# “The Addition and Deletion Effects of the Standard & Poor's 500 Index and Its Dynamic Evolvement from 1990 to 2002: Demand Curves, Market Efficiency, Information, Volume and Return”


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# THE ADDITION AND DELETION EFFECTS OF THE STANDARD & POOR'S 500 INDEX AND ITS DYNAMIC EVOLVEMENT FROM 1990 TO 2002: DEMAND CURVES, MARKET EFFICIENCY, INFORMATION, VOLUME AND RETURN

Libo Sui*

## Abstract

This paper investigates equity market behavior for firms added to or deleted from the S&P 500 index. The S&P 500 index is one of the most widely tracked indexes by investors who wish to remain diversified. Since October 1989, S&P allows approximately 5 days of trading between the announcement date and the change date. In this paper, we use the underlying stock markets data to analyze the post-1989 market behavior of index changes. We examine price and volume history for firms added to or deleted from the S&P 500 from January 1990 through December 2002. We found a mean cumulative abnormal return from announce day to change day of 8.44% for additions and -11.10% for deletions. The abnormal returns still remain at 6.19% for additions and -6.20% for deletions 20 days after the change day. We found an arbitrage space of 3.2% for additions and -6.7% for deletions which use the strategy of buying/selling at the open of AD+1 and covering those positions at the close of CD. We found direct evidence rejecting the downward-sloping long-run demand curves hypothesis which has been supported by most of the prior studies for decades. We demonstrate the demand curves are only downward-sloping in short-run and horizontal in the long-run. We also focus our research on the dynamic evolvement of this effect from 1990 to 2002 which indicates markets are becoming more efficient. Markets need time to adjust to semi-strong form market efficiency when there are some structural changes or new information comes in. We use this sample to demonstrate the relationship between volume, return and information. Our outcome indicates volume does not predict direction, but only price volatility. It is the nature of information (good or bad) that causes the abnormal volume which decides the direction of stock movements. Information plays an important role in the relationship between abnormal volume and abnormal return. The volume is only a proxy of information flow in some cases. This paper also shows how human behaviors such as risk averse and irrationality can influence market efficiency in the short-run and how market evolves from inefficiency to efficiency in the long-run. We worry about the long-run performance of the index funds, because the total premium paid by index fund will accumulate to a significant amount as time goes on. This is one of the increasing problems of index funds.

**Key words:** Standard & Poor's 500, Addition, Deletion, Market Efficiency.
**JEL classification:** G14.

Standard & Poor's 500 index is designed to reflect the U.S. equity markets and, through the markets, the U.S. economy. It consists of 500 stocks selected by market size, liquidity, and industry group representation. Based on the semi-strong form of the efficient markets hypothesis (EMH), which says that no publicly available information is useful in predicting stock returns, indexing has become a very successful strategy of investment. Now, the S&P 500 index is one of the most heavily tracked indexes by worldwide investors.

## 1. Changes in S&P 500 Index

If companies in the index are involved in mergers, are acquired, become bankrupt or significantly restructured such that they no longer meet inclusion criteria or if companies substantially violate one or more of the addition criteria, then, the Standard & Poor's Index committee will delete

* China CITIC Bank.

this stock from the index. In the case that an S&P 500 company merges with or is acquired by another firm, the stock is removed at a date that is close as possible to the tender offer expiration date or to the shareholder vote date. In the situation of corporate restructuring, whether the firm or any of its spin-offs stay in the index after the restructuring is decided on a case-by-case basis. Removal also occurs if a share-holder-approved-recapitalization dramatically changes the firm's debt ratio. When a company files Chapter II for bankruptcy, it will be removed immediately from the index.

If a stock is deleted, in most cases, the committee must select another stock to replace the deleted stock. S&P goes to its candidate replacement pool. The pool contains a set of firms that have been pre-approved by the S&P Index Committee to be included in the S&P 500. The pool is kept secret. The primary objective of the S&P 500 is to be the performance benchmark for U.S. equity markets. The selection criteria for the replacement pool include: 1) industry representation – the firm must be from an important U.S. industry segment; 2) firm size – the firm generally has the highest market value within its industry; 3) number of shareholders – the firm's shares must be widely held to avoid adverse effects of market illiquidity; 4) trading volume – the greater the trading activity of the firm's shares, the more efficient is their pricing and the more timely is the movement in the index; 5) financial soundness – the firm's financial and operating conditions are rigorously analyzed to ensure that added firms will have longevity. Based on these criteria, firms are identified and discussed at the periodic S&P Index Committee meetings. A firm is included in the candidate replacement pool if unanimously approved by the committee.

Table 1

S&P 500 COMPANY CHANGES (1990-2001)

| Reason | 02 | 01 | 00 | 99 | 98 | 97 | 96 | 95 | 94 | 93 | 92 | 91 | 90 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mergers & Acquisitions among companies in the S&P 500 Index | 3 | 15 | 23 | 21 | 24 | 18 | 9 | 14 | 3 | 2 | 2 | 6 | 8 |
| Acquisition by S&P Mid-Cap 400 Index Company | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Acquisition by company outside the Index | 0 | 2 | 9 | 10 | 10 | 6 | 2 | 6 | 4 | 4 | 0 | 2 | 2 |
| Restructurings | 0 | 8 | 6 | 3 | 7 | 4 | 4 | 4 | 4 | 3 | 3 | 1 | 2 |
| Bankruptcies | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 2 |
| Lack of Representation | 0 | 3 | 10 | 4 | 5 | 3 | 9 | 9 | 5 | 3 | 1 | 1 | 0 |
| Moved to MidCap 400 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Moved to SmallCap 600 | 0 | 1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Number | 23 | 30 | 58 | 42 | 48 | 31 | 24 | 33 | 17 | 13 | 7 | 13 | 14 |

The addition and deletion activities have become more frequent in the recent economically prosperous years. In year 2000, there were 58 company changes, which means 10% of the index's stocks were changed, while in 1990 there were only 14 changes. Table 1 shows the statistics of S&P 500 company changes from 1990 to 2001.

Before October 1989, S&P announces the change after the markets close and executes the change when the markets open the next morning. Under this announcement policy, the first opportunity to buy the newly added stock was at the open on the day following the announcement. In October 1989, S&P changed its rule trying to give approximately 5 business days between the announcement day and the change day under possible situation to ease order imbalances. Under the new policy, S&P announces the name of the added and deleted firms, as well as the date on which the change will become effective after the market closes. Usually, S&P will announce the change five business days ahead. On occasion, S&P must use a shorter time due to a bankruptcy filing or acquisition. For example, on October 12 JWP Inc. filed Chapter 11 for bankruptcy. Immediately following the close on that day, S&P announced that JWP Inc. would be dropped and Pioneer Hi-Bred Int'l

would be added the next morning. Under very rare occasions, S&P may also choose to use an announcement interval longer than five days. In June 1994, Microsoft was announced to be added given a sixteen trading day interval due to its high market capitalization.

## 2. Index Fund

According to the stimulus mechanism of most index funds, if the managers can not minimize the tracking error, they will be punished. The fund managers will take some risk if they change their portfolios before the changes occur. At least fund managers would not be awarded because of their actions before the change day. Therefore, most index fund managers choose to change their portfolios on the change day instead of immediately after the announcement day. This behavior and the time window between addition and deletion give us an arbitrage possibility and a valuable chance to study the market behavior.

The fundamental theory of indexing comes from the capital asset pricing model (CAPM) of Sharpe (1964)/Lintner (1965). The CAPM says that investors should hold portfolios that consist of all risky securities in the marketplace, with the proportion of wealth invested in each security equal to that security's market value relative to the total market value of all risky securities. Stock selection and market timing are unnecessary. Ever since then, the growth of the indexing fund has been dramatic. Moreover, Wall Street professionals estimate that privately held funds tracking the S&P 500 index have even greater value than public funds. They estimate about ten percent of the index is held by index funds both public and private.

As the growth of S&P 500 based investments increased since 1970's, several researches on the price and volume patterns of changed stocks have been done by both academia and Wall Street. The results of these studies all came to a similar conclusion: there is an S&P price effect. Due to the increasing scale of index funds based on S&P 500 and the historically high number of changes happened in recent years, this price effect becomes more and more important for Wall Street investors.

## 3. Literature Review

There are altogether three areas related to this topic: First, the empirical evidence and arbitrage opportunities; Second, the explanations for the price movements around the time of an index change; Third, what it means for market efficiency.

### *3.1. Empirical Evidence and Arbitrage Opportunities*

#### *3.1.1. Empirical Evidence*

For the empirical evidence, there is disagreement about aspects of the price effect relating to its magnitude, whether it is increasing, decreasing or stable through time, its duration and reason. One thing is certain: there is always a positive price effect on companies added to the S&P 500 and a negative price effect on companies deleted from the S&P 500. There is opportunity for profit.

For those researches before October 1989 on empirical evidences, the following common conclusions are observed[1]

1. There is a significant positive excess return on the day following the additions of a company to the 500.
2. There is a significant negative excess return on the day following the deletion of a company from the 500.
3. The positive price effect is sustained over the subsequent week and month and appears to be permanent. The range of the price effect is +3.0% to +8.0%.
4. The negative price effect is also sustained over the subsequent week and month and appears to be permanent. The negative effect is about 1.5%.

[1] For additions, see Harris and Gurel (1986) (84 stocks); Shleifer (1986), who examined the 1976-1983 period (102 stocks); and Dhillon and Johnson(1991), who examined the 1978-1988 period (187 stocks). For deletions, see Goetzmann and Garry (1986) who examined the seven deletions on November 30, 1983 (caused by the breakup of AT&T), and Harris and Gurel (1986) who examined the 1978-1983 period (13 stocks).

5. The primary reason behind the price effect is increased demand by index fund managers.
6. Another reason for the price effect may involve qualitative factors such as a perceived increase in the quality of an addition or a tendency by foreign investors to focus only on the S&P 500 list.

For example, during the period of 1976-1983, Shleifer (1986) found an abnormal price increase of 2.79% on the day following the announcement. Using roughly the same period, Harris and Gurel (1986) report a 3.13% average increase.

