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# A Re-Examination of the Index Effect:
# Gambling on Additions to and Deletions from the S&P 500's 'Gold Seal'

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## Abstract

This study examines the abnormal returns, trading activity, volatility and long term performance of stocks that were added to the S&P 500 Index. By using a three-factor pricing model that allows for firm size and value characteristics as well as market risk, we are able to shed new light on the widely observed 'index effect'. We find that the CAPM tends to overstate the performance of large firms and to understate the performance of small firms. We also find a transitory increase in trading volume between the announcement and a few days after the effective date. In terms of the firm's operating performance, we find a significant increase in earnings per share after inclusion, which combines with the stock price rise to leave the average price-earnings ratio largely unaltered. Examining a unique sample of deletions of international companies and replacements with US companies, we find that deleted stocks experienced a considerable and permanent fall in price, inconsistent with the investor recognition hypothesis. The "seal" of S&P 500 Index membership has very long term effects and inclusion appears not to be an information-free event.

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## I. Introduction

One of the strongest implications that follows from the development of the Capital Asset Pricing Model is the efficiency of the market portfolio. The associated CAPM-based tests of managed funds show that the benchmark corresponding to a passive position in a market-wide index offer a severe challenge to active fund managers. This makes the case for fund-management aiming only to match a market portfolio and by the mid-1970s there were already several index funds established in the US market[1]. With these index funds, there is no attempt to "beat the market" or to use active management strategies to make bets on individual stocks. The aim of such funds is to minimize the difference between the returns from the portfolio and the chosen market index. The difference is defined as the tracking error and is usually minimized in practice by the index fund holding all of the securities in the index being tracked, that is, the fund replicates the composition of the index in its portfolio. Thus, whenever a change in the composition of the market index occurs, those index funds that created their portfolios by replication need to rebalance their holdings immediately. Changes in the composition of the major market indices therefore results in trades associated with the needs of index funds and consequently the "index effect" refers to the price pressure that is observed when a stock is added to or deleted from an index. The proportion of funds under management in the US that are indexed has been growing considerably through time and this growth would be expected to ensure a positive demand ('price pressure') for those stocks newly included and a negative demand for the stocks dropped from the index.

In addition to those observed in the US market, price pressures from index changes were also found in the German market for the DAX blue-chip and the DAX mid-cap (Deininger, Kaserer and Roos, 2000), as well as in the New Zealand market (Elayan, Li and Pinfold, 2001). The latter study is of particular interest since the abnormal returns could not be attributed to index fund trading due to the relatively small capitalization of passive funds in New Zealand (0.5% of market capitalization). There

[1] The largest index fund in the US market is the Vanguard 500 Index Fund that was created in 1976.

were also significant price reactions from changes in the in MSCI country indices (Chakrabarti *et al*., 2002) and in particular, the UK (Goodacre and Lawrence, 1994).

Our study focuses on the index effect of S&P 500 additions and builds upon existing studies from three important viewpoints. First, the Fama-French three factor model (Fama and French, 1995) is employed to calculate abnormal returns during an event window around the inclusion, rather than the single-factor models employed exclusively in the current literature. This allows us to determine whether the index effects observed in extant papers can be explained by the use of a broader risk-adjustment model incorporating additional factors that have been widely cited as driving the variation in stock returns. Second, we make use of a longer run of data on index additions than those covered in previous research in this area. We also separately examine a historically unique phenomenon whereby Standard and Poor's deleted a number of international firms in the index during July 2002 and replaced them with US firms. Finally, we examine the impact of index inclusion on a firm's operating performance using some measures not previously examined.

## II. The Selection Criteria and Announcement Policy of the Standard and Poor's Index Committee[2]

Standard and Poor's changed their announcement policy twice – in September 1976 and more recently in October 1989. The latter change was made in order to alleviate the price pressure on the announcement date that occurred prior to this when index inclusion took place immediately the day after announcement. Changes are now pre-announced an average of five days before the event. The period from the announcement date to the effective date can give enough time for institutional investors and index fund managers to adjust their holdings, if they so wish. The announcement, which takes place after the market close, reveals the name of the firm that will be added (deleted) and the exact date that the event will take place . In some cases, however, the exact date of the event is not announced. In those cases, the announcement states only the names of the firms, and the exact event will happen at a date to be

[2] Source: S&P Corporation, www.spglobal.com.

announced. Thus, investors and index fund managers have to wait until the event announcement that will happen at the market close of a future date. The change will then become effective the next morning of the event announcement.

## III. Previous Literature and Candidate Hypotheses that can explain the Index Effect

According to the statements of the S&P 500 Index Committee, changes in the S&P 500 composition are supposed to be information-free events - in other words, they do not convey any new information about the future prospects of the underlying stocks. However, observed stock behavior during the event period is not consistent with this perception and high abnormal returns often occur on the day after the announcement. Beneish and Whaley (1996 and 1997) were the first researchers to examine the effects of the new Standard and Poor's announcement policy implemented in October 1989. They found that the price increase after inclusion was permanent (nearly 4%) and that under the new policy, the average price increase was greater. The importance of the increased demand caused by index funds and other institutional buyers after index changes was tested by Pruitt and Wei (1989), who found a positive relation between the abnormal return on the first day after addition and the net change in institutional ownership. Graham and Pirie (1994) examined the index fund rebalancing that was required when RJR/Nabisco was removed from the S&P 500 Index in February 1989. This event caused a decrease of 0.9% in the aggregate value of the portfolio represented by the S&P 500.

The index effect has been shown in numerous other studies to result in unusual stock price behavior during the event period that cannot be consistent with the efficient markets hypothesis (EMH). Consequently, a number of other hypotheses have been considered to justify this performance. The hypotheses that have been proposed in the previous literature are the Price Pressure Hypothesis, the Imperfect Substitutes/Downward-Sloping Demand Curve for Stocks Hypothesis, the Liquidity Cost Hypothesis, the Information Content/Index Member Certification Hypothesis, and the Market Segmentation/Investor Recognition Hypothesis. Their main differences concern whether the stock price

or volume change is temporary or permanent after the event, what kind of information is revealed with an addition or deletion, and what are the main issues for stock and investor behavior.

*The Price Pressure Hypothesis (PPH)*

The concept underlying this hypothesis is that investors who provide liquidity to the market without having any motivation to trade should be compensated by a premium that reflects their extra costs and the risks of these trades. After the event period, any abnormal return is expected to reverse fully and to reflect the long-term equilibrium price. The effect on trading volumes should closely resemble the price effect. Harris and Gurel's (1986) results were in favor of the Price Pressure Hypothesis since they found a significant stock price increase of 3.13% after inclusion, which was fully reversed after two weeks. Woolridge and Ghosh (1986) found that trading volumes also increased temporarily for the period around the event. Arnott and Vincent (1986) found price increases for additions and price decreases for deletions and both were significant and persistent for a period of four weeks after the event, but they could not tell with certainty if the Price Pressure Hypothesis held. Lamoureux and Wansley (1987), Lynch and Mendenhall (1997), and Malkiel and Radisich (2001) also found significant "price pops" after inclusion but no longer-term effects on prices.

*The Imperfect Substitutes and the Downward-Sloping Demand Curve for Stocks Hypothesis (DSH)*

Scholes (1972) argued that stocks are not "unique works of art" and their demand curves are kept flat by arbitrage between perfect substitutes. However, the imperfect substitutes hypothesis holds that stocks belonging to the S&P 500 Index do not have perfect substitutes and have downward-sloping demand curves. Therefore, their exact characteristics cannot be described by a combination of other securities, and replicating strategies are less than perfect. According to the hypothesis, prices will change to eliminate any excess demand in the market and no reversal is expected in the long-term. In addition, abnormal trading activity should be temporary until the new level of price equilibrium is reached. Shleifer (1986) examined whether the DSH holds in a situation where information effects probably play no role. He found that the share price increase at the announcement date of an index addition was positively related to

the shift of the demand curve for stocks. Wurgler and Zhuravskaya (2002) argued that in reality, stock markets do not work as effectively as theory suggests because individual stocks do not have perfect substitutes and when arbitrageurs hedge with opposite positions in imperfect substitutes, they bear the risk. The DSH could also explain the results of Morck and Yang (2002), who found that S&P 500 membership was associated with significantly higher valuations of member firms.

*The Liquidity Cost Hypothesis (LCH)*

Since the S&P 500 is tracked by the majority of leading index funds, inclusion should enhance the liquidity of the underlying stock. Liquidity ensures the ability to sell a stock immediately and at an appropriate price. Mikkelson and Partch (1985) found that an increase in the stock's liquidity could result in an increase in its price due to lower transaction costs, a finding echoed by Amihud and Mendelson (1986). According to the LCH, inclusion in the S&P 500 Index is an event that promises a permanent increase in the stock's liquidity and therefore prices and trading volumes should both increase permanently to reflect this new advantage of the included stock. Edmister, Graham and Pirie (1996) found permanent price effects attributed to permanently increased liquidity after inclusion and a permanent decrease in trading costs, rejecting the Price Pressure Hypothesis, as well as the Downward Sloping Demand Curve Hypothesis. The results of Erwin and Miller (1998) were also in favor of the Liquidity Cost Hypothesis, since they observed a significant decrease in both the relative and absolute bid-ask spread when a stock was added to the S&P 500.

