JABM
JOURNAL *of*
ACCOUNTING, BUSINESS and MANAGEMENT

Index Premium Trends Resulting from Composition Changes to the S&P 500 and Its Implications for Market Efficiency

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Abstract

Transient price pressures immediately before the announcement events and afterward indicate that there is a violation of market efficiency. This paper empirically investigates the state of the market efficiency by following a procedure outlined by Petajisto who looked at trends in index premium and cumulative abnormal returns from 1990 to 2005. This paper provides an update on index premiums and its implications from 2004 to 2012. For additions and deletions to the S&P 500, we find that the cumulative abnormal return from announcement to effective day has averaged 3.98 % and -9.90%. The index premium has varied from 0.05% in 2011 to a peak of 36.2% in 2008, with an average of 4.5% from 2004 to 2012. We claim that index premium and cumulative abnormal return for additions have decreased in the long run. We also claim that the deletions have a stronger impact on the index premium than the additions.

Keywords: S&P 500, index premium, indexing, abnormal return, cumulative abnormal return, market efficiency.

I. INTRODUCTION

The S&P 500 index has exactly 500 firms intended to represent the U.S. economy. The S&P 500 selects the index based on market capitalization, industry representation, liquidity, trading volume, and financial strength. The policy of Standard and Poor's (S&P) since 1989 is to make announcements of these composition changes one week before their effective date of implementation.

[1]According to S&P, at the end of 2005 about $1.26 trillion was directly indexed to the S&P 500, accounting for slightly over 10% of the market value of stocks in the index and in the future, 50% of the whole stock market is "not an unreasonable target" for the index funds according to Barclays (Petajisto, 2011). That means whenever a stock is replaced by another stock, the indexer will sell the deletions, buy about 10% of the additions' shares, and hold the additions in the portfolio.

The rising popularity of funds that track the S&P 500 index has led to significant abnormal return events since 1989 when Standard and Poor's started to announce additions and deletions of firms in the index one week in advance. For instance, Petajisto (2011) documents the existence of positive abnormal returns for additions and negative abnormal returns for deletions around the announcement of composition changes to the S&P 500 index during the period 1990-2005. The sum of the positive abnormal returns and the absolute value of negative abnormal returns is the index premium. There was also early evidence for a 3% index premium documented by Shleifer, 5-7%, and by Lynch and Mendenhall (Shleifer, 1986; Lynch & Mendenhall, 1997). The purpose of this paper is to investigate whether an index premium still exists, how it behaves in the short term,

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[1] Market reactions to changes in the S&P 500 index: An industry analysis (Malic, 2006).

and its evolution from 2004 to 2012, following the same methodology as in Petajisto's paper.[2]

While speculators have tried to take advantage of these changes and the respective index premiums since October 1989, prior literature suggests that the growing popularity of indexing has led to the market becoming more efficient. Under this assumption, the cumulative abnormal returns and index premiums should be diminishing. Petajisto has also documented that the upward and downward drift happens as early as 10 days before the effective day. In this study, we also investigate whether or not this pre-announcement trend continues and whether or not it happens sooner.

We find that the cumulative abnormal return from announcement to effective day has averaged 3.98 % and -9.90% respectively. The index premium has varied from 0.05% in 2011 to a peak of 36.2% in 2008, with an average of 4.5% from 2004 to 2012. We claim that index premium and cumulative abnormal return for additions have decreased in the long run.

1.1. Background

In 1989, the S&P commission decided to announce composition changes to the index five days before the actual addition or deletion event. The growth in index funds allows time for portfolio managers to make portfolio adjustments. At the time of announcements, investors could buy additions and sell deletions ahead of such announcements speculating that the S&P researched the future performance of the firms involved.

With the growth in index investing over the past 20 years, the observation is the composition changes to the S&P 500 index have mechanically driven up (down) the additions (deletions) abnormal return. We usually call the abnormal return "alpha "in the classical capital assets pricing model (CAPM) world. In the CAPM world, we define abnormal return as the difference between the realized return and the CAPM predicted return.