Recently, there are several important papers based their researches on the phenomena after October 1989.

Beneish and Whaley (1997) is the first paper that studied the influence of the new S&P policy. They examined the effects of Standard and Poor's change in announcement policy regarding new listings to the S&P 500 from January 1986 to June 1994. There are all together 177 additions in this period. They selected 103 suitable additions as their final sample, among which 33 occur under the new policy, while others occur under the old policy. In the period before the change in policy (from January 1986 through September 1989), they found that index funds pay a 3.7% premium for the shares of newly added stocks. Beneish and Whaley also found this premium is driven exclusively by the close-to-open return. It does not represent a profitable trading opportunity and consists with the market efficiency theory. They found a 23% higher premium than was reported in past works. They explain it is a result of the growth of the money indexed to the S&P 500. They also found the price increase during this period appears to be permanent. In the period after the change in policy (October 1989 through June 1994), they found the overnight return is only 3.1%, about 16% lower than the return under the old policy. By the effective day, the stock price has increased by another 4.1%, making the total premium paid for acquiring the new stock 7.2%, which indicates most index funds wait until the effective day to rebalance their portfolios. Although part of the increase reverses after the stock is included in the index, most of the overall price increase appears to be permanent in the sense that the abnormal return is nearly 5% two weeks after the effective day.

Lynch and Mendenhall (1997) examined the changes from March 1990 to April 1995. Altogether, there are 71 additions and deletions during this period. After kicking out the unsuitable firms, they finally setup a clean sample of 34 additions and 15 deletions. They found for both additions and deletions, the data revealed a distinct pattern of stock-price movements. For additions, they found a significantly positive announcement effect, they also found a positive abnormal return of about 3.8% over the period starting the day after the announcement and ending the day before the effective date of the change. Further more a significant negative abnormal return was found following the addition. They also found firms being deleted from the index exhibit a significant post-announcement drift and a significant price reversal, but in directions opposite to those for additions.

Philip A. Cusick (2001) analyzed price and volume data for firms added or deleted from the S&P 500 from October 1989 through December 1999. In total he found 304 additions and 304 deletions within this period. After selection, his final sample was made up of 112 additions and 52 deletions.

He found that for both additions and deletions the data revealed a distinct pattern of price and volume movements. For additions, the stocks exhibit significant increases form the announcement through the change day, and then a decline from the change day through the release-ending period when the price steadied approximately 8% above its pre-announcement price. The effect on deletion is more extreme, as the stock generally settles about 14% below its pre-announcement price. He also found a difference in that deletions does not exhibit a sustained price increase after the change day. For volumes, he found heavy spikes in market-adjusted volume on the day after the announcement and the day of the change. Evidence was found of increased steady state trading volumes after the change for both additions and deletions.

*3.1.2. Arbitrage Opportunities*

Beneish and Whaley (1996) studied overnight and intra-day returns. They argue that if the close-to-close return following the announcement is largely driven by the close-to-open price movement, the efficiency of price-setting in the marketplace is supported. If the close-to-close return is

largely driven by the price movement from the open to the close on the day following the announcement, a case can be made for market inefficiency.

They found that the close-to-close return of pre-October 1989 group appears to be driven by the overnight return. Therefore, there is no arbitrage opportunities and the market is efficient. The data after October 1989, exhibited that the average abnormal return of the strategy of buying the stock and shorting the S&P 500 futures at the open on the day after the announcement day and closing the position at the close of the effective day is 4.011%. This indicates that an abnormal trading profit can be earned after the trading costs.

### *3.2. Explanations for the Price Movements*

For the explanations of the price movements around the time of an index change, there are altogether four hypotheses:

1. The price pressure hypothesis: Says that the price movements around the time of an index change are caused by heavy index funds trading that moves stock prices temporarily away from their equilibrium. The evidence for this hypothesis should be a price reversal after the effective date of the index change.
2. The downward-sloping long-run demand curves hypothesis: Says that as firms enter the S&P 500, index-fund buying removes a substantial fraction of the firm's shares from circulation. This demand by index funds reduces the stock's supply for nonindexing investors, causing the market clearing price to increase. For deletions, this effect should be in the opposite direction. If the long-term demand curves for stocks were horizontal, the reduction of the stock's supply would not influence the stock price. Therefore, the evidence for this hypothesis should be a permanent price effect after the change. Shleifer (1986) and Harris and Gurel (1986) were the first papers to recognize that a permanent price response associated with addition to or deletion from the index is consistent with stocks possessing downward-sloping demand curves.
3. The information hypothesis: Argues that the price movement of change stocks could be due to the information content of S&P's addition and deletion. S&P must have some non-public information about firms and use this information to determine the composition of the index. Jain (1987) supports this hypothesis. He observed significant stock-price movements when firms are added to or deleted from S&P auxiliary indexes.
4. The liquidity hypothesis: If being a member of the S&P 500 leads to more attention by public and analysts, this may, in turn, lead to greater institutional interest, greater trading volume, and lower bid-ask spreads. Harris and Gurel (1986) and Edmister (1995), studying pre-October 1989 data, do find evidence of a permanent increase in trading volume following S&P inclusion.

Prior studies of the effect of inclusion in the S&P 500 index include Shleifer (1986), Harris and Gurel (1986), Dhillon and Johnson (1991), Beneish and Whaley (1996), Lynch and Mendenhall (1997), and Wurgler and Zhu-ravskaya (2002). All but one of the prior studies report that the price increase is permanent, thus, supporting the hypothesis that demand curves for stocks slope downward in the long-run.

Studies based on other events come to mixed conclusions. For example, Scholes (1972), who examines stock price reactions to large-block trades, and Mikkelson and Partch (1985), who study price reactions to announcements of secondary equity offerings, conclude that their results are more consistent with an information effect than with a demand curve effect. Loderer, Cooney, and Van Drunen (1991), who study Dutch auction share repurchases, conclude that their evidence is most consistent with a demand curve effect.

### *3.3. Market Efficiency*

Lynch and Mendenhall (1997) found that the significant abnormal returns following the announcement date are inconsistent with semi-strong form market efficiency[1]. They also found inves-

[1] See Fama (1970, 1991) about the theory and evidence of market efficiency.

tors can use the publicly available information to construct trading rules that earned economically significant abnormal returns in index change. But studies examining the pre-October 1989 period did not show significant daily abnormal returns following the announcement. Therefore, the pre-October 1989 results do not violate semi-strong form efficiency, while the post-October 1989 results do. This discovery gives us a chance to test the market efficiency theory.

## 4. Paper Structure and Data

This paper will study the behavior of equity markets for those stocks added or deleted from S&P 500 index from 1990 to 2002. Our research focuses on the post-October 1989 effect and the evolvement of this effect from 1990 to 2002.

We noticed that most of the papers talking about the post-October effect only have a short period of time to study and only pay attention to the static side of this effect. Our research has a longer time period and we try to reveal the dynamic evolvement of this effect during past decade.

We collected data for this study from several sources. The index addition and deletion information including announcements and changing dates are collected from Standard & Poor's 500 Directory (1990-2003). For some announcement and changing dates which are not provided by Standard & Poor's 500 Directory, we checked Wall Street Journal. Volume, closing prices and open prices are from Bloomberg or Reuters (1990-2002). Stock specific information (for example, the reason of stock changes) is from Wall Street Journal.

The later part of this paper is organized as follows: In section 5, we talk about data selection. In section 6, we talk about methodology. In section 7, we talk about results. Finally, we conclude in section 8.

## 5. Data Selection

There are all together 353 S&P 500 index changes (353 additions, 353 deletions) from 1990 to 2002. Because a significant number of index changes are caused by substantial fundamental changes of deleted companies (merger, acquisition, bankruptcy, restructure . . . ) and those fundamental changes will usually cause huge price movements near index change time, we removed a number of securities in order to study the clean index change effect of the equity markets. We classified the reason of deleting securities from our sample into five categories.

1. We can not find data of one form or another for a security. 55 addition stocks and 51 deletion stocks are deleted from our sample because of the lack of data.
2. There are some index changes for which no trading is required by index funds, such as name changes or replacements due to part of a company spinning off and the child or parent company remaining in the index. 54 additions and 2 deletions are removed because of this reason.
3. Any big changes related with other companies, such as merger, acquisition, split activities and takeover. We searched Wall Street Journal articles close to the change time. Any company which was mentioned in connection with such activities around change time will be deleted from our sample. 2 additions and 188 deletions are kicked out because of this (This is the most popular reason for Standard & Poor's Index Committee delete one stock from S&P 500 index).
4. Bankruptcy, restructuring or recapitalization. There are 8 additions (restructuring and recapitalization) and 48 deletions are removed because of this reason.
5. There are not enough numbers of trading days between announcement day and change day. We require there is at least one day between announcement day and change day. If the change day just follows the announce day, those changes will be the same as pre-1989 changes. We deleted 42 additions and 2 deletions because of this.

Finally, our sample contains 192 additions and 62 deletions. Because a lot of deletions are related with merger, acquisition, split activities and takeover, we have a smaller deletion sample compared with addition sample. Figures 1 and 2 show the frequency distributions of the number of trading days of those additions and deletions between the announcement day and the effective day. The range of additions is from one to sixty nine trading days. The range of deletions is from one to thir-

teen trading days. The mean days of additions is 5.05 trading days. The mean days of deletions is 4.24 trading days. The outliers of additions at sixty nine and fifty trading days are the State Street Corp addition in 1997 and the Quintiles Transnational addition in 1999.