*The Information Content Hypothesis and the Certification of an Index Member (ICH)*

According to this hypothesis, when a stock is included in the index, an important piece of information is revealed that should have a permanent effect on prices and a temporary effect on volume. The S&P 500 certification effect can increase the firm's expected future cash flows since inclusion will help companies to attract new capital more easily because financial institutions may be more willing to lend to firms that are index members. Jacques (1988) found approximately 4% extra return per year (1983-1988) for S&P stocks. The Information Content Hypothesis was supported by the findings of Dhillon and Johnson

(1991), who observed changes in stock prices, bond prices and option prices and found permanent effects. Jain (1987) argued that inclusion conveys new information concerning the investment appeal of a company and he rejected the null hypothesis of a temporary price increase after inclusion in the index.

*The Market- Segmentation and Investor Recognition Hypothesis (IRH)*

According to Merton's (1987) Investor Recognition Hypothesis, investors know of only a subset of all stocks (in this case, only S&P 500 member stocks), hold only the stocks that they are aware of, and demand a premium (shadow cost) for the non-systematic risk that they bear. Chen, Noronha and Singal (2002, 2004) argued that a stock's inclusion in the S&P 500 Index alerts investors to its existence, and since this stock becomes part of their portfolios, the required rate of return should fall due to a reduction in non-systematic risk. Since investors cannot be unaware of a deleted stock, the increase in the shadow cost of a deleted stock should be lower than the decrease in the shadow cost for an included stock. According to their observations of cumulative abnormal returns, there was a permanent effect on the stock price after the index change, and the behavior of additions and deletions was not symmetrical, consistent with the Market Segmentation Hypothesis.

The above hypotheses have been quite controversial, but all found some support in previous studies for explaining abnormal returns during the event. Differences in findings across studies can be attributed to differing sample periods or to differing definitions of what constitutes the short or long run. We aim to contribute to this debate by employing a different method for calculating abnormal returns, and this will be described in the following section.

## IV. Data and Methodology

Standard & Poor's Corporation provided us with the names, announcement dates and effective dates of all the stocks that were added to the S&P 500 Index for the years 1990-2002.[3]

[3] Our initial sample consisted of 353 additions. Stock closing prices adjusted for dividends, market values and trading volumes were obtained from Thomson Datastream. Our final sample contained 272 stocks due to the elimination of some additions for the following reasons: 24 stocks were excluded because there was insufficient historical price information, 6 stocks were

a. *The Event Window and Methodology for the Abnormal Return Calculation*

The results presented below examine the firm's performance from 5 trading days before the announcement date (AD-5). Our short-run event window is defined to end 15 trading days after the effective date (ED+15), and the long-run event window is defined to end 180 trading days after the effective date (ED+180). The average length of the interval between the announcement and effective date is 5 days – this will be explained in detail below.

Previous studies have used a variety of different methods for calculating abnormal returns during the event window. However, the most common method that past studies have used is the single-factor model, incorporating market risk. Estimates of the alpha and beta coefficients would then be obtained using a historic estimation period. However, Jain (1987) and Edmister, Graham and Pirie (1994 and 1996) argued that the parameter estimates derived from the period before the event would be biased since the firms were likely to have performed well before their inclusion in the index. In other words, they might well have been included in the index precisely because of their relatively good recent past performance. Instead of the Capital Asset Pricing Model or a single factor model, we employ the Fama-French 3-factor model (Fama and French, 1995) to control for size and value effects.[4] The Fama-French factors are constructed using the 6 value-weighted portfolios formed on size and book-to-market, obtained from French's web site[5]. In the regression analysis below, the variables are defined as follows. *SMB* (Small Minus Big) is the average return on the three small firm portfolios minus the average return on the three large firm portfolios, *HML* (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios, $R_m$-$R_f$ is the excess return on the market index, which is the

removed due to a lack of data during the event (new firms), 31 stocks were also excluded because the addition was caused either by a merger or by an acquisition, or by a rename/reconstruction of the firm. If those firms had been included, the results would have been biased for two reasons. The first reason concerns the cases where the event of addition happened at the same time as other firm-specific events and therefore investors might buy the stock for reasons other than index membership. The second reason concerns cases where additions did not require a change in index fund holdings.

[4] Over the last few years, researchers have argued that a fourth factor should be included in the model in addition to the above factors of market, size and book-to-market ratio (Du and Denning 2004). The fourth factor concerns the momentum effect , which also appears to significantly affect security returns. However, in previous studies (e.g. Carhart, 1997), data for the momentum factor have been calculated on a monthly basis but our study uses daily data and hence the momentum factor is not employed.

[5] K. French Data Library: The description of the 6 size/book-to-market portfolios and data are available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

value-weighted return on all NYSE, AMEX, and NASDAQ stocks minus the one-month Treasury Bill rate. We estimate two sets of Fama-French coefficients and calculate abnormal returns using both sets: using 250 trading days before the event window; using 250 trading days after the event window. The Fama-French model (FF) is specified as follows for each firm *i* at time *t*:

$$R_{it} - R_{ft} = a + b_m( R_{mt} - R_{ft} ) + b_s SMB_t + b_v HML_t + u_t \quad (1)$$

where variable definitions are as above, *a* is the return when the factor portfolio returns are zero, the *b*'s are sensitivities to each source of risk, and $u_t$ is a disturbance term. The abnormal return for each stock will thus be given by :

$$AR_{it} = R_{it} - R_{ft} - [\hat{a} + \hat{b}_m (R_{mt} - R_{ft}) + \hat{b}_s SMB_t + \hat{b}_v HML_t] \quad (2)$$

The abnormal returns for all stocks are then averaged against the total number of announcements *N* for each day *t* of the event window as:

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{it} \quad (3)$$

where, *t* = AD-5 to ED+15 for the short-term event window, and *t* = AD-5 to ED+180 for the long-term event window. The average abnormal returns are summed over the event window in order to obtain a cumulative average abnormal return $CAAR_{I,T}$ for each time period from day $_I$ to $_T$.

$$CAAR_{I,T} = \sum_{t=I}^{T} AAR_t \quad (4)$$

To test the statistical significance of the *AARs* and *CAARs,* two-tail *t*-tests are performed that are defined as follows. For testing *AARs*:

$$t\text{-}stat = \frac{AAR_t}{\hat{S}(AAR_t)} \quad (5)$$

where, $AAR_t$ is the average abnormal return at time *t*, *t* = AD-5 to ED+15 for the short-term event window and *t* = AD-5 to ED+180 for the long-term event window, $\hat{S}(AAR_t)$ is the standard deviation of the average abnormal returns over the estimation period (250 trading days), given by the following formula:

$$\hat{S}(AAR_t) = \sqrt{\frac{1}{249}\sum_{t=1}^{250}(AAR_t - \overline{AAR_t})^2} \quad (6)$$

For testing *CAAR*:

$$t\text{-}stat = \frac{CAAR_{I,T}}{\hat{S}(AAR_t)\sqrt{n}} \quad (7)$$

where, $CAAR_{I,T}$ is the cumulative average abnormal stock return from day $_I$ to $_T$ and *n* is the number of days between $_I$ and $_T$. The null hypothesis is that the *AARs* and *CAARs* should be zero.

The non-parametric binomial *Z*-test is also performed to test the significance of the percentage of firms that have a positive abnormal return on the event days. The binomial *Z*-statistic is calculated by the following formula:

$$Z - stat = \frac{A - E}{\sqrt{Np(1-p)}} \quad (8)$$

where, *N* is the number of firms in the sample, *A* is the actual number of positive excess returns, *E* is the expected number of positive excess returns ($E=Np$) and *p* is the expected percentage of positive excess returns. The value of *p* was estimated from the post-inclusion estimation period of 250 trading days starting after the end of the long-term event window and was found to be 49.31%. The binomial test is more conservative than the *t*-test and does not require the assumption of normality.

b. *The calculation of Abnormal Returns from AD to ED*

The Standard and Poor's Index Committee announces the name of the included stock, but the event date is not always known at the time of the announcement. On average, the firm is added to the index after five days, but this could vary from one day to seventy days (the latter occurs in only one extreme case). Most intervals are around four and five days; it would be difficult to derive strong conclusions about the price performance after AD+7 since the number of observations is very small. Therefore, our statistical tests will concentrate only on the price behavior in the first seven days after the announcement date.

c. *The Calculation of Abnormal Volumes*

We examine volume patterns before, during and after addition. Volume data could give information about the timing of purchases caused by index funds and other institutional investors, as well as about demand that might have been caused by arbitrageurs. The latter might have entered the market after the announcement date but before the effective date to capture any potential profits that arise from price pressure during the event period. Index funds, on the other hand, might choose to wait for the event date in order to minimize their tracking errors. In order to calculate the level of abnormal volume, volume ratios were computed, a method also employed by Harris and Gurel (1986) and by Beneish and Whaley (1996)[6]. The average relative stock-to-S&P 500 volume ratios were estimated over a period of 12 weeks (60 trading days) before the event window, considered and compared with the daily stock-to index ratios observed during and after the event period. [7] The null hypothesis is that the mean volume ratio across all firms for each day *t* of the event period is one. Apart from the *t*-test, a *Z*-test is also performed for comparison. The value of *p* in the Z-statistic formula, estimated from the pre-inclusion period, was found to be 0.38. The formulae for calculating volume ratios are:

$$\overline{BVR_i} = \frac{1}{60} \sum_{t=AD-65}^{t=AD-5} \left(\frac{V_{it}}{V_{mt}}\right) \tag{10}$$

$$VR_{it} = \frac{V_{it}}{V_{mt}} \div \overline{BVR_i} \tag{11}$$

$$MVR_t = \frac{1}{N} \sum_{i=1}^{N} VR_{it} \tag{12}$$

where the base relative volume ratio $BVR_i$ is the average stock-to-index trading volume in the 12 weeks before the start of the event window, $V_{it}$ and $V_{mt}$ are the trading volume of each stock and the

[6] This analysis uses the average relative (stock-to-index) volume ratio over the estimation period instead of the average stock's trading volume divided by the average S&P 500 trading volume over the same period. This amendment was proposed by Goodacre and Lawrence (1994) as a volume ratio with improved characteristics.

