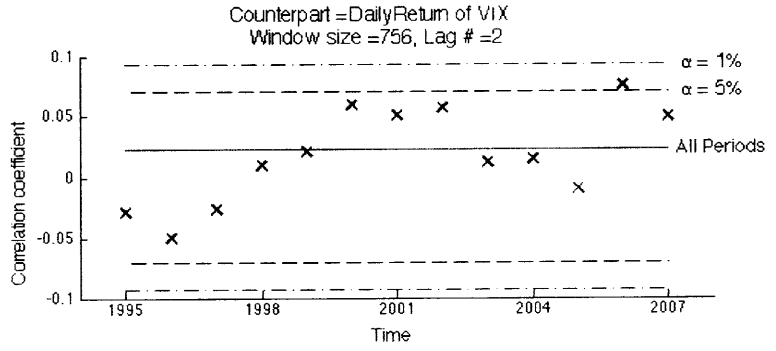
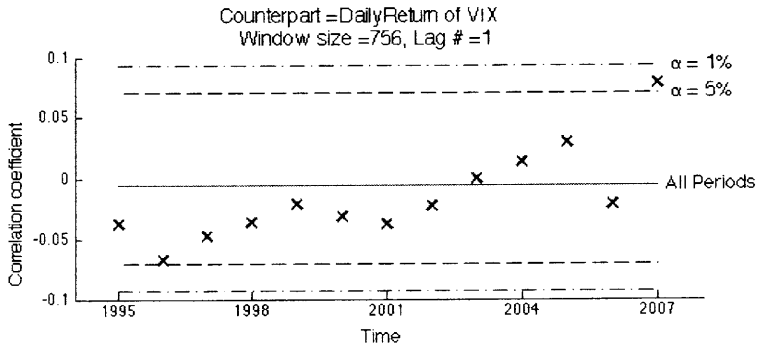


Figure A-62: Change of Correlation with Change of Volatility Index  
 (Period = Weekly, Time Window = 1 year)

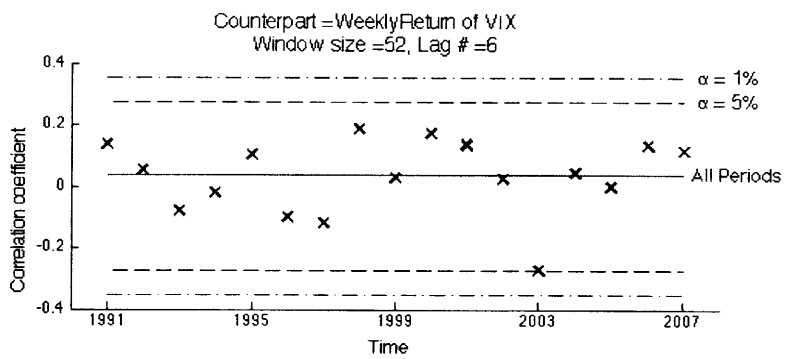
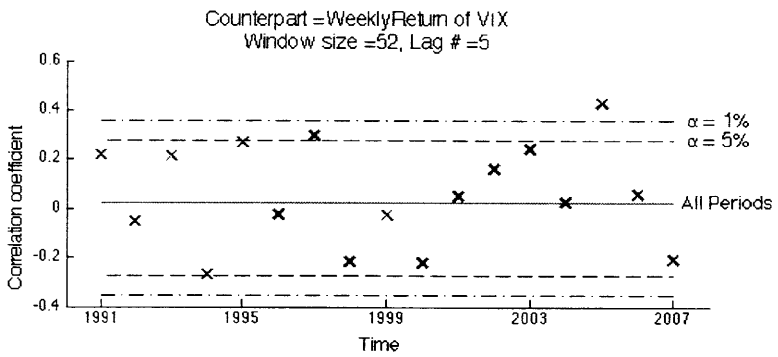
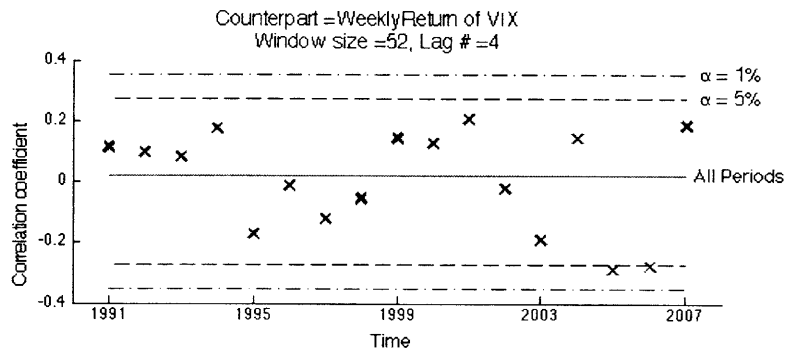
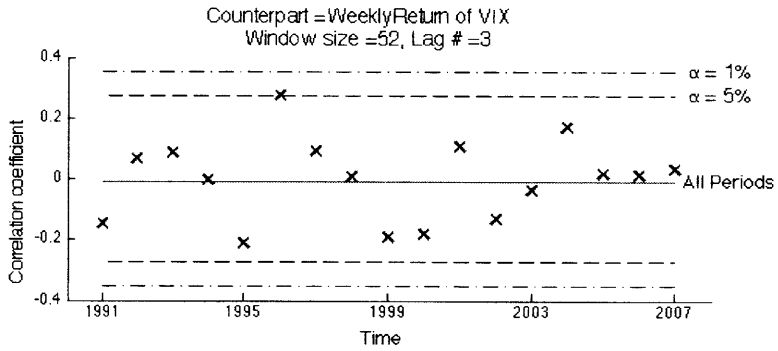
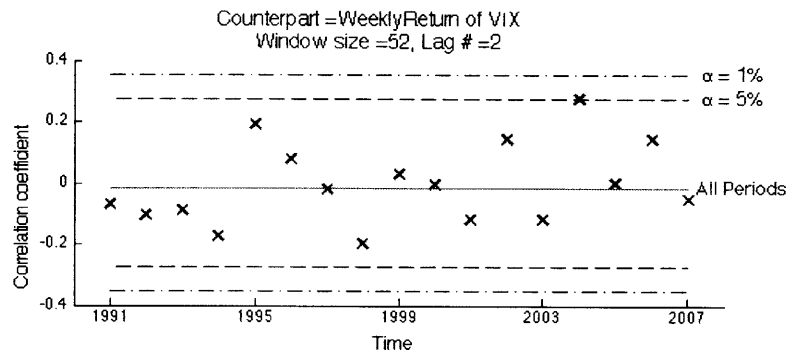
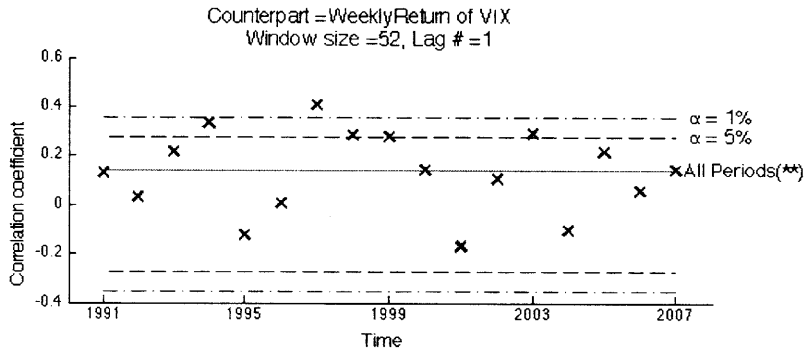


Figure A-63: Change of Correlation with Change of Volatility Index  
 (Period = Weekly, Time Window = 3 years)

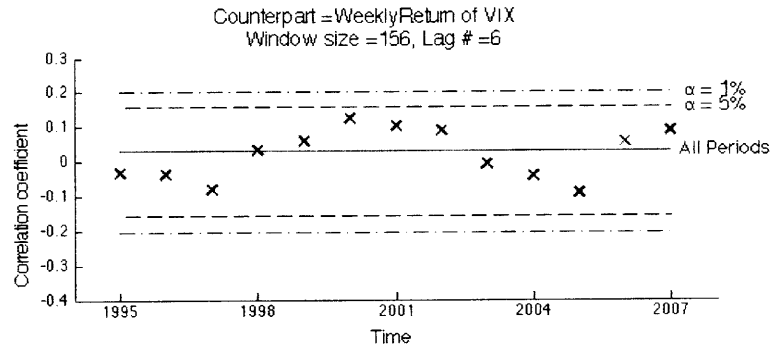
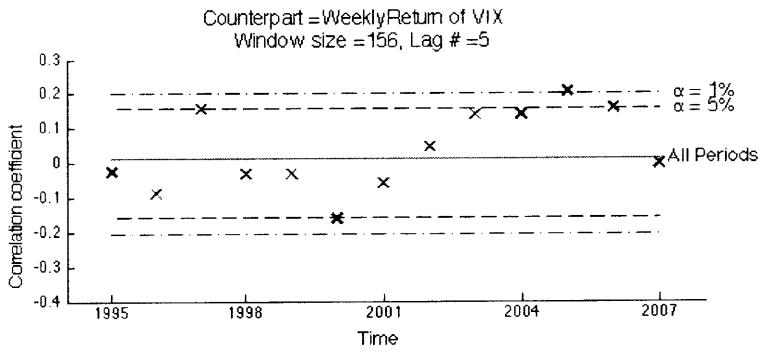
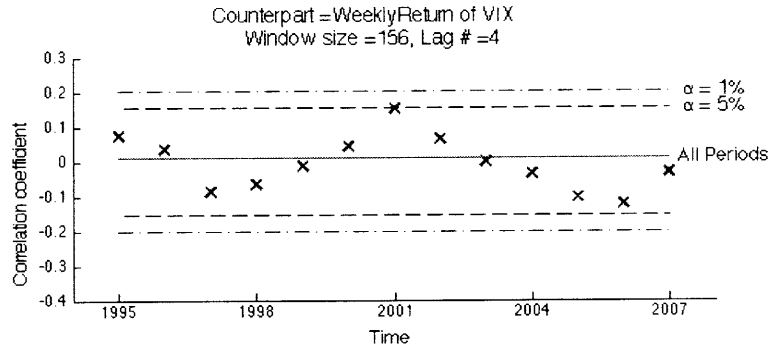
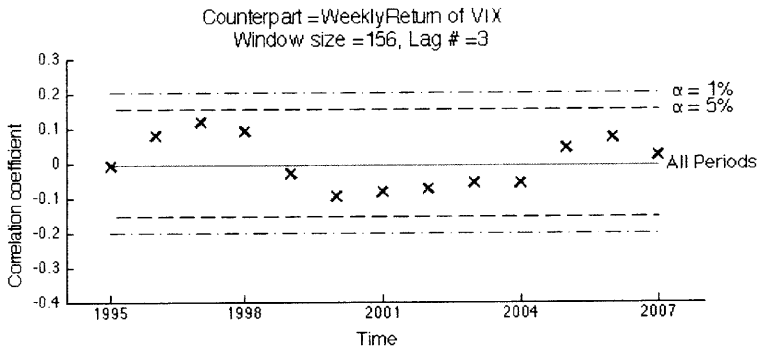
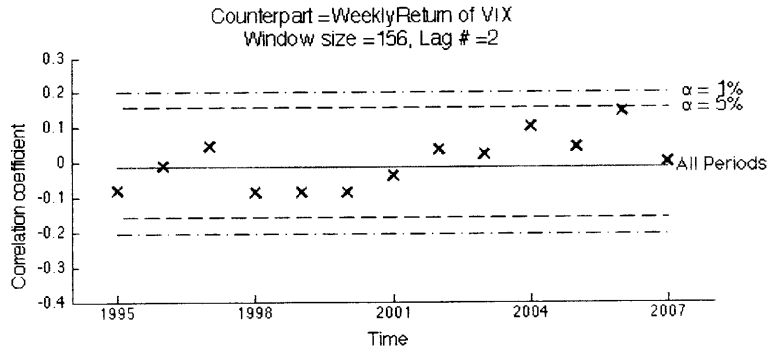
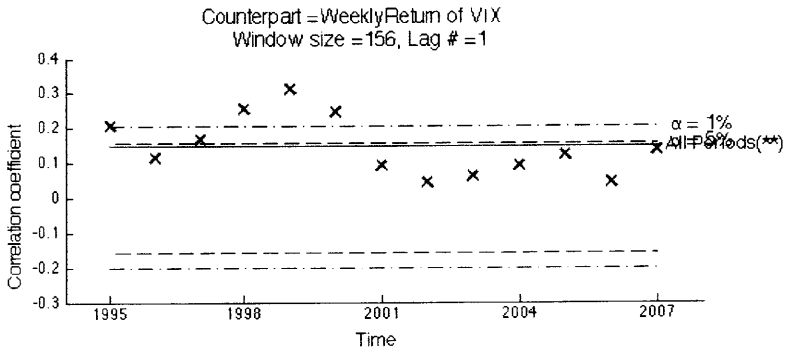




Figure A-64: Change of Correlation with Change of Volatility Index  
 (Period = Monthly, Time Window = 1 year)  
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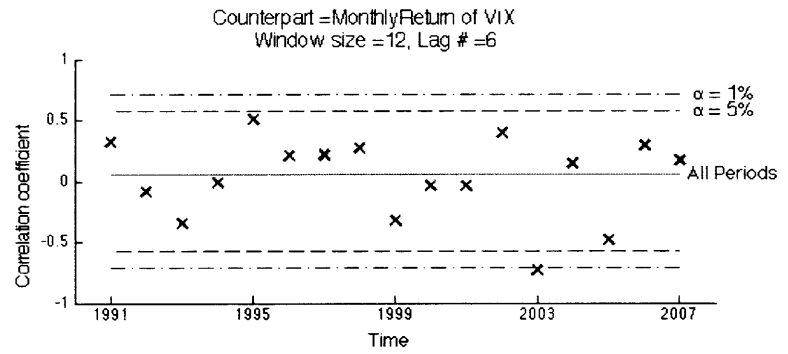
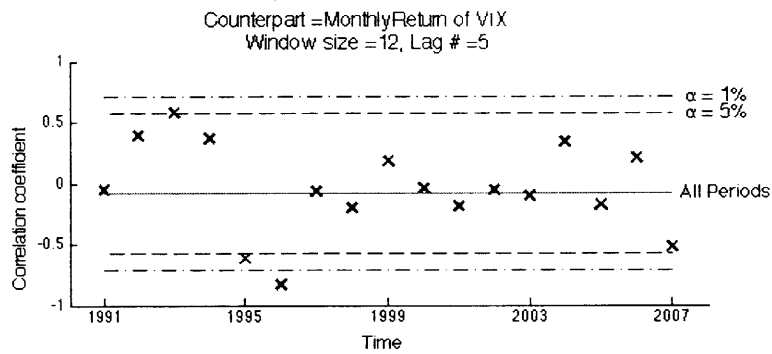
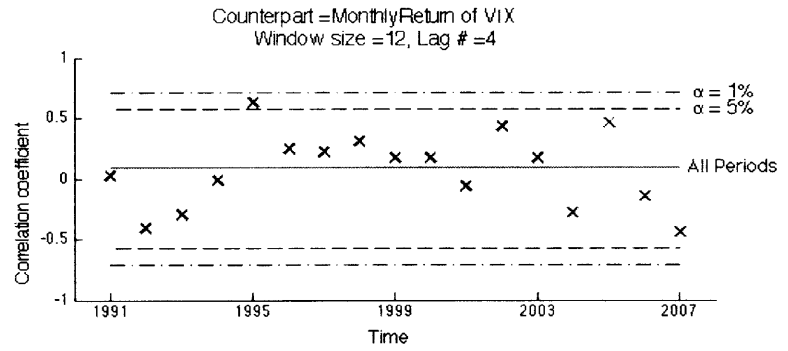
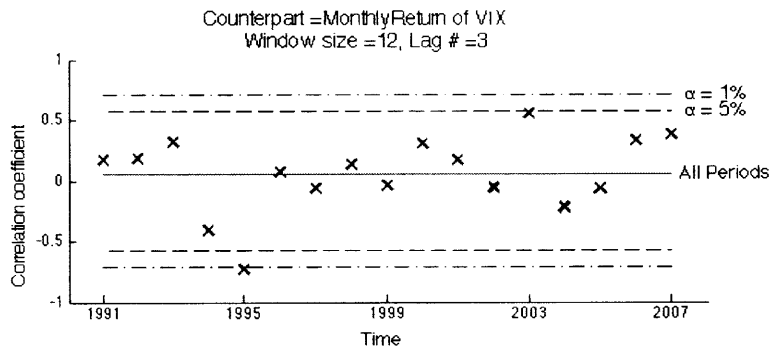
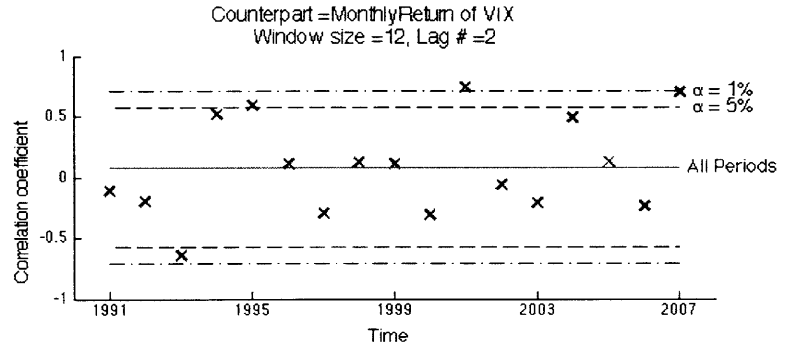
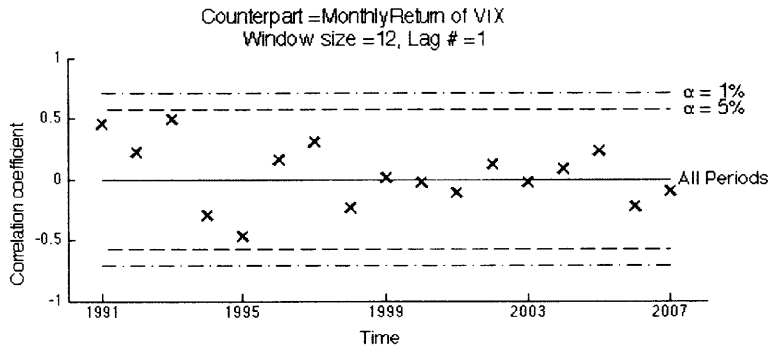


Figure A-65: Change of Correlation with Change of Volatility Index  
 (Period = Monthly, Time Window = 3 years)

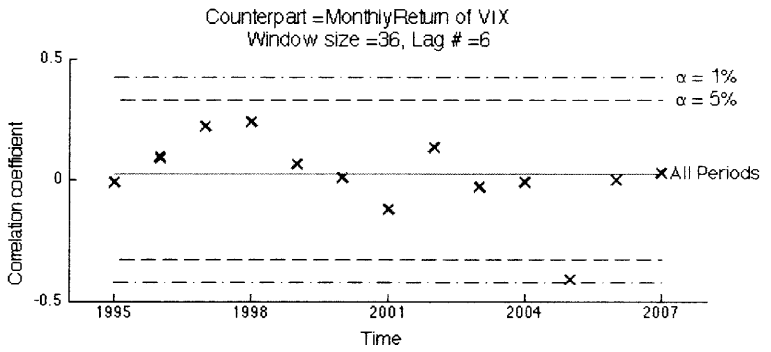
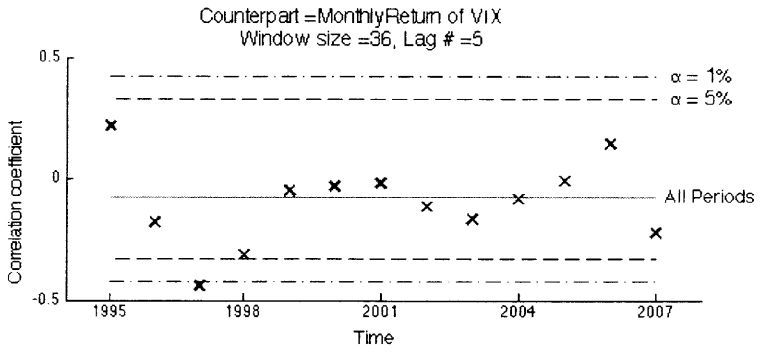
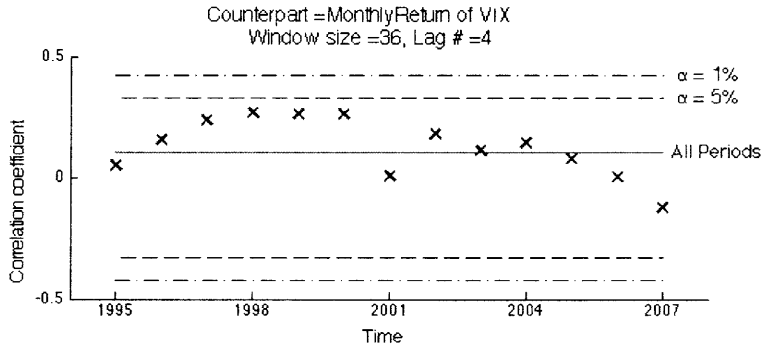
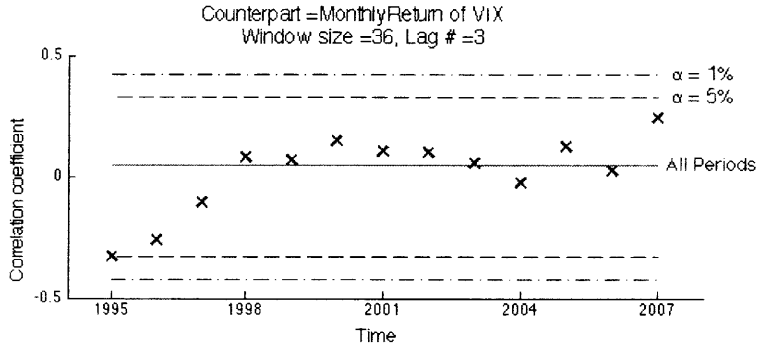
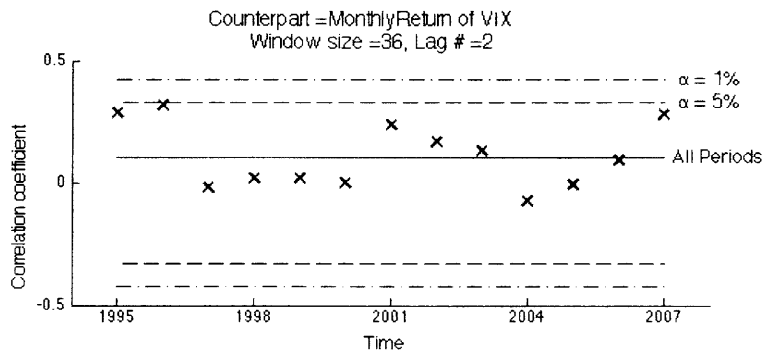
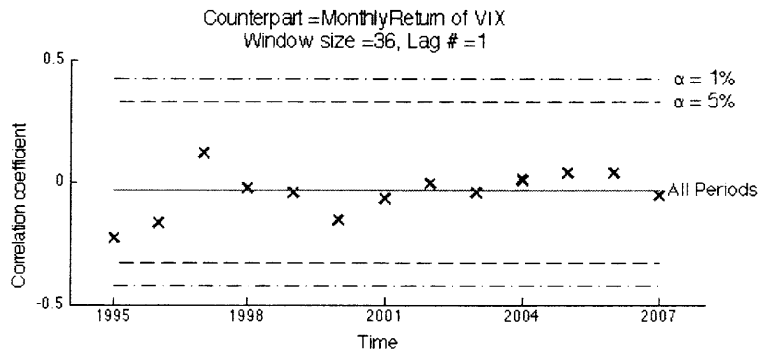


Figure A-66: Change of Correlation with Change of Volatility Index  
 (Period = Quarterly, Time Window = 3 years)  
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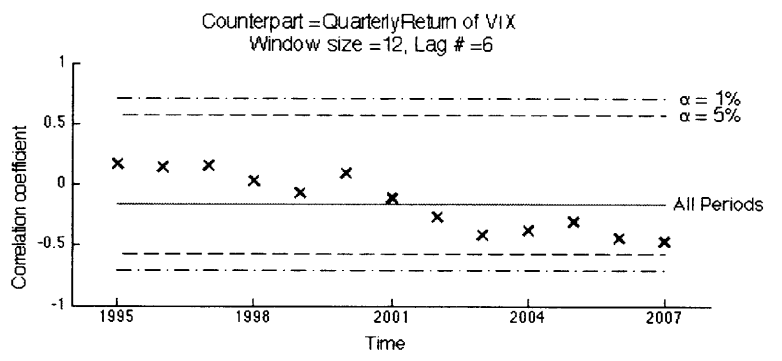
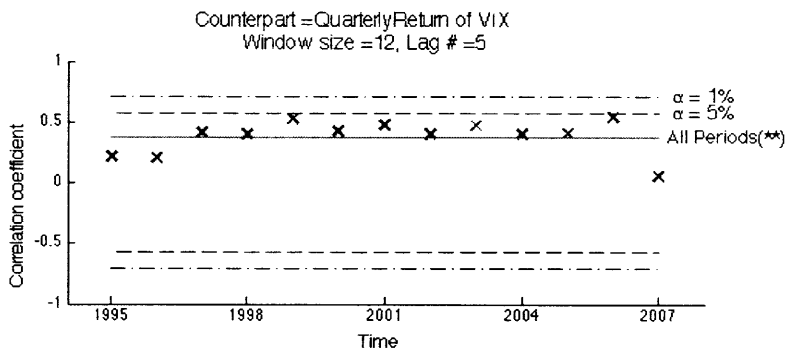
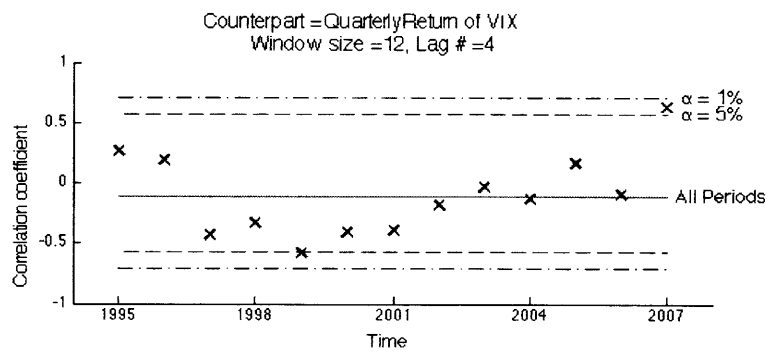
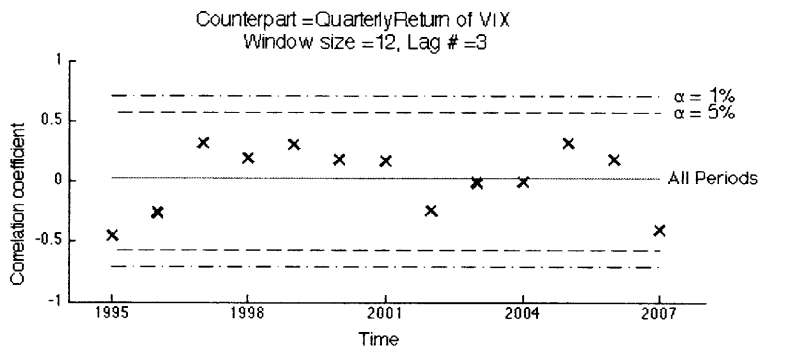
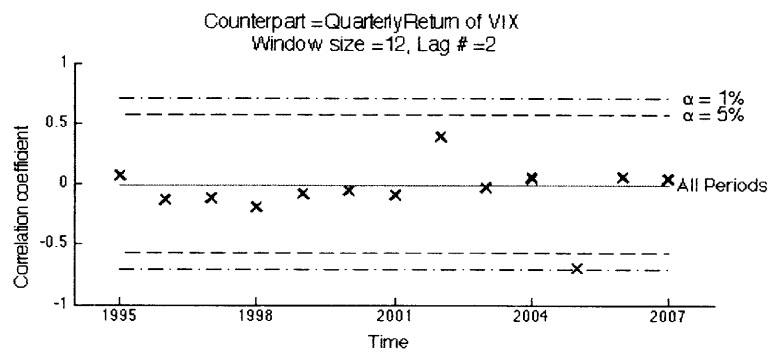
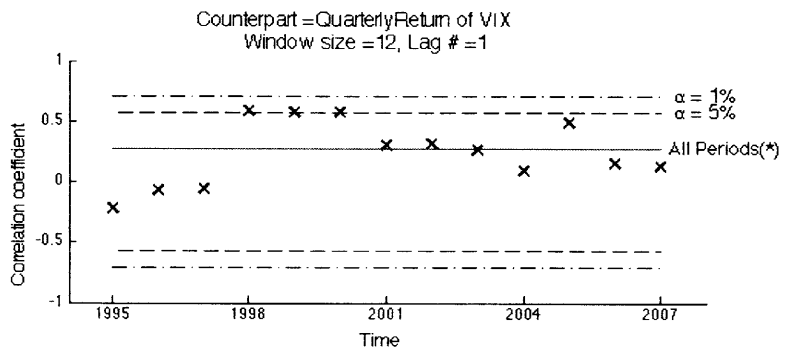
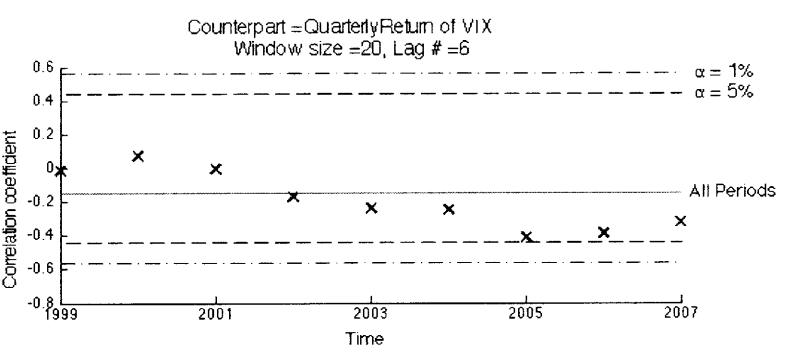
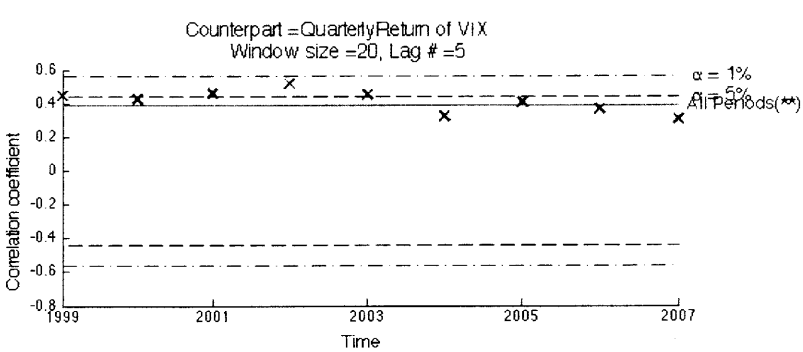
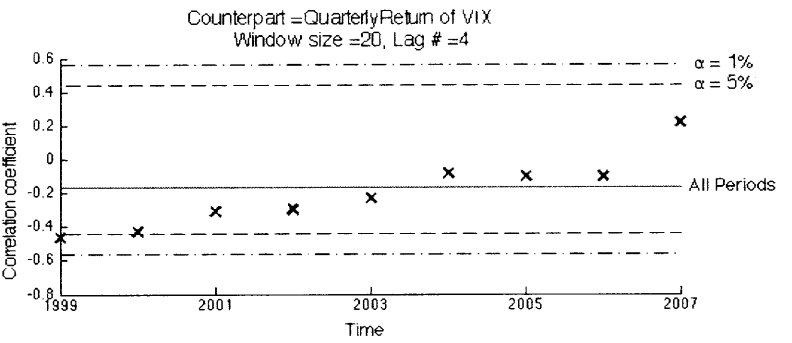
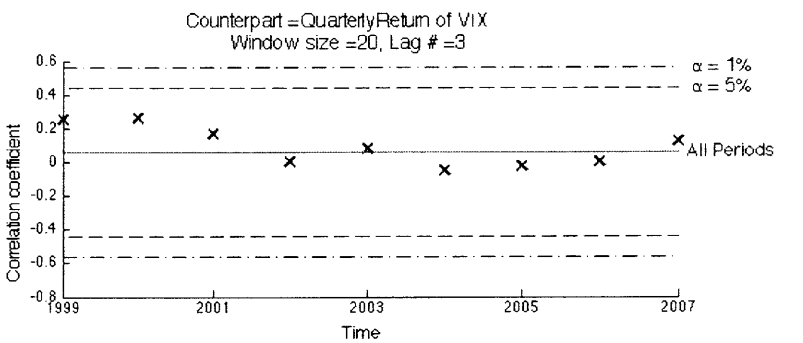
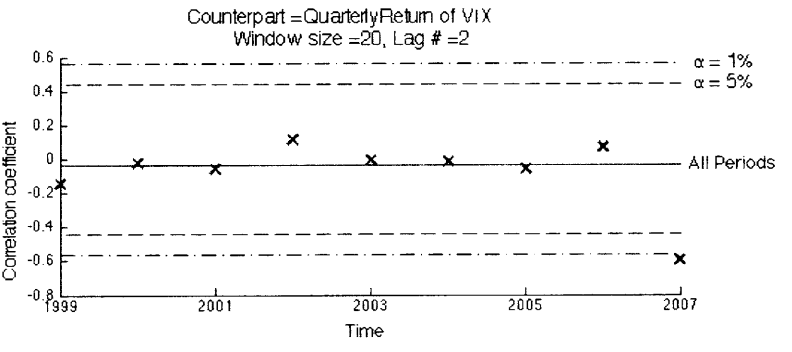
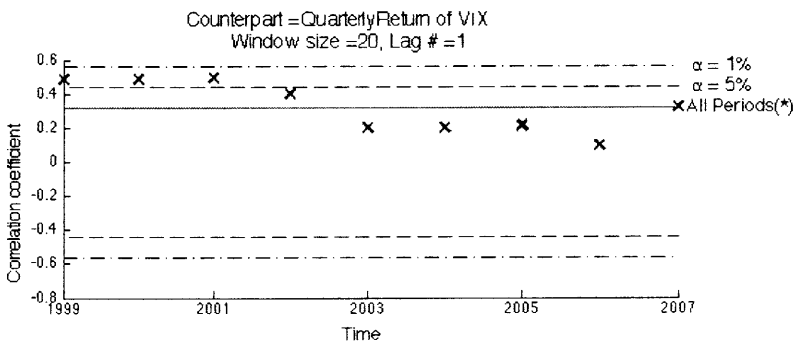


Figure A-67: Change of Correlation with Change of Volatility Index  
 (Period = Quarterly, Time Window = 5 years)



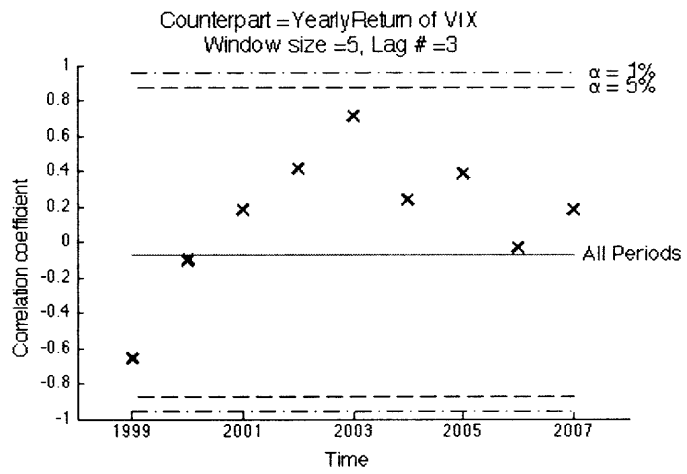
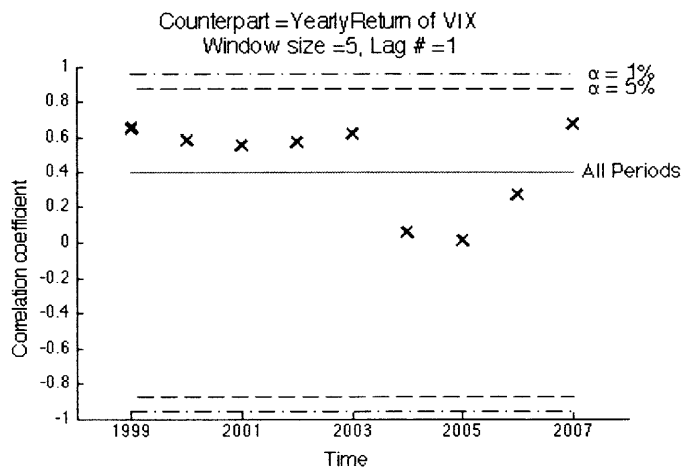
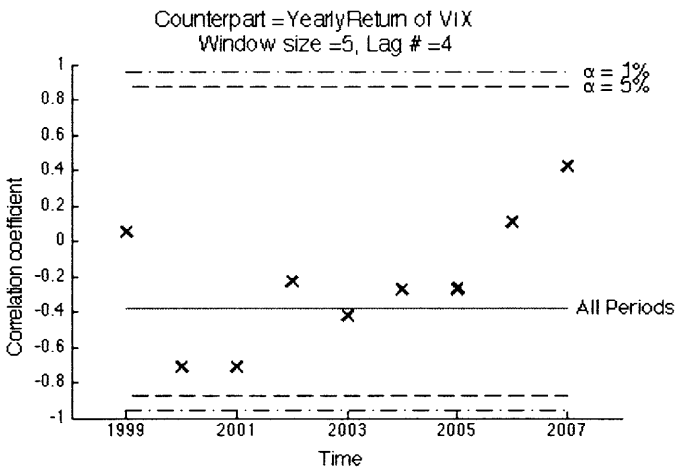
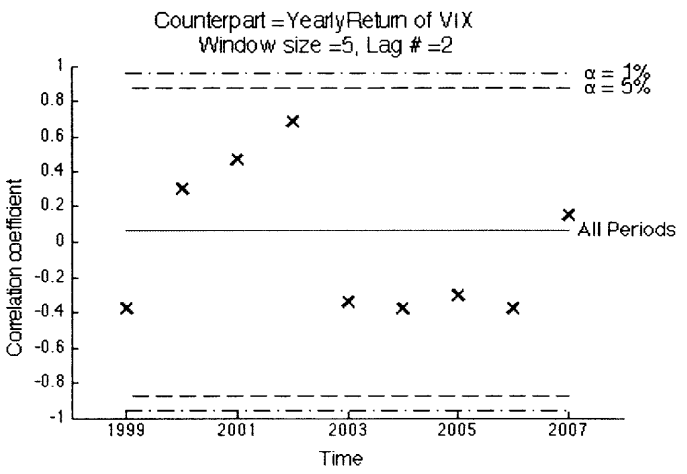


Figure A-68: Change of Correlation with Change of Volatility Index  
(Period = Yearly, Time Window = 5 years)  
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# Appendix B

## Detailed Performances of Strategy Back-Tests

### B.1 Performances of Individual Strategies

Table B.1: Performance Summary of Contrarian and Momentum Strategies

Contrarian and Momentum: Contrarian/Momentum(period, 0)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Contrarian(daily)	0.2398	0.0335	0.0242	0.0304	-0.0277	0.0869	0.0958	-0.0296	0.19	0.006	0.0617
Contrarian(weekly)	0.2025	0.1245	0.03	-0.0902	-0.1593	0.3059	0.0638	0.0483	0.1688	0.1022	0.0717
Contrarian(monthly)	-0.0665	0.1386	0.0397	-0.1307	-0.1227	-0.0178	-0.0103	0.1391	0.0064	-0.0076	-0.007
Contrarian(yearly)	0	0	0	-0.1053	-0.2337	0.2638	-0.0031	0	0	0	-0.0145
Momentum(daily)	0.0217	0.1565	-0.1227	-0.1561	-0.2118	0.1628	-0.0054	0.0614	-0.0452	0.0291	-0.0183
Momentum(weekly)	0.0534	0.0629	-0.1276	-0.0442	-0.0884	-0.0323	0.0246	-0.0174	-0.0279	-0.0607	-0.0274
Momentum(monthly)	0.3569	0.0498	-0.1357	0.0003	-0.1265	0.2867	0.1013	-0.0958	0.1289	0.0432	0.0496
Momentum(yearly)	0.2667	0.1953	-0.1014	-0.028	0	0	0.0933	0.03	0.1362	0.0353	0.0577
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Contrarian(daily)	0.1598	0.1308	0.1811	0.1697	0.2059	0.1149	0.0829	0.0713	0.0736	0.1206	0.1385
Contrarian(weekly)	0.1247	0.124	0.1475	0.1558	0.2085	0.124	0.0709	0.0664	0.0794	0.1159	0.1284
Contrarian(monthly)	0.1497	0.1265	0.1797	0.1789	0.2214	0.1178	0.0601	0.0743	0.0523	0.1072	0.1375
Contrarian(yearly)	0	0	0	0.2134	0.2602	0.1711	0.0031	0	0	0	0.1194
Momentum(daily)	0.1254	0.1248	0.1281	0.1324	0.1591	0.1267	0.0736	0.0739	0.0683	0.1044	0.1154
Momentum(weekly)	0.1603	0.1315	0.1657	0.1485	0.1556	0.1179	0.0853	0.0783	0.0614	0.1097	0.1264
Momentum(monthly)	0.1372	0.1291	0.1301	0.1197	0.1366	0.124	0.0932	0.0708	0.0857	0.1182	0.1165
Momentum(yearly)	0.2031	0.1808	0.2218	0.0283	0	0	0.1108	0.1027	0.1004	0.1596	0.135
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Contrarian(daily)	1.5008	0.2559	0.1338	0.1794	-0.1346	0.7558	1.1559	-0.4153	2.581	0.0499	0.4878
Contrarian(weekly)	1.624	1.0041	0.2035	-0.5789	-0.764	2.4677	0.8998	0.7269	2.1253	0.8823	0.5671
Contrarian(monthly)	-0.4442	1.0954	0.2211	-0.7304	-0.554	-0.1508	-0.1719	1.8716	0.123	-0.0705	-0.0554
Contrarian(yearly)	NaN	NaN	NaN	-0.4937	-0.898	1.5422	-1	NaN	NaN	NaN	-0.115
Momentum(daily)	0.1729	1.2547	-0.9571	-1.1788	-1.3311	1.285	-0.0732	0.8315	-0.6616	0.2786	-0.1444
Momentum(weekly)	0.3329	0.4783	-0.77	-0.2977	-0.5682	-0.2737	0.2885	-0.2225	-0.4543	-0.5535	-0.2171
Momentum(monthly)	2.6008	0.3855	-1.0429	0.0024	-0.9259	2.3118	1.087	-1.352	1.5039	0.3655	0.3926
Momentum(yearly)	1.3129	1.0802	-0.457	-0.992	NaN	NaN	0.842	0.2923	1.3565	0.2212	0.4561
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Contrarian(daily)	0.44	0.49	0.52	0.51	0.56	0.45	0.44	0.44	0.44	0.45	0.48
Contrarian(weekly)	0.38	0.41	0.48	0.5	0.58	0.44	0.41	0.4	0.48	0.4	0.45
Contrarian(monthly)	0.25	0.43	0.69	0.49	0.59	0.33	0.25	0.49	0.17	0.34	0.4
Contrarian(yearly)	0	0	0	0.98	1	1	0	0	0	0	0.3
Momentum(daily)	0.56	0.51	0.48	0.47	0.44	0.55	0.56	0.56	0.56	0.54	0.52
Momentum(weekly)	0.62	0.59	0.52	0.48	0.42	0.56	0.59	0.6	0.51	0.59	0.55
Momentum(monthly)	0.75	0.57	0.31	0.49	0.41	0.67	0.75	0.51	0.83	0.65	0.59
Momentum(yearly)	1	1	1	0	0	0	1	1	1	1	0.7
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Contrarian(daily)	123	125	130	130	138	140	130	141	134	141	133.2
Contrarian(weekly)	23	26	25	27	21	25	22	23	30	27	24.9
Contrarian(monthly)	4	6	7	5	6	4	4	10	4	5	5.5
Contrarian(yearly)	0	0	0	1	0	0	1	0	0	0	0.2
Momentum(daily)	123	125	130	130	138	140	130	141	134	141	133.2
Momentum(weekly)	23	26	25	27	21	25	22	23	30	27	24.9
Momentum(monthly)	4	6	7	5	6	4	4	10	4	5	5.5
Momentum(yearly)	0	0	0	1	0	0	1	0	0	0	0.2