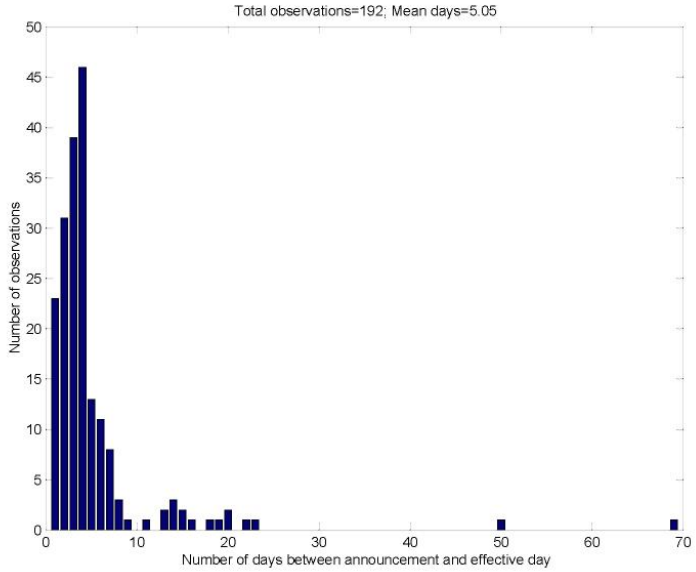


Fig. 1. Frequency distribution of the number of trading days between the announcement day and the effective day for the sample of 234 additions during the period of January 1990-December 2002

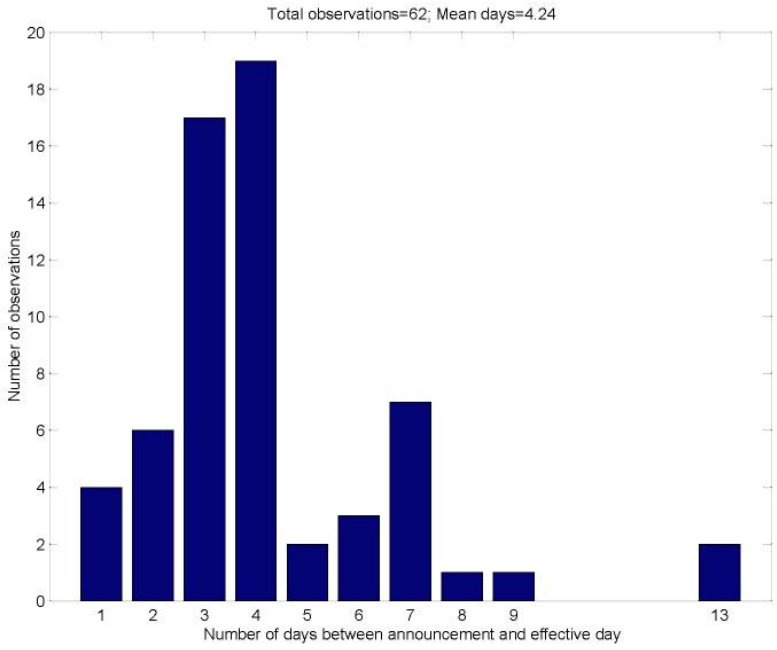


Fig. 2. Frequency distribution of the number of trading days between the announcement day and the effective day for the sample of 64 deletions during January 1990-December 2002

## 6. Methodology

We use an event-study methodology with two event dates for each sample: The announcement date of the addition/deletion, we call AD and the effective date of the addition/deletion, we call CD. S&P always announces changes after market closing of a particular day, therefore the first day of possible prices movements is AD+1 day. S&P will implement those changes using the closing price of the change day (CD). CD is the day on which most index funds will rebalance their portfolios.

### *6.1. Abnormal Return Calculation*

Before starting our research, we need to introduce several basic definitions and measurements of abnormal return.

Definition of Raw Return: We define the raw return for a stock or S&P 500 index as the close price of that stock or index on day $\tau$ minus the close price on day $\tau$-1 and then divided by the close price of that stock or index on AD.

$$RR_{i\tau} = \frac{CP_{i\tau} - CP_{i,\tau-1}}{CP_{iAD}}, \tag{1}$$

Definition of Abnormal Return: The abnormal return for stock i on day $\tau$ ($AR_{IT}$) is defined as the stock's raw return on day $\tau$ ($RR_{IT}$) minus S&P 500's raw return on day $\tau$ ( $SPR_T$).

$$AR_{i\tau} = RR_{i\tau} - SPR_{\tau}. \tag{2}$$

Definition of Mean Abnormal Return: Actually, we are interested in the measure of the abnormal price movement on an event day $\alpha$ which is called mean abnormal return for event day $\alpha$ ($MAR_a$). It is defined as the mathematic average of abnormal returns of every stocks we study on that event day.

$$MAR_{\alpha} = \frac{\sum_{i=1}^{n} AR_{i\alpha}}{N}. \tag{3}$$

Definition of Cumulative Abnormal Return: We are also interested in calculating the cumulative abnormal return between day $\tau_1$ and $\tau_2$ ($CAR_{t\ T1-T2}$). For example, we are particularly interested in the total cumulative abnormal return between announce day and the change day. It is defined as the stock's raw return between day $\tau_1$ and $\tau_2$ ($RR_{IT1\cdot T2}$) minus S&P 500's raw return between day $\tau_1$ and $\tau_2$ ($SPR_{r1-T2}$).

$$CAR_{i,\tau_1-\tau_2} = RR_{i,\tau_1-\tau_2} - SPR_{\tau_1-\tau_2}. \tag{4}$$

Definition of Mean Cumulative Abnormal Return: It is defined as the mathematic average of cumulative abnormal returns of every stock between event day $\tau_1$ and $\tau_2$ .

$$MCAR_{\tau_1-\tau_2} = \frac{\sum_{i=1}^{n} CAR_{i,\tau_1-\tau_2}}{N}. \tag{5}$$

Because the average day between AD+1 (not include AD+1) and CD (not include CD) is different for additions and deletions, we divided this period into four event periods for additions (periods A, B, C, D) and three event periods for deletions (periods A, B, C) to indicate the mean days between AD+1 and CD is four for additions and three for deletions. The mean abnormal returns for those periods are calculated by MCAR between AD+1 (not include AD+1) and CD (not include CD) divided by four for additions and three for deletions. Therefore, MAR for those periods (AD2 to AD5 for additions and AD2 to AD4 for deletions) are only average numbers (not real numbers).

### *6.2. Abnormal Close-Open Difference*

In our study, we need to examine one unique day's abnormal close-open difference. It is the abnormal difference between the close price of announcement day and the open price of the day after that announcement day.

Definition of abnormal close-open difference: Our abnormal close-open difference for stock i on day $\tau$ ($ACO_{IT}$) is defined as the stock's open price on day $\tau$ ($OP_{,r}$) minus the stock's close price on day $\tau$-*1* ($CP_{(r\ 1)}$) divided by the stock's close price on day $\tau$-1 ($CP_{(r\ 1)}$) and then minus the same ratio for the market overall.

$$ACO_{i\tau} = \frac{OP_{i\tau} - CP_{i(\tau-1)}}{CP_{i(\tau-1)}} - \frac{OP_{m\tau} - CP_{m(\tau-1)}}{CP_{m(\tau-1)}}. \quad (6)$$

### *6.3. Arbitrage Opportunity Calculation*

To find and identify the magnitude of arbitrage opportunity is one of the most important purposes of our research.

Definition of Arbitrage Space: The arbitrage opportunity available for stock i (*ASi*) is defined as the difference between the stock's CD+1 closing price ($CD1C_i$) and AD+1 open price ($AD1\ O_i$) divided by the stock's AD+1 open price and then minus the market return between CD+1 close ($CD1C_m$) and AD+1 open ($AD1\ O_m$).

$$AS_i = \frac{CD1C_i - AD1O_i}{AD1O_i} - \frac{CD1C_m - AD1O_m}{AD1O_m}. \quad (7)$$

This is the pure arbitrage caused by index changes. Some researchers define the arbitrage space just as the difference between CD+1 closing price and AD+1 open price divided by the AD+1 open price. If the market changes dramatically during the same period, their definition will cause bias in research.

In this definition, for example, for additions, we assume traders can take the arbitrage opportunity by buying stocks at the open of AD+1 and then selling them at CD close. Actually, for professional traders, their arbitrage space should be bigger than this estimation, we found that open prices of the AD+1 day are statistically higher than the close price in AD+1 day and traders can find a better price in AD+1 day than just taking the open price.

### *6.4. Abnormal Volume Calculation*

Definition of Abnormal Volume: The abnormal volume for stock i on day $\tau$ ($AV_{i\tau}$) is defined as the stock's raw volume on day $\tau$ ($RV_{i\tau}$) minus ten day average volume before AD+1 day ($TDAV_i$) divided by the ten day average volume before AD+1 day and then minus the same ratio for the market overall.

$$AV_{i\tau} = \frac{RV_{i\tau} - TDAV_{i\tau}}{TDAV_{i\tau}} - \frac{RV_{m\tau} - TDAV_{m\tau}}{TDAV_{m\tau}}. \quad (8)$$

Definition of Mean Abnormal Volume: We are interested in the measure of the abnormal volume on an event day $\alpha$ which is called mean abnormal volume for event day $\alpha$ ($MAV_a$). It is defined as the mathematic average of abnormal volume of every stocks we study on that event day.

$$MAV_\alpha = \frac{\sum_{i=1}^{n} AV_{i\alpha}}{N}. \quad (9)$$

Definition of Cumulative Abnormal Volume: We are also interested in calculating the cumulative abnormal volume between day $\tau_1$ and $\tau_2$ ($CAV_{t\ T1\_T2}$). It is defined as the stock's raw volume between day $\tau_1$ and $\tau_2$ ($RV_{IT1}l_{T2}$) minus $TDAV_t$ multiply the number of days (ND) between day $\tau_1$ and $\tau_2$.

$$CAV_{i,\tau_1-\tau_2} = RV_{i,\tau_1-\tau_2} - ND * TDAV_i. \quad (10)$$

Definition of Mean Cumulative Abnormal Volume: It is defined as the mathematic average of cumulative abnormal volumes of every stock between event day $\tau_1$ and $\tau_2$.

$$MCAV_{\tau_1-\tau_2} = \frac{\sum_{i=1}^{n} CAV_{i,\tau_1-\tau_2}}{N}. \quad (11)$$

The same as what we have done in abnormal return, we divide the period between AD+1 (not include AD+1) and CD (not include CD) into four event periods (A, B, C, D) for additions and three event periods for deletions to indicate the mean days between AD+1 and CD. The mean abnormal volumes for those periods are calculated by MCAV between AD+1 (not include AD+1) and CD (not include CD) divided by four for additions and three for deletions. Therefore, MAV for those periods (AD2 to AD5 for additions and AD2 to AD4 for deletions) are only average numbers (not real numbers).