[7] A post-inclusion estimation period is not needed in the case of trading activity, because the events are not anticipated. The price performance might have improved before the event, due to the potentially better performance of the firm but there is no evidence of increased liquidity for the stock. Therefore, the bias mentioned in the previous section does not apply to the volume figures.

corresponding S&P 500 volume at each day *t* of the event window respectively, $MVR_t$ is the mean volume ratio across firms at each day *t* of the event window and *N* is the number of firms in the sample.

## V. Results

*a. Event Window – Short- and Long-Term Price Performance*

We examine firm performance during the short-term event window by calculating abnormal returns in three different ways. First, we use 250 trading days before the event to obtain a first set of the Fama-French model coefficients and then we use 250 trading days after the event window to obtain a second set of coefficients. Those estimates are used to calculate abnormal returns for the event window, taken as AD-5 to ED+15. For comparison, we also use a third method, which involves subtracting the daily return of the market portfolio from the daily return of the stock. Table 1 shows the estimates of the two sets of Fama-French model coefficients with their corresponding *t*-statistics. The last row refers to the *t*-statistics when testing the change in the values of the estimators between the pre-event and the post-event period. The coefficients are all significant apart from that for the book to market factor ($b_v$) using the pre-event period. We also test for whether the average coefficients in the pre-event period are significantly different from those in the post-event period. A relatively high alpha using the pre-event period gives relatively high expected returns and low realized abnormal returns. In other words, pre-period alphas will misleadingly show that after inclusion, the performance of the firm became relatively weak. Therefore, previous studies that used a pre-event period for estimating abnormal returns might have found price reversals purely due to the coefficient bias.

Table 2 presents a summary of the abnormal returns occurring from five days before the announcement date through to fifteen days beyond the effective date. The daily abnormal returns observed one week before the announcement of addition appear to be insignificant apart from AD-3, confirming that there is no anticipation of the event. Since the announcement of the change occurs in the evening, the average abnormal return on the announcement date (AD) should not be significant and the

first trading opportunity must be observed one day after the announcement date, on AD+1. However, there is a marginally significant and positive abnormal return of 0.33% on that day (AD), indicating anticipation or potential leakage of information before the actual announcement. After that day, there is an abnormal return of 4.12% from the close of announcement date (AD) until the close of the next day (AD+1) with a *t*-statistic of 23.32. The percentage of firms in the sample that realize a positive abnormal return on that day is 89.73% (with a *Z*-statistic of 12.1). This value is consistent with the results of previous studies conducted for earlier periods and provides strong evidence of the persistence of positive and significant abnormal returns on AD+1.

As Table 2 shows, although the returns of AD+2, AD+3, AD+4, AD+6 and AD+7 are significant, their levels cannot be compared to that of the AD+1 abnormal return. Therefore, one can argue for two main price increases; one observed on AD+1, followed by a second one on ED. The first one is probably initiated by arbitrageurs and the second by index fund purchases. This argument is analyzed in detail in a later section in conjunction with the trading volume results. Index fund buying cannot cause a price increase on ED equal to that observed on AD+1 because a significant number of arbitrageurs have bought stock on AD+1 and are standing ready to sell to index funds on the event date (ED). After the effective date (ED), three significant partial price reversals are observed. All the following average abnormal returns until 15 trading days after the event (three weeks) are insignificant, providing evidence of only a partial price reversal (apart from ED+12).

The long-run performance of the firm, shown in Figure 1, reveals only a partial reversal in the average firm's stock price. Therefore, we argue that a permanent stock price effect holds at least nine months after the event and this could confirm the importance of the S&P 500's "gold seal" in the long-run and would be consistent with the result reported by Denis *et al*. (2003) that inclusion of a firm within the S&P index leads to an improvement in the firm's performance.

*b. The effects on trading activity*

The volume ratios and the *t*-statistics for testing the null hypothesis that the true value of the mean volume ratio is unity are reported in Table 3 and suggest no anticipation of the event. However, leakage of information may be happening in the morning of announcement date (AD), because the volume is slightly higher than normal (1.19 times) with a *t*-statistic of 3.38, a result that is consistent with Beneish and Whaley (1996). The announcement of addition takes place at the close of AD and therefore, the first trading opportunity after the official announcement occurs on AD+1. On that date, there is a highly significant abnormal volume of 3.67 times greater than normal with a *t*-statistic of 11.88. The abnormal trading pattern is continued for the days between announcement and event. The maximum abnormal volume, however, takes place on the effective date (ED), since in most cases the ED is known in advance from the evening of the announcement date (AD) and index fund managers must rebalance their portfolios to be consistent to the S&P 500 composition that changes next morning (ED+1 opening). The trading volume on the ED is almost 16 times higher than normal with a *t*-statistic of 16.28. After the event date, it takes more than three weeks for the trading volumes of included stocks to fall close to their historical pre-announcement values. Although the volume figures are less than twice the normal ones from ED+3 throughout nine months after the event, they remain significant according to their *t*-statistics for five months after inclusion. The non-parametric binomial *Z*-test also confirms this pattern.

Figure 2 presents the mean cumulative abnormal stock return after addition in accordance with the daily mean volume ratio. It can be seen that the highest abnormal return is not accompanied by the highest abnormal volume. The highest daily abnormal return occurs on AD+1, although the highest trading volume takes place on ED. Therefore, the initial price increase may be caused mainly by arbitrageurs, who try to take advantage of the index change in advance of the actual event by trading the stock on the AD+1. The trading volume on that date is 3.7 times higher than normal. The volume on the event date is almost 16 times greater than normal, however the stock price increase is only 2.13%, because index fund demand is satisfied by the supply of arbitrageurs who are leaving the market. On

ED+1, when the S&P 500 opens with the new composition, the volume observed is 3.7 times greater than normal, a figure the same as that of AD+1. However, the price reversal of almost -1% on that date shows that any buying pressure is exhausted and the market has to react to the continuous and significant price increase since the date of announcement (AD). Moreover, arbitrageurs may continue to unwind their positions and to drop the added stocks from their portfolios. The figures suggest that index fund trading mainly occurs on ED (similar findings to those of Beneish and Whaley 1996).

Another interesting conjecture is that some index funds may have already started buying the added stock before the event, explaining the exhaustion of excess demand for the stock after that date. This would arise if S&P 500 index funds were more concerned with the cost of purchasing the newly included stocks than they were with tracking error. Consistent with the discussion above concerning index fund strategies, Blume and Edelen (2003) show that a strategy of trading the added stock on the first day after announcement can enhance index fund returns with no added risk, but with substantial tracking error. On the other hand, if index funds follow an exact-replication strategy and rebalance their portfolios on the date of the actual change, then there is a profit transferred from index fund investors to arbitrageurs (Chen, Noronha and Singal, 2005). [8]

*c. Division of the sample into three sub-samples based on firm size*

In order to examine firms of different size separately, we divide the observations into three samples based on the market value ratio of the firm. The range of the market value ratios for the added firms over the whole 1990-2002 period varies from 0.01% to 1%. If newly included firms were typical of the existing composition of the index, one would expect that the average included firm should constitute 1/500 (0.2%) of the total S&P 500 market value. However, our sample of additions has an average market value ratio of 0.11%, and only 10% of the added firms are above 0.2%. Notwithstanding the argument that the S&P 500

[8] Interestingly, statements by index fund managers for the changes in the composition of the FTSE 100 index suggest that there are cases where they buy the required shares over three different points in time using the rule of thumb: one third of the shares before the event, one third at the date of the event and one third after the event. However, according to the above results, S&P 500 fund managers seem to have completed their purchases by the date of the event and as Blume and Edelen (2003) showed, most of them follow a full-replication strategy.

already includes most of the largest firms in the US, this shows that the Standard and Poor's Index Committee is not biased towards large firms, and that other inclusion criteria are also important.

To give a more comprehensive picture of the changes in the relative performance of small versus large firms over time, we also split the sample into two sub periods: 1990-1997 and 1998-2002[9]. The price behavior for the period 1990-1997 is shown in Figure 3. Smaller firms outperform medium sized and large firms by a considerable abnormal return margin until one month after the event. After that date, the cumulative abnormal return of the small firms falls. It is also worth noting the variability in the cumulative abnormal return for the small firm band. The medium sized firms experience negative cumulative returns in the long run and their performances are generally worse than those in the other two bands. Large firms appear to have the best long-run performance. In the 1998-2002 period (Figure 4), the short run outperformance of small firms disappears and such firms even experience negative cumulative returns in the long run. On the other hand, the performance of the medium sized firms is improved and their cumulative return does not fall below zero in this period. Finally, large firms seem to have superior risk-adjusted performance and the cumulative return grows continuously even up to around nine months (180 trading days) after the event.