Since 1989, several researchers have investigated the cause of abnormal returns. While there is no definitive explanation that researchers agree on, there are four generally accepted explanations for abnormal returns:

1) Price-pressure-trading volume around effective date forces price away from equilibrium (Gammill & Marsh, 1988).
2) Downward sloping demand curve: mechanical transactions (buy/sell) will (decrease/increase) shares in circulation (Kalay et al., 2004).
3) Information hypothesis: S&P knowledge of non-public information is reflected in the increase/decrease of stock price (McDermott & Hedge, 2000).

Liquidity: increased liquidity to a given stock will draw the attention of people following stock (Amihud & Mendelson, 1986).

II. LITERATURE REVIEW

The S&P 500 index has exactly 500 firms intended to represent the U.S. economy. The index is selected by the S&P 500 based on market capitalization, industry representation, liquidity, trading volume, and financial strength. There have been many papers that have discussed the existence of positive abnormal returns for additions and negative abnormal returns for deletions around the announcement of composition changes to the S&P 500 index (for example, Shankar & Miller, 2006; Nan & Singal, 2015; and Papachristou et al., 2018). This paper differs from the prior literature by looking at

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[2] Due to limited access to Bloomberg terminal, our sample ends in 2012.

the same issue from a different angle: the efficiency of the S&P 500 market. One related study, Nan and Singal (2015), focuses on one negative externality of indexing: the effect on the efficiency of stock prices. They find that "greater indexing leads to less efficient stock prices, as indicated by stronger post-earnings-announcement drift and greater deviations of stock prices from the random walk" Nan and Singal (2015). This study focuses on cumulative abnormal return for additions and deletions in the short and long run.

III. RESEARCH METHODOLOGY

Since we want to compare our index premium with Petajisto's results from 1990 to 2005, we use the same criterion to select the data source and to calculate the index premium but report on changes to the S&P 500 between 2004 and 2012.

For each event stock, we require valid CRSP return data 20 trading days before the announcement day and 20 trading days after the effective day. This eliminates firms that undergo M&A activity such as being spun off or acquired by another firm. It also eliminates firms that were delisted from their exchanges only a few days after their deletion from the index, which may occur for firms experiencing sudden financial distress.

We define the effective day of the index change as trading day zero in event time, so the index is updated using the closing prices of trading day zero. The announcement usually occurs after the close on trading day -5. The additions and deletions for this period were acquired from Bloomberg.

The cumulative abnormal return (CAR) for a stock is defined as the difference between the cumulative gross stock return and the cumulative gross return on the CRSP value-weighted market index, expressed as a percentage of the latter.

$$r_{stock} = \prod_{i=-n}^{j}(1 + r_i)$$ 1

Where i ranges from a specified date before the effective date to an ending date j. The cumulative abnormal return (CAR), relative to the volume-weighted market return is defined to be

$$CAR = \frac{r_{stock} - r_{mkt}}{r_{mkt}}$$ 2

Note that since index changes depend on past returns, this induces a selection bias to the alpha estimates of the market model, so the standard market model is not applicable here and that is why we use market-adjusted returns instead. We normalize the CAR to zero at trading day -10. This allows us to identify a possible pre-announcement drift due to information leakage or other anticipation of the index announcement. Note that with any model to adjust for risk, we are always testing the joint hypothesis of efficient pricing together with the model being correctly specified. However, S&P index changes are unusually robust to this common challenge. First, the initial price impacts can be measured over such a short period, only a few days or weeks, that any risk premium has very little impact on the results. Second, since the events are scattered over random points in calendar time, this reduces the impact of other factors that might systematically influence returns. From 2004 to 2012, S&P changes happened quarterly.