Above are the fundamental definitions and measurements we will use in our research. Basically, we use S&P 500 index as our benchmark for these definition. This will guarantee that the numbers we get are caused by the pure index change effect and not by the markets movements.

### *6.5. Significant Test*

All significance tests are performed using a cross-sectional variance estimator which is introduced by Asquith (1983) and used by Lynch and Mendenhall (1997). We present these significance tests on abnormal return, abnormal close-open difference, arbitrage space and abnormal volume.

For example, for abnormal return, they assume that the $AR_{IT}s$ are cross-sectionally independently and identically distributed normal, then the mean abnormal return for event day $\alpha$ ($MAR_\alpha$) will be a student t distribution with N-1 degrees of freedom. The cross-sectional variance for this distribution is:

$$S^2\left[MAR_\alpha\right]=\frac{1}{N}\sum_{i=1}^{n}\frac{\left[AR_{i\alpha}-MAR_\alpha\right]^2}{N1}. \quad (12)$$

The null hypothesis is:

$$H_0: MAR_\alpha = 0. \quad (13)$$

The alternative hypotheses for additions are $MAR_\alpha > 0$ for event days before CD and $MAR_\alpha < 0$ for event days after CD; the alternative hypotheses for deletions are $MAR_\alpha < 0$ for event days before CD and $MAR_\alpha > 0$ for event days after CD.

For abnormal volume, we do similar tests.

## 7. Results

### *7.1. Price Results*

Tables 2 and 3 present numerical data of mean abnormal return for addition and deletion from AD-10 to CD+20. The MARs between AD+1 and CD are displayed as if each daily MAR over this interval were the interval's MCAR divided by four for additions and three for deletions. Both the announce day price movements and change day price movements are significant.

Figures 3 and 4 present the market adjust price levels from AD-10 to CD+20 using the announce day closing price as benchmark (1 unit). We noticed that the price began to increase or decrease slightly from AD-10 to AD for both figures. This can be explained by the leakage of information or inside trading. After the information of addition or deletion is announced, this movement becomes dramatic. The degrees of price movements for additions and deletions are asymmetric from AD to CD. For addition, we find 8.56% abnormal return for this period. For deletion, the abnormal return is -13.19%. After that, the abnormal return of addition reversed 2.37% to 6.19% and the deletion reversed 6.99% to 6.20% on CD+20. The deletion reverses near three times of the addition. Finally, the abnormal return becomes 6.19% for addition and -6.20% for deletion. The addition and deletion effect becomes symmetric on CD+20 and remains relatively stable near CD+20. This demonstrates that the long-run effects of addition and deletion are similar and symmetric. The asymmetry from AD to CD indicates that people are risk averse and irrational in financial markets in the short-run. Human behaviors such as risk averse can cause inefficient market in the short-run. As time goes on, the market becomes more and more efficient. From this, we believe human behaviors influence the market prices in the short-run and cause a period of inefficient market, but in the long-run, most of these irrational behaviors will reverse to rational levels.

Table 2

Mean Abnormal Return (MAR) for firms added to S&P 500, 1990-2002

| Event Day | N | MAR | P-Value | % AR>0 |
|---|---|---|---|---|
| AD-10 | 189 | -0.27% | 0.8269 | %48 |
| AD-9 | 189 | 0.29% | 0.1244 | %51 |
| AD-8 | 189 | 0.02% | 0.4623 | %50 |
| AD-7 | 189 | -0.04% | 0.5719 | %49 |
| AD-6 | 189 | -0.05% | 0.5867 | %49 |
| AD-5 | 189 | -0.14% | 0.7256 | %47 |
| AD-4 | 190 | 0.28% | 0.2199 | %59 |
| AD-3 | 191 | 0.28% | 0.1145 | %54 |
| AD-2 | 191 | 0.37%* | 0.0425 | %54 |
| AD-1 | 192 | -0.10% | 0.6678 | %48 |
| AD | 192 | 0.18% | 0.2108 | %51 |
| #AD1 | 192 | 4.31%** | 0 | %90 |
| ## AD1 | 192 | 5.12%** | 0 | %91 |
| ### AD1 | 192 | -0.81%** | 0 | %39 |
| AD2 | | 0.65% | | |
| AD3 | | 0.65% | | |
| AD4 | | 0.65% | | |
| AD5 | | 0.65% | | |
| CD | 192 | 1.65%** | 0 | %63 |
| CD1 | 192 | -0.94%** | 0 | %38 |
| CD2 | 192 | -0.33% | 0.0966 | %43 |
| CD3 | 192 | -0.71%* | 0.0050 | %45 |
| CD4 | 192 | -0.21% | 0.1861 | %46 |
| CD5 | 192 | 0.27% | 0.8641 | %55 |
| CD6 | 192 | -0.38% | 0.6799 | %45 |
| CD7 | 192 | 0.24% | 0.8282 | %50 |
| CD8 | 192 | -0.17% | 0.2103 | %48 |
| CD9 | 192 | 0.11% | 0.6921 | %50 |
| CD10 | 192 | -0.14% | 0.2728 | %45 |
| CD11 | 192 | -0.06% | 0.4218 | %48 |
| CD12 | 192 | -0.34% | 0.1006 | %45 |
| CD13 | 192 | 0.22% | 0.8144 | %49 |
| CD14 | 192 | 0.06% | 0.6037 | %52 |
| CD15 | 192 | 0.37% | 0.9384 | %54 |
| CD16 | 192 | -0.13% | 0.3174 | %52 |
| CD17 | 192 | 0.17% | 0.7606 | %45 |
| CD18 | 192 | -0.09% | 0.3457 | %45 |
| CD19 | 192 | -0.31% | 0.1139 | %45 |
| CD20 | 192 | 0.03% | 0.5512 | %50 |

Note: *significant at 5%,**significant at 1%. # is the close to close MAR. ## is the percentage change overnight, this cannot be captured by trader. ### is the MAR during the day, this is the trading profit of the first day from the open price.

Table 3

Mean Abnormal Return (MAR) for firms deleted from S&P 500, 1990-2002

| Event Day | N | MAR | P-Value | % AR>0 |
|---|---|---|---|---|
| AD-10 | 62 | -1.91%* | 0.0356 | %41.94 |
| AD-9 | 62 | 0.51% | 0.7406 | %53.23 |
| AD-8 | 62 | -0.82% | 0.0703 | %48.39 |
| AD-7 | 62 | -0.58% | 0.1471 | %62.90 |
| AD-6 | 62 | -0.17% | 0.1474 | %61.29 |
| AD-5 | 62 | 0.49% | 0.7530 | %64.52 |
| AD-4 | 62 | -1.12% | 0.0612 | %37.10 |
| AD-3 | 62 | -0.99% | 0.0620 | %38.71 |
| AD-2 | 62 | -0.52% | 0.1387 | %43.55 |
| AD-1 | 62 | -0.4% | 0.2220 | %61.29 |
| AD | 62 | 0% | 0.5099 | %48 |
| #AD1 | 62 | -6.48%** | 0 | %15 |
| ## AD1 | 62 | -4.71%** | 0 | %8 |
| ### AD1 | 62 | -1.79%* | 0.0043 | %35 |
| AD2 | | -0.67% | | |
| AD3 | | -0.67% | | |
| AD4 | | -0.67% | | |
| CD | 62 | -2.74%** | 0.0002 | %25.81 |
| CD1 | 62 | -1.96% | 0.8684 | %59.68 |
| CD2 | 62 | 0.05% | 0.4614 | %54.84 |
| CD3 | 62 | -0.03% | 0.5265 | %51.61 |
| CD4 | 62 | -0.09% | 0.5485 | %59.68 |
| CD5 | 62 | -0.06% | 0.5637 | %51.61 |
| CD6 | 62 | 0.99% | 0.0417 | %51.61 |
| CD7 | 62 | 0.16% | 0.4003 | %48.39 |
| CD8 | 62 | 0.01% | 0.4953 | %43.55 |
| CD9 | 62 | 0.14% | 0.3678 | %50.00 |
| CD10 | 62 | 0.57% | 0.1356 | %51.61 |
| CD11 | 62 | 0.72% | 0.0812 | %50.00 |
| CD12 | 62 | 0.57% | 0.1725 | %40.32 |
| CD13 | 62 | -0.03% | 0.5331 | %48.39 |
| CD14 | 62 | 0.40% | 0.2151 | %50.00 |
| CD15 | 62 | 1.11%** | 0.0008 | %69.35 |
| CD16 | 62 | 0.69%* | 0.0391 | %54.84 |
| CD17 | 62 | 1.16%* | 0.0401 | %59.68 |
| CD18 | 62 | -0.12% | 0.6145 | %43.55 |
| CD19 | 62 | 0.45% | 0.2140 | %54.84 |
| CD20 | 62 | 0.30% | 0.2309 | %51.61 |

Note: *significant at 5%,**significant at 1%. # is the close to close MAR. ## is the percentage change overnight, this cannot be captured by trader. ### is the MAR during the day, this is the trading profit of the first day from the open price.

All but one of the prior studies report that the price increase is permanent, supporting the hypothesis that demand curves for stocks slope downward in the long-run. In our research, we divided the total abnormal return between announce day and change day into two parts. The first part is the abnormal return between AD and CD-1, because most index funds change their portfolios on CD, we believe most of the abnormal returns of this period are caused by new information released on AD[1]; the second part is the abnormal return on CD on which most index funds change their portfolios and no new information comes in (the change of index has already been released on AD). Although part of the total price movement from AD to CD appears to be permanent (the abnormal returns still remain at 6.19% for addition and -6.20% for deletion on CD+20), the change day abnormal returns and part of the abnormal returns between AD and CD-1 are reversed on the CD+20. We believe this gives us enough evidence to reject the downward-sloping long-run demand curves hypothesis under the discovery that the index change is not an information free event.