We argue that in the long run, relatively larger firms might be of greater importance when added to the index. One reason could be that buying pressure for those firms would arise not only from index funds but also from other institutional investors such as equity mutual funds. In other words, the included large cap stocks might be more attractive to a wider range of mutual funds. On the other hand, small and medium sized firms could also be less attractive for non-100% index trackers due to the relatively higher transaction costs. Active managers may shun the smaller firms, leading to reduced buying pressure for those firms. The policy of the S&P Index Committee to include relatively large US firms in the S&P 500 suggests that our results are even more striking than they at first appear since the range of market values

[9] We selected this point at which to split the sample in order to ensure a roughly equal number of firms in each of the two sub-samples. Figures showing performance for the whole sample are not shown due to space constraints, but are available upon request.

that we observe is biased towards large firms. The fact that we still find differences among those firms confirms the importance of allowing for firm size when measuring abnormal returns.

Table 4 summarizes the cumulative abnormal returns for each capitalization band and for each time period separately. Concerning the first day after announcement, we observe that the abnormal return has increased through time for both large and small firms, but has decreased for medium sized firms. On the other hand, the price reversal on the first day after the event increased for both large and small firms whereas it decreased for medium sized firms. Examining the level of abnormal return on ED+1, it is clear that small firms experience a lesser price reversal upon inclusion than do medium sized or large firms. Also displayed in Table 4 are the cumulative abnormal returns for longer periods after the event. The importance of considering firms of differing sizes separately is now more apparent. The 9-month cumulative average abnormal return of the larger band firms in the more recent period is 21.4%, up from 7.7% in the earlier period, while the small firm abnormal return average fell from 3.7% to –4.4%. In other words, the performance of the large included firms has improved through time whereas the performance of the small included firms worsened. This effect is washed out when all firms are considered together, and long run cumulative returns averaged 4% and 5.3% in the earlier and latter periods respectively. Thus, only a slight increase in typical cumulative returns is noted for all firms.

*d. The Volatility of Stock Returns for Included Firms*

Confirming previous research, it has been shown in the present study that alpha coefficients significantly change after the event with the beta coefficients, the CAPM measure of systematic risk, remaining unchanged. Since the systematic risk beta was shown to remain unchanged, then a potential change in the total risk of the stock will be interpreted as a change in its specific risk. It is therefore of interest to determine whether the added stock becomes riskier in the sense of its total risk after the inclusion event. Cooper and Woglom (2001) argue that if trading effects contribute to the price increase observed over the period of an inclusion, then they are also expected to cause an increase in stock price volatility. When the stock is added to the S&P 500, it is widely demanded by a variety of index funds as well as other

institutional investors and this causes a short run demand for the stock that leads to the price increase. The authors support a post-addition increase in stock price volatility that reverses almost all of the initial price increase. The existence of an increased price volatility post addition is also consistent with "noise trading" proposed by De Long *et al.* (1990), which causes prices to deviate from their fundamental values. However, if stock inclusions are information-free, the discount rate for the firm's cash flows is not affected in the long run and inclusion in the S&P 500 index does not lead to a higher risk premium. According to the findings for the trading volumes, abnormal trading is temporary and therefore, volatility should return to normal levels after the short run event period.

A test to determine whether the total risk of the included stock, as expressed by the standard deviation of the daily excess return, changes significantly after inclusion is now performed. To avoid the short run "noise" of the event window, daily volatility is measured over the period of 250 trading days before the event window and over the period of 250 trading days after the event window. When the absolute pre-event and post-event volatilities are compared (Table 5), a significant average increase of 9.47% is found. Therefore, on an absolute daily volatility basis, the average added stock seems to become riskier after inclusion. However, the sample of additions covers a thirteen year period from 1990 to 2002 and it is important to incorporate how the overall US market volatility has evolved through time. The market that is considered as benchmark is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks. The average pre-event and post-event relative volatility is compared by taking the ratio of the volatility of the added stock to the corresponding market volatility at the same period, for 250 trading days before and 250 trading days after each event. It appears that there is no significant difference between pre-event and post-event relative volatility (see the second panel of Table 5). Since the market's volatility has also increased over time, the relative changes in stock's volatility before and after the event

become insignificant.[10] Even if the average stock appears to become riskier after the event, on a relative basis, the total risk is unchanged, a result which echoes the lack of change of market risk.

## VII. An Analysis of the Evidence for the Prevailing Hypotheses

Our price and volume results suggest that addition to the S&P 500 is not an information-free event, and that the "seal" of being an index member matters in the long-run. We therefore find support for the Information Content Hypothesis, since the stock price increase seems to be only partially reversed and the trading volume changes are temporary. Our findings support those of Dhillon and Johnson (1991). The basic assumption of the Information Content Hypothesis is that the S&P 500 certification effect might increase the firm's expected future cash flows and could help the firm to attract new capital more easily since financial institutions might be more willing to lend to firms that are index members. The Information Content Hypothesis is also supported by Woolridge and Ghosh (1986) and Jain (1987). Since the price increase is not temporary, we find no evidence in favor of the Price Pressure Hypothesis of Harris and Gurel (1986).

Concerning the volume results, we observe a marginal increase in trading volume in the long-run, consistent with the Liquidity Hypothesis. These results are also consistent with the importance of investor awareness of newly included stocks, as Chen *et al*. (2004) suggested. Recent evidence (see, for example, Barber and Odean, 2007) concerning retail investors shows that they are overwhelmed by the choice of potential asset purchases and therefore they focus only on stocks that catch their attention. However, the volume results are very sensitive to the base volume ratios (average volume over 12 weeks before the event) employed. The volume ratios decrease significantly after the event window and the value of the ratio remains below 1.5 times its historical value in the long-run. Therefore, we could also argue for a temporary increase in volume which is consistent with the Downward Slopping Demand Curve for Index members Hypothesis. However, this hypothesis can only be tested in an information-free environment

[10] These results remained unchanged when the sub-samples based on size, and on the exchange on which the firm is listed, are considered separately.

and since inclusions appear not to be information-free events, it is not possible to draw firm inferences. Our conclusions concerning the information content of inclusion are also consistent with those of Denis *et al*. (2003), who show that included companies experience significant increases in earnings per share forecasts and significant improvements in realized earnings.

According to the S&P Index Committee, inclusion does not reveal anything about the future investment appeal of the company. However, previous literature argues that additions are not information-free events. In an attempt to determine whether the index effect can be best explained by the Information Content Hypothesis, two further tests are performed below, based on examining the price-earnings ratio and earnings per share of newly included firms as a measure of their operating performance, and by examining both added and deleted stocks based on the unique index re-composition that took place on 9$^{th}$ of July 2002.

*a) The Effect of Inclusion on the Firm's Price to Earnings Ratio*

The price to earnings (PE) ratio of the firm reflects the number of times that the current stock price exceeds firm's earnings and is an important measure of firm performance. Inclusion has a permanent effect on stock price and therefore, one should expect that other things being equal, the PE ratio of the firm should increase. Since the PE ratios may be affected by the PE ratio of the market as a whole, it is important to adjust for the performance of the market's PE ratio. The stock PE ratios as well as the S&P 500 PE ratio were collected from *Thomson Datastream*. Since the stock price changes daily, it is possible to obtain different PE ratios every trading day, even if the reported earnings per share may change less frequently. The average daily PE ratio is therefore calculated over 250 trading days before and over 250 trading days after the event window for the stock and for the S&P 500.

On an absolute basis, the price to earnings ratios decreased insignificantly after the event of addition to the S&P 500. The price to earnings ratio for the average firm is very high, indicating that the newly added stocks are mainly growth stocks. In particular, there are a few firms in the sample (e.g.

YAHOO) that have extremely high PE levels and significantly affect the mean PE ratio of the sample[11]. The effect of outliers is confirmed by a test for the equality of medians before and after the event. The median absolute PE is 27.88 before the event and 27.18 after the event. The decrease in the median is also insignificant. In terms of relative price to earnings ratios, the average stock PE ratio is 2.95 times higher than the market's PE ratio over the pre-event period, while it is only 1.97 times higher over the post-event period. However, as reported in Table 6, the decrease is insignificant in a statistical sense. The test for equality of medians results in similar conclusions. The above findings are also consistent with the results of Malkiel and Radisich (2001), who found no evidence of enhanced firm valuation after the event of addition to the S&P 500 index.

*b) The Effect of Inclusion on the Firm's Earnings*

The results of the previous section imply that there must be a change in the firms earnings, given the permanent stock price increase after the event and the unchanged level of the firm's PE ratio. The firm's earnings before and after the event of inclusion are examined, as expressed by the variable EPS (earnings per share) obtained from *Thomson Datastream.* Earnings per share for 250 trading days before the event and for 250 trading days after the event were estimated for each firm. Since the earnings are reported quarterly for most of the firms in the sample, the observations would not change on a daily basis.