Since the index premium is not likely to be constant across our sample period of 26 years, especially given the increasing relative size of index funds, we conduct our analysis separately for each year. Each year we form an equally weighted portfolio of additions at trading day −10 and another portfolio of deletions at trading day -10. We then look at the cumulative buy-and-hold abnormal returns (CARs) on those portfolios.

In addition, we also calculate CAR from -20 days to +20 days for each event to

see if there is any pre-announcement upward and downward drift for additions and deletions from day -20.

IV. RESULTS AND DISCUSSIONS

Market-adjusted abnormal returns were calculated for additions and deletions in each year from 2004 to 2012. By following the procedure outlined by Petajisto (2011), we are able to develop a more comprehensive understanding of changes to the index premium. As shown in Figure 1, investors have nearly doubled the percentage of equities in index funds since 1998. As a result, there should be a growing efficiency in the market.

Figure 1
Growth of Index Investing (ICI, 2013)
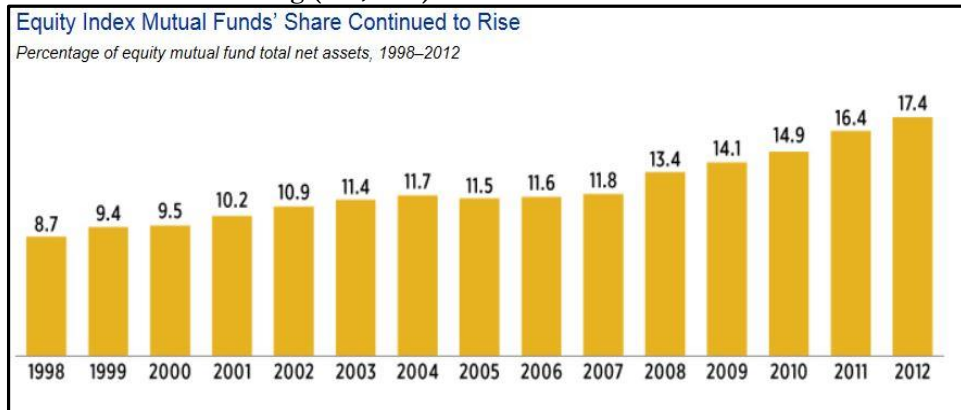
In Table 1, we list the additions and deletions in each year from 2004 to 2012. We find that the CAR in 2008 reaches an extreme high of 39.48%, mainly contributed by the deletions' cumulative abnormal returns (CAR) of -31.79%. T-test shows that 2009-2012 additions CAR and 2009-2011 deletions CAR are not significantly different from zero, therefore we claim that market has become more efficient in pricing S&P 500 additions and deletions. However, for the long run (2004-2012), the average abnormal return is still significant. The market capitalization of added and deleted firms shows a pronounced difference as indicated in Table 2. On average, added funds are nearly 3 times the size of deleted funds.

Table 1
Abnormal Returns for S&P 500 Additions and Deletions (Upper One). The Table Shows the Cumulative Abnormal Returns for All Qualifying Event Stocks from 5 Trading Days before Announcement Day (10 Days before Effective Day). T-test for Additions and Seletions CAR (Lower One)

	Additions		Deletions		Additions-Deletions
	Market-Adjusted		Market-Adjusted		Market-Adjusted
Year	N	CAR	N	CAR	CAR
1990	11	3.60%	7	-22.30%	25.90%
1991	10	9.10%	5	-43.10%	52.20%
1992	6	3.30%	5	-39.40%	42.70%
1993	7	5.10%	6	-6.00%	11.10%
1994	13	6.40%	13	-5.00%	11.40%
1995	23	8.10%	14	-7.80%	15.90%
1996	20	7.40%	14	-7.40%	14.80%
1997	24	11.80%	7	-5.30%	17.10%

To be continued Table 1.