The downward-sloping long-run demand curves hypothesis says that as firms enter the S&P 500, index-fund buying removes a substantial fraction of the firm's shares from circulation. This demand by index funds reduces the stock's supply for nonindexing investors, causing the market clearing price to increase. For deletions, this effect should be in the opposite direction. If the long-term demand curves for stocks were horizontal and no new information comes in at the same time, the reduction of the stock's supply would not influence the stock price. All the prior studies analyze this hypothesis based on the assumption that S&P index change is an information free event, however recently Diane, John, Alexei and Yun demonstrated that S&P index inclusion is not an information free event. Under the assumption of information free, only the abnormal return from AD to CD totally reverses can provide enough evidence rejecting the downward-sloping long-run demand curves hypothesis. While under the assumption that S&P index change is not an information free event, only part of the abnormal return from AD to CD reverses may give enough evidence rejecting the downward-sloping long-run demand curves hypothesis. The permanent part abnormal return can be contributed to the new information released on AD.

For the post-1989 effect, the change day abnormal volume is two times of the cumulative abnormal volume from AD1 to AD5 for additions and three times from AD1 to AD4 for deletions. Therefore, most of the change happens on the change day. At most, without the assumption of information free, if 1.5 times of the change day abnormal return for additions reversed or 1.33 times of the change day abnormal return for deletions reversed, we have enough evidence to reject the downward-sloping long-run demand curve hypothesis. In our research, without the information free assumption, we have enough evidence to reject the downward sloping long-run demand curve hypothesis. The reversing of change day abnormal return and part of the abnormal return between AD and CD-1 reject the downward sloping long-run demand curves hypothesis directly. The change day abnormal return can be explained as the evidence of downward-sloping short-run demand curves not long-run. The abnormal return on CD and part of AD to CD-1 reverses several days later indicates the long-run demand curves of stocks are horizontal.

The mean cumulative abnormal return from AD to CD is 8.44% for addition and -11.10% for deletion. We found an arbitrage space of 3.2% for additions and -6.7% for deletions which use the strategy of buying/selling at the open of AD+1 and covering those positions at the close of CD.

### *7.2. Volume Results*

Tables 4 and 5 present numerical data of mean abnormal volume for additions and deletions from AD-10 to CD+20. The MAVs between AD+1 and CD are displayed as if each daily MAV over this interval were the interval's MCAV divided by four for additions and three for deletions. Both the announce day abnormal volume and change day abnormal volume are significant.

Figures 5 and 6 present the market adjust volume level from AD-10 to CD+20 using the ten day average volume before announce day as the benchmark (1 unit). We noticed that the market adjust volume level on change day is 15.4 times the benchmark for additions and 21.1 times the benchmark for deletions. This indicates most index funds change most of their portfolios on change day.

[1] Diane, John, Alexei and Yun demonstrate that S&P index inclusion is not an information free event.

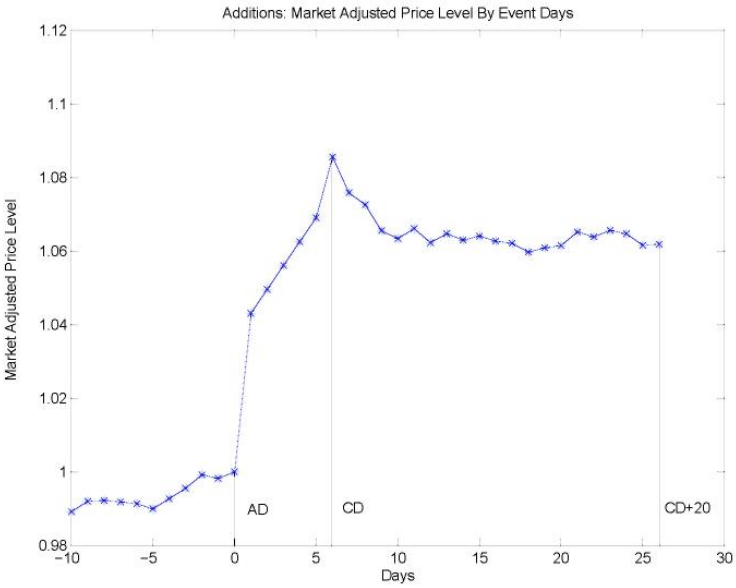


Fig. 3. Market Adjust Price Level for Additions from AD-10 to CD+20 (We use the announce day close price as the benchmark (1 unit), the points on the figure are the mean abnormal price levels for each event day between AD-10 and CD+20)

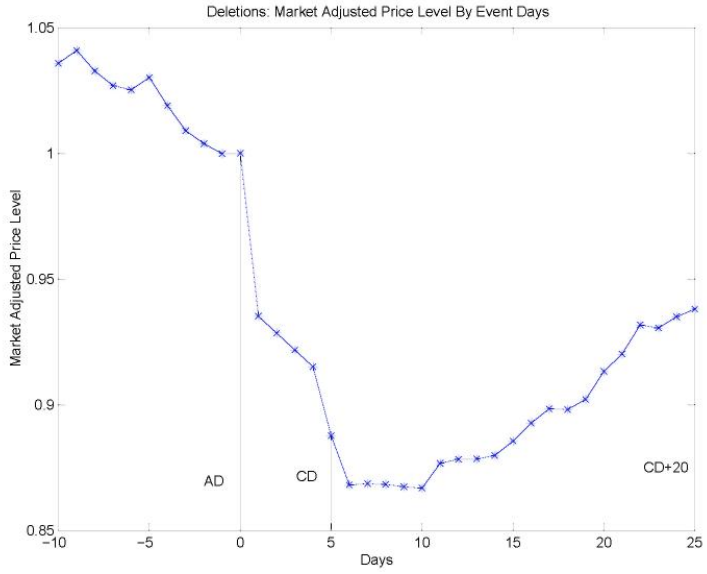


Fig. 4. Market Adjust Price Level for Deletions from AD-10 to CD+20 (We use the announce day close price as the benchmark (1 unit), the points on the figure are the mean abnormal price levels for each event day between AD-10 and CD+20)

Table 4

Mean Abnormal Volume (MAV) for firms added to S&P 500, 1990-2002

| Event Day | N | MAV | P-Value | % AV>0 |
|---|---|---|---|---|
| AD-10 | 189 | -5.65% | 0.8793 | %37 |
| AD-9 | 189 | -5.26% | 0.9038 | %38 |
| AD-8 | 189 | -10.35% | 0.9950 | %35 |
| AD-7 | 189 | -10.70% | 0.9987 | %35 |
| AD-6 | 189 | -4.68% | 0.8658 | %38 |
| AD-5 | 189 | -10.40% | 0.9988 | %33 |
| AD-4 | 190 | -2.61% | 0.7418 | %38 |
| AD-3 | 191 | -8.78% | 0.9442 | %36 |
| AD-2 | 191 | -5.32% | 0.9287 | %36 |
| AD-1 | 192 | -10.17% | 0.9984 | %33 |
| AD | 192 | -0.53% | 0.5488 | %42 |
| AD1 | 192 | 290%** | 0 | %90 |
| AD2 | | 93.92% | | |
| AD3 | | 93.92% | | |
| AD4 | | 93.92% | | |
| AD5 | | 93.92% | | |
| CD | 192 | 1442%** | 0 | %98 |
| CD1 | 192 | 267.5%** | 0 | %85 |
| CD2 | 192 | 220.8%* | 0.0282 | %73 |
| CD3 | 192 | 186.7%* | 0.0458 | %71 |
| CD4 | 192 | 211.4% | 0.0792 | %64 |
| CD5 | 192 | 142.8% | 0.0653 | %59 |
| CD6 | 192 | 114.2%* | 0.0263 | %59 |
| CD7 | 192 | 98.6% | 0.0614 | %57 |
| CD8 | 192 | 149.9% | 0.0956 | %48 |
| CD9 | 192 | 116.5% | 0.0764 | %51 |
| CD10 | 192 | 124.2%* | 0.0424 | %52 |
| CD11 | 192 | 111.9%* | 0.0384 | %54 |
| CD12 | 192 | 117.8%* | 0.0336 | %55 |
| CD13 | 192 | 105.1% | 0.0508 | %58 |
| CD14 | 192 | 95.9% | 0.0668 | %49 |
| CD15 | 192 | 99.1%* | 0.0378 | %50 |
| CD16 | 192 | 65.7% | 0.0695 | %46 |
| CD17 | 192 | 62.7% | 0.0936 | %49 |
| CD18 | 192 | 70.2% | 0.0602 | %48 |
| CD19 | 192 | 125.6% | 0.1124 | %44 |
| CD20 | 192 | 77.8% | 0.0809 | %46 |

Note: *significant at 5%,**significant at 1%.

Table 5

Mean Abnormal Volume (MAV) for firms deleted from S&P 500, 1990-2002

| Event Day | N | MAV | P-Value | % AV>0 |
|---|---|---|---|---|
| AD-10 | 62 | 4.20% | 34.50 | %38.71 |
| AD-9 | 62 | -6.24% | 79.94 | %38.71 |
| AD-8 | 62 | -10.04% | 92.32 | %37.10 |
| AD-7 | 62 | -12.76% | 98.51 | %32.26 |
| AD-6 | 62 | -9.09% | 91.74 | %40.32 |
| AD-5 | 62 | -7.41% | 85.45 | %43.55 |
| AD-4 | 62 | -20.39% | 99.94 | %27.42 |
| AD-3 | 62 | -6.27% | 75.65 | %33.87 |
| AD-2 | 62 | -7.44% | 0.8670 | %40.32 |
| AD-1 | 62 | -0.2696% | 1 | %22.58 |
| AD | 62 | -15.47% | 0.9814 | %34 |
| AD1 | 62 | 254.07%** | 0 | %84 |
| AD2 | | 126.38% | | |
| AD3 | | 126.38% | | |
| AD4 | | 126.38% | | |
| CD | 62 | 2013.67%** | 0 | %98.39 |
| CD1 | 62 | 406.15%** | 0 | %91.94 |
| CD2 | 62 | 177.32%** | 0 | %77.42 |
| CD3 | 62 | 146.03%** | 0 | %72.58 |
| CD4 | 62 | 136.55%** | 0.0002 | %67.74 |
| CD5 | 62 | 107.53%** | 0.0001 | %62.90 |
| CD6 | 62 | 84.70%** | 0.0003 | %66.13 |
| CD7 | 62 | 62.67%** | 0.0012 | %53.23 |
| CD8 | 62 | 62.80%** | 0.0016 | %61.29 |
| CD9 | 62 | 77.31%** | 0.0021 | %56.45 |
| CD10 | 62 | 59.00%* | 0.0190 | %53.23 |
| CD11 | 62 | 26.36%* | 0.0459 | %58.06 |
| CD12 | 62 | 25.51%* | 0.0362 | %54.84 |
| CD13 | 62 | 28.21%* | 0.0252 | %45.16 |
| CD14 | 62 | 28.38%* | 0.0201 | %46.77 |
| CD15 | 62 | 31.00%* | 0.0309 | %51.61 |
| CD16 | 62 | -6.59% | 0.7181 | %38.71 |
| CD17 | 62 | -1.32% | 0.5454 | %41.94 |
| CD18 | 62 | 25.70% | 0.0660 | %49.77 |
| CD19 | 62 | 10.75% | 0.2277 | %41.94 |
| CD20 | 62 | 18.05% | 0.1194 | %41.94 |

Note: *significant at 5%, **significant at 1%.