Earnings per share is an important measure of a firm's performance and any significant changes of firm's earnings after the event may indicate that inclusion is not an information-free event. On the other hand, if the stock is added to the S&P 500 purely because it has already reported relatively good earnings in advance of the event, then earnings before and after addition should not be significantly different. If the latter occurs, then one can argue for a good firm performance as a cause and an index addition as an effect and not the other way round. This would also confirm the argument of the Committee that inclusion does not convey new information to the market about the future investment appeal of the company and that the Committee makes its decisions purely based on already publicly available information.

[11] It is also worth mentioning that the frequency of NASDAQ additions, which are mainly growth stocks, has increased through time.

Table 7 presents the earnings per share (EPS) figures for the average S&P 500 added firm for the year before and the year after the event. It can be seen that there is a significant improvement in the absolute level of earnings after inclusion, which was expected, given the unchanged price to earnings (PE) ratio and the increase in the firm's stock price. The change in the firm's realized earnings per share is significant at the 5% level. Overall, 74.06% of firms in the sample experience EPS increases. Moreover, when the S&P 500's earnings performance was taken into account, the average relative percentage change of the firm's earnings is positive between the period before and after inclusion and significant at the 1% level. 62.76% of the added firms not only realized positive earnings growth but also out-performed that of the S&P 500 from the period before to the period after inclusion.

The stock prices of the added firms may perform better after inclusion because they become more attractive to a larger number of market participants and their potential future stock issues will be supported by index funds. A closer monitoring of the added firms due to the increase in the number of analysts after inclusion (see Chen *et al.*, 2002) may also facilitate their corporate relations with financial institutions concerning debts or other liabilities, thus having an impact on the firm's profitability. Therefore, index membership may be the cause of the firm's better performance and not the effect. The study of Denis *et al.* (2003), conducted over an earlier sample period, provided evidence of an increase in earnings forecasts for future member firms relative to non-index member firms. Therefore, it is not clear whether the firms performed better due to other specific factors or due to the positive effect of index membership, which resulted in realized earnings that were very close to their high forecasts. Nevertheless, in summary, according to the realized EPS after the event, it appears that inclusion should not be considered as an information-free event.

*c) The Index Change of July 9$^{th}$, 2002*

In common with existing research, this study does not examine the performance of deleted stocks due to the lack of data after the event arising from the significant number of mergers and acquisitions that may affect the results for the deleted firms. In particular, the number of deletions that were caused purely

because the firms did not satisfy the Index Committee criteria is very limited. However, there is a separate S&P 500 index change that took place in July 2002 involving the deletion of non-US companies from the S&P 500. In a press release on July 9th, 2002 at 5:15 pm, Standard and Poor's announced the removal of five Canadian and two European companies from the S&P 500, made effective at the market close of the 19th of July 2002. This event was a pure index change in the sense that it was not caused by either bankruptcy or merger/acquisition and it was initiated by Standard and Poor's. The change was made to keep the index representative of the large capitalization segment of the US equity market and to help index funds to achieve lower expenses and tracking errors. Over the previous few years, index users had noted that the presence of non-US companies in the index created difficulties in terms of index tracking[12]. These deleted companies had much larger capitalizations than any previous ones and all of them except Nortel were trading at double-digit prices[13]. Their total contribution to the capitalization of the S&P 500 was almost 2% as of May 31st 2002.

This event is a perfect laboratory for testing the investors' awareness hypothesis, as discussed by Barber and Odean (2007). In addition, Chen, Noronha and Singal (2004) suggest that investors are alerted to the existence of a particular stock by the event of its index inclusion. However, they cannot become unaware of deleted stocks and therefore the effects should not be symmetrical. Table 8 presents the list of firms that were added to and deleted from the S&P 500 on July 9th, 2002. All the deleted firms are Canadian apart from Royal Dutch Petroleum and Unilever, which are from the Netherlands and they were replaced by seven US companies. Although the number of firms is small and statistical inferences about the significance of the results cannot be made with high precision, it is worth examining the pattern of the price and volume performance of these firms. Since the change took place on the same date, with an equal interval between announcement and event for all firms[14] and under the same market conditions, the

[12] Standard and Poor's press release, 9th July 2002.
[13] For more information relating this event, see Standard and Poor's press releases: "Focusing the S&P 500 on US Large Cap Stocks and the removal of Non-US companies in the S&P 500", "Price Changes associated with S&P 500 Deletions: Time Variation and Effect of Size and Share Prices" and "Deletion of Canadian Stocks from the S&P 500", 9th July 2002.
[14] The announcement date was on Tuesday 9th of July and the effective date on Friday 19th of July, an interval of 8 trading days.

comparison becomes more powerful. The positive price reaction of the added firms appears to be symmetrical to the negative reaction of the deleted ones (Figure 5) on the first date after the announcement (AD+1). The average added stock experiences a price increase of 5.2% and the average deleted stock loses 5.8%. Concerning the remainder of the days between announcement and event, the added stocks earn an additional 2.56% and the deleted stocks lose another 5.99%. Therefore, the total average price increase (decrease) for additions (deletions) between AD and ED is 7.76% (-11.8%). After the event date (ED), the added stocks experience three consecutive price reversals (consistent with the behavior of the rest of the additions sample described previously). However, the deleted stocks continue to lose value. Figure 6 shows the asymmetrical pattern of the two different samples, showing that for the deleted sample there is no short run price reversal until two weeks after the event date. Deletions lose more value than additions. According to the attention or investors' awareness theory, an opposite pattern would be expected i.e. the deletions should be less affected.

However, there are two important issues that can undermine this test of Investors' Recognition Hypothesis. The first refers to the fact that the sample size is very small and therefore, the results may be driven by firm-specific effects. The second is based on the argument that the comparison of the two samples may be affected by the differences in the market capitalizations of the related firms. The total market value of the deletions sample is higher than that of the added sample and therefore, more selling pressure is involved on behalf of index funds.[15] Indeed, Figures 7 and 8 provide evidence of a higher abnormal trading activity for the deletions sample. Since the market value of the deleted stocks is higher than that of the added stocks and the days available for rebalancing are the same, any difference in the magnitude of the price shock of additions versus deletions may be solely attributed to market value difference. The selling pressure for the deleted firms will be higher than the buying pressure for the added

[15] On the 19th of July 2002 (event date), the total market capitalization of the deleted firms relative to the S&P 500 market cap was 1.98% and the total market value of the added firms was 1.68%. The difference between these two figures is roughly 18%. Standard and Poor's states that the portfolio rebalancing costs should be considerably lower this time, because this market capitalization difference is not that large as the one during the change related to the break-up of AT&T in 1983. During that change on November 30, 1983 that was related to the addition of seven new telephone companies (the Seven Baby Bells), the total added market capitalization was 0.81% and the total deleted market capitalization was 3.3%.

firms, and the money surplus created from this index change due to the market value difference will be invested accordingly in the rest of the member stocks.[16] Figure 7 shows that over the whole period between announcement and event, the deletions experience a higher mean volume ratio. On the event date (ED) which is the most relevant date for index fund trading, the difference becomes more apparent (Figure 8) and depends on the difference between the total market value of the two samples. For the rest of the dates, this difference diminishes, since index fund rebalancing is completed.[17] Finally, the fact that the change of July 2002 referred to deleted Canadian and European stocks and not to US deleted stocks, may result in a higher negative effect for that sample of firms. The "shadow cost" mentioned by Chen *et al.* (2004) may increase more for the non-US stocks. Therefore, Canadian companies may not be the best representatives of the behavior of the average deleted US firm.

## VIII. Conclusions

This study has examined the performance of the firms that were included in the S&P 500 Index during the period 1990-2002 using the Fama-French Three Factor Model for the abnormal return calculation. The Fama-French model incorporates additional risk factors, giving a potentially more accurate picture of the long-run performance of firms following inclusion after allowing for the performance that would have been expected given their characteristics. The size and book-to-market effects were very important in the years 1990-1997 in particular, the data period employed in most of the extant literature. During the years 1990-2002, the average included firm had an abnormal return of 4.12% on the first day after the announcement and a additional abnormal return of 3.39% gained over the average 5-day interval period between one day after announcement and event-day. These returns were reversed partially over the three consecutive days after the event. Concerning volume effects, we found that on AD+1 and ED+1, trading

[16] See Graham and Pirie (1994) for more details of the price pressure that is observed for the rest of the 499 member firms upon an index change.

[17] The arguments above hold, because the interval between announcement and event is the same for all firms and index funds have the same number of days to complete the selling of deletions and the purchases of additions. The only assumption required though, is a common level of liquidity for all the related to the index change firms, in a sense that increased trading will affect prices, and the magnitude of this effect will be the same for all stocks

activity was 7 and 16 times its normal level respectively. After the event window, trading activity showed a significant reversal and volume ratios subsequently remained below 1.5.

We found evidence of "interval effects", where a larger interval between announcement and event exhausts the positive shock after addition and reduces the positive price momentum after the event. Larger sized firms were also found to outperform both the medium and the small size bands on a risk-adjusted basis until nine months after the event. However, the results were altered when we examined the 1990-1997 and 1998-2002 periods separately. In the 1990-1997 period, small newly included firms outperformed large and medium firms in the short run, but the largest firms did better over the long run period of nine months after the event. In the more recent period (1998-2002), large newly included firms outperformed medium and small firms by a significant abnormal return margin and there was no price reversal for that band in the long run. Overall, the performance of the large included firms has improved through time whereas the performance of the small included firms worsened. These differences cannot be captured by the Capital Asset Pricing Model. For the period 1990-1997, large firm performance is overstated by the CAPM, whereas small firm performance is understated by it relative to an approach that explicitly allows for the impact of firm size on performance. For the period 1998-2002, the two models are more consistent except for the performance of large firms in the long run.