Year	N	Additions Market-Adjusted CAR	N	Deletions Market-Adjusted CAR	Additions-Deletions Market-Adjusted CAR
1998	37	12.70%	10	-13.10%	25.80%
1999	38	10.40%	11	-10.90%	21.30%
2000	48	14.40%	23	-17.80%	32.20%
2001	27	4.20%	14	-20.20%	24.40%
2002	21	7.60%	16	-22.10%	29.70%
2003	8	-1.10%	2	-32.10%	31.00%
2004	17	4.32%	7	-2.80%	7.12%
2005	14	4.10%	2	-20.98%	25.08%
2006	25	6.07%	6	-9.07%	15.14%
2007	34	2.88%	7	-0.39%	3.27%
2008	32	7.69%	14	-31.79%	39.48%
2009	25	2.61%	16	-5.89%	8.50%
2010	12	1.37%	4	4.31%	-2.94%
2011	14	0.43%	10	-0.14%	0.57%
2012	12	1.39%	7	-6.00%	7.39%

| Year	Additions #Firms	CAR	Stdev.	T-stat	Deletions #Firms	CAR	Stdev.	T-stat
2004	17	4.32%	0.03	6.07	7	-2.80%	0.05	-1.42
2005	14	4.10%	0.05	3.18	2	-20.98%	0.13	-2.30
2006	25	6.07%	0.06	4.99	6	-9.07%	0.06	-3.59
2007	34	2.88%	0.06	2.82	7	-0.39%	0.06	-0.18
2008	32	7.69%	0.10	4.31	14	-31.79%	0.30	-3.98
2009	25	2.61%	0.07	1.77	16	-5.89%	0.14	-1.69
2010	12	1.37%	0.05	1.01	4	4.31%	0.08	1.07
2011	14	0.43%	0.07	0.24	10	-0.14%	0.05	-0.09
2012	12	1.39%	0.07	0.70	7	-6.00%	0.07	-2.36
2004-2012	**185**	**3.98%**	**0.07**	**7.54**	**73**	**-9.90%**	**0.19**	**-4.43**

Table 2
Additions and Deletions for Each Year from 2004 to 2012 Tabulated with the Average Market Capitalization and its Standard Deviation for Each Year

Year	Additions Number	Market Cap (Billions) Avg.	Stdev.	Year	Deletions Number	Market Cap (Billions) Avg.	Stdev.
2004	17	8.39	0.19	2004	7	4.29	0.13
2005	14	8.41	0.24	2005	2	0.33	0.03
2006	25	13.07	0.45	2006	6	1.16	0.04
2007	34	10.27	0.21	2007	7	10.37	0.32
2008	32	6.91	0.19	2008	14	3.02	0.31
2009	25	5.25	0.06	2009	16	4.30	0.06
2010	12	11.71	0.17	2010	4	1.95	0.04
2011	14	11.70	0.06	2011	10	1.77	0.16
2012	12	13.25	0.19	2012	7	2.20	0.05
Summary	**185**	**9.88**	**0.20**	**Summary**	**73**	**3.27**	**0.13**

The CAR for additions and deletions that accumulate from ten days before the effective day is plotted in Figure 2. The additions' CARs are quite flat over the year 1990 to 2012. CARs resulting from deletions over the same time have a larger magnitude, but

also appear to be diminishing after 2004. The resulting trend in the 10-day abnormal return spread (additions-deletions) illustrates this declining trend. This is reasonable as the S&P 500 change is initiated by deletions. For those deletions, the fundamentals of the firms do change substantially. According to classical finance theory, the stock price is just the net present value of the stock's future cash flow. The additions are "passively" added to the index. Their fundamentals do not change necessarily, thus we see quite flat additions CAR.