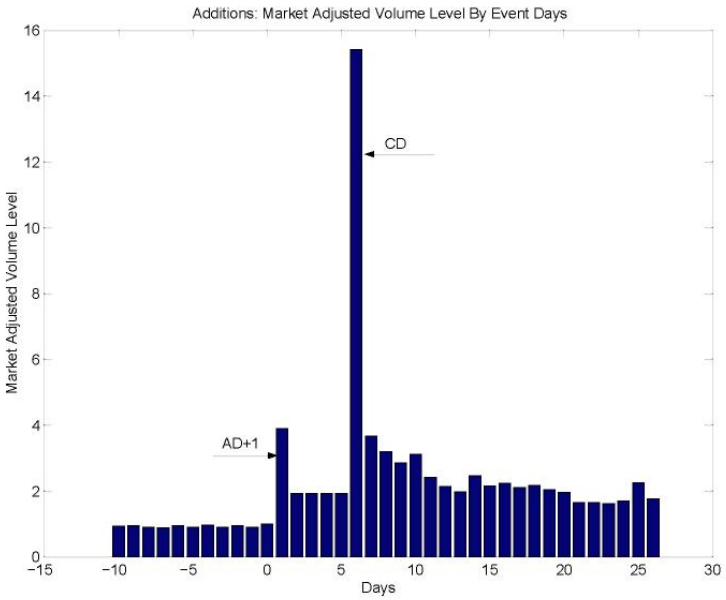


Fig. 5. Market Adjust Volume Level for Additions from AD-10 to CD+20 (We use the ten day average volume before announce day as the benchmark (1 unit), the points on the figure are the mean abnormal volume levels for each event day between AD-10 and CD+20)

### *7.3. Market Efficiency*

One of the most important purpose of this paper is to show the dynamic evolvement of the addition and deletion effect since the starting of Standard and Poor's new regulation.

Our first attempt is to demonstrate the evolvement of the market efficiency of changing the rule. In order to test the market efficient theory, we run linear regression for the arbitrage space against time. The outcomes are shown in Figures 7 and 8. Both figures indicate that as time goes on, the arbitrage spaces become smaller. Especially for the deletions in Figure 8, the arbitrage space has declined dramatically since the beginning and has almost diminished recently. This is strong evidence that somebody is taking advantage of this arbitrage and making the market more efficient. This analysis also demonstrates the periodic inefficiency of markets. When there are some changes or new information comes into market places, markets will become inefficient in the short-run and it will take some time for the market to recalibrate from inefficiency to efficiency. Markets need time to adjust to the semi-strong form market efficiency when there are some structural changes or new information comes in. We call this period of adjustment the "inefficiency window". We believe the length of the inefficiency window is decided by how fast markets can understand and take advantage of the new information. The more difficult the market acclimates to the changes or new information, the longer it will take to return the market to the semi-strong form market efficiency. The short-run profits of traders come from the short-run inefficiency of markets.

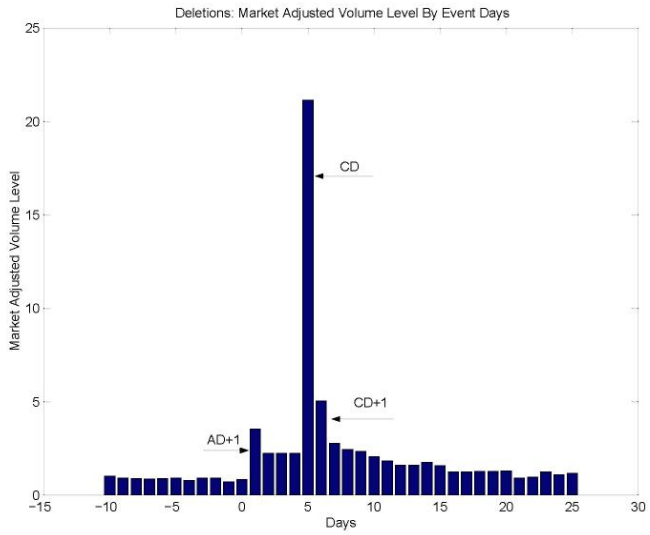


Fig. 6. Market Adjust Volume Level for Deletions from AD-10 to CD+20 (We use the ten day average volume before announce day as the benchmark (1 unit), the points on the figure are the mean abnormal volume levels for each event day between AD-10 and CD+20)

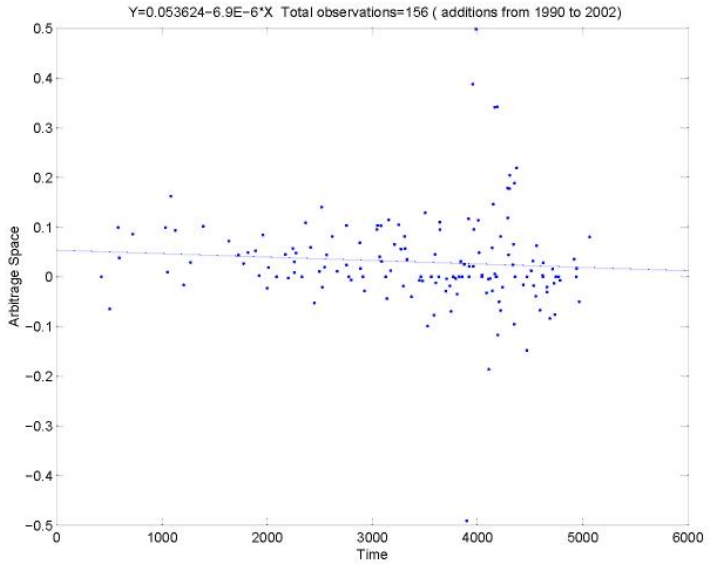


Fig. 7. Arbitrage space of additions against time during the period of January 1990-December 2002 (using average value if there are more than one observations in one day)

Figures 9 and 10 show the relationship between AD+1 day abnormal volume and time for additions and deletions. Both figures show a positive coefficient which indicates more and more people are involved in profiting from this arbitrage.

Figures 11 and 12 show the relationship between CD day abnormal return and time for additions and deletions. Both figures indicate the degree of abnormal return is getting smaller and smaller which also means more and more people are taking advantage of this arbitrage by selling those stocks on CD.

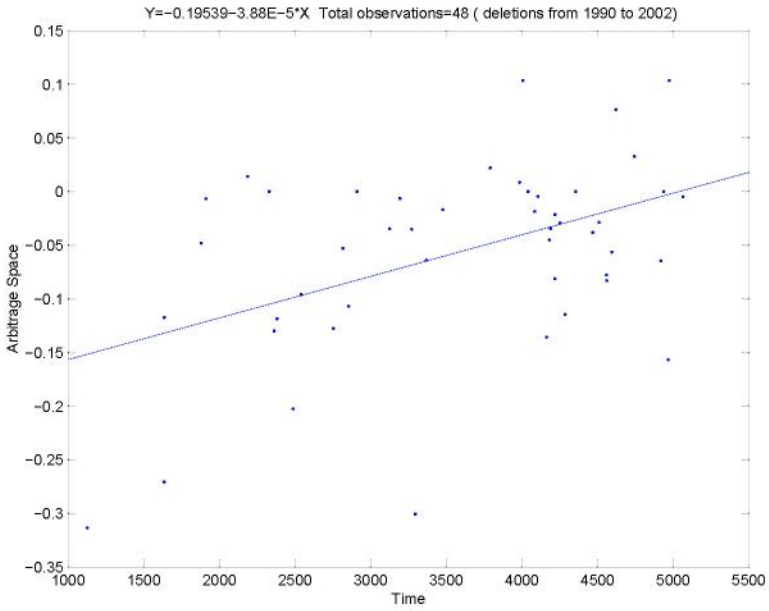


Fig. 8. Arbitrage space of deletions against time during the period of January 1990-December 2002 (using average value if there are more than one observations in one day)

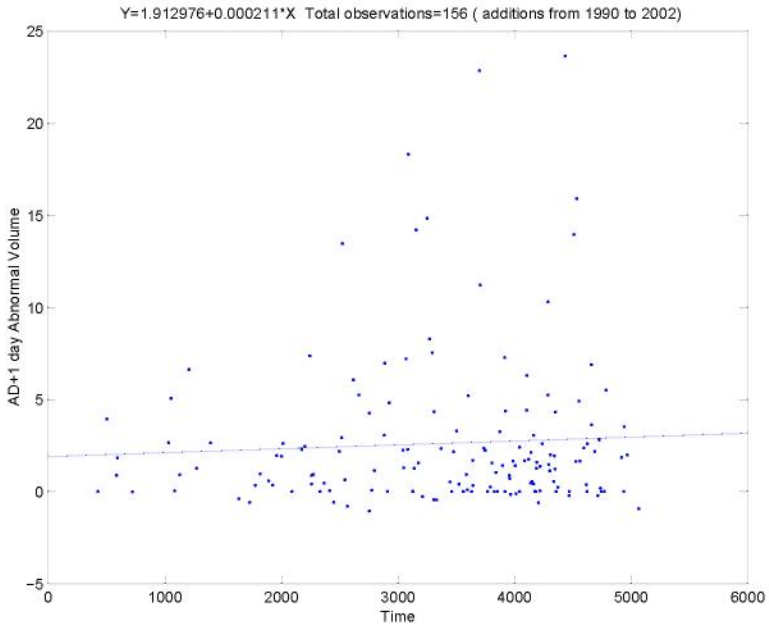


Fig. 9. AD+1 day abnormal volume against time for additions (using average value if there are more than one observations in one day)