This study found no support for the Price Pressure Hypothesis of Harris and Gurel (1986) because the price increases did not fully reverse in the long-run, and the Information Content Hypothesis seemed best able to explain the index effect. We also observed a temporary increase in trading volume, but a significant increases in earnings per share and little increase in stock return volatility. An analysis of the replacement of non-US firms from the index in July 2002 showed that the deleted stocks experienced a considerable and permanent fall in price, inconsistent with the Investor Recognition hypothesis. The "seal" of being an index member seems to matter in the long-run and addition to the S&P 500 Index is apparently not an information-free event. Although the Standard and Poor's Index Committee suggests the contrary, investors seem to prefer index member stocks.

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**Table 1: Fama-French 3-Factor Model**

$R_{it} - R_{ft} = a + b_m(R_{mt} - R_{ft}) + b_s SMB_t + b_v HML_t + u_t$

| Period used for parameter estimation: 250 trading days before the event window | | | | |
|---|---|---|---|---|
| | $a$ | $b_m$ | $b_s$ | $b_v$ |
| Average coefficient | 0.00079 | 1.22029 | 0.41145 | -0.05290 |
| t-statistic | 8.37*** | 37.64*** | 11.62*** | -0.69 |
| Period used for parameter estimation: 250 trading days after the event window | | | | |
| | $a$ | $b_m$ | $b_s$ | $b_v$ |
| Average coefficient | -0.00042 | 1.21970 | 0.15455 | -0.15053 |
| t-statistic | -3.80*** | 37.70*** | 4.37*** | -1.80* |
| Test for Equality of Means Across the 2 Estimation Periods | | | | |
| t-statistic | 8.33*** | 0.01 | 5.13*** | 0.85 |

***significant at 1% level, **significant at 5% level, *significance at 10% level

**Table 2: Abnormal returns around the announcement and effective dates**

| Days | Mean Abnormal Return | *t*-statistic | % of firms with AR>0 | *Z*-statistic | No. of firms |
|---|---|---|---|---|---|
| AD-5 | 0.07% | 0.41 | 48.67% | -0.21 | 263 |
| AD-4 | 0.19% | 1.09 | 54.72% | 1.76 | 265 |
| AD-3 | 0.57% | **3.22** | 55.09% | 1.88 | 265 |
| AD-2 | 0.02% | 0.11 | 49.44% | 0.04 | 267 |
| AD-1 | 0.09% | 0.52 | 49.25% | -0.02 | 268 |
| AD | 0.33% | 1.86 | 51.85% | 0.84 | 270 |
| AD+1 | 4.12% | **23.32** | 89.73% | **12.10** | 224 |
| AD+2 | 0.39% | **2.20** | 53.23% | 1.11 | 201 |
| AD+3 | 0.45% | **2.58** | 55.09% | 1.49 | 167 |
| AD+4 | 0.60% | **3.40** | 56.76% | 1.57 | 111 |
| AD+5 | -0.16% | -0.92 | 55.17% | 0.89 | 58 |
| AD+6 | 1.21% | **6.86** | 67.50% | **2.30** | 40 |
| AD+7 | 0.77% | **4.36** | 60.71% | 1.21 | 28 |
| ED | 2.13% | **12.06** | 70.48% | **6.97** | 271 |
| ED+1 | -0.78% | **-4.40** | 35.29% | **-4.62** | 272 |
| ED+2 | -0.45% | **-2.56** | 45.22% | -1.35 | 272 |
| ED+3 | -0.55% | **-3.10** | 46.32% | -0.98 | 272 |
| ED+4 | -0.05% | -0.31 | 44.12% | -1.71 | 272 |
| ED+5 | 0.27% | 1.52 | 50.37% | 0.35 | 272 |
| ED+6 | -0.13% | -0.72 | 47.06% | -0.74 | 272 |
| ED+7 | -0.01% | -0.06 | 45.59% | -1.23 | 272 |
| ED+8 | -0.13% | -0.74 | 47.06% | -0.74 | 272 |
| ED+9 | -0.22% | -1.24 | 48.16% | -0.38 | 272 |
| ED+10 | -0.09% | -0.53 | 45.96% | -1.11 | 272 |
| ED+11 | 0.22% | 1.25 | 53.68% | 1.44 | 272 |
| ED+12 | -0.37% | **-2.09** | 45.59% | -1.23 | 272 |
| ED+13 | 0.06% | 0.31 | 46.69% | -0.86 | 272 |
| ED+14 | -0.21% | -1.18 | 47.06% | -0.74 | 272 |
| ED+15 | -0.06% | -0.32 | 49.26% | -0.01 | 272 |

Notes: AD and ED denote the announcement and effective dates respectively. Figures in bold denote statistics that are significant at the 5% level or better. Two tail tests are employed.

**Table 3: Mean volume ratios observed over the period of addition to the S&P 500**

| Days | Mean Volume Ratio | *t*-statistic | % of firms with VR>1 | *Z*-statistic | No. of firms |
|---|---|---|---|---|---|
| AD-5 | 1.04 | 0.95 | 36.19% | -0.62 | 257 |
| AD-4 | 1.18 | 1.80 | 40.47% | 0.80 | 257 |
| AD-3 | 1.04 | 0.88 | 37.74% | -0.10 | 257 |
| AD-2 | 1.10 | 1.54 | 39.69% | 0.54 | 257 |
| AD-1 | 1.05 | 1.13 | 40.86% | 0.92 | 257 |
| AD | 1.19 | **3.38** | 42.80% | 1.57 | 257 |
| AD+1 | 3.67 | **11.88** | 91.98% | **16.17** | 212 |
| AD+2 | 2.14 | **10.68** | 81.91% | **12.39** | 188 |
| AD+3 | 1.95 | **9.21** | 74.03% | **9.19** | 154 |
| AD+4 | 1.80 | **6.52** | 70.87% | **6.86** | 103 |
| AD+5 | 1.62 | **4.59** | 74.07% | **5.45** | 54 |
| AD+6 | 1.55 | **3.14** | 68.42% | **3.86** | 38 |
| AD+7 | 1.14 | 1.05 | 50.00% | 1.25 | 26 |
| ED | 15.95 | **16.28** | 96.51% | **19.34** | 258 |
| ED+1 | 3.69 | **11.70** | 94.19% | **18.57** | 258 |
| ED+2 | 2.11 | **9.92** | 81.78% | **14.47** | 258 |
| ED+3 | 1.92 | **8.07** | 75.19% | **12.29** | 258 |
| ED+4 | 1.84 | **6.35** | 71.32% | **11.00** | 258 |
| ED+5 | 1.60 | **5.63** | 58.14% | **6.64** | 258 |
| ED+6 | 1.62 | **6.65** | 59.69% | **7.16** | 258 |
| ED+7 | 1.52 | **5.32** | 57.75% | **6.52** | 258 |
| ED+8 | 1.41 | **5.42** | 55.81% | **5.87** | 258 |
| ED+9 | 1.45 | **5.50** | 55.81% | **5.87** | 258 |
| ED+10 | 1.53 | **5.15** | 57.75% | **6.52** | 258 |
| ED+11 | 1.44 | **5.01** | 57.36% | **6.39** | 258 |
| ED+12 | 1.56 | **5.60** | 53.88% | **5.23** | 258 |
| ED+13 | 1.44 | **4.70** | 55.04% | **5.62** | 258 |
| ED+14 | 1.35 | **5.26** | 51.94% | **4.59** | 258 |
| ED+15 | 1.38 | **4.28** | 53.88% | **5.23** | 258 |

Notes: AD and ED denote the announcement and effective dates respectively. Figures in bold denote statistics that are significant at the 5% level or better.