Contrarian and Momentum on an Arbitrary Market Information Variable: Contrarian/Momentum(period, v, 0)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Momentum(Chg. of VIX, weekly)	0.2903	0.1564	0.158	0.017	-0.2046	0.3058	0.0068	0.0043	0.1207	0.0643	0.0821
Contrarian(Chg. of Trad.Vol., weekly)	0.208	0.1599	0.0081	0.0463	0.0659	0.0881	0.0769	0.0304	0.1229	-0.0149	0.0772
Momentum(Chg. of VIX, quarterly)	0.4749	0.1443	-0.1115	0.0355	-0.0865	0.291	-0.0031	0.0183	0.0637	0.0308	0.0738
Momentum(Chg. of Trad.Vol., yearly)	0.2667	0.1953	-0.0095	-0.1053	0.0057	0.2232	-0.0031	0	0.1178	0.0353	0.0665
Momentum(Chg. of Rf-Rate, daily)	0.144	0.1177	0.12	0.0881	-0.1812	0.1639	0.1881	-0.0709	0.125	-0.0312	0.0597
Momentum(Chg. of VIX, daily)	0.2232	0.0894	0.072	-0.0357	-0.0869	0.1749	-0.0013	0.0193	0.1549	0.0029	0.0571
Momentum(Chg. of VIX, yearly)	0.2667	0.1953	-0.0095	-0.1053	0.0057	0.2232	-0.0031	0	0	0	0.0511
Contrarian(Chg. of VIX, monthly)	0.3414	0.0374	-0.0087	-0.0564	-0.1509	0.2762	0.0236	-0.0381	0.1034	0.047	0.0484
Momentum(Chg. of Rf-Rate, quarterly)	0.1365	0.1964	-0.0806	-0.028	-0.1552	0.092	0.0671	0.03	0.0665	0.0726	0.0349
Contrarian(Chg. of Trad.Vol., daily)	0.2931	0.0229	-0.2096	0.082	-0.0646	0.1115	0.0038	0.0203	0.1192	0.0389	0.0343
Contrarian(Chg. of Trad.Vol., quarterly)	0.1365	0.2065	-0.0578	-0.0406	0.0362	-0.0243	0.0237	0.0197	0.1076	-0.0467	0.0328
Momentum(Chg. of Rf-Rate, monthly)	0.1639	0.0409	-0.0962	-0.0168	-0.0391	0.1392	0.0878	0.03	0.0724	-0.0378	0.0314
Contrarian(Chg. of Trad.Vol., monthly)	0.2461	0.1754	0.0191	-0.1517	-0.1825	0.1266	0.0593	-0.0592	0.0878	0.0671	0.0304
Contrarian(Chg. of Rf-Rate, weekly)	0.1865	0.0132	-0.0551	-0.0093	-0.1789	0.0879	0.0263	-0.0027	0.0994	0.1585	0.0274
Contrarian(Chg. of Rf-Rate, yearly)	0	0.1964	-0.0095	0	-0.238	0.2638	0.0899	-0.0081	0	0	0.0212
Momentum(Chg. of Rf-Rate, yearly)	0.2667	-0.0009	-0.0927	-0.1304	0.0057	0	0	0.0384	0.1362	0.0353	0.0206
Momentum(Chg. of Rf-Rate, weekly)	0.0675	0.1797	-0.049	-0.1223	-0.0667	0.1617	0.062	0.0328	0.0335	-0.1063	0.0145
Momentum(Chg. of Trad.Vol., monthly)	0.0165	0.0169	-0.1182	0.0251	-0.0625	0.1218	0.0289	0.0948	0.0445	-0.0298	0.0115
Contrarian(Chg. of Rf-Rate, monthly)	0.0884	0.1483	-0.0058	-0.1156	-0.2025	0.1094	0.0019	0	0.0595	0.076	0.0105
Momentum(Chg. of Trad.Vol., quarterly)	0.1145	-0.0093	-0.0463	-0.0937	-0.2605	0.2952	0.0647	0.0101	0.0258	0.086	0.0091
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Momentum(Chg. of VIX, weekly)	0.132	0.1265	0.1703	0.1642	0.2107	0.121	0.0816	0.0731	0.0781	0.1199	0.1345
Contrarian(Chg. of Trad.Vol., weekly)	0.1511	0.1369	0.1687	0.1447	0.2031	0.1208	0.0803	0.0734	0.0688	0.1119	0.1326
Momentum(Chg. of VIX, quarterly)	0.1378	0.0859	0.1726	0.1842	0.2245	0.105	0.0031	0.0565	0.0656	0.1481	0.1345
Momentum(Chg. of Trad.Vol., yearly)	0.2031	0.1808	0.0095	0.2134	0.0057	0.1678	0.0031	0	0.099	0.1596	0.1353
Momentum(Chg. of Rf-Rate, daily)	0.1368	0.1408	0.1701	0.1372	0.21	0.1387	0.0921	0.0886	0.0814	0.1046	0.1355
Momentum(Chg. of VIX, daily)	0.1618	0.1298	0.1809	0.1682	0.1945	0.1194	0.0828	0.074	0.073	0.124	0.1375
Momentum(Chg. of VIX, yearly)	0.2031	0.1808	0.0095	0.2134	0.0057	0.1678	0.0031	0	0	0	0.1216
Contrarian(Chg. of VIX, monthly)	0.1311	0.1088	0.1323	0.1242	0.1342	0.1369	0.0813	0.0753	0.0683	0.0921	0.1114
Momentum(Chg. of Rf-Rate, quarterly)	0.0683	0.1808	0.2112	0.0283	0.1029	0.0522	0.0933	0.1027	0.0932	0.08	0.1142
Contrarian(Chg. of Trad.Vol., daily)	0.1389	0.1141	0.146	0.1479	0.2016	0.1136	0.0752	0.0742	0.0748	0.1162	0.1262
Contrarian(Chg. of Trad.Vol., quarterly)	0.0683	0.1321	0.1704	0.1495	0.1544	0.1184	0.0815	0.0853	0.0598	0.1143	0.1191
Momentum(Chg. of Rf-Rate, monthly)	0.108	0.1367	0.1755	0.0535	0.1311	0.1126	0.1015	0.1027	0.0935	0.1269	0.1181
Contrarian(Chg. of Trad.Vol., monthly)	0.154	0.0978	0.1384	0.1718	0.1843	0.1241	0.079	0.0639	0.0552	0.0733	0.1225
Contrarian(Chg. of Rf-Rate, weekly)	0.1526	0.1211	0.1424	0.1719	0.1637	0.1151	0.0526	0.0468	0.0556	0.1152	0.1221
Contrarian(Chg. of Rf-Rate, yearly)	0	0.1808	0.0095	0	0.2601	0.1711	0.1109	0.0081	0	0	0.1192
Momentum(Chg. of Rf-Rate, yearly)	0.2031	0.0009	0.2216	0.2153	0.0057	0	0	0.1023	0.1004	0.1596	0.1352
Momentum(Chg. of Rf-Rate, weekly)	0.1341	0.1342	0.1701	0.1295	0.2022	0.1266	0.0976	0.0914	0.0836	0.1104	0.1326
Momentum(Chg. of Trad.Vol., monthly)	0.1325	0.152	0.1733	0.1296	0.1836	0.1178	0.0778	0.0804	0.0839	0.1417	0.1322
Contrarian(Chg. of Rf-Rate, monthly)	0.172	0.1182	0.1358	0.2085	0.2247	0.1288	0.0446	0	0.0367	0.0967	0.1361
Momentum(Chg. of Trad.Vol., quarterly)	0.1913	0.1234	0.142	0.1549	0.2094	0.1235	0.0752	0.0571	0.0807	0.1113	0.1352
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.2: Performance Summary of Top 20 Contrarian and Momentum Strategies on an Arbitrary Market Information Variable (Annualized Returns and Annualized Volatilities)  
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Contrarian and Momentum on an Arbitrary Market Information Variable: Contrarian/Momentum(period, v, 0)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Momentum(Chg. of VIX, weekly)	2.1988	1.2367	0.9276	0.1035	-0.9711	2.528	0.0831	0.0585	1.5446	0.5361	0.6842
Contrarian(Chg. of Trad.Vol., weekly)	1.3763	1.1686	0.0481	0.3201	0.3245	0.7292	0.9573	0.4141	1.7847	-0.1332	0.6436
Momentum(Chg. of VIX, quarterly)	3.4467	1.6796	-0.6461	0.1927	-0.3853	2.771	-1	0.3249	0.9715	0.2077	0.6152
Momentum(Chg. of Trad.Vol., yearly)	1.3129	1.0802	-1	-0.4937	1	1.3301	-1	NaN	1.1896	0.2212	0.5544
Momentum(Chg. of Rf-Rate, daily)	1.0523	0.8358	0.7056	0.6423	-0.8627	1.1818	2.0427	-0.8008	1.535	-0.2985	0.4979
Momentum(Chg. of VIX, daily)	1.3792	0.6887	0.3981	-0.2122	-0.447	1.4654	-0.0157	0.2602	2.1221	0.0232	0.4758
Momentum(Chg. of VIX, yearly)	1.3129	1.0802	-1	-0.4937	1	1.3301	-1	NaN	NaN	NaN	0.4255
Contrarian(Chg. of VIX, monthly)	2.6041	0.3435	-0.0659	-0.454	-1.1246	2.0173	0.2897	-0.5061	1.5143	0.5103	0.4034
Momentum(Chg. of Rf-Rate, quarterly)	1.9979	1.0863	-0.3813	-0.992	-1.508	1.764	0.7196	0.2923	0.7136	0.9072	0.2911
Contrarian(Chg. of Trad.Vol., daily)	2.1104	0.2011	-1.4358	0.5543	-0.3204	0.9814	0.05	0.2733	1.5948	0.3349	0.2856
Contrarian(Chg. of Trad.Vol., quarterly)	1.9979	1.5638	-0.3389	-0.2714	0.2347	-0.2049	0.2908	0.2312	1.7998	-0.4084	0.2738
Momentum(Chg. of Rf-Rate, monthly)	1.5174	0.2991	-0.5481	-0.3144	-0.2983	1.2364	0.8653	0.2923	0.7751	-0.2977	0.2619
Contrarian(Chg. of Trad.Vol., monthly)	1.5983	1.7941	0.138	-0.8828	-0.9903	1.0202	0.7509	-0.927	1.5906	0.9151	0.2533
Contrarian(Chg. of Rf-Rate, weekly)	1.2225	0.1092	-0.3868	-0.054	-1.0926	0.7636	0.5009	-0.0585	1.7876	1.3756	0.2285
Contrarian(Chg. of Rf-Rate, yearly)	NaN	1.0863	-1	NaN	-0.9151	1.5422	0.8112	-1	NaN	NaN	0.1768
Momentum(Chg. of Rf-Rate, yearly)	1.3129	-1	-0.4184	-0.6059	1	NaN	NaN	0.3757	1.3565	0.2212	0.172
Momentum(Chg. of Rf-Rate, weekly)	0.5038	1.3383	-0.2882	-0.944	-0.33	1.2778	0.6348	0.3595	0.4004	-0.9629	0.1206
Momentum(Chg. of Trad.Vol., monthly)	0.1245	0.1111	-0.6821	0.1935	-0.3405	1.0344	0.3714	1.1801	0.5302	-0.2104	0.0962
Contrarian(Chg. of Rf-Rate, monthly)	0.5135	1.2543	-0.0426	-0.5542	-0.9009	0.8493	0.0433	NaN	1.6198	0.7856	0.0878
Momentum(Chg. of Trad.Vol., quarterly)	0.5988	-0.0757	-0.3261	-0.6047	-1.2437	2.391	0.8605	0.1767	0.3201	0.7723	0.0762
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Momentum(Chg. of VIX, weekly)	0.51	0.47	0.5	0.38	0.54	0.43	0.48	0.48	0.46	0.52	0.48
Contrarian(Chg. of Trad.Vol., weekly)	0.47	0.54	0.46	0.49	0.53	0.5	0.52	0.47	0.44	0.52	0.49
Momentum(Chg. of VIX, quarterly)	0.75	0.25	0.5	0.75	0.51	0.5	0	0.25	0.5	0.75	0.48
Momentum(Chg. of Trad.Vol., yearly)	1	1	0	0.98	0	1	0	0	1	1	0.6
Momentum(Chg. of Rf-Rate, daily)	0.53	0.59	0.6	0.46	0.62	0.66	0.71	0.7	0.66	0.56	0.61
Momentum(Chg. of VIX, daily)	0.47	0.5	0.5	0.45	0.51	0.47	0.43	0.46	0.49	0.48	0.48
Momentum(Chg. of VIX, yearly)	1	1	0	0.98	0	1	0	0	0	0	0.4
Contrarian(Chg. of VIX, monthly)	0.66	0.41	0.42	0.49	0.49	0.58	0.59	0.59	0.58	0.49	0.53
Momentum(Chg. of Rf-Rate, quarterly)	0.24	1	0.75	0	0.25	0.25	0.75	1	0.75	0.49	0.55
Contrarian(Chg. of Trad.Vol., daily)	0.51	0.48	0.5	0.47	0.5	0.53	0.48	0.48	0.53	0.48	0.5
Contrarian(Chg. of Trad.Vol., quarterly)	0.24	0.5	0.5	0.5	0.49	0.24	0.5	0.75	0.5	0.5	0.47
Momentum(Chg. of Rf-Rate, monthly)	0.43	0.67	0.66	0.08	0.33	0.41	0.84	1	0.75	0.5	0.57
Contrarian(Chg. of Trad.Vol., monthly)	0.51	0.35	0.42	0.65	0.66	0.5	0.43	0.42	0.42	0.32	0.47
Contrarian(Chg. of Rf-Rate, weekly)	0.47	0.44	0.42	0.71	0.46	0.48	0.2	0.23	0.39	0.48	0.43
Contrarian(Chg. of Rf-Rate, yearly)	0	1	0	0	1	1	1	0	0	0	0.4
Momentum(Chg. of Rf-Rate, yearly)	1	0	1	0.98	0	0	0	1	1	1	0.6
Momentum(Chg. of Rf-Rate, weekly)	0.53	0.56	0.58	0.27	0.54	0.52	0.8	0.77	0.61	0.51	0.57
Momentum(Chg. of Trad.Vol., monthly)	0.49	0.65	0.58	0.33	0.34	0.5	0.57	0.58	0.58	0.68	0.53
Contrarian(Chg. of Rf-Rate, monthly)	0.57	0.33	0.34	0.9	0.67	0.59	0.16	0	0.25	0.5	0.43
Momentum(Chg. of Trad.Vol., quarterly)	0.76	0.5	0.5	0.48	0.51	0.76	0.5	0.25	0.5	0.5	0.53

Table B.3: Performance Summary of Top 20 Contrarian and Momentum Strategies on an Arbitrary Market Information Variable (Sharpe Ratios and Proportions of In-the-Market)

Table B.4: Performance Summary of Top 20 Contrarian and Momentum Strategies on an Arbitrary Market Information Variable (Numbers of Trading)

Contrarian and Momentum on an Arbitrary Market Information Variable: Contrarian/Momentum(period, v, 0)												
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007	
Momentum(Chg. of VIX, weekly)	32	32	33	21	25	34	26	30	30	33	29.6	
Contrarian(Chg. of Trad.Vol., weekly)	40	36	28	28	28	34	34	38	32	34	33.2	
Momentum(Chg. of VIX, quarterly)	2	2	4	2	2	4	1	2	4	1	2.4	
Momentum(Chg. of Trad.Vol., yearly)	0	0	1	1	1	1	1	0	1	0	0.6	
Momentum(Chg. of Rf-Rate, daily)	112	100	113	115	115	104	105	113	106	126	110.9	
Momentum(Chg. of VIX, daily)	121	132	127	116	129	132	122	132	134	140	128.5	
Momentum(Chg. of VIX, yearly)	0	0	1	1	1	1	1	0	0	0	0.5	
Contrarian(Chg. of VIX, monthly)	6	9	8	5	6	7	7	8	6	7	6.9	
Momentum(Chg. of Rf-Rate, quarterly)	2	1	2	1	2	1	2	0	1	2	1.4	
Contrarian(Chg. of Trad.Vol., daily)	144	145	126	127	144	149	144	148	146	143	141.6	
Contrarian(Chg. of Trad.Vol., quarterly)	2	3	2	2	2	1	4	3	2	2	2.3	
Momentum(Chg. of Rf-Rate, monthly)	6	8	5	2	4	8	5	0	3	6	4.7	
Contrarian(Chg. of Trad.Vol., monthly)	8	8	6	8	8	8	9	9	5	8	7.7	
Contrarian(Chg. of Rf-Rate, weekly)	29	33	18	26	29	22	22	20	20	24	24.3	
Contrarian(Chg. of Rf-Rate, yearly)	0	1	1	0	1	0	0	1	0	0	0.4	
Momentum(Chg. of Rf-Rate, yearly)	0	1	1	0	1	0	0	1	0	0	0.4	
Momentum(Chg. of Rf-Rate, weekly)	29	33	18	26	29	22	22	20	20	24	24.3	
Momentum(Chg. of Trad.Vol., monthly)	8	8	6	8	8	8	9	9	5	8	7.7	
Contrarian(Chg. of Rf-Rate, monthly)	6	8	5	2	4	8	5	0	3	6	4.7	
Momentum(Chg. of Trad.Vol., quarterly)	2	3	2	2	2	1	4	3	2	2	2.3	

Table B.5: Performance Summary of Top 20 Moving Average Convergence and Divergence Strategies (Annualized Returns and Annualized Volatilities)

	Moving Average Convergence Divergence: MACD(ShortWindowSize, LongWindowSize, $\theta$ )										
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
MACD(25, 280, 0.02)	0.2667	0.1953	-0.0279	0	0	0.1499	0.0899	0.03	0.1362	0.0353	0.0837
MACD(20, 240, 0.04)	0.2667	0.1953	-0.0867	0	0	0.1915	0.0899	0.03	0.1362	0.0353	0.0808
MACD(15, 260, 0.04)	0.2667	0.1953	-0.061	0	0	0.1539	0.0899	0.03	0.1362	0.0353	0.0804
MACD(30, 300, 0.02)	0.2667	0.1953	-0.0541	0	0	0.129	0.0899	0.03	0.1362	0.0353	0.0788
MACD(20, 200, 0.06)	0.2667	0.1953	-0.0676	0	0	0.1445	0.0899	0.03	0.1362	0.0353	0.0787
MACD(50, 260, 0.06)	0.2667	0.1953	-0.1014	0.0333	0	0.141	0.0899	0.03	0.1362	0.0353	0.078
MACD(25, 300, 0.02)	0.2667	0.1953	-0.0703	0	0	0.1393	0.0899	0.03	0.1362	0.0353	0.0779
MACD(45, 160, 0.02)	0.1428	0.1953	-0.0254	0	0	0.2041	0.0899	0.03	0.1362	0.0353	0.0779
MACD(20, 300, 0.02)	0.2667	0.1953	-0.061	0	0	0.1257	0.0899	0.03	0.1362	0.0353	0.0777
MACD(15, 220, 0.06)	0.2667	0.1953	-0.0982	0	0	0.1709	0.0899	0.03	0.1362	0.0353	0.0776
MACD(40, 280, 0.02)	0.2667	0.1953	-0.0691	0	0	0.129	0.0899	0.03	0.1362	0.0353	0.0771
MACD(50, 240, 0.06)	0.2667	0.1953	-0.1014	0.0333	0	0.1306	0.0899	0.03	0.1362	0.0353	0.077
MACD(20, 260, 0.02)	0.1576	0.1953	-0.05	0	0	0.209	0.0899	0.03	0.1362	0.0353	0.0769
MACD(45, 280, 0.04)	0.2667	0.1953	-0.0606	0	0	0.1167	0.0899	0.03	0.1362	0.0353	0.0769
MACD(50, 300, 0.06)	0.2667	0.1953	-0.1014	0.0304	0	0.1326	0.0899	0.03	0.1362	0.0353	0.0768
MACD(25, 220, 0.02)	0.1853	0.1953	-0.0492	0	0	0.1765	0.0899	0.03	0.1362	0.0353	0.0766
MACD(25, 240, 0.04)	0.2667	0.1953	-0.105	0	0	0.1665	0.0899	0.03	0.1362	0.0353	0.0764
MACD(45, 220, 0.04)	0.2667	0.1953	-0.0856	0	0	0.1393	0.0899	0.03	0.1362	0.0353	0.0761
MACD(50, 220, 0.06)	0.2667	0.1953	-0.1014	0.0169	0	0.1401	0.0899	0.03	0.1362	0.0353	0.0761
MACD(35, 240, 0.04)	0.2667	0.1953	-0.0906	0	0	0.1445	0.0899	0.03	0.1362	0.0353	0.076
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
MACD(25, 280, 0.02)	0.2031	0.1808	0.2017	0	0	0.1004	0.1109	0.1027	0.1004	0.1596	0.1353
MACD(20, 240, 0.04)	0.2031	0.1808	0.2086	0	0	0.1035	0.1109	0.1027	0.1004	0.1596	0.1366
MACD(15, 260, 0.04)	0.2031	0.1808	0.1999	0	0	0.1005	0.1109	0.1027	0.1004	0.1596	0.135
MACD(30, 300, 0.02)	0.2031	0.1808	0.2057	0	0	0.0979	0.1109	0.1027	0.1004	0.1596	0.1357
MACD(20, 200, 0.06)	0.2031	0.1808	0.215	0	0	0.1003	0.1109	0.1027	0.1004	0.1596	0.1373
MACD(50, 260, 0.06)	0.2031	0.1808	0.2218	0.0697	0	0.09	0.1109	0.1027	0.1004	0.1596	0.1395
MACD(25, 300, 0.02)	0.2031	0.1808	0.204	0	0	0.0983	0.1109	0.1027	0.1004	0.1596	0.1355
MACD(45, 160, 0.02)	0.1722	0.1808	0.2018	0	0	0.1039	0.1109	0.1027	0.1004	0.1596	0.1312
MACD(20, 300, 0.02)	0.2031	0.1808	0.1999	0	0	0.0991	0.1109	0.1027	0.1004	0.1596	0.1349
MACD(15, 220, 0.06)	0.2031	0.1808	0.2097	0	0	0.1016	0.1109	0.1027	0.1004	0.1596	0.1366
MACD(40, 280, 0.02)	0.2031	0.1808	0.2061	0	0	0.0979	0.1109	0.1027	0.1004	0.1596	0.1358
MACD(50, 240, 0.06)	0.2031	0.1808	0.2218	0.0697	0	0.0916	0.1109	0.1027	0.1004	0.1596	0.1396
MACD(20, 260, 0.02)	0.1864	0.1808	0.1982	0	0	0.104	0.1109	0.1027	0.1004	0.1596	0.1326
MACD(45, 280, 0.04)	0.2031	0.1808	0.2152	0	0	0.0927	0.1109	0.1027	0.1004	0.1596	0.1368
MACD(50, 300, 0.06)	0.2031	0.1808	0.2218	0.0696	0	0.0832	0.1109	0.1027	0.1004	0.1596	0.139
MACD(25, 220, 0.02)	0.1843	0.1808	0.1982	0	0	0.1074	0.1109	0.1027	0.1004	0.1596	0.1326
MACD(25, 240, 0.04)	0.2031	0.1808	0.2096	0	0	0.1016	0.1109	0.1027	0.1004	0.1596	0.1366
MACD(45, 220, 0.04)	0.2031	0.1808	0.2141	0	0	0.0983	0.1109	0.1027	0.1004	0.1596	0.1371
MACD(50, 220, 0.06)	0.2031	0.1808	0.2218	0.0684	0	0.0912	0.1109	0.1027	0.1004	0.1596	0.1395
MACD(35, 240, 0.04)	0.2031	0.1808	0.2086	0	0	0.1003	0.1109	0.1027	0.1004	0.1596	0.1363
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Moving Average Convergence Divergence: MACD(ShortWindowSize, LongWindowSize, $\theta$ )											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
MACD(25, 280, 0.02)	1.3129	1.0802	-0.1381	NaN	NaN	1.4922	-0.8112	0.2923	1.3565	0.2212	0.6143
MACD(20, 240, 0.04)	1.3129	1.0802	-0.4154	NaN	NaN	1.8498	0.8112	0.2923	1.3565	0.2212	0.593
MACD(15, 260, 0.04)	1.3129	1.0802	-0.3053	NaN	NaN	1.5317	0.8112	0.2923	1.3565	0.2212	0.5895
MACD(30, 300, 0.02)	1.3129	1.0802	-0.2629	NaN	NaN	1.3178	0.8112	0.2923	1.3565	0.2212	0.5781
MACD(20, 200, 0.06)	1.3129	1.0802	-0.3145	NaN	NaN	1.44	0.8112	0.2923	1.3565	0.2212	0.5774
MACD(50, 260, 0.06)	1.3129	1.0802	-0.457	0.4783	NaN	1.5666	0.8112	0.2923	1.3565	0.2212	0.5718
MACD(25, 300, 0.02)	1.3129	1.0802	-0.3446	NaN	NaN	1.4169	0.8112	0.2923	1.3565	0.2212	0.5716
MACD(45, 160, 0.02)	0.8294	1.0802	-0.1261	NaN	NaN	1.9641	0.8112	0.2923	1.3565	0.2212	0.5712
MACD(20, 300, 0.02)	1.3129	1.0802	-0.3053	NaN	NaN	1.2688	0.8112	0.2923	1.3565	0.2212	0.5699
MACD(15, 220, 0.06)	1.3129	1.0802	-0.4683	NaN	NaN	1.6825	0.8112	0.2923	1.3565	0.2212	0.5691
MACD(40, 280, 0.02)	1.3129	1.0802	-0.3353	NaN	NaN	1.3178	0.8112	0.2923	1.3565	0.2212	0.5654
MACD(50, 240, 0.06)	1.3129	1.0802	-0.457	0.4783	NaN	1.4266	0.8112	0.2923	1.3565	0.2212	0.5646
MACD(20, 260, 0.02)	0.8456	1.0802	-0.2523	NaN	NaN	2.0091	0.8112	0.2923	1.3565	0.2212	0.5643
MACD(45, 280, 0.04)	1.3129	1.0802	-0.2817	NaN	NaN	1.2597	0.8112	0.2923	1.3565	0.2212	0.5639
MACD(50, 300, 0.06)	1.3129	1.0802	-0.457	0.4363	NaN	1.594	0.8112	0.2923	1.3565	0.2212	0.5637
MACD(25, 220, 0.02)	1.0053	1.0802	-0.2484	NaN	NaN	1.6439	0.8112	0.2923	1.3565	0.2212	0.5622
MACD(25, 240, 0.04)	1.3129	1.0802	-0.5011	NaN	NaN	1.6381	0.8112	0.2923	1.3565	0.2212	0.5601
MACD(45, 220, 0.04)	1.3129	1.0802	-0.3995	NaN	NaN	1.4169	0.8112	0.2923	1.3565	0.2212	0.5585
MACD(50, 220, 0.06)	1.3129	1.0802	-0.457	0.2465	NaN	1.5358	0.8112	0.2923	1.3565	0.2212	0.5584
MACD(35, 240, 0.04)	1.3129	1.0802	-0.4346	NaN	NaN	1.44	0.8112	0.2923	1.3565	0.2212	0.5577
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
MACD(25, 280, 0.02)	1	1	0.84	0	0	0.59	1	1	1	1	0.74
MACD(20, 240, 0.04)	1	1	0.91	0	0	0.61	1	1	1	1	0.75
MACD(15, 260, 0.04)	1	1	0.83	0	0	0.6	1	1	1	1	0.74
MACD(30, 300, 0.02)	1	1	0.88	0	0	0.57	1	1	1	1	0.74
MACD(20, 200, 0.06)	1	1	0.94	0	0	0.59	1	1	1	1	0.75
MACD(50, 260, 0.06)	1	1	1	0.06	0	0.51	1	1	1	1	0.76
MACD(25, 300, 0.02)	1	1	0.87	0	0	0.57	1	1	1	1	0.74
MACD(45, 160, 0.02)	0.77	1	0.85	0	0	0.62	1	1	1	1	0.72
MACD(20, 300, 0.02)	1	1	0.83	0	0	0.58	1	1	1	1	0.74
MACD(15, 220, 0.06)	1	1	0.92	0	0	0.6	1	1	1	1	0.75
MACD(40, 280, 0.02)	1	1	0.88	0	0	0.57	1	1	1	1	0.74
MACD(50, 240, 0.06)	1	1	1	0.06	0	0.53	1	1	1	1	0.76
MACD(20, 260, 0.02)	0.88	1	0.81	0	0	0.62	1	1	1	1	0.73
MACD(45, 280, 0.04)	1	1	0.94	0	0	0.54	1	1	1	1	0.75
MACD(50, 300, 0.06)	1	1	1	0.06	0	0.46	1	1	1	1	0.75
MACD(25, 220, 0.02)	0.85	1	0.81	0	0	0.65	1	1	1	1	0.73
MACD(25, 240, 0.04)	1	1	0.92	0	0	0.6	1	1	1	1	0.75
MACD(45, 220, 0.04)	1	1	0.94	0	0	0.57	1	1	1	1	0.75
MACD(50, 220, 0.06)	1	1	1	0.05	0	0.52	1	1	1	1	0.76
MACD(35, 240, 0.04)	1	1	0.91	0	0	0.59	1	1	1	1	0.75

Table B.6: Performance Summary of Top 20 Moving Average Convergence and Divergence Strategies (Sharpe Ratios and Proportions of In-the-Market)

Table B.7: Performance Summary of Top 20 Moving Average Convergence and Divergence Strategies (Numbers of Trading)

Moving Average Convergence Divergence: MACD(ShortWindowSize, LongWindowSize, $\theta$ )											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
MACD(25, 280, 0.02)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(20, 240, 0.04)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(15, 260, 0.04)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(30, 300, 0.02)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(20, 200, 0.06)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(50, 260, 0.06)	0	0	0	1	0	1	0	0	0	0	0.2
MACD(25, 300, 0.02)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(45, 160, 0.02)	2	0	1	0	0	1	0	0	0	0	0.4
MACD(20, 300, 0.02)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(15, 220, 0.06)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(40, 280, 0.02)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(50, 240, 0.06)	0	0	0	1	0	1	0	0	0	0	0.2
MACD(20, 260, 0.02)	2	0	1	0	0	1	0	0	0	0	0.4
MACD(45, 280, 0.04)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(50, 300, 0.06)	0	0	0	1	0	1	0	0	0	0	0.2
MACD(25, 220, 0.02)	2	0	1	0	0	1	0	0	0	0	0.4
MACD(25, 240, 0.04)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(45, 220, 0.04)	0	0	1	0	0	1	0	0	0	0	0.2
MACD(50, 220, 0.06)	0	0	0	1	0	1	0	0	0	0	0.2
MACD(35, 240, 0.04)	0	0	1	0	0	1	0	0	0	0	0.2

Table B.8: Performance Summary of Top 20 Trend-Based Regression Strategies  
(Annualized Returns and Annualized Volatilities)

Returns	Trend-based Regression Algorithm: Trend-based Regression(W, K, $\theta$ )										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression(8, 100, 0.5)	0.2691	0.1191	0.1626	-0.0117	-0.1054	0.2612	-0.0377	-0.0172	0.1398	0.047	0.0759
Trend-based Regression(6, 60, 0.2)	0.2979	0.0598	0.0031	-0.1307	0.0426	0.3153	0.0864	0.0681	0.113	-0.0242	0.0756
Trend-based Regression(6, 60, 0.3)	0.2735	0.066	0.1169	-0.0875	0.0225	0.2695	0.0361	0.0251	0.104	-0.0202	0.0751
Trend-based Regression(6, 90, 0.3)	0.271	0.1177	0.0672	-0.1431	-0.0449	0.2021	0.0728	-0.0062	0.1761	0.0162	0.0663
Trend-based Regression(6, 100, 0.2)	0.2452	0.1125	0.0066	-0.0771	-0.088	0.1899	0.0136	0.0294	0.1513	0.1212	0.0651
Trend-based Regression(8, 60, 0.4)	0.1441	-0.0315	0.1907	-0.2102	0.1732	0.1785	0.066	0.0401	0.1094	0.0432	0.0634
Trend-based Regression(6, 100, 0.4)	0.2559	0.186	-0.0256	-0.0943	-0.0826	0.3758	0.0865	-0.05	0.098	-0.0319	0.0617
Trend-based Regression(8, 100, 0.8)	0.2374	0.085	0.0548	0.1503	-0.2318	0	0.1064	0.03	0.1428	0.1131	0.0614
Trend-based Regression(10, 40, 0)	0.1979	0.2538	-0.0917	0.1321	-0.2396	0.1756	0.0068	0.0735	0.0527	0.1523	0.0611
Trend-based Regression(7, 30, 0.5)	0.3825	0.0077	0.1121	-0.0579	-0.2361	0.2521	0.0782	0.0039	0.1691	0.0229	0.061
Trend-based Regression(9, 60, 0.2)	0.1285	0.0331	-0.0379	-0.0942	0.1514	0.1209	0.1193	0.0291	0.1088	0.0726	0.0603
Trend-based Regression(4, 20, 0.9)	0.5068	0.163	-0.1184	-0.074	-0.1937	0.2619	0.0472	0.0185	0.1658	-0.0142	0.0596
Trend-based Regression(8, 30, 1)	0.0992	0.0508	0.0316	0.0169	-0.1031	0.3017	0.0686	0.0106	0.1478	0.0052	0.0583
Trend-based Regression(5, 40, 0.1)	0.3155	0.2173	-0.0896	-0.0527	-0.2141	0.258	0.0688	0.044	0.0622	0.0793	0.0574
Trend-based Regression(2, 70, 0)	0.1879	-0.1284	0.2145	-0.1228	0.0095	0.1845	0.1069	0.1125	0.059	0.013	0.0571
Trend-based Regression(7, 30, 0.1)	0.2209	0.1545	-0.0043	-0.0461	-0.2073	0.1803	-0.001	0.0401	0.1927	0.1201	0.0569
Trend-based Regression(6, 30, 0.4)	0.2973	0.1587	-0.0069	-0.0228	-0.2357	0.3514	0.024	-0.0016	0.1152	0.0115	0.0568
Trend-based Regression(3, 60, 0.1)	0.1563	0.0231	0.1611	-0.0982	-0.0785	0.1826	0.1065	0.1022	0.0602	-0.0065	0.0566
Trend-based Regression(9, 60, 0.1)	0.1565	-0.0345	-0.0788	0.0115	-0.0337	0.1862	0.1218	0.0235	0.1032	0.1447	0.0563
Trend-based Regression(10, 20, 0.2)	0.2117	0.037	-0.0149	0.2013	-0.2442	0.2035	0.0059	0.0735	0.0843	0.0875	0.0559
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression(8, 100, 0.5)	0.1397	0.1478	0.1153	0.1114	0.1543	0.171	0.0772	0.0721	0.0647	0.1245	0.1229
Trend-based Regression(6, 60, 0.2)	0.1229	0.1305	0.1523	0.1358	0.1759	0.1498	0.0695	0.0622	0.0733	0.1139	0.1242
Trend-based Regression(6, 60, 0.3)	0.11	0.1303	0.1296	0.1065	0.1813	0.1457	0.0712	0.0655	0.0741	0.1122	0.1178
Trend-based Regression(6, 90, 0.3)	0.1267	0.1288	0.1285	0.1432	0.1375	0.1601	0.0731	0.0824	0.0739	0.1115	0.1201
Trend-based Regression(6, 100, 0.2)	0.1098	0.1417	0.1632	0.1507	0.16	0.149	0.0684	0.0751	0.0742	0.1223	0.1265
Trend-based Regression(8, 60, 0.4)	0.0952	0.1163	0.1445	0.1606	0.1414	0.1472	0.0717	0.0679	0.0717	0.1077	0.1172
Trend-based Regression(6, 100, 0.4)	0.1305	0.1405	0.1333	0.1212	0.1335	0.13	0.0787	0.0606	0.0618	0.1282	0.1158
Trend-based Regression(8, 100, 0.8)	0.1125	0.0496	0.1309	0.1275	0.1672	0	0.0958	0.1027	0.0885	0.1034	0.1071
Trend-based Regression(10, 40, 0)	0.1458	0.1313	0.1636	0.1233	0.1733	0.1241	0.0804	0.0772	0.0654	0.109	0.1243
Trend-based Regression(7, 30, 0.5)	0.1282	0.125	0.1596	0.1181	0.1683	0.1235	0.0723	0.0633	0.0687	0.1051	0.1183
Trend-based Regression(9, 60, 0.2)	0.1421	0.132	0.1671	0.1663	0.1806	0.1384	0.0753	0.0747	0.0713	0.1134	0.132
Trend-based Regression(4, 20, 0.9)	0.1567	0.1388	0.1181	0.1231	0.1711	0.1689	0.0655	0.0468	0.0684	0.0845	0.1221
Trend-based Regression(8, 30, 1)	0.0939	0.1056	0.1461	0.1119	0.1803	0.1237	0.0662	0.0815	0.0725	0.1019	0.1133
Trend-based Regression(5, 40, 0.1)	0.125	0.1302	0.1681	0.1323	0.1803	0.136	0.0688	0.0691	0.0651	0.1098	0.1245
Trend-based Regression(2, 70, 0)	0.115	0.1259	0.1624	0.1216	0.1663	0.1378	0.0647	0.0674	0.0706	0.1189	0.1203
Trend-based Regression(7, 30, 0.1)	0.1249	0.1298	0.1689	0.1223	0.1677	0.1239	0.0728	0.0674	0.0746	0.1094	0.1212
Trend-based Regression(6, 30, 0.4)	0.123	0.1291	0.1563	0.1273	0.1782	0.136	0.0704	0.0623	0.0723	0.1038	0.1215
Trend-based Regression(3, 60, 0.1)	0.1074	0.1407	0.1456	0.1176	0.1723	0.1451	0.0701	0.0664	0.0696	0.1129	0.12
Trend-based Regression(9, 60, 0.1)	0.1382	0.1413	0.1664	0.1474	0.1876	0.1346	0.0773	0.0788	0.0705	0.1064	0.1305
Trend-based Regression(10, 20, 0.2)	0.1243	0.131	0.172	0.1433	0.1682	0.1269	0.0818	0.0712	0.0706	0.1139	0.1252
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.9: Performance Summary of Top 20 Trend-Based Regression Strategies  
(Sharpe Ratios and Proportions of In-the-Market)

Trend-based Regression Algorithm: Trend-based Regression(W, K, $\theta$ )											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression(8, 100, 0.5)	1.9256	0.8057	1.4105	-0.1049	-0.6832	1.5272	-0.4877	-0.2378	2.1612	0.3773	0.606
Trend-based Regression(6, 60, 0.2)	2.4245	0.4586	0.0201	-0.9626	0.2424	2.1055	1.2437	1.0938	1.5409	-0.212	0.6038
Trend-based Regression(6, 60, 0.3)	2.4865	0.5063	0.9018	-0.8217	0.1241	1.8498	0.5071	0.3825	1.4022	-0.18	0.5997
Trend-based Regression(6, 90, 0.3)	2.1384	0.9133	0.5229	-0.9996	-0.3267	1.2623	0.996	-0.0756	2.3829	0.1456	0.5295
Trend-based Regression(6, 100, 0.2)	2.2322	0.7937	0.0407	-0.5115	-0.5504	1.2678	0.198	0.3912	2.0377	0.9912	0.5199
Trend-based Regression(8, 60, 0.4)	1.5128	-0.2712	1.3194	-1.3088	1.225	1.2125	0.92	0.5907	1.5256	0.4006	0.506
Trend-based Regression(6, 100, 0.4)	1.9609	1.3243	-0.192	-0.7785	-0.619	2.8906	1.098	-0.8252	1.5849	-0.2485	0.4929
Trend-based Regression(8, 100, 0.8)	2.1101	1.7138	0.4183	1.1791	-1.3864	NaN	1.11	0.2923	1.6141	1.0933	0.49
Trend-based Regression(10, 40, 0)	1.3575	1.9333	-0.5605	1.0709	-1.3824	1.4144	0.0841	0.9526	0.8069	1.3977	0.4881
Trend-based Regression(7, 30, 0.5)	2.9832	0.0619	0.7024	-0.4904	-1.403	2.0409	1.0814	0.0618	2.4614	0.2181	0.4867
Trend-based Regression(9, 60, 0.2)	0.9044	0.2505	-0.2268	-0.5665	0.8383	0.8738	1.5842	0.3896	1.5264	0.6405	0.4816
Trend-based Regression(4, 20, 0.9)	3.2342	1.1743	-1.0024	-0.6011	-1.1319	1.5512	0.7214	0.3948	2.4225	-0.1678	0.476
Trend-based Regression(8, 30, 1)	1.0565	0.4814	0.2164	0.1514	-0.5716	2.44	1.0362	0.1305	2.0379	0.0515	0.4659
Trend-based Regression(5, 40, 0.1)	2.5233	1.6686	-0.5329	-0.3981	-1.1875	1.8977	1.0006	0.6363	0.9555	0.7223	0.458
Trend-based Regression(2, 70, 0)	1.6336	-1.0194	1.3203	-1.0098	0.0574	1.3393	1.6524	1.6696	0.8356	0.1096	0.456
Trend-based Regression(7, 30, 0.1)	1.7676	1.191	-0.0253	-0.3771	-1.2363	1.4551	-0.0131	0.5943	2.5847	1.098	0.4542
Trend-based Regression(6, 30, 0.4)	2.416	1.2291	-0.0444	-0.1792	-1.3223	2.5838	0.3407	-0.0262	1.5931	0.1109	0.4535
Trend-based Regression(3, 60, 0.1)	1.4552	0.1645	1.1061	-0.835	-0.4554	1.258	1.5195	1.5386	0.8641	-0.0573	0.4518
Trend-based Regression(9, 60, 0.1)	1.133	-0.2438	-0.4737	0.0781	-0.1797	1.3833	1.5754	0.2979	1.4627	1.3593	0.4494
Trend-based Regression(10, 20, 0.2)	1.7026	0.2829	-0.0864	1.404	-1.4518	1.6037	0.0722	1.0317	1.1948	0.7685	0.4461
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression(8, 100, 0.5)	0.36	0.65	0.24	0.13	0.38	0.99	0.46	0.36	0.41	0.53	0.45
Trend-based Regression(6, 60, 0.2)	0.45	0.48	0.39	0.51	0.48	0.71	0.42	0.44	0.6	0.49	0.5
Trend-based Regression(6, 60, 0.3)	0.48	0.51	0.37	0.35	0.48	0.66	0.44	0.47	0.6	0.5	0.49
Trend-based Regression(6, 90, 0.3)	0.48	0.48	0.41	0.35	0.39	0.84	0.49	0.58	0.42	0.47	0.49
Trend-based Regression(6, 100, 0.2)	0.39	0.57	0.5	0.58	0.48	0.72	0.4	0.53	0.5	0.47	0.51
Trend-based Regression(8, 60, 0.4)	0.29	0.4	0.37	0.63	0.35	0.73	0.41	0.4	0.53	0.46	0.46
Trend-based Regression(6, 100, 0.4)	0.48	0.56	0.28	0.26	0.27	0.71	0.48	0.31	0.42	0.61	0.44
Trend-based Regression(8, 100, 0.8)	0.48	0.17	0.19	0.35	0.55	0	0.79	1	0.9	0.63	0.51
Trend-based Regression(10, 40, 0)	0.45	0.51	0.46	0.5	0.52	0.49	0.52	0.52	0.5	0.49	0.5
Trend-based Regression(7, 30, 0.5)	0.37	0.47	0.37	0.46	0.48	0.57	0.5	0.46	0.49	0.47	0.46
Trend-based Regression(9, 60, 0.2)	0.43	0.5	0.44	0.67	0.52	0.62	0.46	0.48	0.54	0.51	0.52
Trend-based Regression(4, 20, 0.9)	0.73	0.6	0.2	0.53	0.5	0.99	0.36	0.33	0.58	0.27	0.51
Trend-based Regression(8, 30, 1)	0.25	0.36	0.32	0.38	0.48	0.65	0.33	0.66	0.5	0.36	0.43
Trend-based Regression(5, 40, 0.1)	0.54	0.48	0.49	0.55	0.6	0.58	0.45	0.5	0.55	0.47	0.52
Trend-based Regression(2, 70, 0)	0.43	0.54	0.47	0.46	0.53	0.65	0.35	0.47	0.6	0.45	0.5
Trend-based Regression(7, 30, 0.1)	0.49	0.49	0.45	0.51	0.53	0.54	0.48	0.5	0.53	0.51	0.5
Trend-based Regression(6, 30, 0.4)	0.48	0.54	0.37	0.5	0.52	0.63	0.53	0.45	0.58	0.44	0.5
Trend-based Regression(3, 60, 0.1)	0.44	0.57	0.4	0.44	0.56	0.67	0.45	0.48	0.61	0.45	0.51
Trend-based Regression(9, 60, 0.1)	0.46	0.54	0.47	0.58	0.56	0.59	0.45	0.49	0.53	0.49	0.52
Trend-based Regression(10, 20, 0.2)	0.48	0.51	0.49	0.52	0.51	0.56	0.56	0.56	0.53	0.55	0.53