Figure 1
**10 Day CAR Spread for Additions and Deletions**
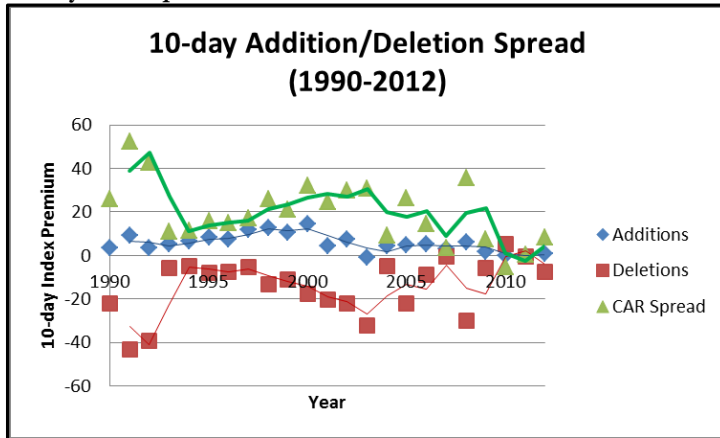
The CARs for 2004-2012 over the 10-day range around the effective date are illustrated in Figure 3. Compared to the period from 1990 to 2005 given in Petajisto's paper (Figure 4), the CAR for additions had dropped by nearly 50% while the CAR for deletions is approximately the same. The dashed lines indicated the 95% confidence interval about the mean CAR. As in the earlier period, CAR for deletions is non-zero and significant before the announcement date. This does not appear to be the case for additions.

Figure 2
**Short-term Abnormal Returns for 2004-2012**
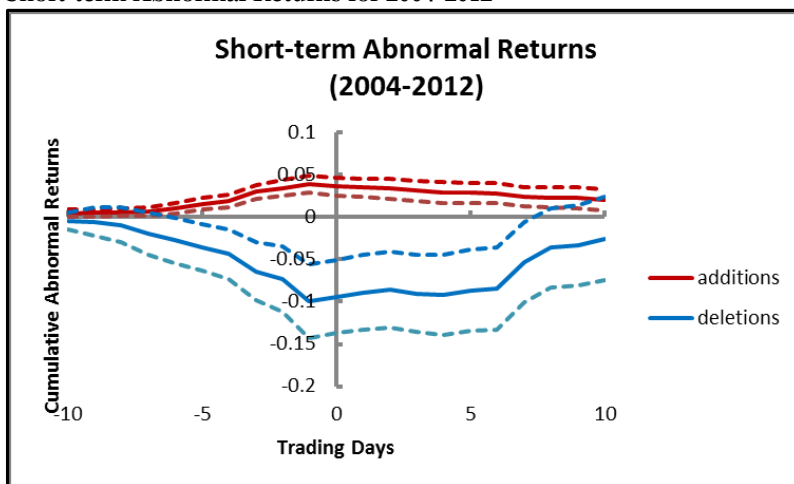
Figure 3
Petajisto Results for CAR for Ten Days Window Around Effective Date[3]
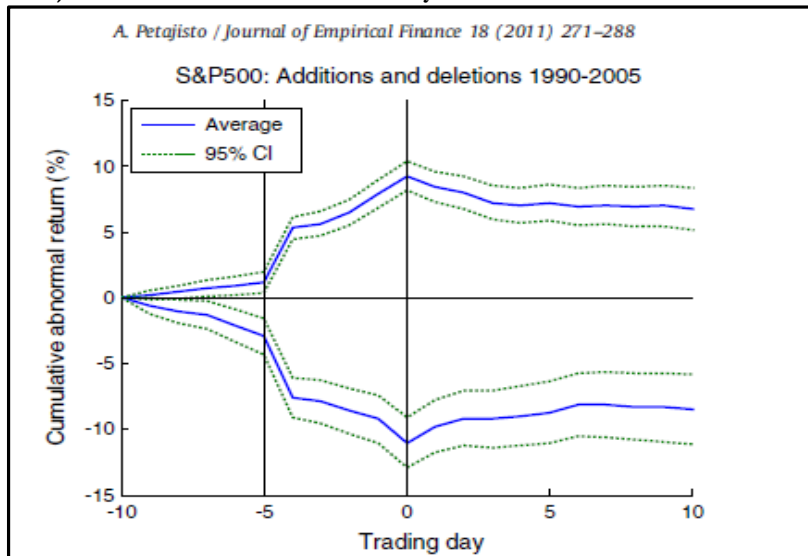
In Figure 5, we find the CAR for additions is almost zero from day -20 to day -10. However, the deletions' CAR starts its downward drift from as early as day -20. We believe that this phenomenon can be explained by the fact that information from the decline in price and market capitalization triggering the removal of these firms from the S&P500.