**Table 4: Cumulative Performance for different time intervals after the event for each size band and for each sub period using a 3-Factor Model**

| | | Average Abnormal Return on: | Firm's Cumulative Performance from AD+1 until: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Dates Periods | AD+1 | ED+1 | ED | ED+5 | ED+15 | ED+30 | ED+60 | ED+120 | ED +180 |
| Large | 1990-1997 | 3.17% | -0.60% | 6.45% | 5.06% | 2.97% | 4.42% | 4.60% | 6.51% | 7.67% |
| Firms | 1998-2002 | 4.95% | -1.04% | 10.44% | 9.28% | 10.76% | 8.85% | 13.64% | 18.96% | 21.36% |
| Medium | 1990-1997 | 5.69% | -1.23% | 8.30% | 5.84% | 4.70% | 4.22% | -0.01% | -1.58% | -0.47% |
| Firms | 1998-2002 | 4.26% | -0.75% | 4.89% | 4.92% | 2.85% | 1.53% | 3.95% | 4.58% | 2.41% |
| Small | 1990-1997 | 4.11% | -0.07% | 7.58% | 5.99% | 6.30% | 4.14% | 0.53% | 2.92% | 3.66% |
| Firms | 1998-2002 | 5.06% | -0.77% | 5.37% | 2.41% | 1.23% | 1.60% | -0.08% | -3.68% | -4.41% |
| Whole | 1990-1997 | 4.26% | -0.72% | 7.34% | 5.52% | 4.23% | 4.30% | 2.16% | 2.91% | 3.97% |
| Sample | 1998-2002 | 4.76% | -0.84% | 6.64% | 5.20% | 4.49% | 3.63% | 5.19% | 5.57% | 5.26% |

**Table 5: Pre-event and post-event absolute and relative volatility**

| **Average Stock Price Daily Volatility** | |
|---|---|
| pre-event period | 2.92% |
| post-event period | 3.20% |
| percentage change | 9.47% |
| *t*-statisic | **1.98**** |
| **Relative Average Stock Price Daily Volatility** | |
| pre-event ratio | 2.96 |
| post-event ratio | 2.93 |
| percentage change | -0.73% |
| *t*-statisic | 0.19 |

Notes: **denotes significance at 5% level

**Table 6: Pre-event and post-event absolute and relative PE ratios**

| **Absolute Price to Earnings Ratio Test of Equality of Mean** | | **Absolute Price to Earnings Ratio Test of Equality of Median** | |
|---|---|---|---|
| pre-event period | 87.17 | pre-event period | 27.88 |
| post-event period | 51.79 | post-event period | 27.18 |
| t-statistic | 0.90 | Wilcoxon/Mann- Whitney test | 0.08 |
| **Relative Price to Earnings Ratio Test of Equality of Mean** | | **Relative Price to Earnings Ratio Test of Equality of Median** | |
| pre-event period | 2.95 | pre-event period | 1.12 |
| post-event period | 1.98 | post-event period | 1.04 |
| t-statistic | 0.78 | Wilcoxon/Mann- Whitney test | 0.80 |

**Table 7: Pre-event and post-event EPS and firm's relative earnings growth**

| **Earnings Per Share** | |
|---|---|
| pre-event period | $1.04 |
| post-event period | $1.20 |
| *t*-statistic | **1.97**** |
| % of firms with $EPS_{POST} > EPS_{PRE}$ | 74.06% |
| *Z*-statistic | **7.44***** |
| **Relative Earnings Growth** | |
| % change | 40.32% |
| *t*-statistic | **4.89***** |
| % of firms outperforming S&P 500 earnings growth before and after the event | 62.76% |
| *Z*-statistic | **3.95***** |

Notes: **significant at 5% level,*** significant at 1% level

**Table 8: List of firms related to the S&P 500 change in July, 2002**

| **Additions** | **Ticker** | **Deletions** | **Ticker** |
|---|---|---|---|
| SunGard Data Systems | SDS | Inco | N |
| Electronic Arts | ERTS | Placer Dome | PDG |
| Principal Financial Group | PFG | Barrick Gold | ABX |
| eBay | EBAY | Alcan | AL |
| Prudential Financial | PRU | Nortel Networks | NT |
| Goldman Sachs | GS | Unilever | UN |
| United Parcel Service | UPS | Royal Dutch Petroleum | RD |