Table B.10: Performance Summary of Top 20 Trend-Based Regression Strategies  
(Numbers of Trading)

Number of Tradings	Trend-based Regression Algorithm: Trend-based Regression(W, K, $\theta$ )										1998-2007
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Trend-based Regression(8, 100, 0.5)	9	9	29	9	9	1	4	10	15	25	12
Trend-based Regression(6, 60, 0.2)	47	55	68	47	50	36	42	54	64	75	53.8
Trend-based Regression(6, 60, 0.3)	37	44	37	25	36	23	25	24	44	59	35.4
Trend-based Regression(6, 90, 0.3)	22	25	38	15	26	15	13	18	42	51	26.5
Trend-based Regression(6, 100, 0.2)	33	40	65	33	44	31	35	44	72	73	47
Trend-based Regression(8, 60, 0.4)	29	28	40	22	32	22	16	22	32	53	29.6
Trend-based Regression(6, 100, 0.4)	13	13	26	9	12	8	6	5	15	33	14
Trend-based Regression(8, 100, 0.8)	5	1	9	5	3	0	1	0	4	7	3.5
Trend-based Regression(10, 40, 0)	123	118	114	97	124	125	123	127	126	106	118.3
Trend-based Regression(7, 30, 0.5)	29	39	35	27	38	13	35	22	36	39	31.3
Trend-based Regression(9, 60, 0.2)	63	58	72	61	68	59	67	70	68	83	66.9
Trend-based Regression(4, 20, 0.9)	10	4	7	9	16	2	7	7	13	17	9.2
Trend-based Regression(8, 30, 1)	7	10	13	9	18	5	12	7	18	25	12.4
Trend-based Regression(5, 40, 0.1)	66	90	85	61	82	85	83	92	101	96	84.1
Trend-based Regression(2, 70, 0)	91	102	127	91	120	126	68	110	123	118	107.6
Trend-based Regression(7, 30, 0.1)	96	95	90	73	88	96	93	95	103	80	90.9
Trend-based Regression(6, 30, 0.4)	29	39	41	27	50	19	37	28	36	49	35.5
Trend-based Regression(3, 60, 0.1)	55	76	61	39	60	51	47	70	77	75	61.1
Trend-based Regression(9, 60, 0.1)	79	83	92	81	90	89	89	102	92	101	89.8
Trend-based Regression(10, 20, 0.2)	76	103	85	82	93	85	88	103	86	98	89.9

Table B.11: Performance Summary of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Annualized Returns and Annualized Volatilities)

Trend-based Regression Algorithm with Trading Volume ( $W:V = 1:1$ ) : Trend-based Regression w/Trad. Vol. ( $W, V, K, \theta$ )											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.5)	0.1687	0.2522	-0.1374	-0.0823	-0.0338	0.1804	0.1835	-0.0052	0.175	0.0301	0.0653
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.9)	0.0976	0.2407	0.0651	0.0534	-0.0232	0.1587	-0.0562	0.0169	0.0267	0.0998	0.0648
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.2)	0.1618	0.2536	-0.1351	-0.0665	-0.0412	0.1905	0.1835	-0.0052	0.172	0.0091	0.0645
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.3)	0.1626	0.2552	-0.1396	-0.0665	-0.0338	0.1785	0.1835	-0.0052	0.172	0.0091	0.0639
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.4)	0.1626	0.2552	-0.1396	-0.0671	-0.0338	0.1785	0.1835	-0.0052	0.172	0.0091	0.0639
Trend-based Regression w/Trad. Vol.(6, 6, 10, 1)	0.0967	0.2407	0.0596	0.0394	-0.0232	0.1587	-0.0562	0.0204	0.0347	0.0935	0.0633
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.6)	0.1189	0.2555	-0.1344	-0.0993	-0.0143	0.1804	0.1835	-0.0052	0.175	0.03	0.0615
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.7)	0.1049	0.2678	-0.1314	-0.1016	-0.0043	0.1459	0.2005	-0.0052	0.175	0.0265	0.0603
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.8)	0.0746	0.2407	0.0651	0.0453	-0.0274	0.1587	-0.0562	0.006	0.0267	0.0998	0.0601
Trend-based Regression w/Trad. Vol.(8, 8, 20, 1)	0.1111	0.215	-0.1051	-0.1115	0.001	0.1526	0.2018	0.0058	0.1773	0.0125	0.0596
Trend-based Regression w/Trad. Vol.(6, 6, 20, 1)	0.0818	0.2753	0.002	-0.0435	-0.0258	0.0696	0.123	-0.0347	0.2002	-0.0239	0.0575
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.8)	0.1068	0.0939	-0.1626	-0.0647	0.1396	0.2018	0.1764	0.0066	0.0284	0.0941	0.0564
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.1)	0.1618	0.2473	-0.1894	-0.0809	-0.0412	0.1905	0.1835	-0.0052	0.172	0.0091	0.0555
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.7)	0.1129	0.08	-0.1696	-0.0664	0.1396	0.2018	0.1764	0.0066	0.0284	0.1013	0.0552
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0)	0.1063	0.1957	0.0137	0.0832	0.0002	0.1156	-0.0444	0.009	0.0011	0.0915	0.055
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.9)	0.1111	0.202	-0.1391	-0.103	0.001	0.143	0.2005	-0.0052	0.1773	0.0265	0.0547
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.8)	0.1049	0.2109	-0.1391	-0.1016	-0.0043	0.1452	0.2005	-0.0052	0.175	0.0265	0.0545
Trend-based Regression w/Trad. Vol.(6, 6, 20, 0.7)	0.0624	0.2856	0.0205	-0.0726	-0.0764	0.0937	0.1185	-0.0251	0.215	-0.0239	0.0538
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.6)	0.084	0.2196	0.0282	0.0577	-0.0274	0.1264	-0.0562	0.0121	0.0163	0.1018	0.0535
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.7)	0.0869	0.2196	0.0312	0.0259	-0.0274	0.1344	-0.0562	0.0156	0.0267	0.1018	0.0531
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.5)	0.1284	0.1352	0.1524	0.1504	0.1862	0.111	0.0779	0.0729	0.0779	0.1136	0.1257
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.9)	0.1608	0.1252	0.146	0.1553	0.1983	0.1238	0.0803	0.073	0.0765	0.1119	0.1311
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.2)	0.1285	0.1352	0.1504	0.1494	0.187	0.1105	0.0779	0.0729	0.0779	0.1155	0.1256
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.3)	0.1285	0.1352	0.1524	0.1494	0.1862	0.111	0.0779	0.0729	0.0779	0.1155	0.1257
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.4)	0.1285	0.1352	0.1524	0.1494	0.1862	0.111	0.0779	0.0729	0.0779	0.1155	0.1257
Trend-based Regression w/Trad. Vol.(6, 6, 10, 1)	0.1608	0.1252	0.1459	0.1566	0.1983	0.1238	0.0803	0.0732	0.0761	0.1117	0.1312
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.6)	0.1212	0.1352	0.1523	0.1515	0.184	0.111	0.0779	0.0729	0.0779	0.1136	0.1248
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.7)	0.1231	0.1356	0.1522	0.1519	0.1844	0.1148	0.0785	0.0729	0.0779	0.1136	0.1255
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.8)	0.1601	0.1252	0.146	0.1555	0.1983	0.1238	0.0803	0.0737	0.0765	0.1119	0.131
Trend-based Regression w/Trad. Vol.(8, 8, 20, 1)	0.1232	0.1317	0.1496	0.1514	0.1843	0.1147	0.0785	0.0737	0.0779	0.1144	0.1248
Trend-based Regression w/Trad. Vol.(6, 6, 20, 1)	0.1315	0.1379	0.1682	0.1379	0.1928	0.1126	0.081	0.0644	0.0741	0.1271	0.1288
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.8)	0.1317	0.1183	0.1619	0.1466	0.1732	0.1164	0.0814	0.0689	0.0629	0.1073	0.1222
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.1)	0.1285	0.1354	0.1508	0.1498	0.187	0.1105	0.0779	0.0729	0.0779	0.1155	0.1257
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.7)	0.1322	0.1176	0.1621	0.1466	0.1732	0.1164	0.0814	0.0689	0.0629	0.1076	0.1223
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0)	0.1599	0.1247	0.1561	0.1569	0.1951	0.1214	0.0812	0.0748	0.076	0.1129	0.1318
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.9)	0.1232	0.1312	0.1523	0.1519	0.1843	0.115	0.0785	0.0729	0.0779	0.1136	0.125
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.8)	0.1231	0.1316	0.1523	0.1519	0.1844	0.1148	0.0785	0.0729	0.0779	0.1136	0.125
Trend-based Regression w/Trad. Vol.(6, 6, 20, 0.7)	0.1313	0.1376	0.1694	0.139	0.1918	0.1167	0.0823	0.0654	0.0734	0.1271	0.1293
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.6)	0.1606	0.1264	0.1479	0.162	0.1983	0.1217	0.0803	0.0742	0.076	0.1119	0.132
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.7)	0.1595	0.1264	0.1479	0.1566	0.1983	0.122	0.0803	0.0742	0.0765	0.1119	0.1313
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Trend-based Regression Algorithm with Trading Volume (W:V = 1:1) : Trend-based Regression w/Trad. Vol.(W, V, K, $\theta$ )											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.5)	1.3136	1.8652	-0.9019	-0.5476	-0.1816	1.6256	2.3565	-0.0711	2.2452	0.2649	0.4975
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.9)	0.6072	1.9221	0.4458	0.344	-0.1171	1.2815	-0.7005	0.231	0.3485	0.8919	0.4937
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.2)	1.2586	1.8756	-0.8982	-0.4452	-0.2202	1.7234	2.3565	-0.0711	2.2081	0.079	0.4916
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.3)	1.2656	1.8872	-0.9161	-0.4452	-0.1816	1.6084	2.3565	-0.0711	2.2081	0.079	0.487
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.4)	1.2656	1.8872	-0.9161	-0.4487	-0.1816	1.6084	2.3565	-0.0711	2.2081	0.079	0.4866
Trend-based Regression w/Trad. Vol.(6, 6, 10, 1)	0.6015	1.9221	0.4083	0.2514	-0.1171	1.2815	-0.7005	0.2783	0.4557	0.8366	0.4823
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.6)	0.981	1.889	-0.8822	-0.6555	-0.0778	1.6256	2.3565	-0.0711	2.2452	0.2644	0.4683
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.7)	0.8526	1.9747	-0.8633	-0.6691	-0.0234	1.2713	2.5536	-0.0711	2.2452	0.233	0.4596
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.8)	0.4661	1.9221	0.4458	0.2916	-0.1379	1.2815	-0.7005	0.081	0.3485	0.8919	0.4581
Trend-based Regression w/Trad. Vol.(8, 8, 20, 1)	0.9014	1.633	-0.7021	-0.7366	0.0055	1.331	2.5697	0.0787	2.2749	0.1093	0.4541
Trend-based Regression w/Trad. Vol.(6, 6, 20, 1)	0.6219	1.9962	0.0119	-0.3158	-0.1339	0.6179	1.519	-0.5384	2.7008	-0.1879	0.4382
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.8)	0.8108	0.7941	-1.0044	-0.4414	0.8064	1.7335	2.1658	0.0964	0.4512	0.8775	0.4294
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.1)	1.2586	1.8269	-1.2561	-0.5396	-0.2202	1.7234	2.3565	-0.0711	2.2081	0.079	0.4227
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.7)	0.8541	0.6801	-1.0467	-0.4526	0.8064	1.7335	2.1658	0.0964	0.4512	0.9414	0.4205
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0)	0.665	1.5689	0.0879	0.5304	0.0008	0.9525	-0.5469	0.1208	0.0141	0.8105	0.4187
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.9)	0.9014	1.5394	-0.9128	-0.6785	0.0055	1.2436	2.5536	-0.0711	2.2749	0.233	0.4165
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.8)	0.8526	1.6023	-0.9128	-0.6691	-0.0234	1.2648	2.5536	-0.0711	2.2452	0.233	0.4149
Trend-based Regression w/Trad. Vol.(6, 6, 20, 0.7)	0.475	2.076	0.1211	-0.5225	-0.3982	0.8029	1.44	-0.3838	2.9313	-0.1879	0.4097
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.6)	0.5227	1.7374	0.1905	0.3559	-0.1379	1.0392	-0.7005	0.1628	0.2145	0.9096	0.4078
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.7)	0.5446	1.7374	0.2108	0.1652	-0.1379	1.1017	-0.7005	0.2095	0.3485	0.9096	0.4043
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.5)	0.51	0.5	0.54	0.5	0.49	0.52	0.49	0.51	0.52	0.5	0.51
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.9)	0.52	0.53	0.46	0.48	0.52	0.52	0.51	0.52	0.53	0.56	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.2)	0.52	0.5	0.53	0.49	0.5	0.52	0.49	0.51	0.51	0.51	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.3)	0.52	0.5	0.54	0.49	0.49	0.52	0.49	0.51	0.51	0.51	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.4)	0.52	0.5	0.54	0.5	0.49	0.52	0.49	0.51	0.51	0.51	0.51
Trend-based Regression w/Trad. Vol.(6, 6, 10, 1)	0.52	0.53	0.46	0.49	0.52	0.52	0.51	0.52	0.52	0.56	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.6)	0.51	0.5	0.53	0.5	0.48	0.52	0.49	0.51	0.52	0.51	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.7)	0.52	0.5	0.53	0.51	0.48	0.52	0.5	0.51	0.52	0.5	0.51
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.8)	0.52	0.53	0.46	0.48	0.52	0.52	0.51	0.52	0.53	0.56	0.52
Trend-based Regression w/Trad. Vol.(8, 8, 20, 1)	0.52	0.48	0.53	0.5	0.48	0.51	0.5	0.52	0.51	0.51	0.51
Trend-based Regression w/Trad. Vol.(6, 6, 20, 1)	0.5	0.5	0.5	0.46	0.49	0.49	0.5	0.43	0.48	0.51	0.49
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.8)	0.5	0.45	0.5	0.51	0.44	0.5	0.54	0.48	0.48	0.48	0.49
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.1)	0.52	0.5	0.54	0.5	0.5	0.52	0.49	0.51	0.51	0.51	0.51
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.7)	0.5	0.44	0.51	0.51	0.44	0.5	0.54	0.48	0.49	0.48	0.49
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0)	0.51	0.51	0.48	0.48	0.52	0.51	0.51	0.52	0.53	0.55	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.9)	0.52	0.48	0.54	0.5	0.48	0.52	0.5	0.51	0.51	0.5	0.51
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.8)	0.52	0.49	0.54	0.51	0.48	0.52	0.5	0.51	0.52	0.5	0.51
Trend-based Regression w/Trad. Vol.(6, 6, 20, 0.7)	0.5	0.5	0.5	0.46	0.48	0.51	0.51	0.44	0.48	0.51	0.49
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.6)	0.52	0.53	0.47	0.48	0.52	0.52	0.51	0.51	0.53	0.56	0.52
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.7)	0.51	0.53	0.47	0.49	0.52	0.52	0.51	0.52	0.53	0.56	0.52

Table B.12: Performance Summary of Top 20 Trend-Based Regression Strategies with Trad. Vol.(W:V = 1:1) (Sharpe Ratios and Proportions of In-the-Market)

Trend-based Regression Algorithm with Trading Volume (W:V = 1:1) : Trend-based Regression w/Trad. Vol.(W, V, K, $\theta$ )											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.5)	143	136	132	124	133	128	133	130	135	131	132.5
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.9)	133	128	117	129	137	127	134	118	134	131	128.8
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.2)	145	140	134	128	139	130	133	130	137	131	134.7
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.3)	143	138	134	128	133	130	133	130	137	131	133.7
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.4)	143	138	134	126	133	130	133	130	137	131	133.5
Trend-based Regression w/Trad. Vol.(6, 6, 10, 1)	133	128	117	129	137	127	134	116	134	129	128.4
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.6)	139	134	130	122	131	128	133	130	135	129	131.1
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.7)	137	134	130	120	127	126	133	130	135	129	130.1
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.8)	135	128	117	131	137	127	134	118	134	131	129.2
Trend-based Regression w/Trad. Vol.(8, 8, 20, 1)	135	128	130	118	127	122	133	130	135	127	128.5
Trend-based Regression w/Trad. Vol.(6, 6, 20, 1)	124	138	133	115	138	121	141	128	139	139	131.6
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.8)	141	137	131	122	126	111	124	131	131	126	128
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.1)	145	142	142	130	139	130	133	130	137	131	135.9
Trend-based Regression w/Trad. Vol.(9, 9, 20, 0.7)	143	137	133	122	126	111	124	131	131	128	128.6
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0)	137	136	127	135	143	137	136	122	142	137	135.2
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.9)	135	130	130	120	127	122	133	130	135	129	129.1
Trend-based Regression w/Trad. Vol.(8, 8, 20, 0.8)	137	132	130	120	127	124	133	130	135	129	129.7
Trend-based Regression w/Trad. Vol.(6, 6, 20, 0.7)	128	140	135	119	144	125	145	128	139	139	134.2
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.6)	137	130	119	133	137	129	134	120	136	133	130.8
Trend-based Regression w/Trad. Vol.(6, 6, 10, 0.7)	137	130	119	133	137	129	134	118	134	133	130.4

Table B.13: Performance Summary of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Numbers of Trading)

Table B.14: Performance Summary of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Annualized Returns and Annualized Volatilities)

Returns	Trend-based Regression Algorithm with Trading Volume (W:V = 2:1) : Trend-based Regression w/Trad. Vol.(W, V, K, $\theta$ )										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.4)	0.3412	0.1317	0.0897	0.0192	0.1168	0.1437	-0.0177	-0.0351	0.1154	0.3342	0.1175
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.3)	0.3564	0.2069	0.0476	-0.0471	0.1373	0.1589	-0.0145	-0.0116	0.1169	0.2925	0.1172
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.2)	0.3377	0.1828	0.0419	-0.0642	0.1704	0.195	-0.0196	-0.0037	0.1091	0.2709	0.115
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0)	0.2958	0.1093	0.0216	0.1024	0.0391	0.3017	0.0127	0.0009	0.0729	0.2463	0.1149
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0)	0.3941	0.1295	0.2238	-0.133	0.1434	0.1638	0.0117	-0.0335	0.1023	0.2143	0.1127
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.4)	0.2323	0.2287	0.3093	-0.082	-0.0878	0.2673	0.038	0.0655	0.0923	0.1292	0.1112
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0.1)	0.4204	0.1183	0.1154	-0.0437	0.1368	0.1192	0.0256	-0.0521	0.0878	0.2531	0.1107
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.1)	0.3703	0.1754	0.1015	-0.1314	0.1891	0.1654	-0.0041	-0.0416	0.0889	0.2633	0.1086
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0)	0.3855	0.1583	0.013	-0.0949	0.2302	0.1969	-0.0081	-0.0133	0.0606	0.2185	0.1061
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0.1)	0.275	0.1035	0.0072	0.0143	0.1267	0.3168	-0.012	-0.0054	0.0734	0.2042	0.1048
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.2)	0.2593	0.0963	0.0821	0.0543	0.1015	0.1686	-0.019	0.0074	0.1979	0.0857	0.1005
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.1)	0.3	0.085	-0.0093	0.0092	0.0054	0.3133	0.0129	0.0093	0.0717	0.2709	0.1
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.3)	0.2362	0.0795	0.088	0.0101	0.1539	0.207	-0.0284	0.0105	0.1878	0.0852	0.0996
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.3)	0.2359	0.2681	0.2515	-0.0896	-0.1192	0.2758	-0.0108	0.065	0.0927	0.11	0.0987
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.3)	0.1601	0.2717	0.1647	-0.0344	-0.0243	0.3543	0.0284	-0.0004	0.0938	0.036	0.0983
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.7)	0.2417	0.2909	0.1329	-0.0877	-0.0895	0.4146	0.0364	-0.0033	0.076	0.0763	0.0982
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0)	0.2378	0.0529	0.0237	0.0538	0.0513	0.2748	0.0009	0.0247	0.1593	0.1246	0.0968
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0)	0.2741	0.094	-0.023	-0.013	0.1081	0.3462	-0.013	-0.0064	0.0775	0.1868	0.0966
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.2)	0.2777	0.0586	0.0147	-0.0098	0.0656	0.2747	0.0007	-0.0183	0.0833	0.2667	0.0954
Trend-based Regression w/Trad. Vol.(6, 3, 70, 0.5)	0.1362	0.2881	0.2525	-0.0743	-0.0639	0.4041	-0.0082	0.0077	0.0954	0.0185	0.0954
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.4)	0.1215	0.1282	0.1438	0.1118	0.1908	0.1159	0.0789	0.0711	0.0743	0.103	0.119
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.3)	0.1251	0.1267	0.1445	0.1176	0.1949	0.1243	0.0803	0.0708	0.0744	0.106	0.1217
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.2)	0.1255	0.129	0.1438	0.1165	0.1984	0.1195	0.0795	0.0718	0.0746	0.1083	0.1221
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0)	0.1258	0.1249	0.1453	0.1339	0.2043	0.1146	0.0803	0.0693	0.0754	0.107	0.124
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0)	0.1296	0.1243	0.1539	0.1259	0.2042	0.124	0.0784	0.0758	0.0756	0.1075	0.1257
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.4)	0.1317	0.1172	0.1648	0.1318	0.1928	0.1251	0.0807	0.0685	0.0743	0.1006	0.1246
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0.1)	0.1289	0.1195	0.1587	0.1165	0.2029	0.1368	0.0777	0.0761	0.0753	0.1031	0.1256
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.1)	0.1225	0.1293	0.1492	0.1176	0.2046	0.1201	0.0812	0.0716	0.0753	0.1104	0.124
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0)	0.1222	0.1277	0.1622	0.1187	0.2051	0.1111	0.0813	0.0718	0.0733	0.11	0.1246
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0.1)	0.1281	0.1274	0.1552	0.1478	0.1985	0.1064	0.0831	0.0717	0.0759	0.0996	0.1253
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.2)	0.1131	0.1204	0.148	0.1479	0.1999	0.1161	0.0775	0.0692	0.0767	0.1048	0.1234
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.1)	0.1269	0.1228	0.1464	0.1337	0.2031	0.1107	0.0799	0.0699	0.0755	0.1073	0.1235
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.3)	0.1115	0.1218	0.1492	0.1438	0.1983	0.1154	0.0753	0.0683	0.0762	0.1048	0.1225
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.3)	0.1286	0.1151	0.1632	0.1474	0.1943	0.1273	0.0786	0.068	0.0747	0.1018	0.126
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.3)	0.1236	0.1223	0.1633	0.1539	0.185	0.1269	0.0756	0.0689	0.0719	0.112	0.1261
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.7)	0.1341	0.1263	0.165	0.1235	0.1917	0.1291	0.0761	0.0648	0.0744	0.1101	0.1255
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0)	0.1177	0.1213	0.1485	0.1489	0.1993	0.1142	0.0792	0.0668	0.0756	0.1074	0.1239
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0)	0.1287	0.1267	0.1573	0.1498	0.197	0.1057	0.0836	0.0707	0.0741	0.1001	0.1254
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.2)	0.1239	0.1212	0.1468	0.1179	0.2031	0.1137	0.0782	0.0707	0.0748	0.1082	0.1217
Trend-based Regression w/Trad. Vol.(6, 3, 70, 0.5)	0.1402	0.1181	0.1685	0.1472	0.1871	0.1189	0.0805	0.0722	0.0758	0.1127	0.1277
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Trend-based Regression Algorithm with Trading Volume (W:V = 2:1) : Trend-based Regression w/Trad. Vol. (W, V, K, $\theta$ )											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.4)	2.8071	1.0274	0.6236	0.172	0.6119	1.2396	-0.2242	-0.4936	1.5538	3.244	0.9205
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.3)	2.8482	1.6325	0.329	-0.4003	0.7046	1.2784	-0.1809	-0.1639	1.5714	2.7583	0.918
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.2)	2.6913	1.4177	0.2914	-0.5508	0.8589	1.6316	-0.2471	-0.0513	1.4615	2.5018	0.9011
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0)	2.3512	0.8752	0.1487	0.7647	0.1914	2.6323	0.1582	0.013	0.9659	2.3015	0.9002
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0)	3.0414	1.0421	1.454	-1.0564	0.7025	1.321	0.1489	-0.4425	1.3544	1.9935	0.883
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.4)	1.7638	1.9507	1.8774	-0.622	-0.4554	2.1369	0.4704	0.957	1.241	1.285	0.871
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0.1)	3.2624	0.9896	0.7268	-0.3755	0.674	0.8711	0.3294	-0.6843	1.1652	2.4551	0.8669
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.1)	3.0224	1.3563	0.6801	-1.1167	0.9242	1.3767	-0.0502	-0.5803	1.1811	2.3858	0.8508
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0)	3.156	1.2396	0.0802	-0.7997	1.1224	1.7727	-0.0996	-0.186	0.8269	1.9873	0.831
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0.1)	2.1459	0.812	0.0462	0.0967	0.6381	2.9768	-0.1451	-0.0748	0.9677	2.0501	0.8207
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.2)	2.2926	0.7998	0.5546	0.3671	0.5079	1.4521	-0.2447	0.1077	2.5802	0.8172	0.7874
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.1)	2.3651	0.6922	-0.0637	0.0691	0.0265	2.8288	0.1612	0.1335	0.9488	2.5259	0.7831
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.3)	2.1188	0.6525	0.5895	0.0703	0.776	1.7948	-0.3773	0.1537	2.465	0.8133	0.7805
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.3)	1.8343	2.3296	1.5413	-0.6079	-0.6132	2.1656	-0.1375	0.9567	1.241	1.0804	0.7735
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.3)	1.2956	2.2221	1.0088	-0.2233	-0.1314	2.7925	0.3751	-0.006	1.3043	0.3214	0.7701
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.7)	1.8025	2.3026	0.8054	-0.7102	-0.4669	3.2106	0.4787	-0.0515	1.022	0.6932	0.7696
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0)	2.0213	0.4358	0.1592	0.3613	0.2572	2.407	0.0119	0.3702	2.1072	1.1598	0.7584
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0)	2.1305	0.7415	-0.1464	-0.0866	0.5488	3.2766	-0.1553	-0.0905	1.0459	1.865	0.7567
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.2)	2.2414	0.4832	0.1	-0.0829	0.323	2.4147	0.0084	-0.2593	1.1135	2.4649	0.7477
Trend-based Regression w/Trad. Vol.(6, 3, 70, 0.5)	0.972	2.439	1.4987	-0.5045	-0.3413	3.3985	-0.1013	0.1073	1.2584	0.1637	0.7474
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.4)	0.51	0.46	0.54	0.37	0.44	0.49	0.49	0.45	0.5	0.55	0.48
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.3)	0.53	0.45	0.54	0.48	0.49	0.54	0.5	0.46	0.52	0.54	0.51
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.2)	0.52	0.47	0.52	0.44	0.52	0.51	0.48	0.47	0.53	0.53	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0)	0.52	0.48	0.5	0.49	0.51	0.51	0.5	0.48	0.52	0.49	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0)	0.5	0.47	0.48	0.47	0.51	0.52	0.5	0.48	0.54	0.51	0.5
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.4)	0.49	0.46	0.49	0.38	0.56	0.52	0.52	0.48	0.53	0.5	0.49
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0.1)	0.5	0.45	0.52	0.45	0.51	0.55	0.49	0.47	0.53	0.52	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.1)	0.52	0.48	0.5	0.48	0.52	0.52	0.5	0.47	0.52	0.52	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0)	0.53	0.49	0.5	0.48	0.52	0.49	0.49	0.49	0.51	0.53	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0.1)	0.54	0.48	0.49	0.51	0.48	0.52	0.5	0.5	0.54	0.44	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.2)	0.49	0.48	0.48	0.5	0.5	0.53	0.48	0.47	0.54	0.45	0.49
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.1)	0.53	0.48	0.51	0.5	0.49	0.49	0.49	0.49	0.53	0.5	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.3)	0.48	0.46	0.5	0.48	0.5	0.53	0.49	0.45	0.53	0.45	0.49
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.3)	0.49	0.45	0.48	0.41	0.56	0.53	0.5	0.48	0.54	0.5	0.49
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.3)	0.51	0.49	0.44	0.44	0.5	0.54	0.47	0.47	0.52	0.5	0.49
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.7)	0.49	0.47	0.42	0.38	0.51	0.52	0.49	0.4	0.52	0.51	0.47
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0)	0.5	0.48	0.48	0.49	0.51	0.5	0.48	0.46	0.5	0.47	0.49
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0)	0.53	0.48	0.49	0.53	0.49	0.51	0.48	0.49	0.53	0.45	0.5
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.2)	0.51	0.48	0.53	0.45	0.49	0.52	0.48	0.48	0.52	0.51	0.5
Trend-based Regression w/Trad. Vol.(6, 3, 70, 0.5)	0.48	0.46	0.46	0.46	0.5	0.46	0.52	0.52	0.57	0.49	0.49

Table B.15: Performance Summary of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Trend-based Regression Algorithm with Trading Volume (W:V = 2:1) : Trend-based Regression w/Trad. Vol.(W, V, K, $\theta$ )											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.4)	105	113	124	73	109	102	118	115	125	118	110.2
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.3)	113	121	128	79	117	122	130	125	129	122	118.6
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.2)	121	125	132	93	123	134	133	138	131	126	125.6
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0)	145	129	146	121	132	151	146	147	133	142	139.2
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0)	131	137	138	123	132	149	155	136	145	138	138.4
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.4)	114	115	109	116	128	126	125	129	124	135	122.1
Trend-based Regression w/Trad. Vol.(4, 2, 100, 0.1)	129	131	130	103	128	145	145	126	139	130	130.6
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0.1)	127	127	142	105	127	140	143	140	131	130	131.2
Trend-based Regression w/Trad. Vol.(4, 2, 80, 0)	135	137	152	119	135	156	149	144	133	136	139.6
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0.1)	132	130	124	124	126	144	135	140	138	133	132.6
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.2)	129	130	112	114	132	135	148	138	138	119	129.5
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.1)	131	123	138	113	126	145	140	139	131	138	132.4
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0.3)	123	128	110	106	126	129	142	132	132	119	124.7
Trend-based Regression w/Trad. Vol.(6, 3, 6, 30, 0.3)	120	121	115	118	132	130	131	131	130	139	126.7
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.3)	120	121	117	116	142	140	127	133	136	136	128.8
Trend-based Regression w/Trad. Vol.(6, 3, 100, 0.7)	98	103	101	94	108	110	107	101	122	124	106.8
Trend-based Regression w/Trad. Vol.(4, 2, 40, 0)	139	136	128	126	148	151	154	146	150	125	140.3
Trend-based Regression w/Trad. Vol.(4, 2, 50, 0)	142	132	130	135	133	148	145	142	144	135	138.6
Trend-based Regression w/Trad. Vol.(4, 2, 70, 0.2)	125	123	130	99	116	135	136	135	131	132	126.2
Trend-based Regression w/Trad. Vol.(6, 3, 70, 0.5)	110	117	113	100	120	110	125	131	116	125	116.7

Table B.16: Performance Summary of Top 20 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Numbers of Trading)

Trend-based Regression with Multiple Variables: TBR(v1, W1; v2, W2; ... vm, Wm; K, $\theta$ )											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	0.1483	0.2783	0.1603	-0.1466	-0.0018	0.1731	0.1107	0.0144	0.1241	0.1069	0.0909
TBR(Index Return, 1; Chg of Rf Rate, 1; 78 weeks, 0)	0.1485	0.2943	0.1457	-0.056	0.0032	0.2524	0.0331	0.0198	0.1423	-0.0208	0.0906
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.1578	0.3115	0.1514	-0.1589	0.0502	0.1826	0.1107	0.0173	0.1118	0.0297	0.0898
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 130 weeks, 0)	0.1307	0.2921	0.1506	-0.1304	0.0798	0.086	0.1014	0.0194	0.1058	0.0998	0.0888
TBR(Index Return, 1; Chg of Trad.Vol., 1; 78 weeks, 0)	0.2503	0.2936	0.0904	-0.1746	0.028	0.2244	0.0552	0.0203	0.119	0.0582	0.0885
TBR(Index Return, 1; Chg of Rf Rate, 1; 63 days, 0)	0.3365	0.1534	-0.0322	0.0019	0.0174	0.2041	0.1685	0.0475	0.0278	-0.0025	0.0867
TBR(Index Return, 1; Chg of VIX, 1; 104 weeks, 0)	0.1611	0.2369	0.1431	-0.1629	0.0701	0.1251	0.0674	0.023	0.1139	0.1216	0.0848
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 52 weeks, 0)	0.1859	0.328	0.0623	-0.1158	0.1468	0.1704	0.0253	-0.0434	0.094	0.0426	0.0831
TBR(Index Return, 1; Chg of Rf Rate, 1; 126 days, 0)	0.2041	0.0836	0.019	-0.0205	0.1173	0.1265	0.1005	-0.0004	0.1232	0.061	0.0795
TBR(Index Return, 1; Chg of VIX, 1; 78 weeks, 0)	0.1843	0.1907	0.0833	-0.1281	0.1581	0.0608	0.0326	0.03	0.1437	0.0742	0.0789
TBR(Index Return, 1; Chg of Rf Rate, 1; 84 days, 0)	0.2345	0.1141	0.1126	-0.0388	-0.0018	0.1845	0.0788	0.048	0.0697	0.016	0.0789
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 105 days, 0)	0.2742	0.1227	0.0119	-0.0136	0.0084	0.129	0.0701	0.0435	0.0788	0.0869	0.0784
TBR(Index Return, 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.1432	0.3115	0.1462	-0.1854	0.0214	0.1796	0.0513	0.0232	0.1346	0.0182	0.0768
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 78 weeks, 0)	0.118	0.1987	0.0805	-0.002	-0.1028	0.3185	0.0808	0.0398	0.0953	-0.0158	0.0755
TBR(Index Return, 1; Chg of Rf Rate, 1; 105 days, 0)	0.264	0.0324	0.0908	-0.0151	0.0638	0.1436	0.0773	-0.0045	0.0823	0.0389	0.0748
TBR(Index Return, 1; Chg of Trad.Vol., 1; 104 weeks, 0)	0.2188	0.2609	0.1506	-0.2558	-0.0224	0.1886	0.1107	0.03	0.1107	0.0584	0.0748
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.0885	0.2812	0.1763	-0.2145	0.0597	0.1452	0.0965	0.0082	0.087	0.0942	0.0748
TBR(Index Return, 1; Chg of Trad.Vol., 1; 52 weeks, 0)	0.2503	0.3224	0.0289	-0.2297	0.0823	0.2547	0.0226	-0.0341	0.0898	0.0717	0.0746
TBR(Index Return, 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.1139	0.2757	0.1506	-0.178	0.031	0.1457	0.0392	0.0294	0.0839	0.1019	0.0733
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; Chg of VIX, 1; 104 weeks, 0)	0.1029	0.2783	0.1514	-0.1575	-0.0173	0.1985	0.0773	0.0146	0.0946	0.0483	0.0728
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	0.1725	0.1499	0.1872	0.1378	0.1253	0.0865	0.0883	0.1013	0.0906	0.1294	0.1313
TBR(Index Return, 1; Chg of Rf Rate, 1; 78 weeks, 0)	0.1747	0.1412	0.1844	0.1112	0.1034	0.0869	0.1003	0.0979	0.0887	0.1421	0.1276
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.1759	0.1481	0.1855	0.1325	0.0706	0.0988	0.0883	0.1009	0.0813	0.1314	0.1271
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 130 weeks, 0)	0.1755	0.1542	0.189	0.1662	0.1331	0.0776	0.0812	0.1003	0.098	0.1332	0.1363
TBR(Index Return, 1; Chg of Trad.Vol., 1; 78 weeks, 0)	0.1782	0.1367	0.1802	0.1181	0.1204	0.094	0.1012	0.0995	0.0856	0.1382	0.1291
TBR(Index Return, 1; Chg of Rf Rate, 1; 63 days, 0)	0.1359	0.1452	0.166	0.0961	0.1397	0.1411	0.0794	0.0792	0.0749	0.1203	0.1218
TBR(Index Return, 1; Chg of VIX, 1; 104 weeks, 0)	0.1691	0.153	0.1894	0.1526	0.0726	0.0655	0.0914	0.1018	0.091	0.1298	0.1283
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 52 weeks, 0)	0.164	0.1414	0.1667	0.1161	0.1334	0.1199	0.1056	0.0812	0.0814	0.1351	0.1277
TBR(Index Return, 1; Chg of Rf Rate, 1; 126 days, 0)	0.1487	0.1552	0.1788	0.0848	0.1274	0.1299	0.089	0.0875	0.0821	0.1364	0.1263
TBR(Index Return, 1; Chg of VIX, 1; 78 weeks, 0)	0.1654	0.1499	0.1822	0.1385	0.1057	0.0651	0.1039	0.0939	0.087	0.1344	0.1276
TBR(Index Return, 1; Chg of Rf Rate, 1; 84 days, 0)	0.1308	0.156	0.1562	0.0859	0.1488	0.1367	0.0858	0.0839	0.0749	0.1294	0.1228
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 105 days, 0)	0.1379	0.1519	0.1703	0.0895	0.1209	0.1384	0.0925	0.0826	0.077	0.1292	0.1228
TBR(Index Return, 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.1753	0.1481	0.1851	0.1276	0.1067	0.0812	0.0938	0.1013	0.0878	0.1341	0.1288
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 78 weeks, 0)	0.167	0.1541	0.1865	0.1313	0.092	0.0853	0.1001	0.0956	0.0851	0.1545	0.1303
TBR(Index Return, 1; Chg of Rf Rate, 1; 105 days, 0)	0.1415	0.155	0.1801	0.082	0.1343	0.1343	0.0918	0.0845	0.0779	0.1361	0.1263
TBR(Index Return, 1; Chg of Trad.Vol., 1; 104 weeks, 0)	0.1843	0.1463	0.189	0.1445	0.1294	0.0866	0.0883	0.1027	0.0898	0.1346	0.1344
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.1858	0.1516	0.1926	0.1543	0.1164	0.0881	0.0767	0.0992	0.0958	0.1251	0.1343
TBR(Index Return, 1; Chg of Trad.Vol., 1; 52 weeks, 0)	0.1782	0.1419	0.1898	0.0945	0.1365	0.1147	0.1071	0.0895	0.088	0.1383	0.1323
TBR(Index Return, 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.1864	0.152	0.189	0.1614	0.1128	0.07	0.0766	0.1015	0.0955	0.1242	0.1334
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; Chg of VIX, 1; 104 weeks, 0)	0.1705	0.1499	0.1855	0.1472	0.094	0.1007	0.0864	0.1008	0.0865	0.1276	0.1296
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.17: Performance Summary of Top 20 Trend-Based Regression Strategies with Multiple Market Information Variables ( $W_i = 1$ ) (Annualized Returns and Annualized Volatilities)