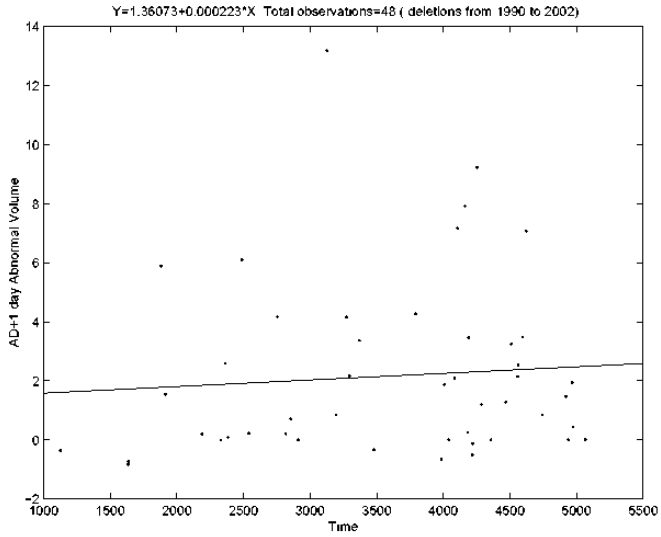


Fig. 10. AD+1 day abnormal volume against time for deletions (using average value if there are more than one observations in one day)

### *7.4. Index Fund Premium*

The second dynamic evolvement we want to present here is the dynamic change of index fund premiums from 1990 to 2002. We define index fund premium as the cumulative abnormal return from announce day to change day. Figures 13 and 14 show the evolvement of index fund premiums from 1990 to 2002.

Both additions and deletions show decline of this index fund premium. The decline for addition is slight while the decline for deletion is obvious. Both tell us, index funds still need to pay a premium in additions and deletions although the magnitude of this premium for deletions declined dramatically during the past decade. We worry about the long-run performance of the index funds because the total premium paid by index fund will accumulate to a significant number as time goes on. This is one of the increasing problems of index funds

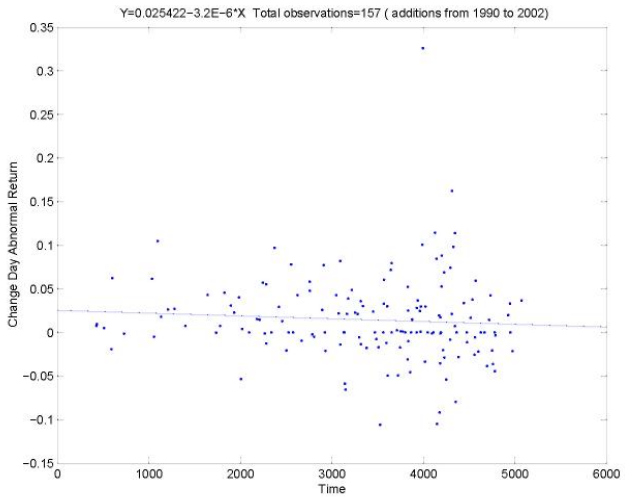


Fig. 11. Change day abnormal return against time for additions (using average value if there are more than one observations in one day)

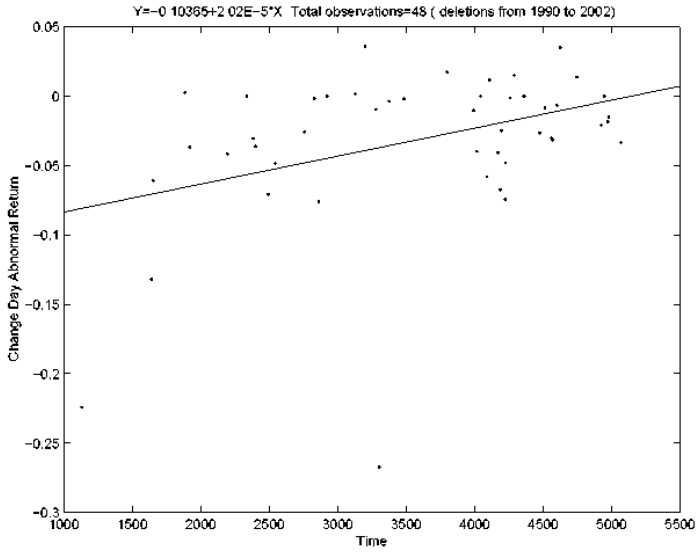


Fig. 12. Change day abnormal return against time for deletions (using average value if there are more than one observations in one day)

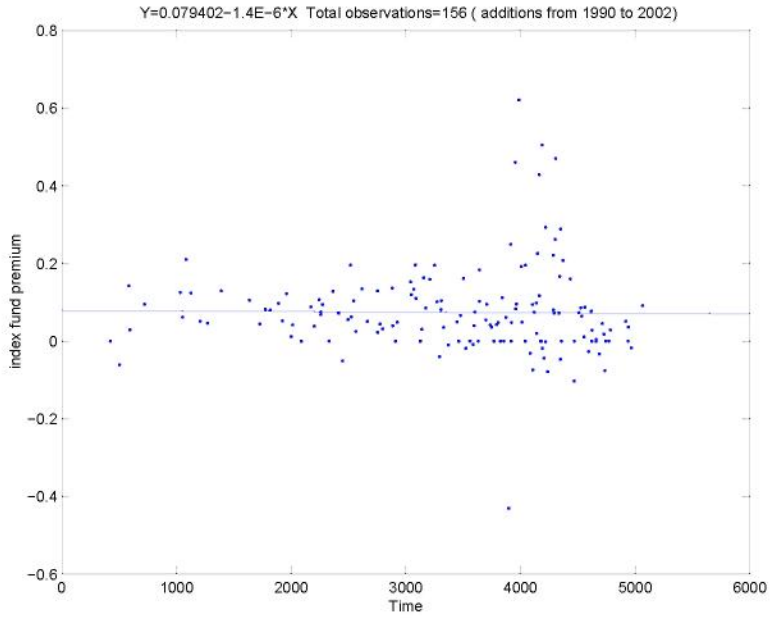


Fig. 13. Index fund premium against time for additions from 1990 to 2002 (using average value if there are more than one observations in one day)

### *7.5. Return Volume relations*

Figures 15, 16, 17 and 18 show the relationship between abnormal return and abnormal volume on AD and CD. On announce day, the coefficient of correlation between abnormal return and abnormal volume is 0.2227 for additions and -0.1664 for deletions. On change day, it becomes -0.10759 for additions and 0.09464 for deletions.

Previous studies have documented the positive contemporaneous correlation between a stock's trading volume and its return. Most of these researches found a positive correlation between contemporaneous trading volume and price changes.

Our outcome on the announce day is consistent with these findings. Both Figures 15 and 16 show a positive correlation between contemporaneous trading volume and absolute price changes. We also found that the directions of price changes are on the opposite side for additions and deletions. Our outcome demonstrates volume does not predict direction, but only price volatility. It is the nature of information (good or bad) causing the abnormal volume which decides the directions of stock movements. For additions (good), the direction is positive; For deletion (bad), the direction is negative.

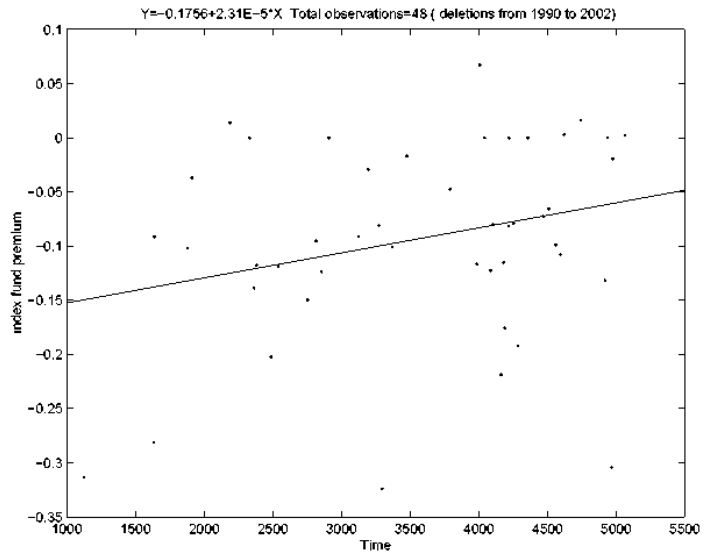


Fig. 14. Index fund premium against time for deletions from 1990 to 2002 (using average value if there are more than one observations in one day)

More interestingly, our outcome on change day (Figures 17 and 18) is inconsistent with what has been found in previous studies. The correlation between contemporaneous trading volume and absolute price changes is negative on change day. We believe this difference is caused by the different information content of abnormal volume on announce day and change day. The announce day abnormal volume is caused by information while the change day abnormal volume does not indicate any additional information, it is only caused by the changing of index funds. From this, we can also conclude that information plays an important role in the relationship between abnormal volume and abnormal return. The volume is only a proxy of information flow in some cases.