**Figure 1: Long-term Cumulative Performance after Addition under the 3-Factor Model**

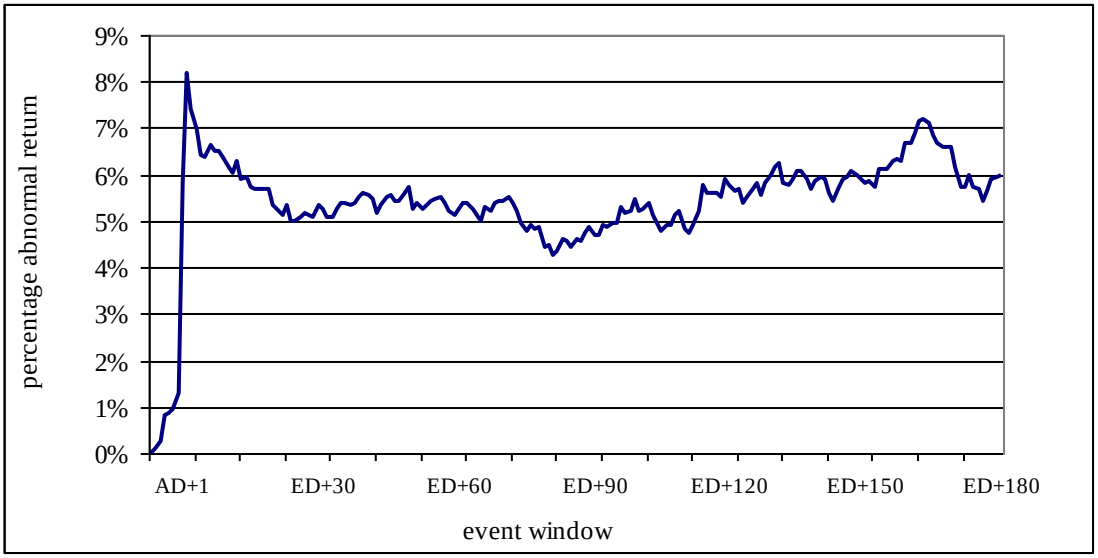


**Figure 2: Volume Ratios and Cumulative Abnormal Returns in the Event Window**

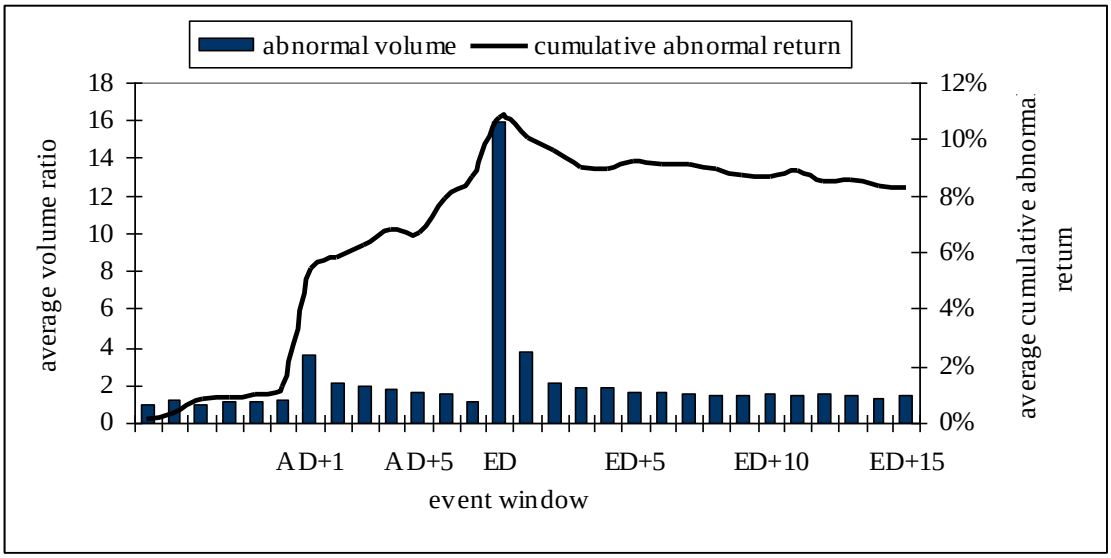

**Figure 3: Long Term Cumulative Performance (1990-1997) using a 3-Factor Model**

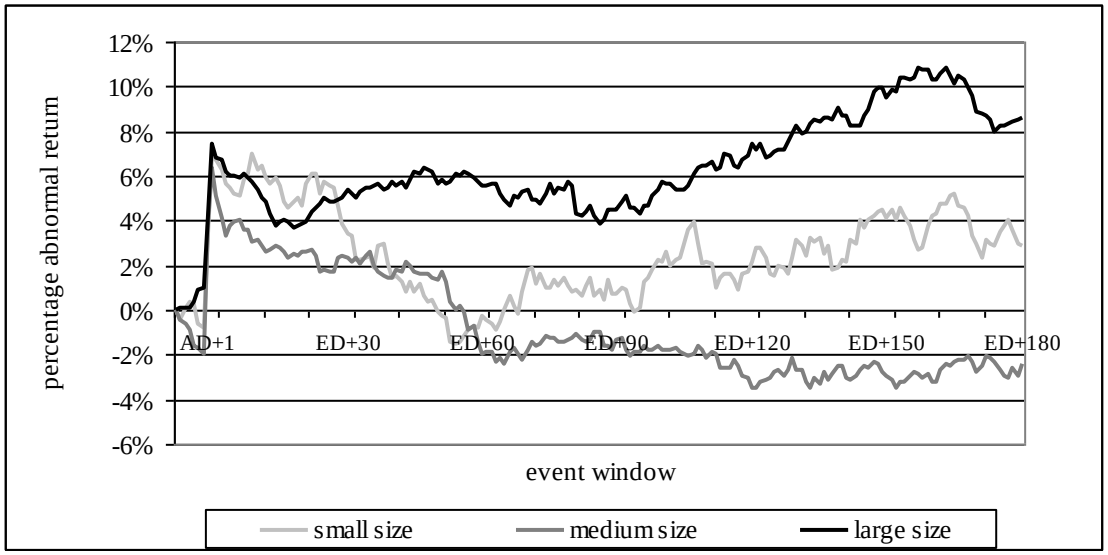


**Figure 4: Long Term Cumulative Performance (1998-2002) using a 3-Factor Model**

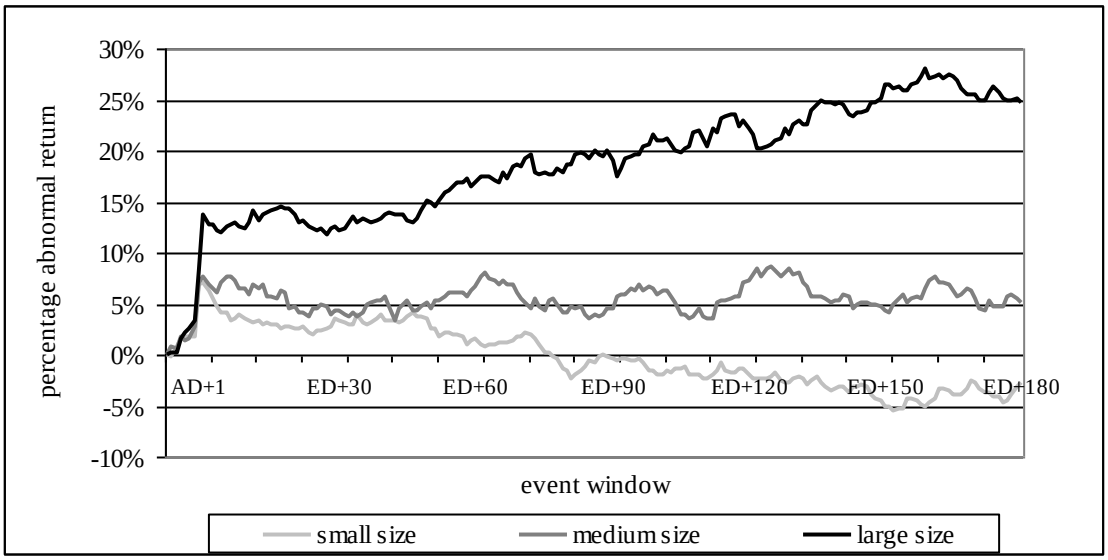

**Figure 5: The performance of the firms related to the S&P 500 index change in July, 2002**

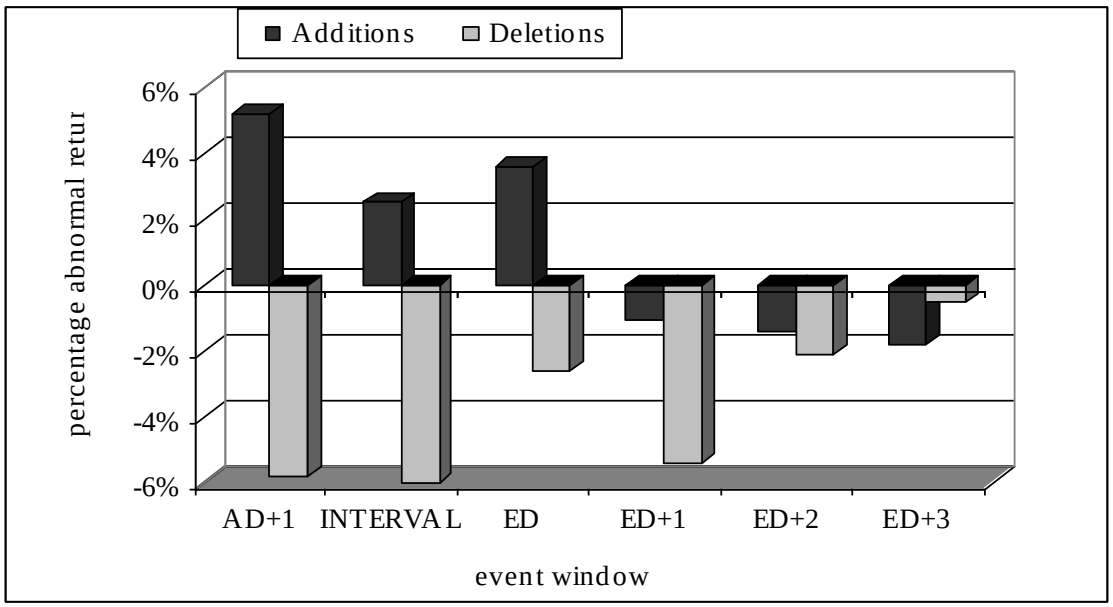


**Figure 6: Cumulative price performance of the firms related to the S&P 500 index change in July, 2002**

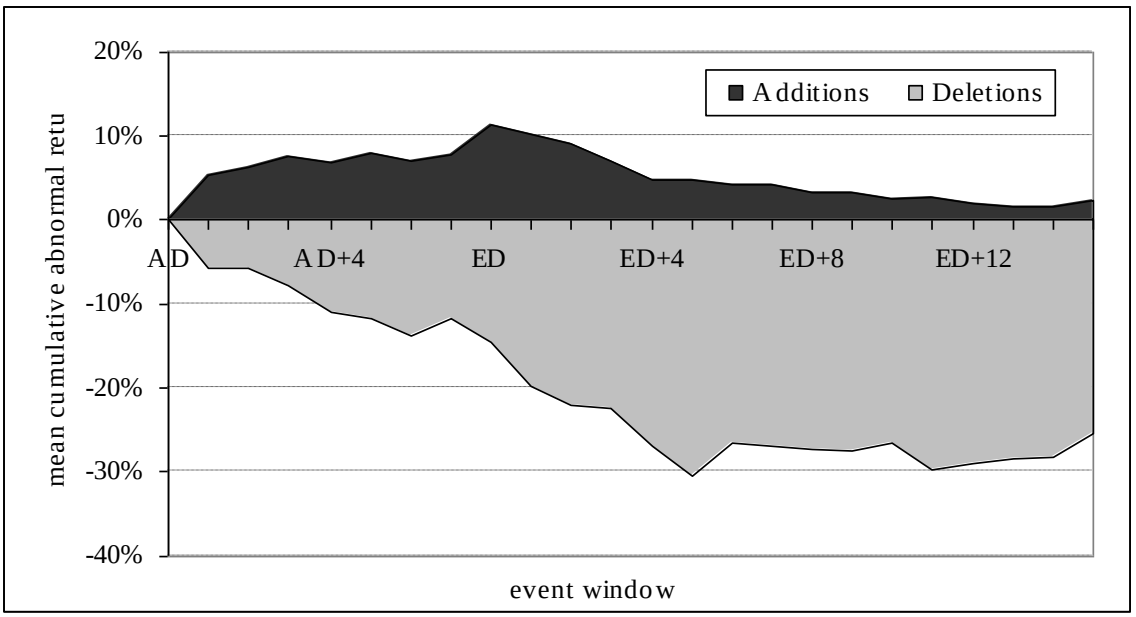

**Figure 7: Abnormal trading activity between announcement and event of the firms related to the S&P 500 change in July, 2002**

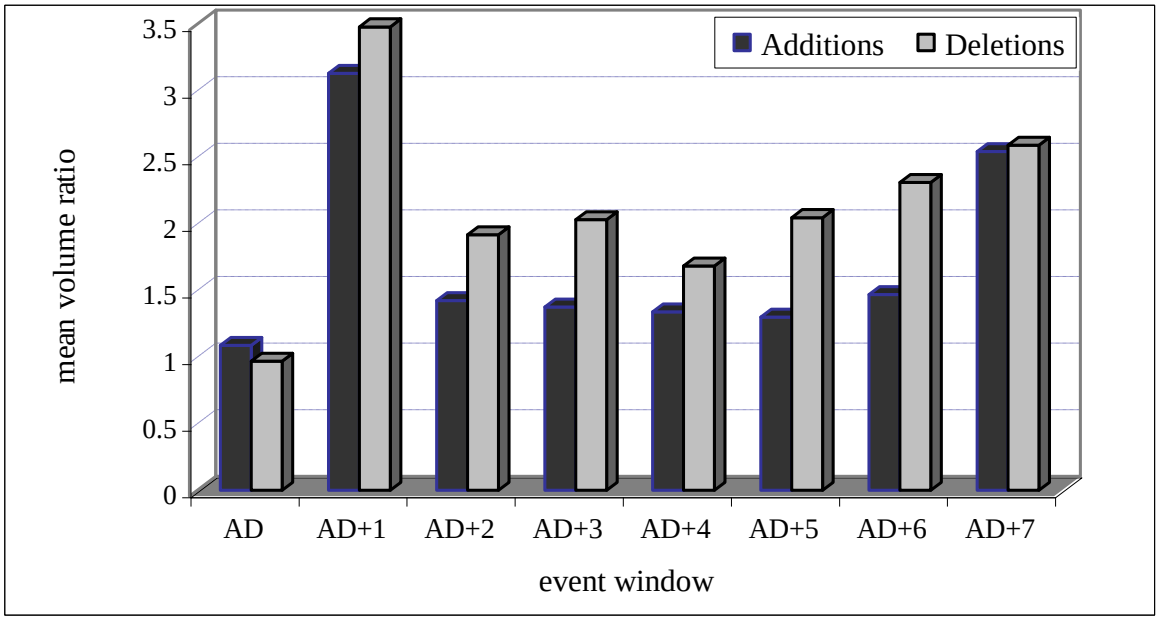


**Figure 8: Abnormal trading activity of the firms related to the S&P 500 change in July 2002, until two weeks after the event**