Trend-based Regression with Multiple Variables: TBR(v1, W1; v2, W2; ... vm, Wm; K, $\theta$ )											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	0.8597	1.8567	0.8561	-1.0634	-0.0142	2.001	1.2538	0.1417	1.3701	0.8266	0.7483
TBR(Index Return, 1; Chg of Rf Rate, 1; 78 weeks, 0)	0.8498	2.0845	0.7901	-0.5037	0.0309	2.9039	0.33	0.2017	1.6042	-0.1461	0.7461
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.8973	2.1036	0.8159	-1.1989	0.712	1.8474	1.2538	0.1714	1.375	0.2259	0.7394
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 130 weeks, 0)	0.7448	1.8936	0.7966	-0.7843	0.5991	1.1088	1.2487	0.1936	1.08	0.7493	0.7311
TBR(Index Return, 1; Chg of Trad.Vol., 1; 78 weeks, 0)	1.4043	2.1478	0.5015	-1.4783	0.2324	2.387	0.5453	0.2045	1.391	0.4209	0.7292
TBR(Index Return, 1; Chg of Rf Rate, 1; 63 days, 0)	2.4769	1.0564	-0.1941	0.0201	0.1243	1.4465	2.1223	0.5994	0.3711	-0.0211	0.7144
TBR(Index Return, 1; Chg of VIX, 1; 104 weeks, 0)	0.9527	1.5486	0.7557	-1.0676	0.9663	1.9112	0.7379	0.2262	1.2507	0.9364	0.6986
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 52 weeks, 0)	1.133	2.3196	0.3737	-0.9976	1.1002	1.4209	0.2392	-0.5351	1.1547	0.3154	0.6841
TBR(Index Return, 1; Chg of Rf Rate, 1; 126 days, 0)	1.3729	0.5387	0.1061	-0.2422	0.9203	0.9735	1.1289	-0.0042	1.5012	0.4469	0.6546
TBR(Index Return, 1; Chg of VIX, 1; 78 weeks, 0)	1.114	1.2721	0.457	-0.925	1.4955	0.9339	0.3138	0.3194	1.6521	0.5524	0.6502
TBR(Index Return, 1; Chg of Rf Rate, 1; 84 days, 0)	1.7921	0.7313	0.7214	-0.4511	-0.012	1.3499	0.9186	0.5719	0.9299	0.1236	0.6498
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 105 days, 0)	1.988	0.8076	0.0697	-0.1524	0.0695	0.9318	0.7582	0.5266	1.0228	0.6727	0.6461
TBR(Index Return, 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.8167	2.1036	0.79	-1.4525	0.2003	2.2132	0.5472	0.2294	1.5341	0.136	0.6327
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 78 weeks, 0)	0.7064	1.2892	0.4314	-0.015	-1.1168	3.7336	0.8076	0.4165	1.1205	-0.1022	0.622
TBR(Index Return, 1; Chg of Rf Rate, 1; 105 days, 0)	1.8656	0.2089	0.5044	-0.1843	0.475	1.0694	0.8414	-0.053	1.0563	0.2856	0.6158
TBR(Index Return, 1; Chg of Trad.Vol., 1; 104 weeks, 0)	1.1872	1.7832	0.7966	-1.7702	-0.173	2.1774	1.2538	0.2923	1.2328	0.4337	0.6157
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.4765	1.8547	0.9154	-1.3908	0.513	1.649	1.2581	0.0828	0.9088	0.753	0.6157
TBR(Index Return, 1; Chg of Trad.Vol., 1; 52 weeks, 0)	1.4043	2.2718	0.1521	-2.4315	0.6026	2.2205	0.211	-0.3808	1.0212	0.5184	0.6141
TBR(Index Return, 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.6113	1.8133	0.7966	-1.103	0.2751	2.0832	0.5114	0.2893	0.8785	0.8201	0.6035
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; Chg of VIX, 1; 104 weeks, 0)	0.6033	1.8567	0.8159	-1.0701	-0.1843	1.9719	0.8941	0.1445	1.0925	0.3783	0.5997
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	0.68	0.66	0.67	0.31	0.13	0.31	0.65	0.96	0.8	0.61	0.58
TBR(Index Return, 1; Chg of Rf Rate, 1; 78 weeks, 0)	0.73	0.6	0.65	0.23	0.14	0.26	0.85	0.83	0.67	0.77	0.57
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.78	0.66	0.67	0.34	0.12	0.33	0.65	0.94	0.62	0.65	0.58
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 130 weeks, 0)	0.74	0.68	0.69	0.44	0.24	0.25	0.53	0.92	0.88	0.67	0.61
TBR(Index Return, 1; Chg of Trad.Vol., 1; 78 weeks, 0)	0.75	0.58	0.62	0.23	0.19	0.34	0.87	0.94	0.73	0.71	0.6
TBR(Index Return, 1; Chg of Rf Rate, 1; 63 days, 0)	0.68	0.71	0.52	0.32	0.4	0.64	0.58	0.6	0.67	0.62	0.57
TBR(Index Return, 1; Chg of VIX, 1; 104 weeks, 0)	0.67	0.68	0.7	0.27	0.06	0.17	0.71	0.98	0.82	0.58	0.56
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 52 weeks, 0)	0.65	0.6	0.63	0.3	0.24	0.56	0.9	0.51	0.59	0.73	0.57
TBR(Index Return, 1; Chg of Rf Rate, 1; 126 days, 0)	0.73	0.79	0.59	0.16	0.34	0.65	0.63	0.67	0.7	0.74	0.6
TBR(Index Return, 1; Chg of VIX, 1; 78 weeks, 0)	0.64	0.64	0.67	0.23	0.08	0.19	0.9	0.87	0.72	0.69	0.56
TBR(Index Return, 1; Chg of Rf Rate, 1; 84 days, 0)	0.67	0.77	0.56	0.24	0.44	0.65	0.58	0.6	0.67	0.67	0.59
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 105 days, 0)	0.71	0.73	0.55	0.22	0.37	0.64	0.69	0.63	0.71	0.72	0.6
TBR(Index Return, 1; Chg of Rf Rate, 1; 104 weeks, 0)	0.76	0.66	0.67	0.3	0.15	0.18	0.69	0.96	0.65	0.66	0.57
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 78 weeks, 0)	0.64	0.68	0.69	0.23	0.12	0.26	0.81	0.79	0.65	0.92	0.58
TBR(Index Return, 1; Chg of Rf Rate, 1; 105 days, 0)	0.72	0.76	0.6	0.18	0.4	0.64	0.63	0.63	0.69	0.7	0.6
TBR(Index Return, 1; Chg of Trad.Vol., 1; 104 weeks, 0)	0.82	0.64	0.69	0.33	0.15	0.32	0.65	1	0.83	0.67	0.61
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.76	0.68	0.71	0.36	0.23	0.26	0.47	0.92	0.82	0.63	0.58
TBR(Index Return, 1; Chg of Trad.Vol., 1; 52 weeks, 0)	0.75	0.62	0.7	0.14	0.23	0.5	0.94	0.73	0.76	0.75	0.61
TBR(Index Return, 1; Chg of Rf Rate, 1; 130 weeks, 0)	0.78	0.7	0.69	0.42	0.17	0.1	0.42	0.96	0.83	0.6	0.57
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; Chg of VIX, 1; 104 weeks, 0)	0.64	0.66	0.67	0.38	0.15	0.33	0.61	0.94	0.65	0.61	0.57

Table B.18: Performance Summary of Top 20 Trend-Based Regression Strategies with Multiple Market Information Variables ( $W_i = 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Trend-based Regression with Multiple Variables: TBR(v1, W1; v2, W2; ... vm, Wm; K, $\theta$ )												
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 104 weeks, 0)	31	27	28	20	14	27	26	4	16	32	22.5	
TBR(Index Return, 1; Chg of Rf Rate, 1; 78 weeks, 0)	23	32	26	16	8	20	11	12	26	17	19.1	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 104 weeks, 0)	22	29	26	24	12	27	26	6	16	28	21.6	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of VIX, 1; 130 weeks, 0)	24	27	26	20	20	23	30	8	12	28	21.8	
TBR(Index Return, 1; Chg of Trad.Vol., 1; 78 weeks, 0)	26	31	28	16	15	30	10	6	24	26	21.2	
TBR(Index Return, 1; Chg of Rf Rate, 1; 63 days, 0)	67	68	105	63	102	115	89	90	72	121	89.2	
TBR(Index Return, 1; Chg of VIX, 1; 104 weeks, 0)	32	25	25	15	6	18	15	2	14	33	18.5	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 52 weeks, 0)	28	31	26	23	24	27	11	27	29	22	24.8	
TBR(Index Return, 1; Chg of Rf Rate, 1; 126 days, 0)	69	50	95	60	86	104	89	108	86	87	83.4	
TBR(Index Return, 1; Chg of VIX, 1; 78 weeks, 0)	33	27	29	13	8	16	9	10	20	23	18.8	
TBR(Index Return, 1; Chg of Rf Rate, 1; 84 days, 0)	65	74	87	61	97	114	97	102	76	100	87.3	
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 105 days, 0)	69	68	103	72	76	98	68	114	77	90	83.5	
TBR(Index Return, 1; Chg of Rf Rate, 1; 104 weeks, 0)	22	29	24	18	10	14	17	4	18	25	18.1	
TBR(Chg of Rf Rate, 1; Chg of VIX, 1; 78 weeks, 0)	29	27	20	16	8	17	12	14	24	7	17.4	
TBR(Index Return, 1; Chg of Rf Rate, 1; 105 days, 0)	67	60	97	56	94	112	91	114	78	101	87	
TBR(Index Return, 1; Chg of Trad.Vol., 1; 104 weeks, 0)	20	29	26	18	14	27	26	0	16	28	20.4	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; 130 weeks, 0)	20	29	24	22	18	21	30	8	12	30	21.4	
TBR(Index Return, 1; Chg of Trad.Vol., 1; 52 weeks, 0)	26	29	26	13	18	27	7	25	21	22	21.4	
TBR(Index Return, 1; Chg of Rf Rate, 1; 130 weeks, 0)	18	27	26	22	12	8	23	4	14	29	18.3	
TBR(Index Return, 1; Chg of Trad.Vol., 1; Chg of Rf Rate, 1; Chg of VIX, 1; 104 weeks, 0)	29	27	26	24	12	25	24	6	18	30	22.1	

Table B.19: Performance Summary of Top 20 Trend-Based Regression Strategies with Multiple Market Information Variables ( $W_i = 1$ ) (Numbers of Trading)

Conditional Probability Table: CPT(v1, v2, ... vm; K)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
CPT(Index Return, Chg of VIX; 78 weeks)	0.2828	0.2332	0.0527	-0.0192	-0.0188	0.3563	0.0721	0.0493	0.1246	0.0057	0.1071
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.2538	0.0948	0.2863	-0.0061	-0.1508	0.359	0.0103	-0.0387	0.1699	0.1929	0.1063
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 105 days)	0.2617	0.0591	0.2146	0.0608	-0.0774	0.2854	0.0172	-0.0251	0.1771	0.0584	0.0969
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 84 days)	0.1883	0.1172	0.223	-0.0065	-0.07	0.25	0.0613	-0.0298	0.1822	0.0418	0.0905
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 126 days)	0.1738	0.1163	0.1104	0.0081	-0.1166	0.2614	0.0382	-0.0057	0.1656	0.1821	0.088
CPT(Index Return, Chg of VIX; 105 days)	0.0717	0.1817	0.0363	0.036	-0.1385	0.2992	0.0959	0.0073	0.2167	0.1304	0.0874
CPT(Chg of Trad.Vol., Chg of Rf Rate; 78 weeks)	0.2385	0.1672	-0.0804	0.0052	0.0898	0.1386	0.0155	0.0277	0.1325	0.0927	0.0791
CPT(Index Return, Chg of Rf Rate; 52 weeks)	0.2055	0.1915	-0.0008	0.011	-0.1401	0.2926	-0.0014	0.0105	0.0986	0.1235	0.0722
CPT(Chg of Trad.Vol., Chg of Rf Rate; 130 weeks)	0.2667	0.1808	-0.0716	-0.1636	0.1261	0.1139	0.0469	0.0341	0.1591	0.0881	0.0712
CPT(Chg of Trad.Vol., Chg of Rf Rate; 105 days)	0.206	0.1581	0.0667	-0.061	-0.0464	0.2396	0.0671	-0.0273	0.1072	0.0404	0.0705
CPT(Chg of Rf Rate, Chg of VIX; 126 days)	0.1187	0.1208	0.0794	0.083	-0.0146	0.1084	0.0691	-0.0153	0.1321	0.021	0.069
CPT(Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	0.2419	0.177	0.0936	-0.1296	-0.0945	0.1347	0.097	0.011	0.1134	0.0781	0.0665
CPT(Index Return, Chg of Rf Rate, Chg of VIX; 105 days)	0.0982	0.1184	-0.0105	0.0506	-0.0088	0.1553	0.0496	-0.0362	0.148	0.1108	0.0655
CPT(Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.1477	0.1766	0.1636	-0.0165	-0.0668	0.1536	-0.0177	-0.085	0.0885	0.1558	0.0652
CPT(Chg of Trad.Vol., Chg of VIX; 156 weeks)	0.2667	0.1877	0.087	-0.0228	-0.1868	0.1331	0.0384	0.0171	0.1656	0.0353	0.065
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	0.3541	0.1201	0.0475	-0.1393	-0.1029	0.1094	0.0804	0.0693	0.1222	0.052	0.0638
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 105 days)	0.2084	0.1041	0.0022	-0.0248	-0.1447	0.2507	0.0848	-0.0291	0.1534	0.084	0.0627
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 78 weeks)	0.279	0.2075	0.0197	-0.0938	-0.0079	0.1213	0.0266	-0.0161	0.0966	0.0332	0.0615
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 105 days)	0.2376	0.1356	-0.0412	-0.1008	-0.1225	0.2115	0.1265	-0.0078	0.1552	0.0873	0.061
CPT(Chg of Trad.Vol., Chg of Rf Rate; 156 weeks)	0.2667	0.1953	-0.0628	-0.1559	-0.0896	0.1361	0.1322	0.0384	0.158	0.0716	0.061
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
CPT(Index Return, Chg of VIX; 78 weeks)	0.1958	0.1748	0.1839	0.1103	0.1357	0.1204	0.0936	0.1001	0.1	0.1574	0.1419
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.1631	0.1388	0.1625	0.0984	0.1536	0.13	0.1002	0.0802	0.0791	0.1408	0.1285
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 105 days)	0.1539	0.1408	0.163	0.1059	0.1614	0.1255	0.1008	0.08	0.0771	0.1361	0.1281
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 84 days)	0.1524	0.1372	0.1691	0.0985	0.1433	0.1218	0.0957	0.0806	0.0738	0.1304	0.124
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 126 days)	0.1667	0.1361	0.1698	0.1006	0.1615	0.1206	0.1002	0.0847	0.0747	0.1286	0.1285
CPT(Index Return, Chg of VIX; 105 days)	0.1402	0.1454	0.1771	0.0923	0.1186	0.1135	0.1036	0.0859	0.0866	0.1376	0.1234
CPT(Chg of Trad.Vol., Chg of Rf Rate; 78 weeks)	0.1734	0.1769	0.1545	0.084	0.154	0.1174	0.0985	0.0928	0.086	0.1445	0.1328
CPT(Index Return, Chg of Rf Rate; 52 weeks)	0.1957	0.1617	0.156	0.1011	0.2068	0.128	0.0927	0.088	0.0921	0.1454	0.1429
CPT(Chg of Trad.Vol., Chg of Rf Rate; 130 weeks)	0.2031	0.1758	0.1956	0.1247	0.158	0.1177	0.0783	0.0882	0.084	0.1455	0.1438
CPT(Chg of Trad.Vol., Chg of Rf Rate; 105 days)	0.1591	0.1467	0.1653	0.1105	0.1421	0.1006	0.1009	0.0937	0.0793	0.1351	0.1266
CPT(Chg of Rf Rate, Chg of VIX; 126 days)	0.1702	0.1463	0.1635	0.1035	0.1255	0.1026	0.1044	0.0941	0.0804	0.1456	0.1271
CPT(Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	0.189	0.1743	0.1972	0.1388	0.1594	0.1282	0.0786	0.0962	0.0815	0.143	0.1444
CPT(Index Return, Chg of Rf Rate, Chg of VIX; 105 days)	0.1356	0.1373	0.1761	0.104	0.1397	0.1053	0.1021	0.0906	0.073	0.143	0.1241
CPT(Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.1701	0.1484	0.1507	0.0902	0.1372	0.0987	0.0979	0.0923	0.077	0.1406	0.1242
CPT(Chg of Trad.Vol., Chg of VIX; 156 weeks)	0.2031	0.1767	0.1995	0.1961	0.2125	0.0889	0.0768	0.0847	0.0897	0.1596	0.1582
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	0.1919	0.1707	0.1997	0.1418	0.1655	0.1173	0.0805	0.0978	0.0857	0.1481	0.1458
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 105 days)	0.1352	0.1338	0.171	0.113	0.167	0.1123	0.1013	0.0844	0.0671	0.133	0.1258
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 78 weeks)	0.1966	0.1751	0.1984	0.1391	0.1757	0.1031	0.0942	0.09	0.0978	0.1561	0.1485
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 105 days)	0.1578	0.1457	0.1716	0.1272	0.1302	0.1154	0.0979	0.0791	0.0747	0.1355	0.1272
CPT(Chg of Trad.Vol., Chg of Rf Rate; 156 weeks)	0.2031	0.1808	0.2088	0.1294	0.1583	0.1188	0.0779	0.0879	0.0834	0.1554	0.1478
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.20: Performance Summary of Top 20 Conditional Probability Table Strategies (Annualized Returns and Annualized Volatilities)

Table B.21: Performance Summary of Top 20 Conditional Probability Table Strategies (Sharpe Ratios and Proportions of In-the-Market)

Conditional Probability Table: CPT(v1, v2, ... vm; k)												
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007	
CPT(Index Return, Chg of VIX; 78 weeks)	1.4439	1.3344	0.2864	-0.1738	-0.1383	2.9602	0.7699	0.4919	1.2467	0.0365	0.8608	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 126 days)	1.5562	0.6827	1.7613	-0.0619	-0.9818	2.7607	0.1032	-0.4823	2.1496	1.3696	0.8542	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 105 days)	1.7007	0.4196	1.3161	0.5737	-0.4796	2.2733	0.1708	-0.3137	2.2977	0.4291	0.7793	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 84 days)	1.2353	0.8545	1.3187	-0.0661	-0.4889	2.0518	0.64	-0.3697	2.4703	0.3203	0.7274	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 126 days)	1.0426	0.8552	0.6504	0.0805	-0.7219	2.1683	0.3809	-0.067	2.2158	1.4158	0.7077	
CPT(Index Return, Chg of VIX; 105 days)	0.5115	1.2492	0.2052	0.3904	-1.1675	2.6364	0.9256	0.0848	2.5024	0.9482	0.7024	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 78 weeks)	1.3753	0.9451	-0.5206	0.0621	0.5827	1.1804	0.1572	0.2985	1.5409	0.6415	0.636	
CPT(Index Return, Chg of Rf Rate; 52 weeks)	1.0501	1.185	-0.0054	0.1088	-0.6775	2.2862	-0.0155	0.1188	1.0703	0.8493	0.5806	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 130 weeks)	1.3129	1.0284	-0.3661	-1.3119	0.7983	0.9678	0.5997	0.3871	1.893	0.6055	0.5723	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 105 days)	1.295	1.0779	0.4032	-0.5522	-0.3267	2.3831	0.6652	-0.2918	1.3517	0.2989	0.5671	
CPT(Chg of Rf Rate, Chg of VIX; 126 days)	0.6974	0.8261	0.4859	0.8022	-0.1165	1.0566	0.662	-0.1625	1.6438	0.1441	0.5544	
CPT(Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	1.2801	1.0154	0.4746	-0.9337	-0.5926	1.0507	1.2348	0.1142	1.3909	0.546	0.5343	
CPT(Index Return, Chg of Rf Rate, Chg of VIX; 105 days)	0.7243	0.8619	-0.0596	0.4864	-0.0633	1.4743	0.4857	-0.4001	2.0263	0.7752	0.5266	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.8681	1.1906	1.0856	-0.1835	-0.4867	1.556	-0.1809	-0.9208	1.1494	1.1083	0.5245	
CPT(Chg of Trad.Vol., Chg of VIX; 156 weeks)	1.3129	1.0625	0.4359	-0.1165	-0.879	1.4977	0.5008	0.2025	1.8458	0.2212	0.5224	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	1.8453	0.7037	0.238	-0.9821	-0.6214	0.9321	0.9985	0.7083	1.4255	0.3509	0.5129	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 105 days)	1.5409	0.7781	0.0131	-0.2195	-0.8665	2.2327	0.8368	-0.344	2.2847	0.6312	0.504	
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 78 weeks)	1.4191	1.1848	0.0994	-0.6744	-0.0449	1.1769	0.2822	-0.1795	0.9876	0.213	0.4947	
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 105 days)	1.506	0.9311	-0.2401	-0.7926	-0.9406	1.8324	1.2923	-0.0985	2.0771	0.6444	0.4908	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 156 weeks)	1.3129	1.0802	-0.3009	-1.2045	-0.5657	1.1456	1.6965	0.4372	1.8957	0.4608	0.4902	
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346	
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007	
CPT(Index Return, Chg of VIX; 78 weeks)	0.86	0.96	0.6	0.23	0.25	0.42	0.65	0.98	0.98	0.94	0.69	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.64	0.58	0.47	0.27	0.39	0.54	0.76	0.65	0.65	0.75	0.57	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 105 days)	0.63	0.6	0.48	0.29	0.39	0.53	0.77	0.66	0.64	0.75	0.57	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 84 days)	0.63	0.58	0.53	0.3	0.39	0.53	0.73	0.61	0.61	0.68	0.56	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 126 days)	0.62	0.56	0.49	0.29	0.4	0.52	0.78	0.67	0.6	0.68	0.56	
CPT(Index Return, Chg of VIX; 105 days)	0.72	0.64	0.61	0.13	0.28	0.53	0.85	0.71	0.72	0.75	0.59	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 78 weeks)	0.81	0.96	0.47	0.15	0.38	0.48	0.79	0.77	0.69	0.79	0.63	
CPT(Index Return, Chg of Rf Rate; 52 weeks)	0.83	0.77	0.58	0.23	0.56	0.54	0.69	0.73	0.84	0.87	0.66	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 130 weeks)	1	0.94	0.73	0.23	0.41	0.5	0.48	0.74	0.69	0.85	0.66	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 105 days)	0.59	0.66	0.46	0.26	0.31	0.41	0.82	0.8	0.67	0.84	0.58	
CPT(Chg of Rf Rate, Chg of VIX; 126 days)	0.69	0.66	0.45	0.2	0.31	0.47	0.89	0.83	0.69	0.82	0.6	
CPT(Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	0.8	0.87	0.73	0.35	0.46	0.56	0.51	0.83	0.63	0.79	0.65	
CPT(Index Return, Chg of Rf Rate, Chg of VIX; 105 days)	0.65	0.62	0.55	0.19	0.32	0.47	0.81	0.7	0.57	0.76	0.56	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 126 days)	0.67	0.66	0.44	0.22	0.35	0.42	0.79	0.83	0.65	0.87	0.59	
CPT(Chg of Trad.Vol., Chg of VIX; 156 weeks)	1	0.92	0.74	0.74	0.54	0.23	0.45	0.67	0.71	1	0.7	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	0.87	0.84	0.77	0.37	0.44	0.48	0.49	0.9	0.68	0.81	0.66	
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 105 days)	0.6	0.56	0.48	0.27	0.36	0.5	0.78	0.67	0.57	0.69	0.55	
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 78 weeks)	0.88	0.91	0.71	0.4	0.37	0.34	0.66	0.71	0.9	0.92	0.68	
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 105 days)	0.66	0.63	0.54	0.28	0.37	0.5	0.75	0.62	0.6	0.75	0.57	
CPT(Chg of Trad.Vol., Chg of Rf Rate; 156 weeks)	1	1	0.85	0.26	0.45	0.52	0.45	0.72	0.67	0.92	0.68	

Table B.22: Performance Summary of Top 20 Conditional Probability Table Strategies (Numbers of Trading)

Number of Tradings	Conditional Probability Table: CPT(v1, v2, ..., vm; K)										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
CPT(Index Return, Chg of VIX; 78 weeks)	7	2	30	14	14	31	20	3	2	4	12.7
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 126 days)	108	97	90	87	114	106	80	120	82	76	96
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 105 days)	108	97	104	85	116	108	82	106	90	86	98.2
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate; 84 days)	100	89	92	91	114	97	81	112	86	88	95
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 126 days)	100	108	108	98	122	118	72	104	112	78	102
CPT(Index Return, Chg of VIX; 105 days)	70	75	71	42	83	97	57	83	70	83	73.1
CPT(Chg of Trad.Vol., Chg of Rf Rate; 78 weeks)	14	2	21	15	24	26	18	20	24	21	18.5
CPT(Index Return, Chg of Rf Rate; 52 weeks)	10	13	21	18	22	23	15	18	12	11	16.3
CPT(Chg of Trad.Vol., Chg of Rf Rate; 130 weeks)	0	6	14	19	17	26	26	24	24	15	17.1
CPT(Chg of Trad.Vol., Chg of Rf Rate; 105 days)	104	101	99	76	72	108	60	76	78	44	81.8
CPT(Chg of Rf Rate, Chg of VIX; 126 days)	101	95	98	70	80	78	42	74	90	58	78.6
CPT(Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	13	13	21	20	23	22	26	12	17	22	18.9
CPT(Index Return, Chg of Rf Rate, Chg of VIX; 105 days)	82	102	109	77	88	84	74	103	101	81	90.1
CPT(Chg of Trad.Vol., Chg of Rf Rate; 126 days)	102	95	95	70	87	115	70	70	96	46	84.6
CPT(Chg of Trad.Vol., Chg of VIX; 156 weeks)	0	8	24	20	20	24	28	28	26	0	17.8
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 104 weeks)	14	14	17	19	22	25	24	9	22	19	18.5
CPT(Index Return, Chg of Trad.Vol., Chg of Rf Rate, Chg of VIX; 105 days)	102	98	92	88	108	102	76	97	115	82	96
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 78 weeks)	13	10	22	26	26	25	25	14	6	6	17.3
CPT(Index Return, Chg of Trad.Vol., Chg of VIX; 105 days)	94	95	95	64	92	104	81	113	100	84	92.2
CPT(Chg of Trad.Vol., Chg of Rf Rate; 156 weeks)	0	0	8	15	19	28	22	26	26	7	15.1

Table B.23: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies (Annualized Returns and Annualized Volatilities)

Nearest Neighbors Algorithm: NN(k, m, $\theta$ , method)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN(14, 50, 0, regression)	0.3143	0.2196	0.1351	-0.0768	-0.1067	0.2971	0.1119	-0.0245	0.0013	0.1051	0.0886
NN(14, 10, 0.7, regression)	0.3819	0.2374	0.2353	-0.0862	-0.0011	0.1087	0.0384	-0.049	0.0565	-0.0031	0.0832
NN(14, 10, 0.9, regression)	0.2859	0.1643	0.2215	-0.1148	0.0209	0.2448	0.0577	-0.031	0.0484	-0.0276	0.0795
NN(14, 10, 0.6, regression)	0.3434	0.1287	0.2157	-0.0445	0.0099	0.1123	0.0394	-0.0686	0.0831	0.0322	0.0791
NN(12, 10, 0.1, average)	0.1699	0.1896	0.181	0.0161	-0.1064	0.1893	-0.0015	0.0167	0.0474	0.1171	0.0774
NN(14, 10, 1, regression)	0.1736	0.1705	0.2511	-0.0531	0.0014	0.1969	0.0637	-0.0612	0.0257	0.0496	0.0769
NN(8, 150, 0.4, regression)	0.2558	0.0225	0.0114	-0.027	-0.1477	0.2638	0.1253	0.0775	0.0994	0.1338	0.0748
NN(2, 150, 0.8, regression)	0.241	0.1953	-0.0188	0.1342	-0.2337	0.2638	0.0899	0.03	0.1362	-0.0081	0.073
NN(14, 100, 0.8, regression)	0.2363	0.1953	-0.0139	-0.0817	-0.1474	0.2638	0.1071	-0.0216	0.1024	0.1707	0.0726
NN(2, 150, 0.7, regression)	0.241	0.1953	-0.0462	0.1342	-0.2337	0.2638	0.0899	0.03	0.1631	-0.0081	0.0725
NN(14, 10, 0.8, regression)	0.3132	0.1868	0.2405	-0.1009	-0.023	0.1864	0.0123	-0.0555	0.0637	-0.028	0.0713
NN(6, 150, 0, regression)	0.159	0.3351	0.0186	-0.012	-0.0469	0.1097	-0.026	0.0618	0.0508	0.105	0.0706
NN(4, 150, 0.6, regression)	0.3605	0.1122	-0.0705	0.0682	-0.2017	0.2638	0.1193	0.0209	0.119	0.0177	0.0703
NN(2, 10, 0.2, regression)	0.2379	-0.0062	0.0713	-0.0822	-0.1332	0.2552	0.1703	0.0073	0.0642	0.1825	0.0692
NN(2, 10, 0.1, regression)	0.1129	-0.0099	0.0834	0.0654	-0.0655	0.1513	0.1731	0.0281	0.0493	0.1258	0.069
NN(14, 50, 0.1, regression)	0.2888	0.2147	0.0471	-0.1442	-0.0908	0.3062	0.0462	-0.0103	0.0134	0.1072	0.0683
NN(10, 300, 0.8, regression)	0.383	0.1953	-0.0825	0.1299	-0.3272	0.2638	0.0899	0.03	0.1362	0.0287	0.067
NN(10, 300, 0.7, regression)	0.383	0.1371	-0.0234	0.1299	-0.3281	0.2482	0.0729	0.03	0.1362	0.0446	0.0668
NN(4, 50, 0.1, average)	0.1713	0.1486	0.1642	-0.0668	-0.2081	0.1838	0.0862	0.0563	0.0903	0.1098	0.0664
NN(8, 450, 0.6, regression)	0.4589	0.1953	-0.1014	-0.1304	-0.2128	0.2638	0.1152	0.031	0.1362	0.0704	0.066
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN(14, 50, 0, regression)	0.1269	0.1132	0.1467	0.1689	0.1958	0.1331	0.0734	0.071	0.0663	0.1108	0.1273
NN(14, 10, 0.7, regression)	0.1313	0.1201	0.1584	0.1519	0.1739	0.1206	0.0823	0.0811	0.0758	0.1175	0.1255
NN(14, 10, 0.9, regression)	0.1237	0.1189	0.1588	0.1564	0.1817	0.1287	0.0826	0.0758	0.078	0.1217	0.1273
NN(14, 10, 0.6, regression)	0.1324	0.1309	0.1588	0.1506	0.1736	0.1186	0.0833	0.0798	0.0732	0.1205	0.1265
NN(12, 10, 0.1, average)	0.1321	0.1155	0.1769	0.1947	0.2258	0.1395	0.0687	0.0823	0.0689	0.1212	0.1419
NN(14, 10, 1, regression)	0.1087	0.1098	0.161	0.1446	0.18	0.1242	0.0864	0.0733	0.0764	0.1174	0.1229
NN(8, 150, 0.4, regression)	0.0989	0.1492	0.1386	0.137	0.2126	0.1711	0.0784	0.0671	0.0625	0.1088	0.1307
NN(2, 150, 0.8, regression)	0.1373	0.1808	0.1462	0.0895	0.2602	0.1711	0.1109	0.1027	0.1004	0.044	0.1459
NN(14, 100, 0.8, regression)	0.1374	0.1808	0.1384	0.1351	0.2054	0.1711	0.095	0.0355	0.0681	0.1344	0.1391
NN(2, 150, 0.7, regression)	0.1373	0.1808	0.1434	0.0895	0.2602	0.1711	0.1109	0.1027	0.0775	0.044	0.1442
NN(14, 10, 0.8, regression)	0.1214	0.1173	0.1539	0.1601	0.1769	0.1374	0.0813	0.0818	0.0756	0.1211	0.1271
NN(6, 150, 0, regression)	0.1258	0.1201	0.148	0.1604	0.2056	0.1292	0.0685	0.0728	0.0696	0.1064	0.1277
NN(4, 150, 0.6, regression)	0.1357	0.0994	0.1155	0.1718	0.2126	0.1711	0.0705	0.1024	0.0614	0.0971	0.132
NN(2, 10, 0.2, regression)	0.1327	0.1019	0.149	0.1495	0.2023	0.1308	0.0725	0.0638	0.0671	0.1123	0.1253
NN(2, 10, 0.1, regression)	0.1403	0.1035	0.1523	0.155	0.197	0.1335	0.074	0.0644	0.0659	0.1166	0.1272
NN(14, 50, 0.1, regression)	0.1203	0.1139	0.1402	0.1664	0.199	0.1356	0.0725	0.0716	0.0693	0.1054	0.1261
NN(10, 300, 0.8, regression)	0.1785	0.1808	0.0896	0.1048	0.2368	0.1711	0.1109	0.1027	0.1004	0.092	0.145
NN(10, 300, 0.7, regression)	0.1785	0.1777	0.0582	0.1048	0.2003	0.1177	0.11	0.1027	0.1004	0.1469	0.1364
NN(4, 50, 0.1, average)	0.1335	0.0892	0.1565	0.2085	0.2539	0.1557	0.0643	0.0768	0.0711	0.1069	0.1446
NN(8, 450, 0.6, regression)	0.1718	0.1808	0.2218	0.2153	0.2381	0.1711	0.0786	0.0894	0.1004	0.0875	0.166
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.24: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies (Sharpe Ratios and Proportions of In-the-Market)

Nearest Neighbors Algorithm: NN(k, m, $\theta$ , method)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN(14, 50, 0, regression)	2.477	1.9393	0.9212	-0.4545	-0.5451	2.2317	1.5236	-0.3445	0.0195	0.949	0.5334
NN(14, 10, 0.7, regression)	2.9079	1.9774	1.4855	-0.5677	-0.0065	0.9017	0.4666	-0.604	0.7447	-0.0262	0.501
NN(14, 10, 0.9, regression)	2.3114	1.3813	1.3948	-0.7342	0.1149	1.9029	0.6987	-0.4092	0.6209	-0.2265	0.479
NN(14, 10, 0.6, regression)	2.5934	0.983	1.3585	-0.2954	0.0571	0.9471	0.4732	-0.859	1.1357	0.267	0.4766
NN(12, 10, 0.1, average)	1.2859	1.641	1.0231	0.0825	-0.4712	1.3575	-0.0213	0.2029	0.688	0.9657	0.4664
NN(14, 10, 1, regression)	1.597	1.5535	1.5595	-0.3673	0.0077	1.5855	0.7367	-0.8348	0.3366	0.4226	0.463
NN(8, 150, 0.4, regression)	2.5864	0.1507	0.0824	-0.1972	-0.6947	1.5422	1.5978	1.1544	1.5897	1.2304	0.4506
NN(2, 150, 0.8, regression)	1.7551	1.0802	-0.1286	1.4997	-0.898	1.5422	0.8112	0.2923	1.3565	-0.184	0.4396
NN(14, 100, 0.8, regression)	1.7201	1.0802	-0.1002	-0.6049	-0.7174	1.5422	1.1274	-0.6065	1.5029	1.2703	0.4374
NN(2, 150, 0.7, regression)	1.7551	1.0802	-0.3219	1.4997	-0.898	1.5422	0.8112	0.2923	2.1044	-0.184	0.4365
NN(14, 10, 0.8, regression)	2.5804	1.5926	1.5631	-0.6301	-0.13	1.3563	0.151	-0.6783	0.843	-0.2309	0.4297
NN(6, 150, 0, regression)	1.2635	2.7907	0.1256	-0.0745	-0.2282	0.8488	-0.379	0.8495	0.7291	0.9869	0.4251
NN(4, 150, 0.6, regression)	2.6575	1.1283	-0.6102	0.3972	-0.9487	1.5422	1.6937	0.2043	1.9388	0.1822	0.4235
NN(2, 10, 0.2, regression)	1.7928	-0.0607	0.4785	-0.5498	-0.6583	1.9508	2.3477	0.1137	0.9562	1.6251	0.4167
NN(2, 10, 0.1, regression)	0.8046	-0.0958	0.5478	0.4218	-0.3325	1.133	2.3404	0.4363	0.7483	1.0787	0.4158
NN(14, 50, 0.1, regression)	2.4009	1.8849	0.3359	-0.867	-0.4563	2.2577	0.637	-0.1441	0.1939	1.0172	0.4112
NN(10, 300, 0.8, regression)	2.1456	1.0802	-0.9211	1.2399	-1.3816	1.5422	0.8112	0.2923	1.3565	0.3116	0.4033
NN(10, 300, 0.7, regression)	2.1456	0.7715	-0.403	1.2399	-1.6382	2.1088	0.6627	0.2923	1.3565	0.3038	0.4023
NN(4, 50, 0.1, average)	1.2825	1.6666	1.0494	-0.3204	-0.8197	1.1809	1.3407	0.7323	1.2698	1.0274	0.4
NN(8, 450, 0.6, regression)	2.6711	1.0802	-0.457	-0.6059	-0.8935	1.5422	1.4661	0.3465	1.3565	0.8041	0.3978
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN(14, 50, 0, regression)	0.48	0.45	0.51	0.55	0.56	0.56	0.47	0.51	0.52	0.48	0.51
NN(14, 10, 0.7, regression)	0.4	0.5	0.48	0.49	0.43	0.52	0.54	0.59	0.52	0.56	0.5
NN(14, 10, 0.9, regression)	0.44	0.45	0.49	0.51	0.47	0.57	0.57	0.54	0.54	0.51	0.51
NN(14, 10, 0.6, regression)	0.42	0.52	0.45	0.49	0.44	0.49	0.55	0.58	0.47	0.6	0.5
NN(12, 10, 0.1, average)	0.36	0.42	0.59	0.71	0.68	0.56	0.46	0.55	0.44	0.51	0.53
NN(14, 10, 1, regression)	0.37	0.4	0.56	0.48	0.46	0.53	0.65	0.54	0.51	0.54	0.5
NN(8, 150, 0.4, regression)	0.26	0.77	0.37	0.55	0.78	1	0.48	0.55	0.49	0.42	0.57
NN(2, 150, 0.8, regression)	0.33	1	0.29	0.27	1	1	1	1	1	0.15	0.7
NN(14, 100, 0.8, regression)	0.34	1	0.33	0.29	0.48	1	0.73	0.06	0.53	0.88	0.56
NN(2, 150, 0.7, regression)	0.33	1	0.29	0.27	1	1	1	1	0.74	0.15	0.68
NN(14, 10, 0.8, regression)	0.44	0.44	0.46	0.54	0.46	0.57	0.53	0.62	0.51	0.54	0.51
NN(6, 150, 0, regression)	0.42	0.42	0.52	0.62	0.61	0.5	0.43	0.52	0.5	0.5	0.5
NN(4, 150, 0.6, regression)	0.59	0.24	0.26	0.67	0.74	1	0.47	0.99	0.55	0.56	0.61
NN(2, 10, 0.2, regression)	0.48	0.4	0.46	0.55	0.5	0.56	0.44	0.44	0.54	0.47	0.48
NN(2, 10, 0.1, regression)	0.5	0.44	0.48	0.56	0.5	0.55	0.45	0.46	0.51	0.47	0.49
NN(14, 50, 0.1, regression)	0.44	0.41	0.49	0.54	0.59	0.58	0.46	0.5	0.55	0.46	0.5
NN(10, 300, 0.8, regression)	0.92	1	0.15	0.29	0.95	1	1	1	1	0.56	0.79
NN(10, 300, 0.7, regression)	0.92	0.91	0.06	0.29	0.7	0.72	0.99	1	1	0.94	0.75
NN(4, 50, 0.1, average)	0.2	0.22	0.56	0.86	0.92	0.71	0.33	0.47	0.5	0.43	0.52
NN(8, 450, 0.6, regression)	0.89	1	1	0.98	0.95	1	0.57	0.88	1	0.56	0.88

Table B.25: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies (Numbers of Trading)

Nearest Neighbors Algorithm: NN(k, m, $\theta$ , method)												
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007	
NN(14, 50, 0, regression)	129	134	146	130	135	133	127	109	114	124	128.1	
NN(14, 10, 0.7, regression)	55	53	63	56	66	55	70	58	57	73	60.6	
NN(14, 10, 0.9, regression)	39	42	48	48	58	38	55	54	49	61	49.2	
NN(14, 10, 0.6, regression)	63	61	77	62	72	57	74	66	69	77	67.8	
NN(12, 10, 0.1, average)	73	81	70	65	62	75	94	99	104	87	81	
NN(14, 10, 1, regression)	33	34	44	46	54	34	43	48	43	59	43.8	
NN(8, 150, 0.4, regression)	15	4	11	15	18	0	7	7	8	22	10.7	
NN(2, 150, 0.8, regression)	1	0	1	1	0	0	0	0	0	1	0.4	
NN(14, 100, 0.8, regression)	1	0	3	2	5	0	2	3	3	4	2.3	
NN(2, 150, 0.7, regression)	1	0	1	1	0	0	0	0	2	1	0.6	
NN(14, 10, 0.8, regression)	49	44	58	54	62	42	63	58	53	69	55.2	
NN(6, 150, 0, regression)	122	128	113	119	121	128	131	124	116	132	123.4	
NN(4, 150, 0.6, regression)	3	3	6	3	6	0	2	2	2	9	3.6	
NN(2, 10, 0.2, regression)	99	88	92	83	84	73	96	84	75	108	88.2	
NN(2, 10, 0.1, regression)	122	111	114	101	108	103	110	94	99	122	108.4	
NN(14, 50, 0.1, regression)	99	98	104	91	100	103	102	92	86	104	97.9	
NN(10, 300, 0.8, regression)	2	0	1	1	2	0	0	0	0	1	0.7	
NN(10, 300, 0.7, regression)	2	1	2	1	3	1	2	0	0	2	1.4	
NN(4, 50, 0.1, average)	22	39	38	16	20	22	53	69	70	66	41.5	
NN(8, 450, 0.6, regression)	2	0	0	0	2	0	2	4	0	1	1.1	