## 8. Conclusion

This paper studies the addition and deletion effects of the Standard & Poor's 500 index from 1990 to 2002. We found direct evidence rejecting the downward-sloping long-run demand curves hypothesis which has been supported by most of the prior studies for decades. We demonstrated that the demand curves are only downward-sloping in the short-run and horizontal in the long-run. We also focused our research on the dynamic evolvement of these effects from 1990 to 2002 which indicates markets are becoming increasingly efficient. Markets need time to adjust to semi-strong form market efficiency when there are some structural changes or new information comes. We use this sample to demonstrate the relationship between volume, return and information. Our outcome indicates volume does not predict direction, but only price volatility. It is the nature

of information (good or bad) which causes the abnormal volume which decides the directions of stock movements. Information plays an important role in the relationship between abnormal volume and abnormal return. The volume is only a proxy of information flow in some cases. This paper also shows how human behaviors such as risk averse can influence market efficiency in the short-run and how market evolves from inefficiency to efficiency in the long-run. The short-run profits of traders come from the short-run inefficiency of markets. We worry about the long-run performance of the index funds, because the total premium paid by index funds will accumulate to a significant amount as time goes on. This is one of the uprising problems of index funds.

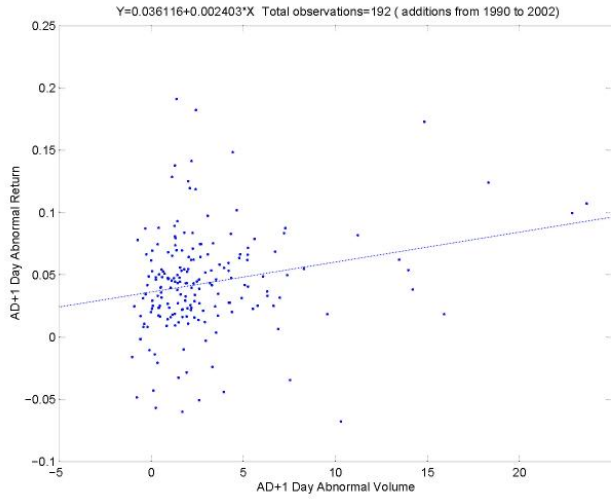


Fig. 15. Relationship between abnormal return and abnormal volume on AD+1 day for additions

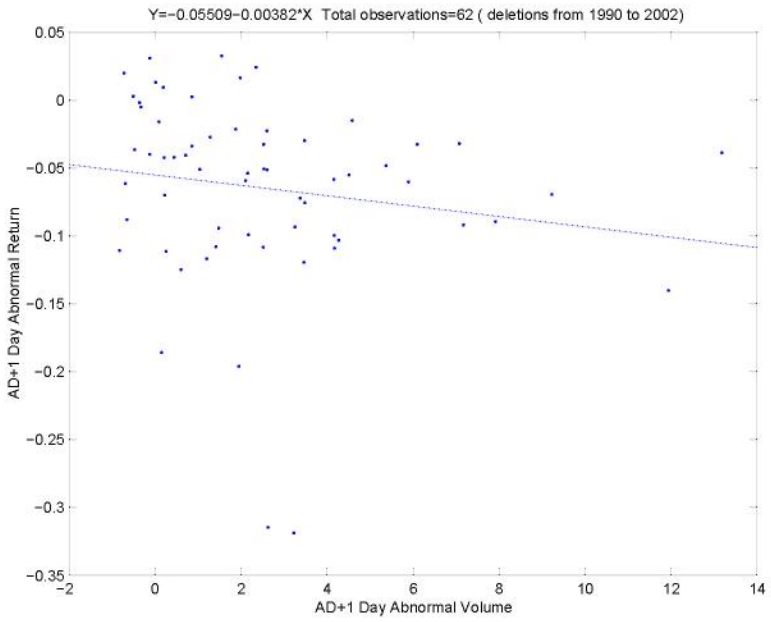


Fig. 16. Relationship between abnormal return and abnormal volume on AD+1 day for deletions

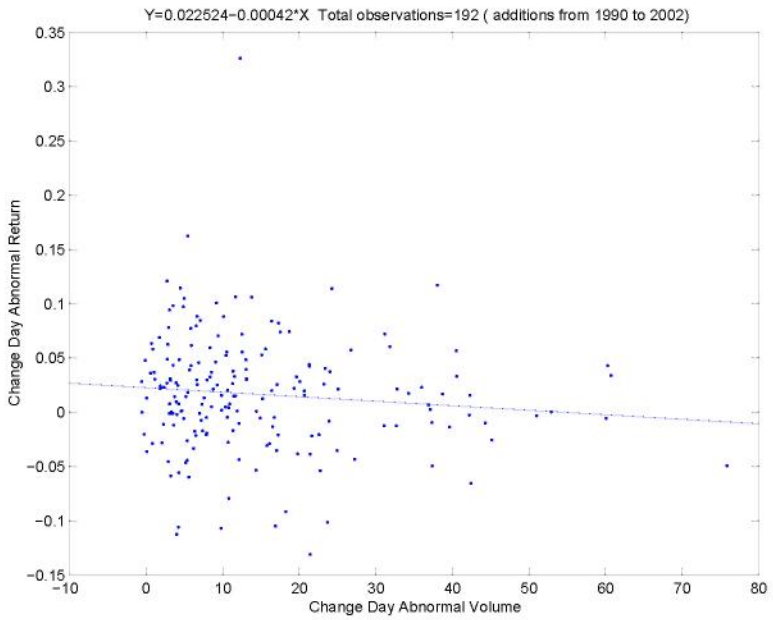


Fig. 17. Relationship between abnormal return and abnormal volume on change day for additions

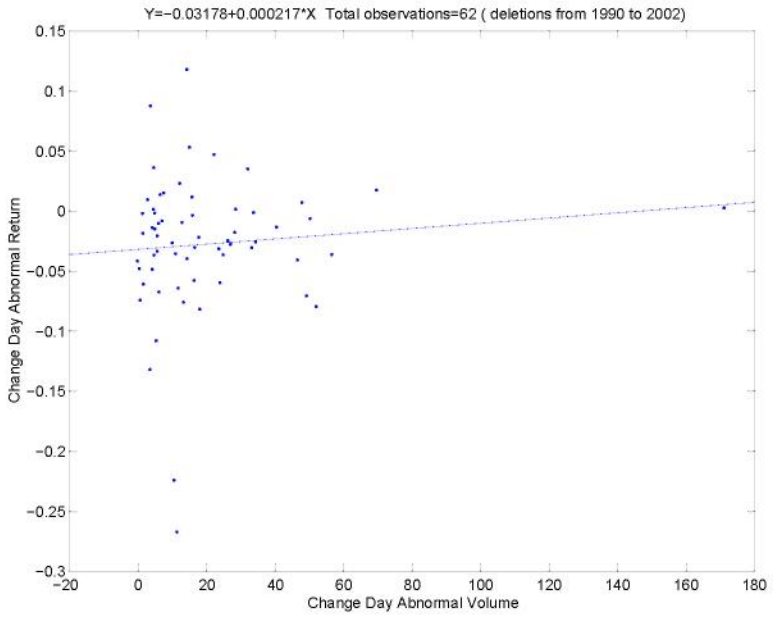


Fig. 18. Relationship between abnormal return and abnormal volume on change day for deletions

There are a total of 353 S&P 500 index changes (353 additions, 353 deletions) from 1990 to 2002. Our clean sample contains 192 additions and 62 deletions from 1990 to 2002. We find a mean cumulative abnormal return from AD to CD of 8.44% for additions and -11.10% for deletions. The abnormal returns still remain at 6.19% for additions and -6.20% for deletions 20 days after

change day. We found an arbitrage space of 3.2% for additions and -6.7% for deletions which use the strategy of buying/selling at the open of AD+1 and covering those positions at the close of CD. We found indications of leakage of information and inside trading.

We found the degree of price movements for additions and deletions are asymmetric from announce day to change day. This asymmetry indicates people are risk averse and irrational in the short-run. Finally, the addition and deletion effects become symmetric on CD+20. This indicates that human behaviors influence the market prices in the short-run and cause a period of inefficient market while most of these irrational behaviors will reverse to efficient levels in the long-run.

Our findings directly reject the downward sloping long-run demand curves hypothesis. We divide the total abnormal return between announce day and change day into two parts. The first part was the abnormal return between AD and CD-1, most of it is caused by new information released on AD; the second part is the abnormal return on CD, most of it is caused by short-run downward-sloping demand curves on CD. The latter part is totally reversed several days later and part of the first part is also reversed on CD+20 in our research. The change day abnormal return can be only explained as the evidence of downward-sloping short-run demand curves not long-run. The abnormal return on CD reversed several days later which indicates the long-run demand curves of stocks are horizontal.

By analyzing the evolvement of this effect, we found as time goes on, the arbitrage spaces become smaller. Markets become more efficient. The analysis also demonstrated the periodic inefficiency of markets. When there are some changes or new information comes into market places, markets will become inefficient in the short-run and it will take some time to recalibrate the market from inefficiency to efficiency. Markets need time to adjust to semi-strong form market efficiency when there are some structural changes or new information comes in. We call these periods of adjustment inefficiency windows. We believe the length of an inefficiency window is decided by how fast markets can understand and take advantage of the new information. The more difficult the market acclimate to the changes or new information, the longer it will take to return the market to efficiency. The short-run profits of traders come from the short-run inefficiency of markets.

Both additions and deletions' index fund premium declined from 1990 to 2002. The decline for addition is slight while the decline for deletion is obvious. However, index funds still need to pay a premium in additions and deletions although the magnitude of this premium for deletions declined dramatically during the past decade. We worry about the long-run performance of the index funds because the total premium paid by index funds will accumulate to a significant amount over time.

Our outcome of the volume return relationship on announce day is consistent with previous findings. Both additions and deletions show a positive correlation between contemporaneous trading volume and price changes on announce day. We also found the directions of price changes are on the opposite side for additions and deletions. Our outcome demonstrates volume does not predict direction, only price volatility. It is the nature of information (good or bad) that causes the abnormal volume which decides the directions of stock movements. For additions (good), the direction is positive; for deletions (bad), the direction is negative.

We found the volume return relationship on announce day and change day are different. The correlation between contemporaneous trading volume and price changes is positive on announce day and negative on change day. We believe this difference is caused by the different information content of abnormal volume on announce day and change day. The announce day abnormal volume is caused by information while the change day abnormal volume does not indicate any additional information. We can conclude that information plays an important role in the relationship between abnormal volume and abnormal return. The volume is only a proxy of information flow in some cases.

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