Table B.26: Performance Summary of Top 20 Nearest Neighbors Algorithm  
 Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Annualized  
 Returns and Annualized Volatilities)  
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Nearest Neighbors Algorithm with Trading Volume (m:l = 1:1) : NN w/Trad. Vol.(m, l, k, $\theta$ , method)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(3, 3, 400, 1, regression)	0.1888	0.2357	0.0493	-0.1213	0.325	0.2207	0.0374	0.0914	0.0514	0.086	0.1097
NN w/Trad. Vol.(3, 3, 400, 0.9, regression)	0.2476	0.2285	0.061	-0.1245	0.3062	0.1921	0.0211	0.1011	0.0508	0.0454	0.106
NN w/Trad. Vol.(3, 3, 500, 1, regression)	0.3295	0.1966	0.0044	0.0186	0.098	0.1857	-0.0133	0.0778	0.0996	0.0546	0.1008
NN w/Trad. Vol.(2, 2, 450, 0.6, regression)	0.205	0.1405	0.0446	-0.0212	0.1067	0.2715	0.103	0.048	0.1359	0.0003	0.1001
NN w/Trad. Vol.(3, 3, 400, 0.8, regression)	0.2701	0.1714	0.0622	-0.0776	0.2615	0.1268	0.0249	0.0966	0.0424	0.0618	0.0993
NN w/Trad. Vol.(3, 3, 500, 0.7, regression)	0.2715	0.2435	0.0506	0.0129	0.0067	0.2796	-0.0017	0.0698	0.0744	0.0292	0.0985
NN w/Trad. Vol.(3, 3, 400, 0.7, regression)	0.3005	0.1109	0.0751	-0.0428	0.1396	0.2617	0.0193	0.0964	0.0154	0.0545	0.0985
NN w/Trad. Vol.(3, 3, 450, 0.8, regression)	0.2137	0.1647	0.1073	-0.0271	0.2319	0.1889	-0.0403	0.0528	0.0472	0.0636	0.0964
NN w/Trad. Vol.(3, 3, 150, 0.7, regression)	0.2286	0.0506	0.1636	0.0434	0.1672	0.1662	0.0468	0.0619	0.0321	0.0245	0.0963
NN w/Trad. Vol.(3, 3, 400, 0.6, regression)	0.2856	0.1126	0.1632	-0.0601	0.0611	0.2794	0.0113	0.0943	0.029	0.029	0.0954
NN w/Trad. Vol.(3, 3, 150, 0.8, regression)	0.2397	0.048	0.2127	0.0238	0.0674	0.2421	0.0499	0.0695	0.0416	-0.0143	0.0944
NN w/Trad. Vol.(3, 3, 450, 0.7, regression)	0.1817	0.1351	0.1249	0.0171	0.1064	0.2556	-0.0479	0.0604	0.0414	0.099	0.0944
NN w/Trad. Vol.(3, 3, 150, 0.6, regression)	0.2617	0.0284	0.1539	0.058	0.1409	0.1293	0.0476	0.0626	0.0287	0.0382	0.0927
NN w/Trad. Vol.(3, 3, 150, 0.9, regression)	0.2116	-0.0066	0.2343	0.0134	0.1383	0.2217	0.0529	0.0624	0.0555	-0.0254	0.0919
NN w/Trad. Vol.(3, 3, 500, 0.6, regression)	0.1828	0.2201	0.0708	0.0032	0.0112	0.2868	0.0024	0.0733	0.0794	0.015	0.0905
NN w/Trad. Vol.(3, 3, 500, 0.9, regression)	0.2509	0.2199	0.0429	-0.0355	0.0512	0.1805	-0.0012	0.0716	0.1008	0.0566	0.0904
NN w/Trad. Vol.(3, 3, 450, 1, regression)	0.1898	0.1781	0.0252	-0.0374	0.2627	0.1501	-0.0348	0.0579	0.0778	0.071	0.09
NN w/Trad. Vol.(3, 3, 400, 0.5, regression)	0.2746	0.1126	0.1777	-0.1012	0.1089	0.1967	-0.0115	0.1183	0.0479	0.0183	0.0892
NN w/Trad. Vol.(2, 2, 450, 0.5, regression)	0.1952	0.1963	0.0666	-0.0897	0.0488	0.2329	0.0891	0.0387	0.1295	0.0057	0.0872
NN w/Trad. Vol.(3, 3, 150, 0.5, regression)	0.2601	0.0413	0.1538	0.0359	0.1492	0.0583	0.0601	0.0604	0.0232	0.0382	0.0858
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(3, 3, 400, 1, regression)	0.1239	0.1323	0.1639	0.1615	0.1907	0.137	0.0826	0.0716	0.0709	0.1071	0.1302
NN w/Trad. Vol.(3, 3, 400, 0.9, regression)	0.1397	0.1324	0.1638	0.1739	0.1954	0.1322	0.08	0.0691	0.0699	0.107	0.1332
NN w/Trad. Vol.(3, 3, 500, 1, regression)	0.1213	0.1301	0.1709	0.1355	0.2079	0.1174	0.0819	0.0705	0.0709	0.0997	0.1276
NN w/Trad. Vol.(2, 2, 450, 0.6, regression)	0.11	0.1296	0.1633	0.1759	0.2006	0.1268	0.0803	0.0741	0.069	0.1065	0.1307
NN w/Trad. Vol.(3, 3, 400, 0.8, regression)	0.1415	0.1348	0.1662	0.1657	0.1967	0.1287	0.0803	0.07	0.0684	0.1082	0.1328
NN w/Trad. Vol.(3, 3, 500, 0.7, regression)	0.1402	0.1233	0.166	0.1509	0.1941	0.1143	0.0837	0.0702	0.0734	0.0991	0.1277
NN w/Trad. Vol.(3, 3, 400, 0.7, regression)	0.1407	0.1301	0.1662	0.1679	0.1868	0.1207	0.0797	0.0695	0.0715	0.1064	0.1302
NN w/Trad. Vol.(3, 3, 450, 0.8, regression)	0.12	0.1298	0.1588	0.1335	0.2077	0.1182	0.084	0.0689	0.0714	0.1124	0.1269
NN w/Trad. Vol.(3, 3, 150, 0.7, regression)	0.1117	0.1142	0.1552	0.1651	0.1764	0.1305	0.0743	0.0724	0.0726	0.1079	0.1236
NN w/Trad. Vol.(3, 3, 400, 0.6, regression)	0.1397	0.1242	0.1674	0.1672	0.1786	0.1191	0.0806	0.0691	0.0722	0.108	0.1285
NN w/Trad. Vol.(3, 3, 150, 0.8, regression)	0.112	0.1138	0.1541	0.1661	0.1837	0.1205	0.0714	0.072	0.073	0.1113	0.1237
NN w/Trad. Vol.(3, 3, 450, 0.7, regression)	0.1306	0.1272	0.1629	0.1369	0.2059	0.1175	0.0843	0.0693	0.0717	0.1131	0.1283
NN w/Trad. Vol.(3, 3, 150, 0.6, regression)	0.1143	0.115	0.1568	0.1647	0.1698	0.1353	0.0744	0.0724	0.0727	0.1063	0.1235
NN w/Trad. Vol.(3, 3, 150, 0.9, regression)	0.1085	0.1143	0.1524	0.1673	0.1931	0.12	0.071	0.0725	0.0739	0.111	0.1248
NN w/Trad. Vol.(3, 3, 500, 0.6, regression)	0.1408	0.1267	0.1668	0.1524	0.1847	0.1161	0.0841	0.0706	0.0735	0.105	0.1277
NN w/Trad. Vol.(3, 3, 500, 0.9, regression)	0.1195	0.1311	0.1719	0.1342	0.202	0.1182	0.0827	0.0702	0.0712	0.1015	0.1269
NN w/Trad. Vol.(3, 3, 450, 1, regression)	0.1234	0.1369	0.1595	0.1336	0.2011	0.1216	0.084	0.0677	0.0693	0.1064	0.1266
NN w/Trad. Vol.(3, 3, 400, 0.5, regression)	0.1396	0.1248	0.1674	0.1572	0.1762	0.1216	0.0788	0.0674	0.0693	0.1074	0.1268
NN w/Trad. Vol.(2, 2, 450, 0.5, regression)	0.11	0.1307	0.1645	0.1682	0.1959	0.1261	0.0804	0.0745	0.0693	0.1064	0.1292
NN w/Trad. Vol.(3, 3, 150, 0.5, regression)	0.1138	0.1152	0.1564	0.1644	0.1718	0.1389	0.0768	0.0716	0.0728	0.1063	0.1241
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.27: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Nearest Neighbors Algorithm with Trading Volume (m:l = 1:1) : NN w/Trad. Vol.(m, l, k, $\theta$ , method)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(3, 3, 400, 1, regression)	1.5235	1.7824	0.3005	-0.7511	1.7038	1.6109	0.4534	1.2763	0.7246	0.8027	0.8837
NN w/Trad. Vol.(3, 3, 400, 0.9, regression)	1.7718	1.726	0.3723	-0.7161	1.5668	1.4531	0.2635	1.4625	0.7275	0.4237	0.8535
NN w/Trad. Vol.(3, 3, 500, 1, regression)	2.7169	1.5107	0.0259	0.1376	0.4713	1.5821	-0.1626	1.1032	1.405	0.5477	0.8121
NN w/Trad. Vol.(2, 2, 450, 0.6, regression)	1.8638	1.0844	0.2734	-0.1203	0.5319	2.1414	1.2823	0.6477	1.9692	0.0027	0.8067
NN w/Trad. Vol.(3, 3, 400, 0.8, regression)	1.9083	1.2713	0.3741	-0.4684	1.3295	0.9852	0.3106	1.3806	0.6194	0.571	0.7999
NN w/Trad. Vol.(3, 3, 500, 0.7, regression)	1.9362	1.9746	0.3049	0.0854	0.0344	2.4464	-0.0198	0.9944	1.0144	0.2946	0.7937
NN w/Trad. Vol.(3, 3, 400, 0.7, regression)	2.1356	0.8521	0.4521	-0.2548	0.7474	2.1683	0.2427	1.3878	0.2152	0.512	0.7933
NN w/Trad. Vol.(3, 3, 450, 0.8, regression)	1.7808	1.2688	0.6755	-0.2027	1.1165	1.5983	-0.4794	0.7665	0.6609	0.5656	0.7765
NN w/Trad. Vol.(3, 3, 150, 0.7, regression)	2.0471	0.4433	1.0539	0.2628	0.9482	1.2737	0.6298	0.8548	0.4419	0.2272	0.7755
NN w/Trad. Vol.(3, 3, 400, 0.6, regression)	2.0442	0.9064	0.9746	-0.3597	0.3423	2.3458	0.1401	1.3639	0.402	0.2685	0.7685
NN w/Trad. Vol.(3, 3, 150, 0.8, regression)	2.1393	0.4223	1.3799	0.1432	0.3671	2.0085	0.699	0.9653	0.57	-0.1282	0.7607
NN w/Trad. Vol.(3, 3, 450, 0.7, regression)	1.3911	1.0628	0.7671	0.1249	0.5167	2.1762	-0.5677	0.8705	0.5772	0.8753	0.76
NN w/Trad. Vol.(3, 3, 150, 0.6, regression)	2.2901	0.2467	0.981	0.3519	0.8296	0.9558	0.64	0.8645	0.395	0.3596	0.7466
NN w/Trad. Vol.(3, 3, 150, 0.9, regression)	1.9493	-0.0579	1.5379	0.0799	0.7161	1.8473	0.7447	0.8613	0.7512	-0.2284	0.7403
NN w/Trad. Vol.(3, 3, 500, 0.6, regression)	1.2982	1.738	0.4243	0.0211	0.0604	2.4699	0.0281	1.0386	1.0804	0.1426	0.7287
NN w/Trad. Vol.(3, 3, 500, 0.9, regression)	2.1002	1.6775	0.2499	-0.2645	0.263	1.5276	-0.0147	1.0195	1.4153	0.5582	0.7281
NN w/Trad. Vol.(3, 3, 450, 1, regression)	1.538	1.3015	0.1578	-0.2801	1.3063	1.234	-0.4138	0.8546	1.1234	0.6674	0.7251
NN w/Trad. Vol.(3, 3, 400, 0.5, regression)	1.9668	0.9023	1.0617	-0.6438	0.6181	1.6183	-0.1457	1.756	0.6913	0.1709	0.7184
NN w/Trad. Vol.(2, 2, 450, 0.5, regression)	1.7744	1.5017	0.4046	-0.5331	0.2493	1.8467	1.1074	0.52	1.8677	0.0534	0.7022
NN w/Trad. Vol.(3, 3, 150, 0.5, regression)	2.2859	0.3582	0.9834	0.2181	0.8684	0.42	0.7824	0.8431	0.3184	0.3596	0.691
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(3, 3, 400, 1, regression)	0.45	0.51	0.55	0.54	0.54	0.59	0.5	0.48	0.55	0.51	0.52
NN w/Trad. Vol.(3, 3, 400, 0.9, regression)	0.46	0.51	0.55	0.56	0.55	0.54	0.48	0.46	0.54	0.48	0.51
NN w/Trad. Vol.(3, 3, 500, 1, regression)	0.51	0.46	0.54	0.46	0.61	0.38	0.5	0.47	0.51	0.43	0.49
NN w/Trad. Vol.(2, 2, 450, 0.6, regression)	0.39	0.46	0.58	0.59	0.62	0.45	0.52	0.52	0.48	0.43	0.5
NN w/Trad. Vol.(3, 3, 400, 0.8, regression)	0.48	0.51	0.56	0.54	0.57	0.5	0.49	0.47	0.54	0.48	0.51
NN w/Trad. Vol.(3, 3, 500, 0.7, regression)	0.46	0.44	0.54	0.52	0.58	0.4	0.53	0.49	0.52	0.44	0.49
NN w/Trad. Vol.(3, 3, 400, 0.7, regression)	0.5	0.52	0.57	0.54	0.55	0.46	0.48	0.48	0.55	0.47	0.51
NN w/Trad. Vol.(3, 3, 450, 0.8, regression)	0.47	0.48	0.52	0.45	0.6	0.4	0.53	0.47	0.51	0.51	0.49
NN w/Trad. Vol.(3, 3, 150, 0.7, regression)	0.5	0.44	0.52	0.57	0.5	0.5	0.47	0.53	0.5	0.49	0.5
NN w/Trad. Vol.(3, 3, 400, 0.6, regression)	0.49	0.48	0.58	0.53	0.54	0.43	0.48	0.47	0.54	0.49	0.5
NN w/Trad. Vol.(3, 3, 150, 0.8, regression)	0.5	0.43	0.5	0.57	0.52	0.49	0.45	0.52	0.51	0.51	0.5
NN w/Trad. Vol.(3, 3, 450, 0.7, regression)	0.47	0.48	0.55	0.47	0.61	0.4	0.53	0.48	0.5	0.51	0.5
NN w/Trad. Vol.(3, 3, 150, 0.6, regression)	0.52	0.45	0.54	0.57	0.49	0.5	0.47	0.52	0.5	0.48	0.51
NN w/Trad. Vol.(3, 3, 150, 0.9, regression)	0.46	0.44	0.49	0.59	0.56	0.48	0.45	0.51	0.52	0.5	0.5
NN w/Trad. Vol.(3, 3, 500, 0.6, regression)	0.48	0.46	0.57	0.53	0.57	0.43	0.52	0.48	0.52	0.44	0.5
NN w/Trad. Vol.(3, 3, 500, 0.9, regression)	0.45	0.46	0.55	0.46	0.62	0.4	0.53	0.49	0.51	0.46	0.49
NN w/Trad. Vol.(3, 3, 450, 1, regression)	0.48	0.54	0.52	0.45	0.59	0.42	0.53	0.45	0.49	0.48	0.5
NN w/Trad. Vol.(3, 3, 400, 0.5, regression)	0.5	0.48	0.58	0.55	0.53	0.45	0.47	0.44	0.51	0.49	0.5
NN w/Trad. Vol.(2, 2, 450, 0.5, regression)	0.4	0.47	0.57	0.57	0.59	0.46	0.51	0.54	0.5	0.43	0.5
NN w/Trad. Vol.(3, 3, 150, 0.5, regression)	0.51	0.46	0.53	0.57	0.5	0.54	0.49	0.51	0.5	0.48	0.51

Table B.28: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Numbers of Trading)

Nearest Neighbors Algorithm with Trading Volume (m:l = 1:1) : NN w/Trad. Vol.(m, l, k, $\theta$ , method)													
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007		
NN w/Trad. Vol.(3, 3, 400, 1, regression)	87	78	84	72	80	55	78	82	87	91	79.4		
NN w/Trad. Vol.(3, 3, 400, 0.9, regression)	95	80	84	74	84	57	84	88	87	101	83.4		
NN w/Trad. Vol.(3, 3, 500, 1, regression)	93	70	72	65	73	51	76	78	85	107	77		
NN w/Trad. Vol.(2, 2, 450, 0.6, regression)	96	92	81	82	80	74	91	92	92	92	87.2		
NN w/Trad. Vol.(3, 3, 400, 0.8, regression)	101	84	88	74	86	63	90	90	93	107	87.6		
NN w/Trad. Vol.(3, 3, 500, 0.7, regression)	115	82	88	81	81	63	94	94	93	117	90.8		
NN w/Trad. Vol.(3, 3, 400, 0.7, regression)	113	90	90	76	92	71	94	96	93	115	93		
NN w/Trad. Vol.(3, 3, 450, 0.8, regression)	100	84	86	73	81	65	88	86	94	110	86.7		
NN w/Trad. Vol.(3, 3, 150, 0.7, regression)	97	109	95	98	100	69	108	97	116	117	100.6		
NN w/Trad. Vol.(3, 3, 400, 0.6, regression)	117	102	98	84	100	77	96	100	97	119	99		
NN w/Trad. Vol.(3, 3, 150, 0.8, regression)	97	109	87	90	94	65	100	93	114	113	96.2		
NN w/Trad. Vol.(3, 3, 450, 0.7, regression)	110	88	92	77	91	75	90	94	96	110	92.3		
NN w/Trad. Vol.(3, 3, 150, 0.6, regression)	111	113	101	100	106	77	112	99	118	121	105.8		
NN w/Trad. Vol.(3, 3, 150, 0.9, regression)	87	99	81	80	82	65	98	93	104	111	90		
NN w/Trad. Vol.(3, 3, 500, 0.6, regression)	121	92	98	83	99	69	94	104	93	123	97.6		
NN w/Trad. Vol.(3, 3, 500, 0.9, regression)	99	72	76	71	75	59	86	86	89	109	82.2		
NN w/Trad. Vol.(3, 3, 450, 1, regression)	90	72	78	73	71	55	80	82	88	91	78		
NN w/Trad. Vol.(3, 3, 400, 0.5, regression)	125	102	102	90	104	83	98	104	101	121	103		
NN w/Trad. Vol.(2, 2, 450, 0.5, regression)	96	98	87	86	86	78	99	104	98	98	93		
NN w/Trad. Vol.(3, 3, 150, 0.5, regression)	111	119	105	106	112	77	114	109	122	121	109.6		

Table B.29: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Annualized Returns and Annualized Volatilities)

Nearest Neighbors Algorithm with Trading Volume (m:l = 2:1) : NN w/Trad. Vol.(m, l, k, $\theta$ , method)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(16, 8, 150, 0.1, regression)	-0.0106	0.1478	0.1501	0.0356	0.2759	0.1864	0.045	-0.02	0.0763	0.1356	0.0987
NN w/Trad. Vol.(16, 8, 150, 0, regression)	-0.027	0.1512	0.1589	0.0367	0.2457	0.22	0.0185	-0.0136	0.0787	0.127	0.0959
NN w/Trad. Vol.(16, 8, 150, 0.2, regression)	-0.0372	0.1377	0.1397	0.0371	0.2121	0.1913	0.0319	-0.0248	0.0524	0.1404	0.0849
NN w/Trad. Vol.(16, 8, 150, 0.3, regression)	-0.0029	0.1232	0.185	0.0105	0.1888	0.1694	0.0326	-0.0352	0.048	0.1296	0.082
NN w/Trad. Vol.(12, 6, 200, 0.4, regression)	0.1872	0.1889	0.0671	0.015	-0.0253	0.0305	0.0173	0.1442	0.0954	0.1021	0.0799
NN w/Trad. Vol.(16, 8, 250, 0.8, regression)	0.0371	0.0886	0.1611	-0.1209	0.1021	0.393	0.1212	-0.0857	0.0696	0.1066	0.0794
NN w/Trad. Vol.(8, 4, 300, 0.4, regression)	0.1841	0.1453	-0.0402	0.2441	-0.0408	0.253	0.0586	-0.045	-0.012	0.0962	0.0786
NN w/Trad. Vol.(16, 8, 300, 0, regression)	0.1312	0.0364	0.1071	-0.0676	0.0722	0.2808	0.0993	-0.0912	0.149	0.0814	0.0751
NN w/Trad. Vol.(16, 8, 250, 1, regression)	0.0435	0.067	0.1864	-0.0545	0.0253	0.2883	0.1228	-0.0941	0.0818	0.1135	0.0729
NN w/Trad. Vol.(14, 7, 500, 0.9, regression)	0.2471	0.1299	0.0083	-0.0318	0.1116	0.1425	0.1127	-0.0703	0.0741	0.0373	0.0725
NN w/Trad. Vol.(16, 8, 250, 0.9, regression)	0.0418	0.0278	0.1655	-0.0338	0.0066	0.3463	0.1335	-0.0941	0.0777	0.1135	0.0725
NN w/Trad. Vol.(4, 2, 50, 0.1, average)	0.0855	0.0296	0.433	-0.0146	-0.2053	0.3205	0.107	-0.0012	0.1188	-0.02	0.0722
NN w/Trad. Vol.(8, 4, 300, 0.5, regression)	0.1956	0.1302	-0.0601	0.1727	-0.0021	0.214	0.0673	-0.0564	-0.0126	0.117	0.072
NN w/Trad. Vol.(16, 8, 300, 1, regression)	0.1354	0.0489	0.0907	-0.062	0.1149	0.2366	0.0775	-0.0912	0.1324	0.0718	0.0716
NN w/Trad. Vol.(16, 8, 450, 0.9, regression)	0.1365	0.0405	0.3524	-0.0387	-0.0931	0.2794	0.0636	-0.0605	0.0809	0.0298	0.0709
NN w/Trad. Vol.(12, 6, 200, 0.5, regression)	0.1107	0.1868	0.0638	0.0176	-0.047	0.038	0.02	0.1387	0.0954	0.1014	0.0706
NN w/Trad. Vol.(8, 4, 300, 0.2, regression)	0.2006	0.1395	0.0275	0.1982	-0.1225	0.2105	0.0237	-0.0387	-0.0058	0.1097	0.0687
NN w/Trad. Vol.(12, 6, 200, 0.7, regression)	0.1608	0.2121	0.0296	0.0449	-0.0302	-0.0102	0.0113	0.116	0.1044	0.0693	0.0683
NN w/Trad. Vol.(16, 8, 250, 0.7, regression)	0.0436	0.1135	0.1446	-0.1625	0.0953	0.3412	0.1173	-0.0862	0.0715	0.079	0.0681
NN w/Trad. Vol.(16, 8, 450, 0.1, regression)	0.1088	0.0945	0.2774	-0.08	-0.0846	0.3199	-0.021	-0.0481	0.1028	0.0831	0.0673
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(16, 8, 150, 0.1, regression)	0.1628	0.1332	0.1478	0.166	0.1925	0.1318	0.0774	0.0786	0.0731	0.1094	0.1332
NN w/Trad. Vol.(16, 8, 150, 0, regression)	0.1623	0.133	0.1483	0.1689	0.1911	0.1324	0.0791	0.0783	0.0731	0.1091	0.1335
NN w/Trad. Vol.(16, 8, 150, 0.2, regression)	0.1623	0.1338	0.1475	0.1672	0.1909	0.1326	0.0781	0.0787	0.072	0.1095	0.1332
NN w/Trad. Vol.(16, 8, 150, 0.3, regression)	0.1646	0.1344	0.1574	0.1685	0.1908	0.1321	0.0779	0.0794	0.0719	0.1113	0.1349
NN w/Trad. Vol.(12, 6, 200, 0.4, regression)	0.1339	0.135	0.1556	0.1497	0.2106	0.1104	0.0768	0.075	0.0741	0.1059	0.1294
NN w/Trad. Vol.(16, 8, 250, 0.8, regression)	0.1576	0.1398	0.1593	0.1671	0.1954	0.1296	0.0847	0.0744	0.0703	0.098	0.1341
NN w/Trad. Vol.(8, 4, 300, 0.4, regression)	0.1307	0.128	0.1374	0.1641	0.1955	0.1117	0.0815	0.0697	0.0684	0.1039	0.1253
NN w/Trad. Vol.(16, 8, 300, 0, regression)	0.1585	0.13	0.1469	0.1706	0.2021	0.1342	0.0819	0.0739	0.0738	0.1096	0.1346
NN w/Trad. Vol.(16, 8, 250, 1, regression)	0.1577	0.1393	0.1592	0.1653	0.1962	0.1384	0.0831	0.0747	0.0703	0.099	0.1348
NN w/Trad. Vol.(14, 7, 500, 0.9, regression)	0.1423	0.1363	0.1697	0.1245	0.1788	0.13	0.0756	0.0701	0.0701	0.1077	0.1261
NN w/Trad. Vol.(16, 8, 250, 0.9, regression)	0.1576	0.138	0.1602	0.1658	0.1966	0.1342	0.0834	0.0747	0.0704	0.099	0.1345
NN w/Trad. Vol.(4, 2, 50, 0.1, average)	0.0599	0.0787	0.158	0.205	0.2566	0.1484	0.0652	0.0712	0.0626	0.0986	0.137
NN w/Trad. Vol.(8, 4, 300, 0.5, regression)	0.1307	0.1273	0.1363	0.1666	0.1984	0.1102	0.0796	0.0691	0.0688	0.1045	0.1257
NN w/Trad. Vol.(16, 8, 300, 1, regression)	0.1586	0.1308	0.1471	0.1704	0.1984	0.1347	0.0819	0.0739	0.0741	0.1088	0.1341
NN w/Trad. Vol.(16, 8, 450, 0.9, regression)	0.1514	0.1306	0.1625	0.1749	0.192	0.118	0.0808	0.069	0.0754	0.1099	0.133
NN w/Trad. Vol.(12, 6, 200, 0.5, regression)	0.1397	0.1351	0.1555	0.1503	0.2118	0.1109	0.0767	0.0757	0.0741	0.1059	0.1304
NN w/Trad. Vol.(8, 4, 300, 0.2, regression)	0.1384	0.1268	0.136	0.1658	0.1949	0.1164	0.0826	0.0696	0.0687	0.1034	0.1264
NN w/Trad. Vol.(12, 6, 200, 0.7, regression)	0.1398	0.1366	0.1556	0.1491	0.2078	0.1135	0.0766	0.0758	0.0707	0.1091	0.1301
NN w/Trad. Vol.(16, 8, 250, 0.7, regression)	0.1578	0.139	0.1603	0.1673	0.1964	0.1271	0.0848	0.0755	0.0703	0.1	0.1343
NN w/Trad. Vol.(16, 8, 450, 0.1, regression)	0.1562	0.136	0.1574	0.1704	0.195	0.1231	0.0778	0.073	0.0713	0.1128	0.1338
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Nearest Neighbors Algorithm with Trading Volume (m:l = 2:1) : NN w/Trad. Vol.(m, l, k, $\theta$ , method)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(16, 8, 150, 0.1, regression)	-0.0654	1.1094	1.0154	0.2145	1.4332	1.4142	0.5811	-0.2541	1.0436	1.2396	0.7373
NN w/Trad. Vol.(16, 8, 150, 0, regression)	-0.1663	1.1369	1.0718	0.2171	1.2854	1.6616	0.2339	-0.1741	1.0765	1.1637	0.7164
NN w/Trad. Vol.(16, 8, 150, 0.2, regression)	-0.2294	1.0295	0.947	0.222	1.1115	1.4429	0.4086	-0.315	0.727	1.2831	0.6341
NN w/Trad. Vol.(16, 8, 150, 0.3, regression)	-0.0179	0.917	1.1754	0.0623	0.9898	1.2824	0.4178	-0.4435	0.6679	1.1645	0.6126
NN w/Trad. Vol.(12, 6, 200, 0.4, regression)	1.3984	1.3991	0.4311	0.1002	-0.1204	0.2759	0.2258	1.9212	1.2865	0.9643	0.5973
NN w/Trad. Vol.(16, 8, 250, 0.8, regression)	0.2354	0.6335	1.0116	-0.7238	0.5227	3.031	1.4298	-1.1524	0.9896	1.0872	0.5931
NN w/Trad. Vol.(8, 4, 300, 0.4, regression)	1.4089	1.1354	-0.2925	1.487	-0.2087	2.2658	0.7192	-0.6455	-0.1758	0.9257	0.5874
NN w/Trad. Vol.(16, 8, 300, 0, regression)	0.8273	0.2799	0.729	-0.3962	0.3575	2.0914	1.2131	-1.233	2.0197	0.7423	0.5613
NN w/Trad. Vol.(16, 8, 250, 1, regression)	0.2762	0.4809	1.1708	-0.3298	0.129	2.0836	1.4777	-1.2599	1.1631	1.1462	0.5449
NN w/Trad. Vol.(14, 7, 500, 0.9, regression)	1.7365	0.9533	0.0489	-0.2552	0.6243	1.0964	1.4908	-1.0028	1.056	0.3462	0.5418
NN w/Trad. Vol.(16, 8, 250, 0.9, regression)	0.2652	0.2012	1.033	-0.2036	0.0335	2.5799	1.6018	-1.2599	1.1028	1.1462	0.5417
NN w/Trad. Vol.(4, 2, 50, 0.1, average)	1.426	0.3763	2.7401	-0.0713	-0.7999	2.1596	1.6419	-0.0165	1.8969	-0.2033	0.5395
NN w/Trad. Vol.(8, 4, 300, 0.5, regression)	1.4964	1.0228	-0.4407	1.0367	-0.0108	1.9422	0.8458	-0.8161	-0.1828	1.1199	0.5381
NN w/Trad. Vol.(16, 8, 300, 1, regression)	0.8539	0.3738	0.6164	-0.3638	0.5794	1.756	0.946	-1.233	1.7858	0.6606	0.535
NN w/Trad. Vol.(16, 8, 450, 0.9, regression)	0.901	0.3099	2.1683	-0.2212	-0.4852	2.3677	0.7865	-0.8768	1.0732	0.2711	0.5299
NN w/Trad. Vol.(12, 6, 200, 0.5, regression)	0.793	1.3821	0.4104	0.117	-0.222	0.3428	0.2601	1.8326	1.2865	0.9571	0.5274
NN w/Trad. Vol.(8, 4, 300, 0.2, regression)	1.4502	1.0999	0.2024	1.1955	-0.6284	1.8087	0.2872	-0.5563	-0.085	1.0611	0.5131
NN w/Trad. Vol.(12, 6, 200, 0.7, regression)	1.1506	1.5532	0.1905	0.3013	-0.1456	-0.0902	0.1471	1.5304	1.4763	0.635	0.5106
NN w/Trad. Vol.(16, 8, 250, 0.7, regression)	0.2762	0.8168	0.9024	-0.9711	0.4851	2.6852	1.3832	-1.1419	1.0175	0.7903	0.5086
NN w/Trad. Vol.(16, 8, 450, 0.1, regression)	0.6969	0.695	1.762	-0.4695	-0.4337	2.599	-0.2695	-0.6589	1.4415	0.7371	0.503
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(16, 8, 150, 0.1, regression)	0.55	0.53	0.52	0.55	0.52	0.52	0.5	0.51	0.53	0.47	0.52
NN w/Trad. Vol.(16, 8, 150, 0, regression)	0.53	0.52	0.52	0.56	0.5	0.52	0.51	0.51	0.53	0.46	0.52
NN w/Trad. Vol.(16, 8, 150, 0.2, regression)	0.56	0.52	0.51	0.55	0.52	0.52	0.51	0.52	0.52	0.47	0.52
NN w/Trad. Vol.(16, 8, 150, 0.3, regression)	0.57	0.53	0.53	0.56	0.52	0.53	0.51	0.52	0.52	0.49	0.53
NN w/Trad. Vol.(12, 6, 200, 0.4, regression)	0.44	0.58	0.51	0.46	0.58	0.52	0.51	0.57	0.48	0.5	0.51
NN w/Trad. Vol.(16, 8, 250, 0.8, regression)	0.48	0.57	0.55	0.57	0.59	0.53	0.53	0.46	0.49	0.49	0.53
NN w/Trad. Vol.(8, 4, 300, 0.4, regression)	0.5	0.51	0.47	0.46	0.5	0.44	0.47	0.46	0.48	0.52	0.48
NN w/Trad. Vol.(16, 8, 300, 0, regression)	0.51	0.54	0.51	0.58	0.58	0.56	0.5	0.47	0.48	0.51	0.52
NN w/Trad. Vol.(16, 8, 250, 1, regression)	0.48	0.55	0.55	0.58	0.55	0.6	0.51	0.47	0.48	0.49	0.53
NN w/Trad. Vol.(14, 7, 500, 0.9, regression)	0.56	0.48	0.46	0.46	0.48	0.52	0.47	0.51	0.47	0.5	0.49
NN w/Trad. Vol.(16, 8, 250, 0.9, regression)	0.48	0.56	0.56	0.58	0.58	0.56	0.52	0.47	0.49	0.49	0.53
NN w/Trad. Vol.(4, 2, 50, 0.1, average)	0.15	0.19	0.5	0.93	0.95	0.65	0.37	0.45	0.4	0.36	0.49
NN w/Trad. Vol.(8, 4, 300, 0.5, regression)	0.5	0.5	0.45	0.49	0.51	0.44	0.47	0.46	0.5	0.52	0.48
NN w/Trad. Vol.(16, 8, 300, 1, regression)	0.51	0.54	0.51	0.58	0.57	0.57	0.49	0.47	0.48	0.51	0.52
NN w/Trad. Vol.(16, 8, 450, 0.9, regression)	0.46	0.51	0.6	0.65	0.58	0.48	0.5	0.42	0.52	0.48	0.52
NN w/Trad. Vol.(12, 6, 200, 0.5, regression)	0.45	0.58	0.51	0.48	0.59	0.52	0.51	0.57	0.48	0.5	0.52
NN w/Trad. Vol.(8, 4, 300, 0.2, regression)	0.5	0.49	0.48	0.47	0.49	0.46	0.47	0.45	0.48	0.5	0.48
NN w/Trad. Vol.(12, 6, 200, 0.7, regression)	0.45	0.58	0.5	0.48	0.58	0.51	0.51	0.58	0.45	0.5	0.52
NN w/Trad. Vol.(16, 8, 250, 0.7, regression)	0.48	0.57	0.55	0.57	0.61	0.52	0.52	0.48	0.5	0.5	0.53
NN w/Trad. Vol.(16, 8, 450, 0.1, regression)	0.5	0.56	0.53	0.59	0.57	0.53	0.47	0.48	0.52	0.5	0.52

Table B.30: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Table B.31: Performance Summary of Top 20 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Numbers of Trading)

Number of Tradings	Nearest Neighbors Algorithm with Trading Volume ( $m:l = 2:1$ ) : NN w/Trad. Vol.( $m, l, k, \theta$ , method)										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
NN w/Trad. Vol.(16, 8, 150, 0.1, regression)	121	116	130	117	118	115	126	118	130	124	121.5
NN w/Trad. Vol.(16, 8, 150, 0, regression)	127	118	136	121	120	119	132	120	130	124	124.7
NN w/Trad. Vol.(16, 8, 150, 0.2, regression)	119	112	126	115	118	111	124	118	122	122	118.7
NN w/Trad. Vol.(16, 8, 150, 0.3, regression)	115	112	118	113	114	109	116	116	122	118	115.3
NN w/Trad. Vol.(12, 6, 200, 0.4, regression)	113	101	117	115	109	109	121	118	112	119	113.4
NN w/Trad. Vol.(16, 8, 250, 0.8, regression)	91	91	90	89	92	86	121	105	99	115	97.9
NN w/Trad. Vol.(8, 4, 300, 0.4, regression)	92	103	101	96	104	86	132	106	110	107	103.7
NN w/Trad. Vol.(16, 8, 300, 0, regression)	131	121	124	113	124	124	139	115	127	132	125
NN w/Trad. Vol.(16, 8, 250, 1, regression)	83	79	88	85	84	76	113	103	95	109	91.5
NN w/Trad. Vol.(14, 7, 500, 0.9, regression)	66	65	70	84	76	73	107	97	111	92	84.1
NN w/Trad. Vol.(16, 8, 250, 0.9, regression)	85	85	88	89	86	82	119	103	97	109	94.3
NN w/Trad. Vol.(4, 2, 50, 0.1, average)	30	22	38	9	12	29	60	67	80	55	40.2
NN w/Trad. Vol.(8, 4, 300, 0.5, regression)	86	99	97	86	100	82	122	98	106	103	97.9
NN w/Trad. Vol.(16, 8, 300, 1, regression)	125	119	122	109	118	116	133	115	127	126	121
NN w/Trad. Vol.(16, 8, 450, 0.9, regression)	89	81	85	74	80	64	111	93	99	109	88.5
NN w/Trad. Vol.(12, 6, 200, 0.5, regression)	109	95	117	111	105	103	121	114	112	117	110.4
NN w/Trad. Vol.(8, 4, 300, 0.2, regression)	106	119	121	118	114	108	136	116	110	115	116.3
NN w/Trad. Vol.(12, 6, 200, 0.7, regression)	101	83	113	109	97	97	115	106	102	113	103.6
NN w/Trad. Vol.(16, 8, 250, 0.7, regression)	95	97	90	91	92	90	123	111	99	117	100.5
NN w/Trad. Vol.(16, 8, 450, 0.1, regression)	129	115	120	113	114	118	141	123	115	139	122.7

## B.2 Performances of Voting Strategy in Combination with Individual Strategies

Table B.32: Performance Summary of Voting among Moving Average Convergence and Divergence Strategies (Annualized Returns and Annualized Volatilities)

Voting among Moving Average Convergence Divergence : Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.2667	0.0661	0	0	0	0	0	0	0	0	0.0305
Voting(10, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(15, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(20, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(25, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(30, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(35, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(40, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(45, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(50, monthly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(5, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(10, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(15, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(20, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(25, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(30, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(35, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(40, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(45, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Voting(50, yearly)	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.2031	0.1565	0	0	0	0	0	0	0	0	0.0811
Voting(10, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(15, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(20, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(25, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(30, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(35, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(40, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(45, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(50, monthly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(5, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(10, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(15, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(20, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(25, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(30, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(35, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(40, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(45, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Voting(50, yearly)	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802



Table B.33: Performance Summary of Voting among Moving Average Convergence and Divergence Strategies (Sharpe Ratios and Proportions of In-the-Market)

Voting among Moving Average Convergence Divergence : Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	1.3129	0.4225	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	0.3761
Voting(10, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(15, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(20, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(25, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(30, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(35, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(40, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(45, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(50, monthly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(5, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(10, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(15, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(20, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(25, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(30, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(35, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(40, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(45, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Voting(50, yearly)	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	1	0.72	0	0	0	0	0	0	0	0	0.17
Voting(10, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(15, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(20, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(25, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(30, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(35, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(40, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(45, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(50, monthly)	1	1	1	1	1	1	1	1	1	1	1
Voting(5, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(10, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(15, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(20, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(25, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(30, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(35, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(40, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(45, yearly)	1	1	1	1	1	1	1	1	1	1	1
Voting(50, yearly)	1	1	1	1	1	1	1	1	1	1	1

Table B.34: Performance Summary of Voting among Moving Average Convergence and Divergence Strategies (Numbers of Trading)

Voting among Moving Average Convergence Divergence : Voting(k, period)											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0	1	0	0	0	0	0	0	0	0	0.1
Voting(10, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(15, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(20, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(25, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(30, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(35, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(40, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(45, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(50, monthly)	0	0	0	0	0	0	0	0	0	0	0
Voting(5, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(10, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(15, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(20, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(25, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(30, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(35, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(40, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(45, yearly)	0	0	0	0	0	0	0	0	0	0	0
Voting(50, yearly)	0	0	0	0	0	0	0	0	0	0	0

Table B.35: Performance Summary of Voting among Trend-Based Regression Strategies (Annualized Returns and Annualized Volatilities)

Voting among Trend-based Regression Algorithm: Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.118	0.0146	-0.0607	-0.0237	-0.1354	0.1767	0.0202	0.0037	0.0803	0.0389	0.0198
Voting(10, monthly)	0.096	0.0596	0.0865	0.0467	-0.2415	0.0669	0.0493	-0.0329	0.069	0.0453	0.0194
Voting(15, monthly)	0.1476	-0.0134	0.0887	0.0334	-0.1945	0.1341	0.0333	-0.0431	0.0617	0.0989	0.0299
Voting(20, monthly)	0.2608	-0.0522	0.0916	0.0445	-0.0851	0.0954	-0.0091	0.0551	0.0971	0.0734	0.0533
Voting(25, monthly)	0.1684	-0.0086	-0.033	0.0174	-0.0134	0.0869	0.0042	0.0534	0.1177	0.0619	0.0437
Voting(30, monthly)	0.1447	0.0042	-0.0948	0.062	-0.0572	0.088	-0.0183	0.023	0.1273	0.0598	0.0312
Voting(35, monthly)	0.1688	0.0454	-0.0395	-0.0864	-0.0826	0.1674	-0.0244	0.0805	0.1303	0.0468	0.0366
Voting(40, monthly)	0.3476	0.0318	-0.0864	-0.1314	-0.0863	0.19	-0.0067	0.0585	0.1303	0.0549	0.0416
Voting(45, monthly)	0.2505	0.0261	-0.0907	-0.0979	-0.0701	0.1486	-0.001	0.0582	0.1377	0.0242	0.0331
Voting(50, monthly)	0.3364	-0.0498	-0.1219	-0.0474	-0.0289	0.1373	-0.0067	0.0535	0.1033	0.0325	0.0341
Voting(5, yearly)	0.1823	0.0354	-0.0012	-0.1785	-0.2225	0.0966	0.0067	-0.0005	0.0842	0.0398	-0.0029
Voting(10, yearly)	0.2051	0.0107	-0.0803	-0.2429	-0.2225	0.1311	0.0569	-0.0411	0.0805	0.004	-0.0197
Voting(15, yearly)	0.2338	0.0521	-0.0533	-0.1703	-0.2455	0.0586	0.0598	-0.0476	0.0922	0.0513	-0.0058
Voting(20, yearly)	0.2107	0.0018	-0.0452	-0.0696	-0.2225	0.0487	0.0592	-0.0191	0.082	0.0574	0.0043
Voting(25, yearly)	0.2285	0.1126	0.0221	0.019	-0.2318	0.1239	0.0848	-0.0438	0.1027	0.0442	0.0391
Voting(30, yearly)	0.2157	0.0505	-0.1228	-0.0682	-0.2318	0.0989	0.0591	-0.0225	0.0576	0.0407	0.0004
Voting(35, yearly)	0.1144	0.0068	-0.0896	-0.0295	-0.2318	0.1219	0.0354	-0.0369	0.0552	0.0418	-0.0065
Voting(40, yearly)	0.1154	0.0522	-0.0729	-0.0033	-0.2225	0.2055	0.0508	-0.0411	0.032	0.0418	0.0097
Voting(45, yearly)	0.1114	0.0994	-0.0301	0.0355	-0.2225	0.2055	0.0256	-0.0411	0.0531	0.0308	0.0208
Voting(50, yearly)	0.116	0.0747	-0.0301	0.0355	-0.2225	0.114	0.0256	-0.0411	0.0494	0.0326	0.0107
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1337	0.1299	0.1473	0.1211	0.1715	0.1454	0.066	0.0658	0.0632	0.1059	0.1207
Voting(10, monthly)	0.1426	0.1298	0.1318	0.1262	0.1641	0.1414	0.0627	0.0553	0.0637	0.0999	0.1177
Voting(15, monthly)	0.1356	0.1277	0.1327	0.1338	0.145	0.1291	0.0677	0.0621	0.0755	0.0978	0.1147
Voting(20, monthly)	0.1461	0.1267	0.1298	0.116	0.168	0.126	0.0609	0.0569	0.0751	0.1045	0.1163
Voting(25, monthly)	0.1347	0.1258	0.1298	0.1145	0.1731	0.1245	0.0618	0.0626	0.0735	0.102	0.1153
Voting(30, monthly)	0.1203	0.1223	0.1212	0.1354	0.1739	0.1095	0.0613	0.0619	0.0719	0.1057	0.1134
Voting(35, monthly)	0.1166	0.1142	0.1247	0.1479	0.1761	0.1206	0.0602	0.068	0.0708	0.1052	0.1157
Voting(40, monthly)	0.1177	0.1183	0.1169	0.1466	0.1727	0.1231	0.064	0.0664	0.0728	0.1113	0.1158
Voting(45, monthly)	0.1112	0.1137	0.1323	0.1537	0.1754	0.1174	0.0589	0.0664	0.0733	0.1073	0.1165
Voting(50, monthly)	0.119	0.1063	0.1307	0.1452	0.1804	0.1188	0.0598	0.0642	0.0745	0.1083	0.1163
Voting(5, yearly)	0.1584	0.113	0.1431	0.1142	0.1734	0.1407	0.0852	0.0677	0.0682	0.11	0.1224
Voting(10, yearly)	0.1424	0.1047	0.1315	0.1108	0.1734	0.1408	0.0647	0.066	0.0663	0.1106	0.1166
Voting(15, yearly)	0.1438	0.1013	0.1365	0.1145	0.1759	0.1376	0.061	0.0789	0.0696	0.1078	0.1179
Voting(20, yearly)	0.1417	0.1105	0.0999	0.0918	0.1734	0.1439	0.0617	0.0712	0.0703	0.1072	0.1126
Voting(25, yearly)	0.1441	0.1207	0.0993	0.092	0.1672	0.1424	0.0829	0.0755	0.0696	0.1079	0.1144
Voting(30, yearly)	0.1494	0.1098	0.1388	0.1024	0.1672	0.1495	0.06	0.0769	0.0702	0.1078	0.1185
Voting(35, yearly)	0.1428	0.1104	0.0947	0.1006	0.1672	0.1486	0.087	0.0879	0.069	0.1078	0.1155
Voting(40, yearly)	0.1423	0.1172	0.1129	0.097	0.1734	0.1527	0.0923	0.066	0.0656	0.1078	0.1176
Voting(45, yearly)	0.1425	0.1122	0.0738	0.1047	0.1734	0.1527	0.0938	0.066	0.0685	0.1076	0.1149
Voting(50, yearly)	0.143	0.113	0.0738	0.1047	0.1734	0.0846	0.0938	0.066	0.0686	0.1076	0.1078
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.36: Performance Summary of Voting among Trend-Based Regression Strategies (Sharpe Ratios and Proportions of In-the-Market)

Voting among Trend-based Regression Algorithm: Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.8827	0.1121	-0.4117	-0.196	-0.7892	1.2153	0.306	0.0567	1.2713	0.367	0.1640
Voting(10, monthly)	0.6729	0.4593	0.6567	0.3703	-1.4718	0.4732	0.7852	-0.5956	1.0835	0.4536	0.1648
Voting(15, monthly)	1.0883	-0.1051	0.6682	0.2493	-1.342	1.0391	0.4921	-0.6952	0.8175	1.011	0.2607
Voting(20, monthly)	1.7847	-0.4118	0.7054	0.3835	-0.5063	0.7577	-0.1501	0.9693	1.2933	0.7026	0.4583
Voting(25, monthly)	1.2507	-0.0685	-0.2542	0.152	-0.0773	0.6983	0.0672	0.8532	1.6007	0.6068	0.3790
Voting(30, monthly)	1.2033	0.034	-0.782	0.4583	-0.3287	0.8039	-0.2981	0.372	1.7706	0.5661	0.2751
Voting(35, monthly)	1.448	0.3972	-0.3165	-0.5841	-0.4693	1.3887	-0.4054	1.1844	1.8415	0.4445	0.3163
Voting(40, monthly)	2.9546	0.2687	-0.7395	-0.8968	-0.4999	1.5434	-0.105	0.8809	1.7894	0.4931	0.3592
Voting(45, monthly)	2.2523	0.2298	-0.6859	-0.6369	-0.3996	1.2654	-0.0162	0.8772	1.8793	0.2252	0.2841
Voting(50, monthly)	2.8269	-0.4685	-0.9327	-0.3264	-0.1602	1.156	-0.1113	0.8342	1.3861	0.3	0.2932
Voting(5, yearly)	1.1507	0.3129	-0.0083	-1.5639	-1.2835	0.6862	0.0782	-0.0074	1.2354	0.3615	-0.0237
Voting(10, yearly)	1.4402	0.1022	-0.6108	-2.1931	-1.2835	0.9311	0.8787	-0.6218	1.2144	0.0364	-0.1690
Voting(15, yearly)	1.6259	0.5147	-0.3904	-1.4879	-1.396	0.4261	0.98	-0.6033	1.3249	0.4755	-0.0492
Voting(20, yearly)	1.4872	0.0167	-0.4522	-0.7585	-1.2835	0.3387	0.9603	-0.2688	1.165	0.5349	0.0382
Voting(25, yearly)	1.5858	0.9326	0.2224	0.2063	-1.3864	0.8702	1.0229	-0.581	1.4762	0.4095	0.3418
Voting(30, yearly)	1.4432	0.4599	-0.8851	-0.6661	-1.3864	0.6614	0.984	-0.2926	0.8211	0.3778	0.0034
Voting(35, yearly)	0.801	0.0619	-0.9465	-0.2933	-1.3864	0.82	0.4073	-0.4193	0.8	0.3872	-0.0563
Voting(40, yearly)	0.8109	0.445	-0.6455	-0.0344	-1.2835	1.3459	0.5511	-0.6218	0.4871	0.3872	0.0825
Voting(45, yearly)	0.7819	0.8861	-0.4084	0.3394	-1.2835	1.3459	0.2732	-0.6218	0.776	0.2864	0.1810
Voting(50, yearly)	0.8109	0.6611	-0.4084	0.3394	-1.2835	1.3471	0.2732	-0.6218	0.7205	0.3024	0.0993
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.4	0.52	0.36	0.47	0.54	0.72	0.32	0.52	0.46	0.37	0.47
Voting(10, monthly)	0.4	0.4	0.32	0.5	0.48	0.62	0.29	0.41	0.49	0.32	0.42
Voting(15, monthly)	0.36	0.41	0.32	0.51	0.35	0.57	0.33	0.46	0.59	0.36	0.43
Voting(20, monthly)	0.54	0.38	0.3	0.43	0.4	0.55	0.3	0.43	0.59	0.36	0.43
Voting(25, monthly)	0.38	0.38	0.29	0.42	0.49	0.55	0.31	0.46	0.59	0.36	0.42
Voting(30, monthly)	0.3	0.37	0.29	0.54	0.47	0.44	0.3	0.46	0.63	0.4	0.42
Voting(35, monthly)	0.31	0.33	0.33	0.56	0.5	0.52	0.29	0.51	0.61	0.39	0.43
Voting(40, monthly)	0.38	0.34	0.31	0.54	0.49	0.54	0.33	0.5	0.62	0.41	0.45
Voting(45, monthly)	0.33	0.33	0.31	0.62	0.51	0.5	0.26	0.5	0.62	0.39	0.44
Voting(50, monthly)	0.35	0.3	0.27	0.54	0.49	0.5	0.27	0.48	0.62	0.37	0.42
Voting(5, yearly)	0.55	0.46	0.48	0.45	0.56	0.71	0.63	0.42	0.54	0.47	0.53
Voting(10, yearly)	0.48	0.46	0.25	0.46	0.56	0.7	0.35	0.33	0.54	0.43	0.45
Voting(15, yearly)	0.5	0.44	0.31	0.47	0.57	0.65	0.3	0.54	0.55	0.46	0.48
Voting(20, yearly)	0.48	0.45	0.16	0.29	0.56	0.7	0.31	0.5	0.55	0.46	0.45
Voting(25, yearly)	0.51	0.51	0.13	0.27	0.55	0.73	0.61	0.47	0.55	0.48	0.48
Voting(30, yearly)	0.5	0.43	0.3	0.27	0.55	0.81	0.27	0.47	0.54	0.48	0.46
Voting(35, yearly)	0.46	0.45	0.1	0.25	0.55	0.8	0.64	0.65	0.56	0.47	0.49
Voting(40, yearly)	0.46	0.43	0.17	0.25	0.56	0.9	0.71	0.33	0.54	0.47	0.48
Voting(45, yearly)	0.44	0.38	0.09	0.25	0.56	0.9	0.71	0.33	0.54	0.46	0.47
Voting(50, yearly)	0.46	0.41	0.09	0.25	0.56	0.48	0.71	0.33	0.54	0.47	0.43

Number of Tradings	Voting among Trend-based Regression Algorithm: Voting(k, period)										
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	69	66	69	59	52	41	70	67	56	67	61.6
Voting(10, monthly)	58	62	68	45	60	39	67	62	64	67	59.2
Voting(15, monthly)	62	64	60	55	55	50	73	68	58	69	61.4
Voting(20, monthly)	64	60	52	49	55	44	64	71	56	67	58.2
Voting(25, monthly)	59	55	56	47	55	46	62	71	50	71	57.2
Voting(30, monthly)	53	51	54	39	45	48	55	72	48	66	53.1
Voting(35, monthly)	55	47	58	31	47	40	59	70	48	62	51.7
Voting(40, monthly)	55	47	56	35	47	40	59	62	52	60	51.3
Voting(45, monthly)	51	49	48	27	43	46	59	64	54	53	49.4
Voting(50, monthly)	46	50	44	23	41	46	57	66	48	55	47.6
Voting(5, yearly)	95	21	30	83	5	25	17	8	134	43	46.1
Voting(10, yearly)	105	28	21	65	5	21	8	1	140	38	43.2
Voting(15, yearly)	93	26	33	41	7	20	9	10	133	40	41.2
Voting(20, yearly)	101	23	14	21	5	14	9	10	135	44	37.6
Voting(25, yearly)	95	29	10	17	3	19	12	8	125	46	36.4
Voting(30, yearly)	93	28	10	18	3	10	10	7	129	46	35.4
Voting(35, yearly)	73	26	3	15	3	10	9	3	128	44	31.4
Voting(40, yearly)	70	31	3	13	5	5	8	1	124	44	30.4
Voting(45, yearly)	71	30	1	13	5	5	6	1	126	50	30.8
Voting(50, yearly)	61	26	1	13	5	1	6	1	126	46	28.6

Table B.37: Performance Summary of Voting among Trend-Based Regression Strategies (Numbers of Trading)

Voting among Trend-based Regression Algorithm with Trading Volume (V:W) = (1:1) : Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.301	0.0284	-0.0845	0.0852	-0.1592	0.1394	0.0716	-0.0497	0.122	0.1302	0.051
Voting(10, monthly)	0.195	0.114	-0.0577	0.1859	-0.1342	0.1055	0.1008	-0.0384	0.1278	0.1506	0.0694
Voting(15, monthly)	0.1227	0.0502	-0.0687	0.1278	-0.1104	0.0618	0.056	-0.0289	0.1446	0.1239	0.0443
Voting(20, monthly)	0.1048	0.0612	-0.0569	0.117	-0.0152	0.0035	0.0574	-0.0419	0.0869	0.0642	0.0364
Voting(25, monthly)	0.268	0.1217	-0.0576	0.0374	-0.0918	-0.0068	0.0042	-0.0339	0.1066	0.0141	0.0317
Voting(30, monthly)	0.2708	0.1409	-0.0245	-0.0572	-0.1475	-0.0039	0.0448	-0.0451	0.1047	0.014	0.0238
Voting(35, monthly)	0.2999	0.1209	0.0058	-0.0659	-0.0357	-0.0286	0.0634	-0.0136	0.0754	0.0386	0.0415
Voting(40, monthly)	0.2844	0.1316	-0.0798	-0.0552	-0.0591	-0.0146	0.0998	-0.0306	0.1157	0.0139	0.0352
Voting(45, monthly)	0.2181	0.1777	-0.0634	-0.0587	-0.0844	0.013	0.0879	0.0125	0.1143	0.0043	0.0376
Voting(50, monthly)	0.2024	0.2146	-0.0494	-0.0497	-0.1557	-0.0003	0.0735	0.0063	0.097	-0.0322	0.0247
Voting(5, yearly)	0.3105	0.0605	-0.0501	-0.0081	-0.2541	0.1371	0.0936	-0.0252	0.042	-0.0239	0.0188
Voting(10, yearly)	0.2882	0.0558	-0.0425	0.0291	-0.2541	0.1632	0.1899	-0.0163	0.0332	-0.0239	0.0322
Voting(15, yearly)	0.3174	0.0741	-0.046	0.0885	-0.1072	0.1371	0.1509	0.0052	0.0404	-0.0239	0.0577
Voting(20, yearly)	0.2172	0.0674	-0.1056	0.0508	-0.1825	0.1251	0.1774	0.015	0.0461	-0.0074	0.0337
Voting(25, yearly)	0.196	0.0609	-0.1056	0.0772	-0.1777	0.1354	0.1713	-0.0218	0.0512	0.0885	0.0411
Voting(30, yearly)	0.1675	0.0557	-0.0959	-0.0064	-0.2194	0.1304	0.1685	0.0264	0.055	0.0352	0.025
Voting(35, yearly)	0.184	0.0463	-0.0927	-0.0608	-0.2327	0.0632	0.1593	0.038	0.0856	0.0353	0.0154
Voting(40, yearly)	0.1739	0.0731	-0.1071	-0.023	-0.1915	0.0572	0.181	0.0274	0.0745	0.0511	0.0256
Voting(45, yearly)	0.1623	0.0836	-0.0685	-0.0531	-0.1807	0.1028	0.1449	0.021	0.0745	-0.0122	0.0222
Voting(50, yearly)	0.1489	0.0595	-0.0227	-0.0964	-0.1857	0.0846	0.1342	0.0169	0.0749	-0.0237	0.014
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1507	0.123	0.1295	0.1332	0.1801	0.1212	0.0868	0.0734	0.0733	0.1039	0.1219
Voting(10, monthly)	0.1565	0.1306	0.1474	0.1336	0.1672	0.1136	0.0828	0.0729	0.076	0.1031	0.1227
Voting(15, monthly)	0.1553	0.1277	0.1585	0.1297	0.1685	0.1171	0.0813	0.0693	0.0767	0.1113	0.1242
Voting(20, monthly)	0.1573	0.131	0.1605	0.1245	0.1642	0.1164	0.0838	0.0683	0.0726	0.1155	0.1241
Voting(25, monthly)	0.1455	0.1287	0.1585	0.1183	0.1847	0.1184	0.0871	0.0686	0.0728	0.1113	0.1245
Voting(30, monthly)	0.1448	0.1355	0.1586	0.1238	0.1697	0.1183	0.0835	0.0695	0.0698	0.1072	0.1228
Voting(35, monthly)	0.1435	0.1336	0.1615	0.126	0.1836	0.1125	0.0867	0.069	0.067	0.1057	0.1244
Voting(40, monthly)	0.1431	0.1341	0.159	0.1293	0.1855	0.1157	0.0832	0.071	0.0718	0.1052	0.1251
Voting(45, monthly)	0.1453	0.1353	0.1628	0.1276	0.1904	0.1175	0.0839	0.0697	0.0738	0.1149	0.1276
Voting(50, monthly)	0.1469	0.1362	0.163	0.1245	0.1848	0.1137	0.0818	0.0708	0.0692	0.1198	0.1265
Voting(5, yearly)	0.1309	0.1285	0.1456	0.1543	0.1678	0.1092	0.081	0.0688	0.0661	0.1271	0.1227
Voting(10, yearly)	0.1301	0.1275	0.1458	0.1513	0.1678	0.1116	0.0808	0.0674	0.0656	0.1271	0.1222
Voting(15, yearly)	0.1307	0.128	0.1457	0.1526	0.1693	0.1092	0.0822	0.0681	0.0661	0.1271	0.1227
Voting(20, yearly)	0.1333	0.1282	0.1474	0.1511	0.1698	0.1088	0.0809	0.0679	0.0663	0.1261	0.1228
Voting(25, yearly)	0.1397	0.1299	0.1474	0.1491	0.1696	0.1092	0.082	0.0689	0.0689	0.1188	0.123
Voting(30, yearly)	0.1358	0.13	0.147	0.1498	0.1714	0.1076	0.082	0.0674	0.0687	0.1243	0.1232
Voting(35, yearly)	0.136	0.1291	0.1471	0.1538	0.1676	0.1073	0.081	0.0686	0.074	0.1247	0.1234
Voting(40, yearly)	0.136	0.126	0.1466	0.1561	0.1722	0.1095	0.0806	0.0704	0.0732	0.1234	0.1241
Voting(45, yearly)	0.1356	0.1269	0.1435	0.1555	0.1721	0.1082	0.0793	0.0676	0.0732	0.1255	0.1235
Voting(50, yearly)	0.1369	0.1248	0.1432	0.1424	0.1719	0.1082	0.0793	0.0682	0.0732	0.1224	0.1215
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.38: Performance Summary of Voting among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Annualized Returns and Annualized Volatilities)

Voting among Trend-based Regression Algorithm with Trading Volume (V:W) = (1:1) : Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	1.9974	0.2311	-0.6528	0.6398	-0.8843	1.1501	0.8255	-0.6774	1.6633	1.2531	0.4184
Voting(10, monthly)	1.2454	0.8724	-0.3915	1.3914	-0.8023	0.9283	1.2174	-0.5265	1.6813	1.4612	0.5656
Voting(15, monthly)	0.7901	0.3931	-0.433	0.9849	-0.6548	0.5276	0.6882	-0.4175	1.8844	1.1131	0.3567
Voting(20, monthly)	0.6663	0.4674	-0.3548	0.9401	-0.0926	0.0299	0.684	-0.6129	1.1971	0.5562	0.2933
Voting(25, monthly)	1.8413	0.9462	-0.3636	0.316	-0.4972	-0.0575	0.0486	-0.4938	1.4656	0.1269	0.2546
Voting(30, monthly)	1.8701	1.0401	-0.1543	-0.4621	-0.8691	-0.0332	0.5369	-0.6489	1.5001	0.1308	0.1938
Voting(35, monthly)	2.0906	0.9047	0.0362	-0.5232	-0.1947	-0.2545	0.7316	-0.1976	1.1253	0.3647	0.3336
Voting(40, monthly)	1.9877	0.9811	-0.5022	-0.4271	-0.3187	-0.1258	1.1999	-0.4319	1.612	0.1322	0.2814
Voting(45, monthly)	1.5007	1.3129	-0.3898	-0.4601	-0.4433	0.1106	1.0475	0.1801	1.5492	0.0375	0.2947
Voting(50, monthly)	1.3781	1.5759	-0.3032	-0.3991	-0.8428	-0.003	0.8984	0.0884	1.4016	-0.2688	0.1953
Voting(5, yearly)	2.3725	0.4707	-0.3442	-0.0523	-1.514	1.2553	1.1558	-0.3662	0.6352	-0.1879	0.1532
Voting(10, yearly)	2.2155	0.4379	-0.2915	0.1925	-1.514	1.4625	2.3487	-0.2423	0.5059	-0.1879	0.2635
Voting(15, yearly)	2.4279	0.5792	-0.3154	0.5801	-0.6329	1.2553	1.8352	0.076	0.6105	-0.1879	0.4703
Voting(20, yearly)	1.629	0.5254	-0.7165	0.336	-1.0748	1.1496	2.1923	0.2213	0.6944	-0.059	0.2744
Voting(25, yearly)	1.4031	0.4686	-0.7165	0.5178	-1.0476	1.2399	2.0895	-0.3169	0.7429	0.7451	0.3341
Voting(30, yearly)	1.2337	0.4285	-0.6525	-0.0426	-1.2796	1.2124	2.0544	0.3914	0.8009	0.2832	0.2029
Voting(35, yearly)	1.3535	0.3585	-0.63	-0.3955	-1.388	0.5894	1.9671	0.5545	1.1562	0.2828	0.1248
Voting(40, yearly)	1.2788	0.5805	-0.7306	-0.1477	-1.1124	0.5225	2.2453	0.3889	1.0179	0.4143	0.2063
Voting(45, yearly)	1.1967	0.6592	-0.4771	-0.3417	-1.0497	0.9505	1.8273	0.3108	1.0179	-0.0968	0.1798
Voting(50, yearly)	1.0876	0.477	-0.1584	-0.6772	-1.0803	0.782	1.6921	0.2482	1.0229	-0.1937	0.1152
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.48	0.48	0.44	0.43	0.44	0.54	0.48	0.51	0.5	0.52	0.48
Voting(10, monthly)	0.5	0.49	0.44	0.44	0.41	0.51	0.45	0.51	0.49	0.52	0.48
Voting(15, monthly)	0.48	0.48	0.47	0.45	0.41	0.52	0.45	0.48	0.53	0.52	0.48
Voting(20, monthly)	0.5	0.52	0.47	0.45	0.39	0.5	0.47	0.46	0.52	0.51	0.48
Voting(25, monthly)	0.54	0.52	0.47	0.44	0.44	0.52	0.5	0.49	0.49	0.5	0.49
Voting(30, monthly)	0.51	0.52	0.46	0.46	0.42	0.52	0.47	0.49	0.49	0.5	0.48
Voting(35, monthly)	0.51	0.54	0.47	0.46	0.46	0.51	0.49	0.51	0.48	0.5	0.49
Voting(40, monthly)	0.52	0.54	0.46	0.46	0.47	0.52	0.48	0.51	0.51	0.48	0.49
Voting(45, monthly)	0.53	0.53	0.48	0.46	0.46	0.51	0.48	0.52	0.53	0.52	0.5
Voting(50, monthly)	0.53	0.53	0.5	0.45	0.48	0.51	0.46	0.5	0.52	0.53	0.5
Voting(5, yearly)	0.5	0.52	0.5	0.5	0.48	0.5	0.48	0.46	0.48	0.51	0.49
Voting(10, yearly)	0.49	0.51	0.5	0.49	0.48	0.5	0.5	0.46	0.47	0.51	0.49
Voting(15, yearly)	0.49	0.51	0.5	0.5	0.48	0.5	0.48	0.46	0.47	0.51	0.49
Voting(20, yearly)	0.48	0.51	0.49	0.49	0.49	0.5	0.51	0.47	0.48	0.5	0.49
Voting(25, yearly)	0.5	0.54	0.49	0.49	0.5	0.5	0.5	0.47	0.5	0.49	0.5
Voting(30, yearly)	0.48	0.54	0.49	0.48	0.48	0.52	0.5	0.47	0.5	0.49	0.5
Voting(35, yearly)	0.48	0.54	0.49	0.49	0.46	0.52	0.49	0.46	0.53	0.5	0.5
Voting(40, yearly)	0.47	0.53	0.48	0.49	0.47	0.53	0.49	0.47	0.52	0.52	0.5
Voting(45, yearly)	0.47	0.54	0.48	0.49	0.47	0.53	0.48	0.45	0.52	0.52	0.5
Voting(50, yearly)	0.47	0.54	0.48	0.48	0.48	0.53	0.47	0.46	0.52	0.52	0.49

Table B.39: Performance Summary of Voting among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Table B.40: Performance Summary of Voting among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Numbers of Trading)

Voting among Trend-based Regression Algorithm with Trading Volume (V:W) = (1:1) : Voting(k, period)													
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007		
Voting(5, monthly)	131	143	100	110	96	99	129	123	143	135	120.9		
Voting(10, monthly)	125	127	102	112	94	97	127	113	131	133	116.1		
Voting(15, monthly)	133	149	110	114	94	117	137	115	147	137	125.3		
Voting(20, monthly)	137	145	108	113	97	107	139	117	147	127	123.7		
Voting(25, monthly)	133	135	118	118	118	125	157	135	149	129	131.7		
Voting(30, monthly)	133	135	116	117	109	127	149	137	145	133	130.1		
Voting(35, monthly)	133	133	110	125	119	135	145	139	147	143	132.9		
Voting(40, monthly)	133	129	108	125	121	135	149	139	147	147	133.3		
Voting(45, monthly)	137	129	114	125	123	137	147	133	143	145	133.3		
Voting(50, monthly)	139	133	112	123	121	133	145	139	141	135	132.1		
Voting(5, yearly)	141	132	130	127	114	110	82	151	137	139	126.3		
Voting(10, yearly)	139	134	132	127	114	110	118	153	141	139	130.7		
Voting(15, yearly)	133	136	132	129	124	110	128	153	139	139	132.3		
Voting(20, yearly)	123	136	134	127	122	112	116	133	141	139	128.3		
Voting(25, yearly)	129	140	134	133	126	110	122	153	145	139	133.1		
Voting(30, yearly)	127	142	134	127	128	114	122	141	143	137	131.5		
Voting(35, yearly)	127	142	134	129	128	118	118	141	139	129	130.5		
Voting(40, yearly)	129	144	132	127	128	118	118	141	141	135	131.3		
Voting(45, yearly)	129	146	138	127	128	126	128	141	141	131	133.5		
Voting(50, yearly)	127	146	140	127	124	130	128	143	141	129	133.5		



Table B.41: Performance Summary of Voting among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Annualized Returns and Annualized Volatilities)

	Voting among Trend-based Regression Algorithm with Trading Volume (V:W) = (2:1) : Voting(k, period)										
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	-0.0765	0.1248	-0.1701	-0.0713	-0.0028	-0.0306	0.1033	0.0586	-0.0496	0.1659	0.0002
Voting(10, monthly)	-0.0605	0.2791	-0.1561	-0.0082	-0.1037	0.0051	0.112	0.0399	0.0414	0.0927	0.0177
Voting(15, monthly)	-0.0096	0.2385	-0.1686	-0.0816	-0.0667	0.0265	0.0596	0.0497	0.0079	0.1492	0.0146
Voting(20, monthly)	0.0292	0.1388	-0.1751	-0.1189	-0.0309	0.1065	0.0625	0.0356	-0.0028	0.1147	0.0112
Voting(25, monthly)	0.2671	0.0886	-0.0579	-0.0305	-0.1451	0.0933	0.0145	-0.0024	0.0216	0.1213	0.0316
Voting(30, monthly)	0.2335	0.0921	-0.0403	0.0171	-0.088	0.0964	0.0652	-0.0025	0.0051	0.0964	0.0441
Voting(35, monthly)	0.2182	0.1688	-0.1584	-0.0366	-0.1306	0.0618	0.0321	0.0262	-0.0069	0.0973	0.0209
Voting(40, monthly)	0.1573	0.1912	-0.146	0.0217	-0.0857	0.0892	0.0358	0.0323	0.0268	0.0745	0.0352
Voting(45, monthly)	0.1812	0.2302	-0.1033	-0.1053	-0.037	-0.0139	0.0073	0.0218	0.0369	0.1224	0.0286
Voting(50, monthly)	0.1419	0.0864	-0.1206	-0.0884	-0.0647	-0.0093	-0.0104	0.0093	0.0737	0.0842	0.0069
Voting(5, yearly)	0.2152	-0.0884	0.2217	-0.0496	0.1182	0.0072	0.0687	-0.0251	0.0651	0.1989	0.0678
Voting(10, yearly)	0.1925	-0.0203	0.077	-0.0164	0.019	0.0145	0.0594	-0.0205	0.067	0.2185	0.0561
Voting(15, yearly)	0.2334	0.0131	0.1817	-0.0648	0.0416	0.0145	0.0949	-0.0124	0.0931	0.2185	0.0771
Voting(20, yearly)	0.1888	0.0375	0.1737	-0.0129	0.0505	0.0167	0.0582	-0.0077	0.0919	0.2393	0.0805
Voting(25, yearly)	0.1925	0.0301	0.1426	-0.0283	-0.0196	0.0227	0.0545	-0.0288	0.0968	0.2003	0.0631
Voting(30, yearly)	0.177	0.0726	0.1394	-0.1149	-0.0181	0.0251	0.0744	-0.0184	0.1038	0.2421	0.0636
Voting(35, yearly)	0.1944	0.066	0.1358	-0.1343	-0.0647	0.0911	0.0901	0.0372	0.1151	0.2365	0.0713
Voting(40, yearly)	0.2217	0.0855	0.1252	-0.136	-0.1036	0.134	0.0801	0.0544	0.1211	0.2491	0.0765
Voting(45, yearly)	0.251	0.0529	0.0784	-0.1555	-0.156	0.1071	0.0789	0.0241	0.1211	0.2438	0.0562
Voting(50, yearly)	0.2545	0.03	0.1146	-0.1502	-0.1575	0.1847	0.076	0.0617	0.1229	0.2423	0.0689
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1345	0.1282	0.1589	0.1504	0.1971	0.1124	0.0773	0.0749	0.0665	0.1105	0.1273
Voting(10, monthly)	0.1393	0.1323	0.1607	0.1561	0.1952	0.1162	0.0785	0.0735	0.0674	0.1134	0.1295
Voting(15, monthly)	0.1341	0.1368	0.1512	0.1598	0.1973	0.1175	0.077	0.0729	0.0687	0.1108	0.1289
Voting(20, monthly)	0.1143	0.1332	0.159	0.1546	0.1984	0.1134	0.0739	0.0702	0.0691	0.1156	0.1268
Voting(25, monthly)	0.1122	0.1263	0.1603	0.1515	0.1973	0.1204	0.0744	0.0664	0.0698	0.1172	0.1262
Voting(30, monthly)	0.1145	0.1248	0.1666	0.1483	0.2095	0.1193	0.0737	0.0685	0.0692	0.1202	0.1288
Voting(35, monthly)	0.1133	0.1265	0.1584	0.1529	0.2111	0.1194	0.0752	0.0728	0.0687	0.1165	0.1286
Voting(40, monthly)	0.1403	0.124	0.1556	0.1541	0.2076	0.1161	0.0709	0.0722	0.0715	0.1151	0.1297
Voting(45, monthly)	0.138	0.1304	0.1558	0.1468	0.2023	0.1168	0.0696	0.0732	0.0759	0.115	0.1287
Voting(50, monthly)	0.1403	0.1317	0.1558	0.147	0.2014	0.1195	0.0711	0.0746	0.0757	0.1181	0.1296
Voting(5, yearly)	0.1211	0.1226	0.1689	0.1382	0.2021	0.1097	0.0776	0.0682	0.0754	0.1116	0.1261
Voting(10, yearly)	0.123	0.1274	0.1613	0.1409	0.2064	0.1093	0.0835	0.068	0.0754	0.1102	0.127
Voting(15, yearly)	0.125	0.1305	0.1662	0.1395	0.2056	0.1093	0.0783	0.0685	0.0751	0.1102	0.1275
Voting(20, yearly)	0.1243	0.1291	0.1648	0.1365	0.206	0.1093	0.0773	0.0692	0.0766	0.1093	0.1268
Voting(25, yearly)	0.1246	0.1264	0.1527	0.1443	0.207	0.1063	0.0788	0.0726	0.0763	0.1064	0.1259
Voting(30, yearly)	0.123	0.1273	0.1524	0.14	0.1988	0.1068	0.0797	0.0758	0.0782	0.1093	0.1246
Voting(35, yearly)	0.1244	0.129	0.1519	0.1395	0.2019	0.1086	0.0802	0.0753	0.0784	0.1094	0.1255
Voting(40, yearly)	0.1225	0.1272	0.1516	0.1428	0.1925	0.1105	0.0801	0.0739	0.0785	0.1096	0.124
Voting(45, yearly)	0.1213	0.1283	0.1516	0.1446	0.1816	0.1126	0.0801	0.0773	0.0787	0.1095	0.123
Voting(50, yearly)	0.1213	0.1308	0.1512	0.1446	0.19	0.1176	0.0802	0.0759	0.0787	0.1095	0.1249
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.42: Performance Summary of Voting among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Voting among Trend-based Regression Algorithm with Trading Volume (V:W) = (2:1) : Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	-0.569	0.9737	-1.0706	-0.4739	-0.0142	-0.2724	1.3366	0.7822	-0.7464	1.5017	0.0016
Voting(10, monthly)	-0.4341	2.1105	-0.9717	-0.0525	-0.5314	0.044	1.4256	0.5429	0.6136	0.8178	0.1367
Voting(15, monthly)	-0.0719	1.7442	-1.115	-0.5105	-0.3382	0.2253	0.7746	0.6822	0.1156	1.3463	0.1133
Voting(20, monthly)	0.2551	1.0426	-1.1016	-0.7689	-0.1556	0.9393	0.8458	0.5073	-0.0407	0.9925	0.0883
Voting(25, monthly)	2.3805	0.7015	-0.3612	-0.2011	-0.7357	0.7752	0.1943	-0.0356	0.3103	1.0343	0.2504
Voting(30, monthly)	2.0382	0.7382	-0.242	0.1149	-0.4202	0.8082	0.8848	-0.0363	0.073	0.8015	0.3424
Voting(35, monthly)	1.926	1.3341	-0.9999	-0.239	-0.6186	0.5176	0.4267	0.3594	-0.0999	0.8353	0.1625
Voting(40, monthly)	1.1208	1.5423	-0.9384	0.1408	-0.4127	0.7678	0.5049	0.4469	0.3755	0.6475	0.2714
Voting(45, monthly)	1.3129	1.7652	-0.6634	-0.7174	-0.183	-0.1188	0.105	0.2978	0.4861	1.0644	0.2222
Voting(50, monthly)	1.0108	0.6561	-0.7743	-0.6016	-0.3212	-0.0778	-0.1463	0.1253	0.9729	0.7134	0.0532
Voting(5, yearly)	1.7773	-0.721	1.3126	-0.3587	0.585	0.0656	0.8852	-0.3684	0.8637	1.7822	0.5377
Voting(10, yearly)	1.5657	-0.1595	0.4776	-0.1164	0.0922	0.1325	0.7111	-0.3017	0.8881	1.9836	0.4417
Voting(15, yearly)	1.8671	0.1007	1.0935	-0.4647	0.2022	0.1325	1.2111	-0.1813	1.24	1.9836	0.6047
Voting(20, yearly)	1.5189	0.2909	1.0539	-0.0944	0.2452	0.1527	0.7533	-0.1106	1.2001	2.1889	0.6349
Voting(25, yearly)	1.5452	0.2381	0.9337	-0.1962	-0.0945	0.2132	0.6911	-0.397	1.2694	1.8829	0.5012
Voting(30, yearly)	1.4388	0.5705	0.9146	-0.8207	-0.0912	0.2354	0.9337	-0.243	1.3283	2.215	0.5104
Voting(35, yearly)	1.563	0.5114	0.8941	-0.9628	-0.3204	0.8391	1.123	0.4933	1.4672	2.1621	0.5681
Voting(40, yearly)	1.8094	0.6723	0.8257	-0.9522	-0.5379	1.2128	0.9996	0.7361	1.5431	2.2729	0.6169
Voting(45, yearly)	2.0692	0.4119	0.517	-1.0751	-0.8588	0.9512	0.9851	0.3112	1.5386	2.2263	0.4569
Voting(50, yearly)	2.097	0.2294	0.7575	-1.0393	-0.829	1.5703	0.9478	0.8127	1.5607	2.2125	0.5516
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.44	0.46	0.55	0.47	0.56	0.5	0.47	0.49	0.48	0.51	0.49
Voting(10, monthly)	0.46	0.5	0.54	0.51	0.53	0.52	0.5	0.48	0.52	0.51	0.51
Voting(15, monthly)	0.47	0.51	0.53	0.51	0.52	0.53	0.49	0.46	0.5	0.51	0.5
Voting(20, monthly)	0.46	0.49	0.52	0.52	0.52	0.5	0.48	0.44	0.51	0.52	0.5
Voting(25, monthly)	0.48	0.48	0.52	0.5	0.53	0.54	0.5	0.45	0.52	0.51	0.5
Voting(30, monthly)	0.49	0.48	0.55	0.5	0.52	0.55	0.52	0.46	0.52	0.49	0.51
Voting(35, monthly)	0.46	0.5	0.58	0.51	0.55	0.56	0.49	0.49	0.52	0.5	0.52
Voting(40, monthly)	0.48	0.49	0.54	0.5	0.55	0.52	0.48	0.49	0.54	0.46	0.5
Voting(45, monthly)	0.48	0.48	0.54	0.5	0.52	0.54	0.5	0.49	0.55	0.47	0.51
Voting(50, monthly)	0.48	0.51	0.56	0.52	0.52	0.55	0.47	0.51	0.55	0.48	0.52
Voting(5, yearly)	0.48	0.47	0.48	0.38	0.51	0.51	0.52	0.44	0.5	0.52	0.48
Voting(10, yearly)	0.48	0.49	0.48	0.42	0.52	0.51	0.56	0.43	0.5	0.5	0.49
Voting(15, yearly)	0.5	0.5	0.48	0.4	0.51	0.51	0.52	0.44	0.5	0.5	0.48
Voting(20, yearly)	0.48	0.5	0.46	0.4	0.52	0.5	0.5	0.44	0.5	0.5	0.48
Voting(25, yearly)	0.5	0.48	0.45	0.45	0.53	0.48	0.52	0.48	0.48	0.48	0.48
Voting(30, yearly)	0.49	0.48	0.44	0.44	0.53	0.5	0.52	0.53	0.49	0.49	0.49
Voting(35, yearly)	0.5	0.49	0.44	0.43	0.53	0.52	0.54	0.52	0.5	0.49	0.5
Voting(40, yearly)	0.49	0.48	0.44	0.44	0.52	0.52	0.53	0.5	0.5	0.5	0.49
Voting(45, yearly)	0.48	0.49	0.44	0.43	0.52	0.54	0.54	0.52	0.51	0.49	0.5
Voting(50, yearly)	0.48	0.5	0.44	0.42	0.5	0.54	0.54	0.5	0.51	0.49	0.49

Voting among Trend-based Regression Algorithm with Trading Volume (V:W) = (2:1) : Voting(k, period)											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	112	109	134	107	120	116	118	130	117	125	118.8
Voting(10, monthly)	118	107	130	113	142	108	110	128	113	127	119.6
Voting(15, monthly)	118	119	130	115	136	118	128	132	127	127	125
Voting(20, monthly)	110	121	132	115	132	124	124	118	127	127	123
Voting(25, monthly)	116	123	126	123	124	120	124	128	125	117	122.6
Voting(30, monthly)	124	121	126	115	122	122	138	132	123	119	124.2
Voting(35, monthly)	126	115	130	111	124	122	136	142	125	129	126
Voting(40, monthly)	130	115	128	113	124	128	140	142	119	123	126.2
Voting(45, monthly)	130	115	130	107	124	134	132	142	123	119	125.6
Voting(50, monthly)	134	115	126	109	120	132	130	144	113	117	124
Voting(5, yearly)	132	135	119	92	132	141	132	113	115	110	122.1
Voting(10, yearly)	128	125	127	90	118	139	128	113	115	110	119.3
Voting(15, yearly)	127	114	117	92	122	139	130	113	117	110	118.1
Voting(20, yearly)	129	112	115	92	120	141	130	119	121	110	118.9
Voting(25, yearly)	127	113	114	90	112	132	131	117	122	113	117.1
Voting(30, yearly)	127	113	112	94	104	136	125	116	118	110	115.5
Voting(35, yearly)	127	109	114	100	112	142	125	124	125	111	118.9
Voting(40, yearly)	127	111	110	98	114	138	129	130	123	111	119.1
Voting(45, yearly)	127	111	108	100	112	138	129	144	121	111	120.1
Voting(50, yearly)	127	115	108	104	123	141	131	140	122	112	122.3

Table B.43: Performance Summary of Voting among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Numbers of Trading)

Table B.44: Performance Summary of Voting among Nearest Neighbors Algorithm  
Strategies (Annualized Returns and Annualized Volatilities)

Voting among Nearest Neighbors Algorithm: Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1492	0.0582	-0.1856	-0.1264	-0.2046	0.179	0.0265	0.0451	0.0726	0.0945	0.0021
Voting(10, monthly)	0.3043	0.0192	-0.1152	-0.1807	-0.1225	0.1398	0.011	-0.0579	0.044	0.147	0.0095
Voting(15, monthly)	0.15	0.129	-0.1202	-0.1067	-0.2378	0.1941	0.0542	-0.0049	0.0616	0.0212	0.0055
Voting(20, monthly)	0.2346	0.2463	-0.1613	-0.1221	-0.2622	0.1165	-0.0083	0.0478	0.0117	0.0234	0.0004
Voting(25, monthly)	0.085	0.2158	-0.108	-0.1479	-0.2503	0.1473	-0.0326	-0.089	0.0159	-0.0326	-0.0287
Voting(30, monthly)	0.0678	0.273	-0.1609	-0.2457	-0.3074	0.0854	-0.0137	-0.0219	0.0549	-0.0019	-0.0411
Voting(35, monthly)	0.1484	0.3258	-0.1599	-0.1943	-0.3088	0.1619	-0.02	-0.0795	0.0439	-0.0372	-0.0283
Voting(40, monthly)	0.237	0.229	-0.0134	-0.175	-0.2616	0.1161	-0.001	-0.0612	0.0472	-0.027	-0.0026
Voting(45, monthly)	0.2265	0.2566	0.0316	-0.1955	-0.2614	0.0925	-0.0626	0.013	0.048	0.0058	0.0033
Voting(50, monthly)	0.2205	0.2153	-0.1472	-0.1956	-0.2888	0.1391	-0.0392	0.0387	0.0327	0.0077	-0.0154
Voting(5, yearly)	0.241	0.1953	-0.0956	-0.1021	-0.1063	0	0.0618	-0.0357	0.0259	0.1082	0.0228
Voting(10, yearly)	0	0	-0.008	-0.1169	0.0731	0.2638	0.0615	0.0045	0.0175	0.1042	0.0359
Voting(15, yearly)	0.383	0.1953	-0.0362	-0.0707	0.0008	0.2027	0.0928	-0.0219	0.0175	0.023	0.0709
Voting(20, yearly)	0.383	0.1953	-0.0595	-0.0821	0.0008	0.2638	0.0179	-0.0251	0	0.0195	0.0621
Voting(25, yearly)	0.241	0.1953	-0.048	-0.1013	0	0	0.0028	0.0974	0	0.0303	0.0371
Voting(30, yearly)	0.241	0.1953	-0.0259	-0.1192	0	0	0.012	0.047	0.0125	0.0774	0.0393
Voting(35, yearly)	0	0	-0.017	-0.1263	0	0	0.0754	0.0015	0.0125	0.046	-0.0021
Voting(40, yearly)	0	0	-0.0388	-0.066	-0.3052	0	0.037	0.0516	0	0.0909	-0.0294
Voting(45, yearly)	0	0	-0.0064	-0.095	-0.3052	0	0.0277	0.067	0	0.046	-0.0328
Voting(50, yearly)	0	0	-0.0171	-0.1164	-0.3052	0	0.071	0.0202	0.0125	0.046	-0.0353
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1441	0.1016	0.1851	0.1949	0.1676	0.1425	0.0773	0.0711	0.06	0.0959	0.1325
Voting(10, monthly)	0.1126	0.1106	0.1387	0.1895	0.1861	0.1433	0.0745	0.0756	0.0631	0.1005	0.1267
Voting(15, monthly)	0.0969	0.1208	0.1689	0.1992	0.2457	0.1452	0.0669	0.0753	0.0633	0.1148	0.1418
Voting(20, monthly)	0.1054	0.1235	0.1718	0.2001	0.2484	0.1489	0.0562	0.0782	0.062	0.1229	0.1442
Voting(25, monthly)	0.107	0.1236	0.1657	0.2047	0.2443	0.1357	0.0488	0.071	0.0654	0.1195	0.1415
Voting(30, monthly)	0.0988	0.1274	0.1688	0.1891	0.2114	0.1444	0.0667	0.0686	0.0625	0.1216	0.1355
Voting(35, monthly)	0.0911	0.1228	0.1705	0.2065	0.2115	0.152	0.0472	0.063	0.0617	0.1185	0.1367
Voting(40, monthly)	0.1033	0.1177	0.1418	0.2049	0.2166	0.1458	0.0505	0.0672	0.062	0.1127	0.1336
Voting(45, monthly)	0.1079	0.1235	0.1417	0.2065	0.2133	0.1475	0.0444	0.0766	0.0611	0.113	0.1346
Voting(50, monthly)	0.1112	0.1196	0.1802	0.2065	0.2117	0.151	0.0409	0.0769	0.0599	0.1163	0.1393
Voting(5, yearly)	0.1373	0.1808	0.1206	0.1636	0.1803	0	0.0647	0.0643	0.0591	0.106	0.1218
Voting(10, yearly)	0	0	0.1258	0.1546	0.2069	0.1711	0.0724	0.0628	0.0642	0.0993	0.1162
Voting(15, yearly)	0.1785	0.1808	0.1275	0.163	0.1541	0.1684	0.0628	0.0702	0.0642	0.1048	0.1354
Voting(20, yearly)	0.1785	0.1808	0.1275	0.1632	0.1541	0.1711	0.0636	0.0597	0	0.093	0.1329
Voting(25, yearly)	0.1373	0.1808	0.1281	0.1725	0	0	0.0546	0.0709	0	0.0738	0.1054
Voting(30, yearly)	0.1373	0.1808	0.1261	0.1816	0	0	0.0553	0.0683	0.0678	0.0832	0.1094
Voting(35, yearly)	0	0	0.126	0.2019	0	0	0.0598	0.0801	0.0678	0.0438	0.0855
Voting(40, yearly)	0	0	0.1227	0.2111	0.16	0	0.051	0.0729	0	0.0805	0.0998
Voting(45, yearly)	0	0	0.1224	0.2131	0.16	0	0.0501	0.0774	0	0.0438	0.0982
Voting(50, yearly)	0	0	0.1221	0.2147	0.16	0	0.0608	0.0816	0.0678	0.0438	0.1017
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.45: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies (Sharpe Ratios and Proportions of In-the-Market)

Voting among Nearest Neighbors Algorithm: Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	1.0353	0.5725	-1.0024	-0.6486	-1.2211	1.2556	0.3429	0.6345	1.2102	0.9858	0.0158
Voting(10, monthly)	2.7015	0.1734	-0.8304	-0.9536	-0.6579	0.9754	0.1472	-0.7665	0.697	1.4629	0.0750
Voting(15, monthly)	1.5484	1.0674	-0.7118	-0.5357	-0.9678	1.337	0.8102	-0.0653	0.9739	0.1849	0.0388
Voting(20, monthly)	2.2258	1.9939	-0.939	-0.6101	-1.0558	0.7827	-0.147	0.611	0.1881	0.1903	0.0028
Voting(25, monthly)	0.7943	1.7459	-0.6516	-0.7222	-1.0247	1.0849	-0.6672	-1.253	0.244	-0.2727	-0.2028
Voting(30, monthly)	0.6863	2.143	-0.9531	-1.2991	-1.4542	0.5916	-0.2053	-0.319	0.8779	-0.0157	-0.3033
Voting(35, monthly)	1.6291	2.6526	-0.9379	-0.9411	-1.4596	1.065	-0.4243	-1.2618	0.7107	-0.3143	-0.2070
Voting(40, monthly)	2.2939	1.9461	-0.0946	-0.8538	-1.2075	0.796	-0.0205	-0.9107	0.7603	-0.2398	-0.0195
Voting(45, monthly)	2.1	2.0773	0.2233	-0.9465	-1.2253	0.6269	-1.4086	0.17	0.7852	0.0518	0.0245
Voting(50, monthly)	1.984	1.8004	-0.8171	-0.9474	-1.3641	0.9218	-0.9584	0.503	0.5452	0.0658	-0.1106
Voting(5, yearly)	1.7551	1.0802	-0.7924	-0.6245	-0.5897	NaN	0.9554	-0.5556	0.4378	1.0208	0.1872
Voting(10, yearly)	NaN	NaN	-0.0636	-0.756	0.3535	1.5422	0.8492	0.0718	0.2719	1.0494	0.3090
Voting(15, yearly)	2.1456	1.0802	-0.2838	-0.4337	0.0049	1.2038	1.4769	-0.3114	0.2719	0.2194	0.5236
Voting(20, yearly)	2.1456	1.0802	-0.4661	-0.5032	0.0049	1.5422	0.281	-0.4214	NaN	0.2093	0.4673
Voting(25, yearly)	1.7551	1.0802	-0.3747	-0.587	NaN	NaN	0.052	1.3747	NaN	0.41	0.3520
Voting(30, yearly)	1.7551	1.0802	-0.2052	-0.6564	NaN	NaN	0.216	0.6876	0.1838	0.9302	0.3592
Voting(35, yearly)	NaN	NaN	-0.1346	-0.6255	NaN	NaN	1.2616	0.019	0.1838	1.0495	-0.0246
Voting(40, yearly)	NaN	NaN	-0.3161	-0.3128	-1.9072	NaN	0.7269	0.7069	NaN	1.1291	-0.2946
Voting(45, yearly)	NaN	NaN	-0.0521	-0.4459	-1.9072	NaN	0.5525	0.866	NaN	1.0495	-0.3340
Voting(50, yearly)	NaN	NaN	-0.1396	-0.5423	-1.9072	NaN	1.1682	0.2471	0.1838	1.0495	-0.3471
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.47	0.39	0.63	0.88	0.58	0.61	0.46	0.52	0.35	0.39	0.53
Voting(10, monthly)	0.39	0.38	0.47	0.79	0.63	0.64	0.43	0.59	0.37	0.46	0.52
Voting(15, monthly)	0.29	0.48	0.65	0.83	0.85	0.66	0.44	0.56	0.4	0.39	0.56
Voting(20, monthly)	0.35	0.49	0.71	0.86	0.88	0.62	0.28	0.54	0.4	0.52	0.56
Voting(25, monthly)	0.35	0.49	0.7	0.89	0.8	0.54	0.19	0.44	0.4	0.42	0.52
Voting(30, monthly)	0.29	0.5	0.69	0.73	0.63	0.62	0.38	0.38	0.41	0.5	0.51
Voting(35, monthly)	0.23	0.5	0.6	0.92	0.65	0.67	0.18	0.33	0.37	0.4	0.49
Voting(40, monthly)	0.32	0.46	0.39	0.9	0.65	0.6	0.19	0.43	0.38	0.36	0.47
Voting(45, monthly)	0.32	0.5	0.39	0.92	0.66	0.62	0.18	0.53	0.37	0.37	0.49
Voting(50, monthly)	0.33	0.48	0.72	0.93	0.69	0.65	0.16	0.53	0.35	0.46	0.53
Voting(5, yearly)	0.33	1	0.44	0.56	0.52	0	0.38	0.4	0.36	0.48	0.45
Voting(10, yearly)	0	0	0.47	0.5	0.45	1	0.39	0.41	0.4	0.38	0.4
Voting(15, yearly)	0.92	1	0.47	0.58	0.33	0.91	0.33	0.47	0.4	0.42	0.58
Voting(20, yearly)	0.92	1	0.47	0.6	0.33	1	0.34	0.36	0	0.31	0.53
Voting(25, yearly)	0.33	1	0.47	0.61	0	0	0.25	0.44	0	0.27	0.34
Voting(30, yearly)	0.33	1	0.46	0.71	0	0	0.25	0.44	0.42	0.33	0.4
Voting(35, yearly)	0	0	0.47	0.85	0	0	0.36	0.59	0.42	0.13	0.28
Voting(40, yearly)	0	0	0.46	0.94	0.55	0	0.23	0.47	0	0.32	0.3
Voting(45, yearly)	0	0	0.46	0.96	0.55	0	0.23	0.54	0	0.13	0.29
Voting(50, yearly)	0	0	0.45	0.98	0.55	0	0.37	0.63	0.42	0.13	0.35

Table B.46: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies (Numbers of Trading)

Voting among Nearest Neighbors Algorithm: Voting(k, period)												
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007	
Voting(5, monthly)	60	93	65	21	56	76	71	54	69	68	63.3	
Voting(10, monthly)	58	92	63	34	46	61	55	63	46	61	57.9	
Voting(15, monthly)	57	82	64	28	44	64	46	57	60	64	56.6	
Voting(20, monthly)	54	83	62	22	38	57	43	57	62	59	53.7	
Voting(25, monthly)	50	77	56	16	50	49	38	50	60	51	49.7	
Voting(30, monthly)	39	72	54	18	54	52	41	46	54	51	48.1	
Voting(35, monthly)	42	65	48	14	56	45	38	44	56	51	45.9	
Voting(40, monthly)	42	65	42	14	58	37	38	39	59	49	44.3	
Voting(45, monthly)	42	63	46	16	52	43	32	31	51	55	43.1	
Voting(50, monthly)	40	61	40	14	46	39	28	25	55	53	40.1	
Voting(5, yearly)	1	0	132	55	12	0	19	84	9	49	36.1	
Voting(10, yearly)	0	0	125	57	1	0	9	79	1	58	33	
Voting(15, yearly)	2	0	128	61	1	1	10	89	1	39	33.2	
Voting(20, yearly)	2	0	130	67	1	0	9	58	0	23	29	
Voting(25, yearly)	1	0	132	65	0	0	8	36	0	19	26.1	
Voting(30, yearly)	1	0	140	47	0	0	8	25	1	5	22.7	
Voting(35, yearly)	0	0	137	39	0	0	5	20	1	2	20.4	
Voting(40, yearly)	0	0	137	14	1	0	6	30	0	4	19.2	
Voting(45, yearly)	0	0	139	10	1	0	6	22	0	2	18	
Voting(50, yearly)	0	0	143	2	1	0	5	16	1	2	17	

Voting among Nearest Neighbors Algorithm with Trading Volume (m, l) = (1:1) : Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.0592	-0.0385	0.013	0.0229	-0.0987	-0.0562	-0.0098	0.0469	0.1191	0.0152	0.0056
Voting(10, monthly)	0.0309	0.0178	-0.0001	0.0107	-0.1202	-0.0988	0.0333	0.0043	0.145	-0.0493	-0.0051
Voting(15, monthly)	0.1006	0.1735	-0.0436	0.0891	-0.0963	-0.0529	0.0554	0.0136	0.1555	-0.0338	0.0324
Voting(20, monthly)	-0.0831	0.0454	-0.0998	0.0237	-0.0234	-0.0864	0.0672	-0.0176	0.1053	-0.0085	-0.0099
Voting(25, monthly)	0.0741	-0.008	-0.0074	-0.0291	-0.1053	-0.012	0.0625	-0.0221	0.0784	-0.0122	0.0005
Voting(30, monthly)	0.1245	0.0416	-0.0352	0.0127	-0.0041	0.0027	0.0603	-0.0274	0.0982	-0.0435	0.0216
Voting(35, monthly)	0.096	0.0491	0.0664	-0.051	-0.0144	0.0165	0.0738	-0.0218	0.094	-0.0406	0.0254
Voting(40, monthly)	-0.0055	0.0631	0.0272	-0.0063	-0.0659	0.0139	0.0622	-0.0067	0.0882	-0.0524	0.0107
Voting(45, monthly)	0.0117	0.1125	0.0248	0.0351	-0.0382	0.0139	0.0888	-0.0259	0.1053	0.0069	0.0323
Voting(50, monthly)	0.0622	0.0254	0.0012	0.047	-0.0403	-0.0449	0.0886	-0.0265	0.1207	0.0071	0.0227
Voting(5, yearly)	0	0.0775	-0.0598	-0.1043	-0.2089	0.1346	0.0096	-0.0429	0.0817	-0.0017	-0.0161
Voting(10, yearly)	0	0.0471	0.031	-0.0538	-0.2043	0.1138	0.0546	-0.0308	0.0932	-0.0006	0.0011
Voting(15, yearly)	0	0.0699	0.0664	-0.0362	-0.2043	0.1435	0.0223	0.0149	0.0812	0.0486	0.0164
Voting(20, yearly)	0	0.1057	-0.1437	-0.0503	-0.2044	0.1724	0.0546	-0.0031	0.102	0.023	-0.0006
Voting(25, yearly)	0	0.1634	-0.1022	-0.0441	-0.191	0.1484	0.0119	0.0085	0.1246	0.0364	0.0099
Voting(30, yearly)	0	0.1145	-0.0616	-0.05	-0.1671	0.1003	0.0567	0.0321	0.1137	0.0396	0.014
Voting(35, yearly)	0	0.0705	-0.0178	-0.0712	-0.2125	0.1481	0.0684	0.0146	0.0469	0.0446	0.0046
Voting(40, yearly)	0	0.2506	-0.0539	-0.0287	-0.1652	0.197	0.0352	0.0068	0.0397	0.0289	0.025
Voting(45, yearly)	0	0.1655	-0.11	0.0064	-0.2085	0.1205	0.0457	0.0225	0.0482	0.0359	0.0073
Voting(50, yearly)	0	0	-0.0611	0.0078	-0.2016	0.1442	0.0537	0.0152	0.0362	0.041	-0.0002
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1318	0.1198	0.1508	0.154	0.185	0.1296	0.0798	0.0745	0.0766	0.0894	0.1245
Voting(10, monthly)	0.1467	0.1146	0.1494	0.1618	0.1811	0.129	0.0827	0.0732	0.0836	0.0996	0.1272
Voting(15, monthly)	0.1253	0.1176	0.1426	0.1702	0.1819	0.1253	0.0822	0.0709	0.0786	0.0984	0.1246
Voting(20, monthly)	0.1228	0.122	0.1647	0.1717	0.1777	0.1322	0.0838	0.07	0.0809	0.0945	0.1277
Voting(25, monthly)	0.13	0.1206	0.1495	0.1618	0.1833	0.1312	0.0836	0.0713	0.0835	0.0898	0.1256
Voting(30, monthly)	0.1349	0.1178	0.1417	0.1627	0.1901	0.1305	0.0819	0.071	0.0839	0.0973	0.1265
Voting(35, monthly)	0.1302	0.1198	0.1468	0.1545	0.1929	0.1297	0.0783	0.0701	0.0822	0.1019	0.1261
Voting(40, monthly)	0.121	0.1163	0.1529	0.1531	0.1813	0.1303	0.0808	0.0703	0.0833	0.0939	0.1233
Voting(45, monthly)	0.1193	0.1195	0.152	0.1545	0.1729	0.1301	0.0754	0.0745	0.0793	0.0987	0.1223
Voting(50, monthly)	0.1163	0.1197	0.153	0.1541	0.1674	0.131	0.0752	0.0748	0.0784	0.0981	0.1213
Voting(5, yearly)	0	0.1191	0.1656	0.1577	0.1667	0.1265	0.0596	0.0633	0.0753	0.0568	0.1126
Voting(10, yearly)	0	0.122	0.1633	0.1639	0.1668	0.1239	0.0698	0.0612	0.0775	0.0276	0.1127
Voting(15, yearly)	0	0.1206	0.1616	0.165	0.1668	0.1187	0.0709	0.0655	0.0763	0.0613	0.1135
Voting(20, yearly)	0	0.1233	0.1653	0.1652	0.1668	0.1191	0.0754	0.0647	0.0769	0.0655	0.1149
Voting(25, yearly)	0	0.1267	0.1581	0.1651	0.1644	0.1191	0.0781	0.0644	0.0783	0.0512	0.1134
Voting(30, yearly)	0	0.1232	0.1626	0.1654	0.1678	0.1197	0.0742	0.0643	0.0788	0.0741	0.1152
Voting(35, yearly)	0	0.1249	0.1615	0.1652	0.1727	0.1261	0.0724	0.0663	0.075	0.065	0.1158
Voting(40, yearly)	0	0.1328	0.162	0.1693	0.1663	0.1277	0.0755	0.0653	0.075	0.0772	0.1175
Voting(45, yearly)	0	0.1231	0.1571	0.1723	0.1677	0.1205	0.0768	0.0644	0.0753	0.0731	0.1154
Voting(50, yearly)	0	0	0.1583	0.1733	0.1724	0.1195	0.0756	0.0648	0.0736	0.0739	0.1095
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.47: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Annualized Returns and Annualized Volatilities)

Table B.48: Performance Summary of Voting among Nearest Neighbors Algorithm  
 Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ )  
 (Sharpe Ratios and Proportions of In-the-Market)

Voting among Nearest Neighbors Algorithm with Trading Volume (m, l) = (1:1) : Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.4493	-0.3211	0.0865	0.1484	-0.5334	-0.4334	-0.1228	0.63	1.5547	0.1703	0.0450
Voting(10, monthly)	0.2104	0.1552	-0.001	0.0664	-0.6636	-0.7658	0.4029	0.0586	1.734	-0.4953	-0.0401
Voting(15, monthly)	0.8032	1.4747	-0.3055	0.5235	-0.5294	-0.4224	0.6744	0.1922	1.9772	-0.3439	0.2600
Voting(20, monthly)	-0.6773	0.3721	-0.6059	0.138	-0.1319	-0.6532	0.8023	-0.2519	1.301	-0.09	-0.0775
Voting(25, monthly)	0.5699	-0.0663	-0.0498	-0.1799	-0.5746	-0.0912	0.7475	-0.3096	0.9389	-0.1358	0.0040
Voting(30, monthly)	0.9225	0.3528	-0.2482	0.0784	-0.0217	0.0209	0.7368	-0.3858	1.1702	-0.4471	0.1708
Voting(35, monthly)	0.7369	0.4101	0.4524	-0.33	-0.0749	0.127	0.9422	-0.3113	1.1441	-0.3988	0.2014
Voting(40, monthly)	-0.0457	0.542	0.1782	-0.0413	-0.3633	0.1067	0.7694	-0.0954	1.0596	-0.5583	0.0868
Voting(45, monthly)	0.0985	0.9416	0.1631	0.2272	-0.2208	0.107	1.1776	-0.3477	1.3282	0.0699	0.2641
Voting(50, monthly)	0.5348	0.2122	0.008	0.3048	-0.2406	-0.3429	1.1783	-0.3545	1.5406	0.0729	0.1871
Voting(5, yearly)	NaN	0.6502	-0.361	-0.6609	-1.2529	1.0635	0.1605	-0.6777	1.0853	-0.0295	-0.1430
Voting(10, yearly)	NaN	0.3863	0.19	-0.3281	-1.2249	0.9179	0.7829	-0.5043	1.2036	-0.0212	0.0098
Voting(15, yearly)	NaN	0.5793	0.411	-0.2192	-1.2249	1.2088	0.3144	0.2278	1.0643	0.7931	0.1445
Voting(20, yearly)	NaN	0.8568	-0.8697	-0.3044	-1.2251	1.4475	0.7241	-0.0482	1.3268	0.3503	-0.0052
Voting(25, yearly)	NaN	1.2895	-0.6465	-0.2668	-1.1616	1.246	0.1529	0.1315	1.5908	0.7118	0.0873
Voting(30, yearly)	NaN	0.9297	-0.3791	-0.3026	-0.9957	0.8376	0.7639	0.4988	1.4424	0.5344	0.1215
Voting(35, yearly)	NaN	0.5647	-0.11	-0.4311	-1.2305	1.175	0.9442	0.22	0.6251	0.6863	0.0397
Voting(40, yearly)	NaN	1.887	-0.333	-0.1694	-0.9933	1.5427	0.4657	0.104	0.5286	0.3739	0.2128
Voting(45, yearly)	NaN	1.3445	-0.7002	0.0373	-1.2434	1.0002	0.595	0.3502	0.6398	0.4907	0.0633
Voting(50, yearly)	NaN	NaN	-0.3862	0.0451	-1.1691	1.2061	0.71	0.2349	0.4926	0.5549	-0.0018
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.48	0.43	0.53	0.43	0.56	0.51	0.5	0.5	0.48	0.4	0.48
Voting(10, monthly)	0.42	0.43	0.53	0.55	0.57	0.52	0.52	0.51	0.64	0.44	0.51
Voting(15, monthly)	0.45	0.42	0.5	0.6	0.6	0.5	0.5	0.54	0.51	0.46	0.51
Voting(20, monthly)	0.37	0.45	0.5	0.6	0.58	0.52	0.5	0.52	0.52	0.44	0.5
Voting(25, monthly)	0.38	0.46	0.48	0.55	0.56	0.48	0.5	0.56	0.57	0.43	0.5
Voting(30, monthly)	0.39	0.43	0.47	0.55	0.57	0.51	0.48	0.53	0.56	0.41	0.49
Voting(35, monthly)	0.36	0.46	0.48	0.48	0.58	0.5	0.44	0.53	0.51	0.41	0.48
Voting(40, monthly)	0.32	0.45	0.49	0.43	0.56	0.5	0.46	0.55	0.56	0.39	0.47
Voting(45, monthly)	0.31	0.44	0.51	0.46	0.56	0.49	0.44	0.61	0.54	0.41	0.48
Voting(50, monthly)	0.29	0.44	0.5	0.46	0.55	0.52	0.44	0.62	0.56	0.38	0.47
Voting(5, yearly)	0	0.45	0.5	0.54	0.45	0.53	0.32	0.46	0.47	0.13	0.38
Voting(10, yearly)	0	0.44	0.49	0.55	0.45	0.47	0.42	0.43	0.45	0.03	0.37
Voting(15, yearly)	0	0.47	0.51	0.57	0.45	0.43	0.42	0.48	0.45	0.12	0.39
Voting(20, yearly)	0	0.46	0.52	0.57	0.45	0.4	0.46	0.47	0.46	0.13	0.39
Voting(25, yearly)	0	0.48	0.52	0.56	0.43	0.41	0.45	0.46	0.52	0.1	0.39
Voting(30, yearly)	0	0.46	0.52	0.58	0.49	0.42	0.44	0.47	0.54	0.15	0.41
Voting(35, yearly)	0	0.45	0.48	0.58	0.59	0.42	0.43	0.49	0.49	0.13	0.41
Voting(40, yearly)	0	0.53	0.5	0.59	0.52	0.45	0.44	0.48	0.5	0.17	0.42
Voting(45, yearly)	0	0.47	0.48	0.6	0.54	0.41	0.43	0.47	0.49	0.15	0.41
Voting(50, yearly)	0	0	0.48	0.58	0.58	0.4	0.43	0.48	0.48	0.15	0.36



Voting among Nearest Neighbors Algorithm with Trading Volume (m, l) = (1:1) : Voting(k, period)											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	79	101	123	88	109	110	115	92	91	104	101.2
Voting(10, monthly)	91	102	112	76	103	102	117	86	77	104	97
Voting(15, monthly)	83	98	124	82	115	112	127	104	93	106	104.4
Voting(20, monthly)	82	105	124	86	105	108	131	100	91	114	104.6
Voting(25, monthly)	73	112	116	90	103	104	127	110	89	102	102.6
Voting(30, monthly)	81	116	118	82	111	106	115	116	89	98	103.2
Voting(35, monthly)	83	118	124	84	109	112	103	112	87	112	104.4
Voting(40, monthly)	81	108	120	81	114	110	105	102	89	112	102.2
Voting(45, monthly)	79	114	124	93	110	116	105	100	103	112	105.6
Voting(50, monthly)	79	120	118	97	108	112	105	98	101	114	105.2
Voting(5, yearly)	0	93	90	115	110	58	53	109	66	12	70.6
Voting(10, yearly)	0	91	104	112	111	62	100	108	70	8	76.6
Voting(15, yearly)	0	101	116	116	111	72	98	106	80	10	81
Voting(20, yearly)	0	101	98	116	109	72	108	102	82	14	80.2
Voting(25, yearly)	0	101	102	116	103	80	102	108	92	18	82.2
Voting(30, yearly)	0	95	110	112	69	78	110	110	90	12	78.6
Voting(35, yearly)	0	87	114	110	36	89	108	120	94	12	77
Voting(40, yearly)	0	73	118	108	38	91	102	120	100	14	76.4
Voting(45, yearly)	0	59	116	112	63	88	100	114	102	12	76.6
Voting(50, yearly)	0	0	121	110	71	90	106	116	104	12	73

Table B.49: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) (Numbers of Trading)

Voting among Nearest Neighbors Algorithm with Trading Volume (m, l) = (2:1) : Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.0176	0.0364	-0.2633	-0.0257	-0.139	0.1763	-0.0326	0.0447	0.0444	-0.0419	-0.0251
Voting(10, monthly)	0.0194	0.0194	-0.3115	-0.0639	-0.0723	0.1089	0.0261	0.0536	0.0427	-0.0854	-0.0336
Voting(15, monthly)	-0.0019	0.0283	-0.2751	-0.037	-0.1592	0.1629	0.0366	0.0512	0.0232	-0.0254	-0.0269
Voting(20, monthly)	-0.0346	-0.0146	-0.2961	0.0382	-0.2369	0.2438	-0.0286	0.0968	0.0305	-0.0552	-0.0372
Voting(25, monthly)	0.0091	-0.0856	-0.3253	-0.0809	-0.2058	0.2737	-0.0423	0.111	0.0515	-0.0306	-0.0455
Voting(30, monthly)	0.0811	-0.0498	-0.3235	-0.0113	-0.3012	0.1765	-0.021	0.0633	0.0637	-0.0226	-0.048
Voting(35, monthly)	0.1264	0.0093	-0.3125	0.0992	-0.1518	0.2068	-0.0044	0.0859	0.0933	0.0637	0.0101
Voting(40, monthly)	0.1601	0.0165	-0.209	0.0627	-0.1957	0.1532	0.0272	0.084	0.0855	0.0567	0.0162
Voting(45, monthly)	0.1405	-0.022	-0.219	-0.0546	-0.2161	0.1527	0.0286	0.0488	0.0679	0.0001	-0.0153
Voting(50, monthly)	0.0692	-0.0303	-0.2248	-0.0192	-0.1494	0.0973	0.0235	0.0405	0.0856	-0.0197	-0.018
Voting(5, yearly)	0	0.0102	-0.0457	-0.0275	-0.1192	0.1913	0.0825	-0.0637	0.1469	0.026	0.0161
Voting(10, yearly)	0	-0.0056	-0.0494	-0.02	-0.2494	0.1728	0.0006	-0.0744	0.1469	0.0434	-0.0101
Voting(15, yearly)	0.2667	-0.0094	0.0398	-0.0659	-0.2217	0.1102	0.0018	-0.059	0.1322	0.0566	0.0173
Voting(20, yearly)	0.2667	0.0523	-0.0317	-0.0368	-0.2803	0.2035	0.0278	-0.046	0.1481	0.0928	0.0285
Voting(25, yearly)	0.2667	-0.041	-0.001	-0.0067	-0.2517	0.1188	0.0229	-0.0499	0.1634	0.0638	0.0196
Voting(30, yearly)	0.2667	0.0026	-0.0453	-0.0819	-0.2286	0.2098	0.0309	-0.0417	0.1668	0.0795	0.026
Voting(35, yearly)	0.2667	-0.0179	-0.0176	-0.0617	-0.1996	0.2379	0.049	-0.0447	0.1811	0.0655	0.0366
Voting(40, yearly)	0	-0.045	-0.0464	-0.056	-0.2417	0.2181	0.0371	0.0009	0.1757	0.0814	0.0047
Voting(45, yearly)	0	-0.0394	-0.0958	-0.0493	-0.2586	0.2359	0.0491	-0.0329	0.1926	0.0292	-0.0059
Voting(50, yearly)	0	-0.0611	-0.1002	-0.0417	-0.2474	0.2221	0.0162	-0.0283	0.1809	0.0718	-0.0072
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1467	0.1157	0.1473	0.1454	0.1973	0.1058	0.0682	0.0746	0.0811	0.1061	0.1249
Voting(10, monthly)	0.1522	0.1185	0.1593	0.1452	0.1972	0.1081	0.0694	0.0742	0.0783	0.1192	0.1284
Voting(15, monthly)	0.1497	0.1292	0.1621	0.1441	0.1887	0.1068	0.0682	0.0685	0.069	0.1079	0.1261
Voting(20, monthly)	0.1586	0.1246	0.167	0.1435	0.185	0.1085	0.0673	0.0697	0.0697	0.1151	0.1275
Voting(25, monthly)	0.1564	0.1178	0.1551	0.1757	0.1808	0.1165	0.0661	0.0677	0.0698	0.1159	0.1291
Voting(30, monthly)	0.1625	0.115	0.1627	0.1605	0.1894	0.1131	0.0672	0.071	0.0716	0.1127	0.1296
Voting(35, monthly)	0.1621	0.1152	0.1566	0.1376	0.1964	0.1117	0.0674	0.0699	0.0738	0.1073	0.1267
Voting(40, monthly)	0.1637	0.1153	0.1626	0.1308	0.1911	0.1109	0.0702	0.0717	0.0739	0.1022	0.1259
Voting(45, monthly)	0.1634	0.1142	0.1567	0.1571	0.1913	0.1143	0.0695	0.0733	0.0726	0.1079	0.1287
Voting(50, monthly)	0.1595	0.1115	0.1527	0.159	0.1944	0.1106	0.0683	0.0699	0.0737	0.1113	0.128
Voting(5, yearly)	0	0.1267	0.162	0.1751	0.1926	0.1326	0.0686	0.0647	0.07	0.1196	0.1248
Voting(10, yearly)	0	0.1257	0.1382	0.1744	0.2049	0.1322	0.0706	0.0649	0.07	0.1228	0.1241
Voting(15, yearly)	0.2031	0.1249	0.1503	0.1747	0.2008	0.1289	0.0668	0.0663	0.0692	0.1152	0.1392
Voting(20, yearly)	0.2031	0.1294	0.1447	0.1742	0.1972	0.1333	0.069	0.0638	0.0666	0.1105	0.1384
Voting(25, yearly)	0.2031	0.1256	0.1478	0.1717	0.1976	0.1275	0.0718	0.0643	0.0656	0.1105	0.1377
Voting(30, yearly)	0.2031	0.1288	0.1466	0.1768	0.1956	0.1281	0.0787	0.0639	0.066	0.1161	0.1391
Voting(35, yearly)	0.2031	0.1305	0.1411	0.178	0.1902	0.1276	0.0774	0.0645	0.0674	0.108	0.1374
Voting(40, yearly)	0	0.1326	0.1425	0.1779	0.1926	0.1286	0.0775	0.0639	0.0682	0.1154	0.123
Voting(45, yearly)	0	0.1315	0.1362	0.178	0.1916	0.132	0.077	0.0668	0.0692	0.1127	0.1223
Voting(50, yearly)	0	0.1328	0.1366	0.1784	0.1899	0.1329	0.0783	0.0666	0.0672	0.1148	0.1225
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.50: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Annualized Returns and Annualized Volatilities)

Table B.51: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Sharpe Ratios and Proportions of In-the-Market)

Voting among Nearest Neighbors Algorithm with Trading Volume (m, l) = (2:1) : Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1202	0.3148	-1.7881	-0.177	-0.7043	1.6669	-0.478	0.5987	0.5477	-0.3952	-0.2010
Voting(10, monthly)	0.1277	0.1637	-1.9552	-0.4402	-0.3667	1.0071	0.3765	0.7226	0.546	-0.7165	-0.2617
Voting(15, monthly)	-0.0129	0.2188	-1.6976	-0.2569	-0.8438	1.5261	0.5364	0.7481	0.3363	-0.2358	-0.2133
Voting(20, monthly)	-0.218	-0.1174	-1.7737	0.2663	-1.2806	2.2465	-0.4251	1.3889	0.4372	-0.4791	-0.2918
Voting(25, monthly)	0.0583	-0.7269	-2.0971	-0.4604	-1.1387	2.3493	-0.6398	1.6402	0.7378	-0.2641	-0.3524
Voting(30, monthly)	0.4988	-0.4332	-1.9878	-0.0702	-1.5897	1.5606	-0.3118	0.8913	0.8895	-0.2001	-0.3704
Voting(35, monthly)	0.7797	0.0809	-1.995	0.7211	-0.7728	1.8512	-0.0656	1.229	1.264	0.5932	0.0797
Voting(40, monthly)	0.9775	0.1429	-1.2856	0.4795	-1.0243	1.3817	0.3876	1.1715	1.1568	0.5544	0.1287
Voting(45, monthly)	0.8597	-0.1928	-1.3977	-0.3474	-1.1299	1.3365	0.4117	0.6655	0.9351	0.0011	-0.1189
Voting(50, monthly)	0.434	-0.2714	-1.4723	-0.1206	-0.7682	0.8795	0.3439	0.5795	1.1606	-0.1775	-0.1406
Voting(5, yearly)	NaN	0.0804	-0.2819	-0.1572	-0.6188	1.4429	1.2032	-0.9848	2.099	0.2171	0.1290
Voting(10, yearly)	NaN	-0.0443	-0.3576	-0.1144	-1.217	1.3072	0.0079	-1.1458	2.099	0.3529	-0.0814
Voting(15, yearly)	1.3129	-0.0753	0.2646	-0.377	-1.1042	0.8545	0.0266	-0.8894	1.9103	0.4914	0.1243
Voting(20, yearly)	1.3129	0.4042	-0.2191	-0.2115	-1.4211	1.5268	0.4035	-0.7207	2.2232	0.8401	0.2059
Voting(25, yearly)	1.3129	-0.3267	-0.0067	-0.039	-1.2734	0.9315	0.3194	-0.7751	2.4891	0.5773	0.1423
Voting(30, yearly)	1.3129	0.0202	-0.3093	-0.4632	-1.1686	1.6373	0.3929	-0.653	2.5291	0.6849	0.1869
Voting(35, yearly)	1.3129	-0.1373	-0.1249	-0.3465	-1.0492	1.8644	0.6332	-0.6938	2.6878	0.6065	0.2664
Voting(40, yearly)	NaN	-0.3394	-0.3254	-0.3147	-1.2548	1.6951	0.4788	0.0135	2.5739	0.7049	0.0382
Voting(45, yearly)	NaN	-0.3	-0.7035	-0.277	-1.3494	1.7872	0.6378	-0.4921	2.7845	0.2589	-0.0482
Voting(50, yearly)	NaN	-0.4596	-0.7334	-0.234	-1.3029	1.671	0.2067	-0.4251	2.691	0.625	-0.0588
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.47	0.39	0.46	0.52	0.56	0.48	0.4	0.47	0.57	0.4	0.47
Voting(10, monthly)	0.59	0.43	0.48	0.5	0.53	0.46	0.44	0.48	0.54	0.47	0.49
Voting(15, monthly)	0.56	0.46	0.52	0.5	0.54	0.45	0.44	0.45	0.5	0.46	0.49
Voting(20, monthly)	0.59	0.45	0.52	0.48	0.54	0.48	0.42	0.48	0.5	0.5	0.5
Voting(25, monthly)	0.55	0.43	0.47	0.53	0.51	0.52	0.41	0.48	0.51	0.49	0.49
Voting(30, monthly)	0.61	0.44	0.49	0.48	0.53	0.48	0.44	0.51	0.51	0.49	0.5
Voting(35, monthly)	0.62	0.44	0.48	0.42	0.52	0.49	0.44	0.48	0.5	0.49	0.49
Voting(40, monthly)	0.63	0.45	0.49	0.41	0.59	0.51	0.45	0.51	0.52	0.48	0.5
Voting(45, monthly)	0.64	0.45	0.48	0.49	0.58	0.5	0.46	0.52	0.51	0.49	0.51
Voting(50, monthly)	0.58	0.43	0.45	0.49	0.6	0.48	0.43	0.52	0.5	0.52	0.5
Voting(5, yearly)	0	0.49	0.51	0.66	0.51	0.52	0.4	0.46	0.47	0.5	0.45
Voting(10, yearly)	0	0.49	0.48	0.6	0.58	0.54	0.4	0.47	0.47	0.52	0.45
Voting(15, yearly)	1	0.48	0.49	0.62	0.57	0.54	0.36	0.48	0.45	0.49	0.55
Voting(20, yearly)	1	0.45	0.49	0.62	0.54	0.55	0.4	0.45	0.43	0.48	0.54
Voting(25, yearly)	1	0.49	0.48	0.59	0.56	0.53	0.4	0.46	0.42	0.5	0.54
Voting(30, yearly)	1	0.49	0.48	0.6	0.54	0.54	0.44	0.45	0.44	0.51	0.55
Voting(35, yearly)	1	0.49	0.48	0.62	0.55	0.54	0.44	0.47	0.44	0.49	0.55
Voting(40, yearly)	0	0.5	0.49	0.62	0.57	0.54	0.44	0.46	0.45	0.49	0.46
Voting(45, yearly)	0	0.5	0.45	0.62	0.56	0.54	0.44	0.46	0.46	0.5	0.46
Voting(50, yearly)	0	0.5	0.45	0.63	0.56	0.54	0.45	0.48	0.45	0.51	0.46

Voting among Nearest Neighbors Algorithm with Trading Volume (m, l) = (2:1) : Voting(k, period)											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	102	96	92	95	93	91	115	93	99	101	97.7
Voting(10, monthly)	84	109	107	103	95	89	105	101	95	115	100.3
Voting(15, monthly)	86	108	107	114	91	93	111	100	110	124	104.4
Voting(20, monthly)	88	106	105	112	101	117	113	94	102	124	106.2
Voting(25, monthly)	88	110	103	106	95	117	115	102	108	132	107.6
Voting(30, monthly)	88	100	105	102	89	117	121	106	110	130	106.8
Voting(35, monthly)	84	96	105	98	93	121	117	108	114	126	106.2
Voting(40, monthly)	90	100	109	98	93	121	119	110	116	118	107.4
Voting(45, monthly)	88	94	111	96	101	115	119	116	114	130	108.4
Voting(50, monthly)	86	102	107	94	101	119	121	116	114	122	108.2
Voting(5, yearly)	0	97	104	68	74	111	57	87	114	105	81.7
Voting(10, yearly)	0	95	126	78	80	107	101	85	114	115	90.1
Voting(15, yearly)	0	96	120	82	93	104	99	87	110	117	90.8
Voting(20, yearly)	0	98	124	84	90	103	102	90	108	111	91
Voting(25, yearly)	0	108	126	92	99	100	112	92	110	113	95.2
Voting(30, yearly)	0	108	124	94	100	99	124	92	110	123	97.4
Voting(35, yearly)	0	108	132	94	94	96	119	96	110	125	97.4
Voting(40, yearly)	0	107	122	94	84	96	125	96	112	121	95.7
Voting(45, yearly)	0	111	116	98	74	98	127	98	112	119	95.3
Voting(50, yearly)	0	105	112	98	80	98	137	98	112	125	96.5

Table B.52: Performance Summary of Voting among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) (Numbers of Trading)

Voting among All Strategies : Voting(k, period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1424	0.0689	-0.2431	0.0112	-0.0768	0.0751	0.0666	0.0614	0.097	0.0523	0.0194
Voting(10, monthly)	0.0342	0.1146	-0.1369	-0.0149	-0.1102	0.0764	0.0264	0.0232	0.039	0.0408	0.0064
Voting(15, monthly)	-0.0598	0.2426	-0.1812	-0.0665	-0.1583	0.0882	0.0115	0.0354	0.0743	0.0559	-0.0029
Voting(20, monthly)	-0.1112	0.2365	-0.2801	-0.0082	-0.1544	0.0669	0.0291	-0.006	0.0859	0.0141	-0.0224
Voting(25, monthly)	-0.0857	0.2292	-0.3351	0.0035	-0.1737	-0.0733	0.0076	-0.0344	0.0909	-0.0123	-0.0495
Voting(30, monthly)	0.0344	0.1649	-0.2379	-0.0534	-0.2477	-0.048	-0.0216	0.0003	0.0707	0.0366	-0.0384
Voting(35, monthly)	0.0137	0.1526	-0.1996	0.0146	-0.2657	0.0326	0.0212	0.0552	0.0197	0.0583	-0.0177
Voting(40, monthly)	0.1674	0.2049	-0.2369	-0.0232	-0.1242	0.0152	0.0197	0.0419	-0.0055	0.11	0.009
Voting(45, monthly)	0.2011	0.1794	-0.1783	-0.0378	-0.1606	0.0204	0.0054	0.0184	-0.01	0.0453	0.0016
Voting(50, monthly)	0.0922	0.1539	-0.1167	0.037	-0.1891	0.0674	-0.012	0.0304	-0.0146	0.046	0.0048
Voting(5, yearly)	0.2152	0.0128	-0.0869	-0.0562	-0.2043	0.0167	0.0687	-0.0599	0.1363	0.2006	0.0163
Voting(10, yearly)	0.1925	0.0707	-0.0796	-0.0432	-0.2043	0.0145	0.0695	-0.0905	0.1406	0.2363	0.0222
Voting(15, yearly)	0.2334	0.0742	-0.0435	-0.043	-0.2276	0.0145	0.0572	-0.0821	0.1416	0.1928	0.023
Voting(20, yearly)	0.1757	0	-0.0644	-0.0392	-0.1995	0.0145	0.0353	-0.0803	0.1284	0.2001	0.0102
Voting(25, yearly)	0.1812	0.1953	-0.0464	-0.0615	-0.2057	0.0107	0.0534	-0.0616	0.1538	0.158	0.0297
Voting(30, yearly)	0.205	0.041	-0.0385	-0.0982	-0.1334	0.116	0.0397	-0.0727	0.1355	0.2011	0.033
Voting(35, yearly)	0.1733	0.0641	-0.0417	-0.0636	-0.1746	0.1048	0.034	-0.0609	0.1332	0.1743	0.0282
Voting(40, yearly)	0.1733	0.0555	-0.0316	-0.082	-0.146	0.0525	0.0497	-0.0676	0.1588	0.1892	0.0293
Voting(45, yearly)	0.2087	-0.0238	-0.0267	-0.0796	-0.1422	0.0406	0.0576	-0.0675	0.1448	0.1943	0.0244
Voting(50, yearly)	0.223	0.0008	-0.0549	-0.0742	-0.1806	0.1114	0.0624	-0.0444	0.1759	0.1962	0.0337
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.1445	0.1255	0.1401	0.1429	0.2068	0.1091	0.0787	0.0732	0.0777	0.1084	0.1268
Voting(10, monthly)	0.1308	0.1241	0.1431	0.1353	0.2077	0.1214	0.0759	0.075	0.0763	0.1056	0.1255
Voting(15, monthly)	0.1406	0.1288	0.1377	0.1443	0.2212	0.1205	0.0751	0.0728	0.0762	0.1044	0.1293
Voting(20, monthly)	0.1434	0.1277	0.1586	0.1467	0.2023	0.1212	0.0787	0.075	0.0769	0.108	0.1298
Voting(25, monthly)	0.1443	0.1367	0.1665	0.145	0.2084	0.1163	0.0772	0.0747	0.0783	0.1037	0.1318
Voting(30, monthly)	0.1383	0.1313	0.1405	0.1291	0.2074	0.1177	0.0731	0.0751	0.0773	0.1035	0.1254
Voting(35, monthly)	0.1393	0.1303	0.1386	0.1366	0.2013	0.1151	0.0667	0.0735	0.0771	0.1071	0.1246
Voting(40, monthly)	0.1572	0.1335	0.1417	0.131	0.1988	0.1145	0.0672	0.074	0.0786	0.0985	0.1258
Voting(45, monthly)	0.1548	0.1272	0.1351	0.1344	0.2016	0.1139	0.0706	0.0708	0.079	0.102	0.1252
Voting(50, monthly)	0.1537	0.1268	0.1456	0.1433	0.1895	0.1152	0.0688	0.0719	0.0772	0.1031	0.1254
Voting(5, yearly)	0.1211	0.1028	0.1202	0.1826	0.1668	0.1094	0.0776	0.0618	0.0697	0.1097	0.1181
Voting(10, yearly)	0.123	0.0616	0.1254	0.1753	0.1668	0.1093	0.0771	0.0668	0.0698	0.1077	0.1149
Voting(15, yearly)	0.125	0.0866	0.1275	0.1734	0.1674	0.1093	0.0802	0.0677	0.0699	0.1137	0.1176
Voting(20, yearly)	0.1238	0	0.1249	0.1736	0.1755	0.1093	0.0747	0.0687	0.0693	0.1173	0.1152
Voting(25, yearly)	0.1249	0.1808	0.126	0.1685	0.1743	0.1094	0.0768	0.0654	0.0667	0.1186	0.1279
Voting(30, yearly)	0.1245	0.1302	0.1276	0.171	0.1751	0.1159	0.0775	0.0648	0.0691	0.119	0.123
Voting(35, yearly)	0.1234	0.101	0.1267	0.17	0.1832	0.119	0.0777	0.0649	0.069	0.1173	0.1212
Voting(40, yearly)	0.1234	0.124	0.1263	0.1721	0.1833	0.1217	0.0793	0.0649	0.0689	0.1179	0.124
Voting(45, yearly)	0.1227	0.1025	0.1228	0.1749	0.1841	0.1242	0.08	0.0664	0.0697	0.1178	0.1225
Voting(50, yearly)	0.1202	0.1109	0.1235	0.1773	0.1848	0.1277	0.0799	0.066	0.0716	0.1162	0.1238
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802

Table B.53: Performance Summary of Voting among All Strategies  
(Annualized Returns and Annualized Volatilities)

Voting among All Strategies : Voting(k, period)											
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.9854	0.5489	-1.735	0.0786	-0.3714	0.6882	0.8463	0.8382	1.2476	0.482	0.1530
Voting(10, monthly)	0.2618	0.9233	-0.9568	-0.11	-0.5306	0.6289	0.3479	0.309	0.5118	0.3867	0.0510
Voting(15, monthly)	-0.4255	1.8839	-1.3166	-0.4607	-0.7157	0.732	0.1532	0.4858	0.9751	0.5353	-0.0224
Voting(20, monthly)	-0.7753	1.8524	-1.7661	-0.0556	-0.7635	0.5522	0.3703	-0.0804	1.1179	0.1302	-0.1726
Voting(25, monthly)	-0.5941	1.6771	-2.0129	0.024	-0.8335	-0.6298	0.0978	-0.4603	1.1613	-0.1182	-0.3756
Voting(30, monthly)	0.2489	1.2557	-1.6933	-0.4138	-1.1946	-0.4083	-0.2947	0.0037	0.9149	0.3535	-0.3062
Voting(35, monthly)	0.0982	1.171	-1.4406	0.1065	-1.3197	0.2833	0.3183	0.7516	0.2552	0.5437	-0.1421
Voting(40, monthly)	1.0649	1.5348	-1.6721	-0.1771	-0.625	0.1329	0.2937	0.5668	-0.0704	1.1161	0.0715
Voting(45, monthly)	1.2988	1.4106	-1.3196	-0.2813	-0.7966	0.1792	0.0764	-0.2598	-0.1268	0.4444	0.0128
Voting(50, monthly)	0.6	1.213	-0.8013	0.2578	-0.9977	0.5851	-0.1742	0.4229	-0.1886	0.4462	0.0383
Voting(5, yearly)	1.7773	0.1245	-0.7224	-0.308	-1.2249	0.1525	0.8852	-0.9695	1.9548	1.8279	0.1380
Voting(10, yearly)	1.5657	1.1483	-0.6346	-0.2462	-1.2249	0.1325	0.9015	-1.3552	2.0154	2.1928	0.1932
Voting(15, yearly)	1.8671	0.8567	-0.3408	-0.248	-1.359	0.1325	0.714	-1.2128	2.0249	1.6953	0.1956
Voting(20, yearly)	1.4189	NaN	-0.5152	-0.2259	-1.1369	0.1325	0.4727	-1.1684	1.8534	1.7055	0.0885
Voting(25, yearly)	1.4502	1.0802	-0.3683	-0.3646	-1.1802	0.0981	0.6955	-0.9428	2.3075	1.332	0.2322
Voting(30, yearly)	1.6459	0.3151	-0.302	-0.5742	-0.7614	1.0007	0.5119	-1.1228	1.9623	1.6902	0.2683
Voting(35, yearly)	1.4036	0.6344	-0.329	-0.3741	-0.9534	0.8806	0.4382	-0.9382	1.9298	1.4861	0.2327
Voting(40, yearly)	1.4036	0.4478	-0.2501	-0.4767	-0.7967	0.4314	0.6271	-1.0418	2.3049	1.6044	0.2363
Voting(45, yearly)	1.7015	-0.2321	-0.2179	-0.455	-0.7724	0.3269	0.7201	-1.0169	2.0753	1.6488	0.1992
Voting(50, yearly)	1.855	0.0069	-0.4445	-0.4186	-0.9773	0.8726	0.7812	-0.6722	2.4565	1.6882	0.2722
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	0.46	0.51	0.49	0.47	0.6	0.44	0.44	0.49	0.45	0.49	0.48
Voting(10, monthly)	0.45	0.48	0.47	0.45	0.61	0.53	0.42	0.51	0.47	0.48	0.49
Voting(15, monthly)	0.44	0.49	0.5	0.49	0.64	0.51	0.43	0.49	0.5	0.45	0.49
Voting(20, monthly)	0.46	0.51	0.51	0.51	0.56	0.52	0.45	0.49	0.52	0.46	0.5
Voting(25, monthly)	0.49	0.57	0.52	0.5	0.55	0.5	0.45	0.51	0.5	0.44	0.5
Voting(30, monthly)	0.48	0.53	0.47	0.46	0.57	0.51	0.44	0.48	0.5	0.46	0.49
Voting(35, monthly)	0.49	0.54	0.45	0.47	0.56	0.48	0.41	0.5	0.52	0.49	0.49
Voting(40, monthly)	0.53	0.56	0.47	0.48	0.56	0.47	0.43	0.49	0.51	0.45	0.5
Voting(45, monthly)	0.54	0.52	0.45	0.5	0.59	0.46	0.44	0.48	0.52	0.43	0.49
Voting(50, monthly)	0.5	0.51	0.48	0.52	0.56	0.48	0.4	0.49	0.52	0.46	0.49
Voting(5, yearly)	0.48	0.42	0.44	0.67	0.45	0.51	0.52	0.45	0.46	0.46	0.49
Voting(10, yearly)	0.48	0.21	0.47	0.62	0.45	0.51	0.54	0.48	0.46	0.49	0.47
Voting(15, yearly)	0.5	0.3	0.47	0.6	0.46	0.51	0.54	0.44	0.47	0.46	0.48
Voting(20, yearly)	0.48	0	0.46	0.6	0.48	0.51	0.5	0.45	0.45	0.51	0.44
Voting(25, yearly)	0.5	1	0.46	0.6	0.46	0.5	0.5	0.46	0.44	0.48	0.54
Voting(30, yearly)	0.49	0.62	0.46	0.59	0.48	0.49	0.5	0.44	0.44	0.51	0.5
Voting(35, yearly)	0.49	0.46	0.46	0.58	0.49	0.51	0.51	0.44	0.43	0.48	0.49
Voting(40, yearly)	0.49	0.6	0.45	0.59	0.48	0.53	0.52	0.45	0.43	0.48	0.5
Voting(45, yearly)	0.48	0.44	0.45	0.62	0.51	0.54	0.54	0.46	0.43	0.48	0.5
Voting(50, yearly)	0.47	0.46	0.46	0.62	0.53	0.53	0.54	0.44	0.46	0.48	0.5

Table B.54: Performance Summary of Voting among All Strategies (Sharpe Ratios and Proportions of In-the-Market)

Table B.55: Performance Summary of Voting among All Strategies  
(Numbers of Trading)

Voting among All Strategies : Voting(k, period)											
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Voting(5, monthly)	111	94	124	98	95	112	103	96	120	107	106
Voting(10, monthly)	111	96	110	96	101	115	119	116	125	107	109.6
Voting(15, monthly)	109	94	116	104	93	105	127	122	133	107	111
Voting(20, monthly)	107	96	120	108	99	101	133	122	131	105	112.2
Voting(25, monthly)	120	109	106	116	101	108	130	118	125	105	113.8
Voting(30, monthly)	120	113	104	120	113	104	122	124	119	104	114.3
Voting(35, monthly)	116	107	106	122	113	112	118	118	121	101	113.4
Voting(40, monthly)	114	115	121	119	109	108	124	122	119	117	116.8
Voting(45, monthly)	112	119	125	111	105	108	122	118	121	117	115.8
Voting(50, monthly)	112	115	111	113	111	120	128	128	119	125	118.2
Voting(5, yearly)	132	22	131	66	111	139	132	81	112	44	97
Voting(10, yearly)	128	7	128	74	111	139	130	81	114	109	102.1
Voting(15, yearly)	127	6	128	82	113	139	130	107	114	59	100.5
Voting(20, yearly)	128	0	127	82	115	139	128	113	114	95	104.1
Voting(25, yearly)	127	0	130	88	117	130	127	115	110	99	104.3
Voting(30, yearly)	128	4	136	96	117	124	131	125	112	123	109.6
Voting(35, yearly)	128	8	132	96	117	116	127	121	110	111	106.6
Voting(40, yearly)	128	20	132	92	119	106	123	123	112	113	106.8
Voting(45, yearly)	127	19	137	92	117	112	119	119	110	107	105.9
Voting(50, yearly)	127	31	131	96	117	108	119	123	112	103	106.7

### **B.3 Performances of Best Performer Selection Strategy in Combination with Individual Strategies**



Table B.56: Performance Summary of Best Performer Selection among Moving Average Convergence and Divergence Strategies

	Best Performer Selection with Moving Average Convergence Divergence:						Best Performer Selection(period)				
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.2488	0.1514	-0.0223	-0.1083	-0.0437	0.2086	0.0587	-0.0724	0.0868	-0.0043	0.0441
Best Perf. Select.(yearly)	0.2667	0.1953	-0.047	0	0	0	0.0899	-0.0201	0.1362	0.0353	0.0613
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1353	0.1613	0.1884	0.0787	0.1012	0.1383	0.0857	0.0713	0.0791	0.1087	0.1208
Best Perf. Select.(yearly)	0.2031	0.1808	0.2025	0	0	0	0.1109	0.0956	0.1004	0.1596	0.1311
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	1.8391	0.9388	-0.1183	-1.3766	-0.4315	1.5086	0.6855	-1.0157	1.0962	-0.0394	0.3652
Best Perf. Select.(yearly)	1.3129	1.0802	-0.2323	NaN	NaN	NaN	0.8112	-0.2102	1.3565	0.2212	0.4674
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.77	0.85	0.75	0.24	0.27	0.75	0.63	0.51	0.81	0.55	0.61
Best Perf. Select.(yearly)	1	1	0.86	0	0	0	1	0.81	1	1	0.67
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	1	2	1	0	2	0	4	0	2	2	1.4
Best Perf. Select.(yearly)	0	0	1	0	0	0	0	4	0	0	0.5

Moving Average Convergence Divergence (Number of Strategies = 1210)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
MACD(10, 120, 0 )	1	1209	1	4	1207	1
MACD(5, 140, 0 )	2	1207	1205	1	5	1210
MACD(15, 120, 0 )	3	1206	3	7	1205	1201
MACD(35, 100, 0 )	4	1204	1210	3	1208	1204
MACD(10, 100, 0.02 )	5	2	7	1208	2	1208
MACD(20, 120, 0 )	6	3	1206	1210	1	1203
MACD(50, 300, 0.20 )	7	7	9	8	9	5
MACD(50, 300, 0.18 )	8	8	10	9	10	6
MACD(50, 300, 0.16 )	9	9	11	10	11	7
MACD(50, 300, 0.14 )	10	10	12	11	12	8
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
MACD(50, 300, 0.20 )	1	1	109	328	656	901
MACD(50, 300, 0.18 )	2	2	110	329	657	902
MACD(50, 300, 0.16 )	3	3	111	330	658	886
MACD(50, 300, 0.14 )	4	4	112	331	1186	1
MACD(50, 300, 0.12 )	5	5	113	332	528	2
MACD(50, 300, 0.10 )	6	6	114	333	1161	3
MACD(50, 300, 0.08 )	7	7	115	334	1042	4
MACD(50, 300, 0.06 )	8	8	116	335	3	5
MACD(50, 300, 0.04 )	9	9	117	1174	16	6

Table B.57: Ranking Transition of Top 10 Moving Average Convergence and Divergence Strategies in Five Subsequent Periods

Table B.58: Performance Summary of Best Performer Selection among Trend-Based Regression Strategies

	Best Performer Selection with Trend-based Regression Algorithm:					Best Performer Selection(period)					
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.2218	0.1748	-0.0531	-0.0553	-0.1184	0.1671	-0.0095	-0.0021	0.0794	0.0854	0.0434
Best Perf. Select.(yearly)	0.0503	0.0482	-0.0917	-0.2209	-0.2442	0.1785	-0.0411	-0.0092	0.1004	0.088	-0.0234
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1138	0.1304	0.1693	0.1457	0.1725	0.1417	0.0786	0.0691	0.0708	0.1101	0.1256
Best Perf. Select.(yearly)	0.1353	0.1183	0.1636	0.1112	0.1682	0.1472	0.0792	0.0612	0.0689	0.1167	0.1224
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	1.9495	1.3402	-0.3136	-0.3797	-0.6861	1.1794	-0.1209	-0.0308	1.1212	0.7757	0.3457
Best Perf. Select.(yearly)	0.3717	0.4073	-0.5605	-1.9872	-1.4518	1.2125	-0.5192	-0.1505	1.4572	0.754	-0.1911
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.5	0.51	0.46	0.51	0.44	0.61	0.44	0.5	0.55	0.5	0.5
Best Perf. Select.(yearly)	0.42	0.43	0.46	0.44	0.51	0.73	0.57	0.39	0.56	0.55	0.51
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	58	59	64	74	67	62	64	63	67	81	65.9
Best Perf. Select.(yearly)	77	54	114	87	93	22	29	9	138	51	67.4

Table B.59: Ranking Transition of Top 10 Trend-Based Regression Strategies in Five Subsequent Periods

Trend-based Regression Algorithm (Number of Strategies = 990)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
Trend-based Regression(5, 60, 0.3)	1	64	19	129	224	855
Trend-based Regression(3, 90, 0.1)	2	258	906	296	350	673
Trend-based Regression(3, 80, 0.1)	3	927	465	433	451	637
Trend-based Regression(3, 40, 0.2)	4	902	208	217	802	90
Trend-based Regression(2, 40, 0.2)	5	990	209	38	156	882
Trend-based Regression(3, 100, 0.1)	6	28	901	481	289	549
Trend-based Regression(5, 10, 0.4)	7	8	152	281	788	401
Trend-based Regression(2, 100, 0.1)	8	112	943	439	940	596
Trend-based Regression(10, 90, 0.3)	9	158	240	399	44	988
Trend-based Regression(10, 10, 0)	10	268	167	184	883	502
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
Trend-based Regression(10, 80, 0.1)	1	710	517	680	907	528
Trend-based Regression(9, 80, 0.1)	2	692	164	398	600	473
Trend-based Regression(7, 10, 0.1)	3	242	818	985	76	814
Trend-based Regression(7, 10, 0.2)	4	236	862	989	368	832
Trend-based Regression(7, 10, 0)	5	305	651	990	66	913
Trend-based Regression(10, 90, 0.2)	6	558	197	844	862	470
Trend-based Regression(9, 80, 0)	7	563	894	769	539	571
Trend-based Regression(6, 10, 0.1)	8	260	963	976	129	939
Trend-based Regression(10, 20, 0)	9	277	675	682	31	642
Trend-based Regression(10, 20, 0.1)	10	362	832	548	2	815

Best Performer Selection with Trend-based Regression Algorithm with Trading Volume (W:V = 1:1): Best Performer Selection(period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select. (monthly)	0.194	-0.0242	-0.065	0.0711	-0.14	0.0029	0.0677	-0.0632	0.1077	0.1202	0.0225
Best Perf. Select. (yearly)	-0.0015	0.0303	-0.0501	0.0534	-0.2498	0.1179	0.1386	-0.0331	0.0275	-0.0239	-0.0048
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select. (monthly)	0.1526	0.1203	0.1486	0.1489	0.1649	0.1081	0.0837	0.0757	0.0706	0.1076	0.1226
Best Perf. Select. (yearly)	0.1248	0.1283	0.1456	0.1553	0.1677	0.0973	0.0818	0.0693	0.0657	0.1271	0.1212
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select. (monthly)	1.271	-0.2014	-0.4376	0.4776	-0.8491	0.0267	0.8089	-0.8338	1.525	1.1175	0.1835
Best Perf. Select. (yearly)	-0.0117	0.2363	-0.3442	0.344	-1.4897	1.2123	1.694	-0.4779	0.4187	-0.1879	-0.0394
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select. (monthly)	0.52	0.46	0.51	0.43	0.43	0.47	0.44	0.55	0.48	0.53	0.48
Best Perf. Select. (yearly)	0.48	0.51	0.5	0.48	0.48	0.4	0.47	0.46	0.48	0.51	0.48
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select. (monthly)	135	130	126	116	82	99	120	121	138	137	120.4
Best Perf. Select. (yearly)	14	140	130	129	112	20	131	152	135	139	110.2

Table B.60: Performance Summary of Best Performer Selection among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ )

Table B.61: Ranking Transition of Top 10 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) in Five Subsequent Periods

Trend-based Regression Algorithm with Trading Volume (W:V = 1:1) (Number of Strategies = 990)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.1)	1	738	343	367	753	895
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.4)	2	581	345	282	213	981
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.3)	3	583	344	370	208	982
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.2)	4	739	342	369	212	894
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.9)	5	723	637	516	407	656
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0)	6	734	341	366	752	655
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.8)	7	722	638	265	431	657
Trend-based Regression w/Trad. Vol.(6, 6, 70, 0.5)	8	579	634	292	209	980
Trend-based Regression w/Trad. Vol.(6, 6, 80, 0.3)	9	678	524	764	424	579
Trend-based Regression w/Trad. Vol.(6, 6, 80, 0.6)	10	350	331	829	425	778
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
Trend-based Regression w/Trad. Vol.(10, 10, 10, 1)	1	889	760	175	886	128
Trend-based Regression w/Trad. Vol.(9, 9, 50, 0.3)	2	49	132	868	306	779
Trend-based Regression w/Trad. Vol.(9, 9, 50, 0.2)	3	50	125	887	406	822
Trend-based Regression w/Trad. Vol.(9, 9, 50, 0.1)	4	67	88	875	455	785
Trend-based Regression w/Trad. Vol.(9, 7, 50, 0.3)	5	114	254	761	507	675
Trend-based Regression w/Trad. Vol.(9, 9, 50, 0)	6	71	118	852	329	810
Trend-based Regression w/Trad. Vol.(9, 9, 50, 0.4)	7	34	227	822	286	715
Trend-based Regression w/Trad. Vol.(10, 10, 10, 0.6)	8	600	972	343	521	127
Trend-based Regression w/Trad. Vol.(10, 10, 10, 0.9)	9	765	775	91	502	22
Trend-based Regression w/Trad. Vol.(7, 7, 50, 0.2)	10	143	363	713	734	654

Table B.62: Performance Summary of Best Performer Selection among Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ )

	Best Performer Selection with Trend-based Regression Algorithm with Trading Volume (W:V = 2:1):							Best Performer Selection(period)			
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.183	0.1336	-0.1196	-0.0879	-0.0266	0.0211	0.136	-0.0423	0.0249	0.1833	0.0351
Best Perf. Select.(yearly)	0.215	-0.0767	0.1202	-0.0628	0.1358	0.0482	0.0824	-0.0205	0.0364	0.2218	0.0653
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.135	0.1194	0.1486	0.1522	0.1909	0.1132	0.0782	0.0774	0.0782	0.1103	0.1255
Best Perf. Select.(yearly)	0.124	0.1221	0.1594	0.1436	0.2018	0.1143	0.0786	0.068	0.0771	0.111	0.1262
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	1.3556	1.1192	-0.8043	-0.5773	-0.1392	0.1867	1.7375	-0.5466	0.3185	1.662	0.2801
Best Perf. Select.(yearly)	1.7338	-0.6284	0.7538	-0.4374	0.6729	0.4216	1.0491	-0.3017	0.4728	1.9975	0.5176
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.44	0.42	0.49	0.48	0.48	0.44	0.5	0.52	0.51	0.52	0.48
Best Perf. Select.(yearly)	0.5	0.47	0.48	0.44	0.51	0.51	0.52	0.43	0.49	0.52	0.49
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	124	109	121	86	127	114	115	123	113	128	116
Best Perf. Select.(yearly)	140	130	127	86	136	138	128	113	128	112	123.8

Table B.63: Ranking Transition of Top 10 Trend-Based Regression Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) in Five Subsequent Periods

Trend-based Regression Algorithm with Trading Volume (W:V = 2:1) (Number of Strategies = 770)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
Trend-based Regression w/Trad. Vol.(4, 2, 30, 0.7)	1	331	624	557	45	57
Trend-based Regression w/Trad. Vol.(4, 2, 30, 0.6)	2	406	625	765	47	49
Trend-based Regression w/Trad. Vol.(4, 2, 50, 1)	3	510	760	682	377	43
Trend-based Regression w/Trad. Vol.(12, 6, 10, 0)	4	691	58	92	86	694
Trend-based Regression w/Trad. Vol.(12, 6, 10, 0.5)	5	593	29	175	52	690
Trend-based Regression w/Trad. Vol.(12, 6, 10, 0.1)	6	743	57	219	84	691
Trend-based Regression w/Trad. Vol.(12, 6, 10, 0.2)	7	674	59	339	85	689
Trend-based Regression w/Trad. Vol.(12, 6, 10, 0.6)	8	590	211	173	55	693
Trend-based Regression w/Trad. Vol.(4, 2, 30, 0.8)	9	541	702	767	46	64
Trend-based Regression w/Trad. Vol.(4, 2, 30, 0.5)	10	100	616	757	48	53
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
Trend-based Regression w/Trad. Vol.(12, 6, 90, 0)	1	184	680	645	449	612
Trend-based Regression w/Trad. Vol.(12, 6, 70, 0.3)	2	122	758	602	430	437
Trend-based Regression w/Trad. Vol.(12, 6, 80, 0)	3	198	735	684	387	372
Trend-based Regression w/Trad. Vol.(12, 6, 90, 0.1)	4	186	662	705	476	559
Trend-based Regression w/Trad. Vol.(12, 6, 90, 0.4)	5	123	602	675	256	534
Trend-based Regression w/Trad. Vol.(12, 6, 90, 0.3)	6	222	529	692	235	598
Trend-based Regression w/Trad. Vol.(12, 6, 90, 0.2)	7	191	514	706	293	634
Trend-based Regression w/Trad. Vol.(12, 6, 70, 0.2)	8	144	767	663	414	576
Trend-based Regression w/Trad. Vol.(12, 6, 70, 0.4)	9	190	752	617	409	477
Trend-based Regression w/Trad. Vol.(12, 6, 70, 0.5)	10	234	763	596	369	513



Table B.64: Performance Summary of Best Performer Selection among Nearest Neighbors Algorithm Strategies

Best Performer Selection with Nearest Neighbors Algorithm: Best Performer Selection(period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.387	0.0543	-0.1607	-0.1593	-0.2357	0.1085	0.0164	-0.0367	0.0469	-0.0496	-0.0159
Best Perf. Select.(yearly)	0.3915	0.1614	-0.0587	-0.0531	-0.2082	0.2638	0.0547	-0.0412	0.0166	0.1059	0.0506
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1273	0.1081	0.1591	0.1773	0.1997	0.1208	0.0738	0.0724	0.0658	0.0997	0.1281
Best Perf. Select.(yearly)	0.1614	0.0863	0.1169	0.1446	0.2017	0.1711	0.0511	0.0622	0.072	0.1087	0.1271
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	3.0411	0.5025	-1.01	-0.8983	-1.1803	0.8979	0.222	-0.5062	0.7126	-0.4975	-0.1244
Best Perf. Select.(yearly)	2.4258	1.8711	-0.5019	-0.3673	-1.0323	1.5422	1.0695	-0.6619	0.23	0.9747	0.3985
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.5	0.42	0.54	0.73	0.64	0.52	0.42	0.5	0.45	0.38	0.51
Best Perf. Select.(yearly)	0.73	0.31	0.47	0.48	0.58	1	0.34	0.37	0.49	0.46	0.52
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	83	89	86	47	82	72	107	99	95	85	84.5
Best Perf. Select.(yearly)	2	11	135	46	108	0	46	72	41	110	57.1

Table B.65: Ranking Transition of Top 10 Nearest Neighbors Algorithm Strategies  
in Five Subsequent Periods

Nearest Neighbors Algorithm (Number of Strategies = 1694)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
NN(14, 10, 0.5, regression)	1	1209	1	4	1207	1
NN(14, 10, 0.9, regression)	2	1207	1205	1	5	1210
NN(14, 10, 1, regression)	3	1206	3	7	1205	1201
NN(14, 10, 0.6, regression)	4	1204	1210	3	1208	1204
NN(14, 10, 0.7, regression)	5	2	7	1208	2	1208
NN(4, 10, 0, average)	6	3	1206	1210	1	1203
NN(4, 10, 0.1, average)	7	7	9	8	9	5
NN(14, 10, 0.8, regression)	8	8	10	9	10	6
NN(6, 100, 0, regression)	9	9	11	10	11	7
NN(14, 10, 0.3, regression)	10	10	12	11	12	8
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
NN(10, 100, 0.7, regression)	1	1	109	328	656	901
NN(4, 400, 0.5, regression)	2	2	110	329	657	902
NN(14, 300, 0.8, regression)	3	3	111	330	658	886
NN(14, 250, 0.9, regression)	4	4	112	331	1186	1
NN(14, 250, 0.8, regression)	5	5	113	332	528	2
NN(8, 100, 0.8, regression)	6	6	114	333	1161	3
NN(10, 250, 0.9, regression)	7	7	115	334	1042	4
NN(10, 250, 0.8, regression)	8	8	116	335	3	5
NN(10, 50, 0.7, regression)	9	9	117	1174	16	6
NN(10, 200, 0.6, regression)	10	10	118	1140	17	7

Table B.66: Performance Summary of Best Performer Selection among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ )

Best Performer Selection with Nearest Neighbors Algorithm with Trading Volume (m:l = 1:1): Best Performer Selection(period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.0156	0.0264	-0.0174	0.0595	-0.1759	0.1579	0.0789	0.0005	0.0944	0.022	0.0226
Best Perf. Select.(yearly)	0.2667	0.0645	0.0186	-0.0767	-0.2043	0.2207	0.0368	-0.054	0.1856	0.028	0.0395
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1351	0.1181	0.1364	0.1758	0.189	0.1306	0.0831	0.0723	0.0744	0.0966	0.1271
Best Perf. Select.(yearly)	0.2031	0.1221	0.1596	0.158	0.1668	0.137	0.0806	0.0623	0.078	0.0967	0.1338
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1156	0.2235	-0.1278	0.3387	-0.9305	1.2084	0.9496	0.0065	1.2681	0.2278	0.1777
Best Perf. Select.(yearly)	1.3129	0.5283	0.1165	-0.4853	-1.2249	1.6109	0.4563	-0.867	2.3787	0.2896	0.2948
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.46	0.39	0.48	0.54	0.63	0.46	0.56	0.5	0.56	0.46	0.5
Best Perf. Select.(yearly)	1	0.48	0.52	0.55	0.45	0.59	0.48	0.46	0.48	0.31	0.53
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	73	80	113	84	100	100	117	95	100	104	96.6
Best Perf. Select.(yearly)	0	98	117	123	111	55	108	109	115	16	85.2

Table B.67: Ranking Transition of Top 10 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 1 : 1$ ) in Five Subsequent Periods

Nearest Neighbors Algorithm with Trading Volume (m:l = 1:1), (Number of Strategies = 1452)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
NN w/Trad. Vol.(3, 3, 1, regression)	1	80	807	1107	852	475
NN w/Trad. Vol.(3, 3, 0.9, regression)	2	81	808	1108	853	476
NN w/Trad. Vol.(3, 3, 0.8, regression)	3	82	809	1109	854	477
NN w/Trad. Vol.(3, 3, 0.5, regression)	4	79	816	1017	850	479
NN w/Trad. Vol.(3, 3, 0.4, regression)	5	48	812	1018	1319	637
NN w/Trad. Vol.(3, 3, 0.3, regression)	6	49	813	1019	1320	638
NN w/Trad. Vol.(3, 3, 0.2, regression)	7	50	814	1020	1321	639
NN w/Trad. Vol.(3, 3, 0.1, regression)	8	47	806	1015	1322	641
NN w/Trad. Vol.(3, 3, 0, regression)	9	51	815	1014	1318	640
NN w/Trad. Vol.(3, 3, 0.7, regression)	10	83	810	1110	851	478
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
NN w/Trad. Vol.(4, 4, 0.5, average)	1	29	508	894	1345	1181
NN w/Trad. Vol.(2, 2, 0.7, average)	2	27	734	414	635	855
NN w/Trad. Vol.(7, 7, 1, average)	3	30	69	895	881	868
NN w/Trad. Vol.(7, 7, 0.9, average)	4	31	70	896	882	869
NN w/Trad. Vol.(7, 7, 0.8, average)	5	32	71	897	883	870
NN w/Trad. Vol.(7, 7, 0.7, average)	6	33	72	898	884	871
NN w/Trad. Vol.(7, 7, 0.6, average)	7	34	73	899	885	872
NN w/Trad. Vol.(7, 7, 0.5, average)	8	35	74	900	886	873
NN w/Trad. Vol.(7, 7, 0.4, average)	9	36	75	901	887	874
NN w/Trad. Vol.(7, 7, 0.3, average)	10	37	76	902	888	875

Table B.68: Performance Summary of Best Performer Selection among Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ )

Best Performer Selection with Nearest Neighbors Algorithm with Trading Volume (m:l = 2:1): Best Performer Selection(period)											
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.005	0.0602	-0.2048	0.055	-0.159	0.2669	-0.0117	0.064	0.0985	0.0239	0.0120
Best Perf. Select.(yearly)	0.1081	0.0093	-0.0067	-0.0146	-0.1	0.1864	-0.0537	-0.082	0.1363	0.0038	0.0148
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1486	0.1165	0.1656	0.1536	0.2051	0.1103	0.0735	0.0737	0.0815	0.1043	0.1301
Best Perf. Select.(yearly)	0.1054	0.1267	0.1584	0.205	0.1902	0.1318	0.0574	0.0668	0.0697	0.0917	0.1299
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.0339	0.5168	-1.2365	0.3581	-0.7752	2.4194	-0.1585	0.8676	1.208	0.2294	0.0922
Best Perf. Select.(yearly)	1.0256	0.0731	-0.0424	-0.0713	-0.526	1.4142	-0.9359	-1.2276	1.9548	0.0411	0.1137
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.52	0.4	0.47	0.6	0.58	0.44	0.44	0.48	0.51	0.49	0.49
Best Perf. Select.(yearly)	0.17	0.49	0.51	0.93	0.5	0.52	0.33	0.46	0.46	0.3	0.47
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	84	89	111	88	96	105	104	106	117	116	101.6
Best Perf. Select.(yearly)	6	96	104	9	73	115	60	93	112	106	77.4

Table B.69: Ranking Transition of Top 10 Nearest Neighbors Algorithm Strategies with Index Return and Chg. of Trad. Vol. ( $W_1 : W_2 = 2 : 1$ ) in Five Subsequent Periods

Nearest Neighbors Algorithm with Trading Volume (m:l = 2:1), (Number of Strategies = 1694)						
Best Perf. Select.(monthly)	Dec97	Jan98	Feb98	Mar98	Apr98	May98
NN w/Trad. Vol.(14, 7, 350, 0, regression)	1	241	665	1255	992	193
NN w/Trad. Vol.(14, 7, 350, 0.1, regression)	2	240	668	1279	994	190
NN w/Trad. Vol.(14, 7, 400, 0.1, regression)	3	1433	723	1249	1362	642
NN w/Trad. Vol.(14, 7, 400, 0.2, regression)	4	1432	669	1599	1360	641
NN w/Trad. Vol.(14, 7, 400, 0, regression)	5	414	722	1254	1361	91
NN w/Trad. Vol.(16, 8, 10, 0, regression)	6	1146	1205	681	66	48
NN w/Trad. Vol.(16, 8, 10, 0.9, regression)	7	1634	1332	1137	253	150
NN w/Trad. Vol.(16, 8, 10, 1, regression)	8	1633	1139	1295	250	152
NN w/Trad. Vol.(16, 8, 10, 0.2, regression)	9	1559	1156	813	13	83
NN w/Trad. Vol.(16, 8, 10, 0.3, regression)	10	1627	1155	814	92	85
Best Perf. Select.(yearly)	1997	1998	1999	2000	2001	2002
NN w/Trad. Vol.(10, 5, 10, 0.4, average)	1	915	1150	144	323	714
NN w/Trad. Vol.(14, 7, 10, 0.6, average)	2	1094	91	842	1524	87
NN w/Trad. Vol.(16, 8, 350, 0, regression)	3	884	969	190	1544	83
NN w/Trad. Vol.(16, 8, 500, 1, average)	4	50	114	844	970	990
NN w/Trad. Vol.(16, 8, 500, 0.9, average)	5	51	115	845	971	991
NN w/Trad. Vol.(16, 8, 500, 0.8, average)	6	52	116	846	972	992
NN w/Trad. Vol.(16, 8, 500, 0.7, average)	7	53	117	847	973	993
NN w/Trad. Vol.(16, 8, 500, 0.6, average)	8	54	118	848	974	994
NN w/Trad. Vol.(16, 8, 500, 0.5, average)	9	55	119	849	975	995
NN w/Trad. Vol.(16, 8, 500, 0.4, average)	10	56	120	850	976	996

Table B.70: Performance Summary of Best Performer Selection among All Strategies

	Best Performer Selection among All Strategies:					Best Performer Selection(period)					
Returns	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.0571	0.0107	-0.2428	-0.0177	-0.1482	0.176	0.0439	0.0352	0.1226	-0.0223	-0.0057
Best Perf. Select.(yearly)	0.215	0.0482	-0.0587	-0.0146	-0.2043	0.2207	0.0824	-0.054	0.1363	0.088	0.038
Buy-and-Hold	0.2667	0.1953	-0.1014	-0.1304	-0.2337	0.2638	0.0899	0.03	0.1362	0.0353	0.0423
Volatilities	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.1274	0.1246	0.1453	0.1647	0.1694	0.1299	0.0782	0.0721	0.0747	0.105	0.1239
Best Perf. Select.(yearly)	0.124	0.1183	0.1169	0.205	0.1668	0.137	0.0786	0.0623	0.0697	0.1167	0.1266
Buy-and-Hold	0.2031	0.1808	0.2218	0.2153	0.2602	0.1711	0.1109	0.1027	0.1004	0.1596	0.1802
Sharpe Ratios	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.4484	0.0857	-1.6713	-0.1075	-0.8746	1.3555	0.5616	0.4877	1.6405	-0.2124	-0.0462
Best Perf. Select.(yearly)	1.7338	0.4073	-0.5019	-0.0713	-1.2249	1.6109	1.0491	-0.867	1.9548	0.754	0.3005
Buy-and-Hold	1.3129	1.0802	-0.457	-0.6059	-0.898	1.5422	0.8112	0.2923	1.3565	0.2212	0.2346
Pin	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	0.46	0.53	0.49	0.56	0.47	0.5	0.46	0.48	0.46	0.46	0.49
Best Perf. Select.(yearly)	0.5	0.43	0.47	0.93	0.45	0.59	0.52	0.46	0.46	0.55	0.53
Number of Tradings	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-2007
Best Perf. Select.(monthly)	102	103	110	108	100	109	114	106	111	95	105.8
Best Perf. Select.(yearly)	140	54	135	9	111	55	128	109	112	51	90.4









Table B.74: Transition of yearly Top 10 Strategies (1997-2006)

Top 10 Strategies (yearly)				
1997	1998	1999	2000	2001
Trend-based Regression w/ Trad. Vol.(12, 6, 90, 0)	Trend-based Regression(4, 20, 0.3)	NN(6, 450, 0, regression)	NN w/ Trad. Vol.(4, 2, 50, 0.1, average)	NN w/ Trad. Vol.(4, 4, 10, 0.5, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 70, 0.3)	Trend-based Regression(4, 20, 0.9)	NN(4, 200, 0, regression)	NN w/ Trad. Vol.(16, 8, 450, 0.8, regression)	NN w/ Trad. Vol.(4, 4, 10, 0.4, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 80, 0)	Trend-based Regression(4, 10, 1)	NN(12, 400, 0, regression)	Trend-based Regression w/ Trad. Vol.(6, 3, 50, 1)	NN w/ Trad. Vol.(4, 4, 10, 0, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 90, 0.1)	Trend-based Regression(3, 20, 0.6)	NN(6, 50, 0, regression)	NN w/ Trad. Vol.(16, 8, 450, 1, regression)	NN w/ Trad. Vol.(4, 4, 10, 0.1, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 90, 0.4)	Trend-based Regression(4, 30, 0.2)	NN(6, 350, 0, regression)	NN w/ Trad. Vol.(16, 8, 500, 0.8, regression)	NN w/ Trad. Vol.(4, 4, 10, 0.3, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 90, 0.3)	NN w/ Trad. Vol.(14, 7, 100, 0.6, regression)	NN(6, 500, 0, regression)	NN w/ Trad. Vol.(16, 8, 450, 0.9, regression)	NN w/ Trad. Vol.(4, 4, 10, 0.2, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 90, 0.2)	NN(10, 50, 0.5, regression)	Trend-based Regression w/ Trad. Vol.(6, 3, 70, 0)	NN w/ Trad. Vol.(16, 8, 450, 0.7, regression)	NN w/ Trad. Vol.(4, 4, 10, 0.6, regression)
Trend-based Regression w/ Trad. Vol.(12, 6, 70, 0.2)	Trend-based Regression w/ Trad. Vol.(4, 2, 20, 0.4)	NN(6, 150, 0.1, regression)	NN w/ Trad. Vol.(16, 8, 500, 0.4, regression)	Trend-based Regression w/ Trad. Vol.(4, 2, 10, 0.1)
Trend-based Regression w/ Trad. Vol.(12, 6, 70, 0.4)	NN(2, 150, 0.5, regression)	NN(6, 200, 0, regression)	NN w/ Trad. Vol.(16, 8, 500, 0.5, regression)	Trend-based Regression w/ Trad. Vol.(4, 2, 10, 0)
Trend-based Regression w/ Trad. Vol.(12, 6, 70, 0.5)	NN(12, 350, 0.4, regression)	NN(6, 250, 0, regression)	NN w/ Trad. Vol.(16, 8, 450, 0.5, regression)	Trend-based Regression w/ Trad. Vol.(2, 2, 10, 0.7)
2002	2003	2004	2005	2006
NN w/ Trad. Vol.(3, 3, 400, 1, regression)	Trend-based Regression w/ Trad. Vol.(6, 3, 30, 0.2)	NN w/ Trad. Vol.(6, 6, 450, 0.8, regression)	NN w/ Trad. Vol.(12, 6, 400, 0.4, regression)	Trend-based Regression(9, 40, 0.5)
NN w/ Trad. Vol.(3, 3, 400, 0.9, regression)	Trend-based Regression w/ Trad. Vol.(6, 3, 30, 0.1)	NN w/ Trad. Vol.(4, 2, 400, 0.4, regression)	NN w/ Trad. Vol.(12, 6, 400, 0.3, regression)	Trend-based Regression w/ Trad. Vol.(8, 4, 70, 0)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.7)	Trend-based Regression(5, 20, 0.6)	NN w/ Trad. Vol.(6, 6, 450, 0.7, regression)	NN w/ Trad. Vol.(5, 5, 350, 0, average)	Trend-based Regression(10, 40, 0.5)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.8)	Trend-based Regression w/ Trad. Vol.(6, 3, 30, 0)	NN w/ Trad. Vol.(4, 2, 400, 0.6, regression)	NN w/ Trad. Vol.(12, 6, 400, 0.1, regression)	NN w/ Trad. Vol.(10, 5, 150, 0, average)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.3)	Trend-based Regression w/ Trad. Vol.(6, 3, 60, 0)	NN w/ Trad. Vol.(4, 2, 400, 0.7, regression)	NN w/ Trad. Vol.(12, 6, 400, 0.5, regression)	NN w/ Trad. Vol.(7, 7, 250, 0.1, average)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.4)	Trend-based Regression w/ Trad. Vol.(6, 3, 60, 0.3)	NN w/ Trad. Vol.(4, 2, 400, 0.3, regression)	NN w/ Trad. Vol.(12, 6, 400, 0.2, regression)	Trend-based Regression w/ Trad. Vol.(8, 4, 70, 0.1)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.2)	Trend-based Regression w/ Trad. Vol.(6, 3, 30, 0.4)	NN w/ Trad. Vol.(6, 6, 450, 0.9, regression)	NN w/ Trad. Vol.(6, 3, 150, 0.6, regression)	Trend-based Regression w/ Trad. Vol.(8, 4, 70, 0.2)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.9)	Trend-based Regression w/ Trad. Vol.(6, 3, 30, 0.6)	Trend-based Regression w/ Trad. Vol.(12, 6, 10, 0.6)	NN w/ Trad. Vol.(12, 6, 400, 1, regression)	Trend-based Regression w/ Trad. Vol.(8, 4, 70, 0.5)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 1)	NN w/ Trad. Vol.(7, 7, 50, 0.9, regression)	NN w/ Trad. Vol.(4, 2, 400, 0.5, regression)	NN w/ Trad. Vol.(12, 6, 400, 0, regression)	Trend-based Regression(8, 30, 0.7)
Trend-based Regression w/ Trad. Vol.(12, 6, 20, 0.1)	Trend-based Regression w/ Trad. Vol.(6, 3, 100, 0.7)	Trend-based Regression w/ Trad. Vol.(12, 6, 10, 0.5)	NN w/ Trad. Vol.(16, 8, 500, 0.1, average)	Trend-based Regression w/ Trad. Vol.(8, 4, 70, 0.4)

Table B.75: Ranking Transition of Top 10 Strategies in Five Subsequent Periods

Eight Strategy Classes (Number of Strategies = 8808)						
<i>Best Perf. Select. (monthly)</i>	Dec97	Jan98	Feb98	Mar98	Apr98	May98
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.1)</i>	1	7192	4518	4705	7444	8569
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.4)</i>	2	5478	4520	4302	1046	8778
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.3)</i>	3	5480	4519	4736	1041	8779
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.2)</i>	4	7193	4517	4735	1045	8568
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.9)</i>	5	5897	5483	5213	1586	7888
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0)</i>	6	7188	4516	4704	7443	7886
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.8)</i>	7	5896	5484	4195	1685	7889
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 70, 0.5)</i>	8	5476	5480	4376	1042	8777
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 80, 0.3)</i>	9	5793	5139	6072	1661	7641
<i>TBR(Index Return, 6; Chg of Trad.Vol., 6; 80, 0.6)</i>	10	1530	4486	6312	1662	8237
<i>Best Perf. Select. (yearly)</i>	1997	1998	1999	2000	2001	2002
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0)</i>	1	3506	8479	8104	4198	5313
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.3)</i>	2	3229	8774	7784	4057	3342
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 80, 0)</i>	3	3587	8708	8348	3755	2559
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.1)</i>	4	3513	8381	8499	4374	4651
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.4)</i>	5	3238	7995	8268	2920	4324
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.3)</i>	6	3733	6874	8415	2790	5135
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 90, 0.2)</i>	7	3537	6761	8502	3086	5658
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.2)</i>	8	3334	8796	8225	3957	4908
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.4)</i>	9	3534	8762	7871	3917	3651
<i>TBR(Index Return, 12; Chg of Trad.Vol., 6; 70, 0.5)</i>	10	3777	8788	7737	3641	4037

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