Figure 5
**CAR from Deletions Prior to Announcement Date**
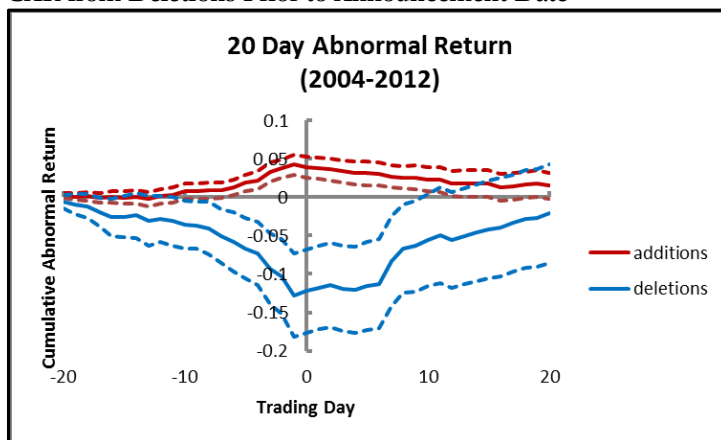
In Figure 6, we study the long-term return reversal of additions and deletions for 2004-2012. We find that additions CAR reverts to zero about 30 days after effective day. This is quite different from 1990-2005. In Figure 7, the additions CAR persist for quite a long time at a 5% level for 1990-2005. Deletions CAR reverts to zero around day 20, comparing to day 40 for 1990-2005. For additions CAR, we find that it reverts to zero around day 30. This is very different from the period 1990-2005, Figure 7 suggests the additions CAR persist for quite a long time. Again, the market is becoming more efficient in pricing both additions and deletions.
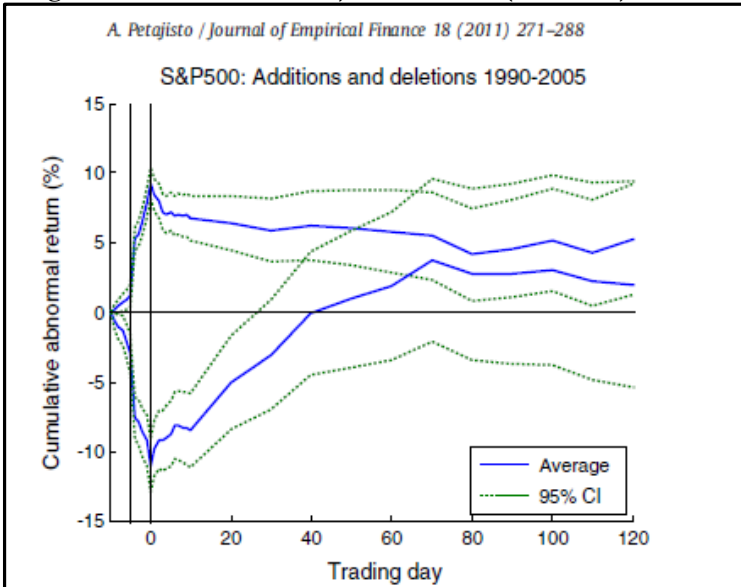
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[3] The index premium and its hidden cost for index fund (Petajisto, 2011).

Figure 6
**Long-Term Trend in CAR from 2004-2012**
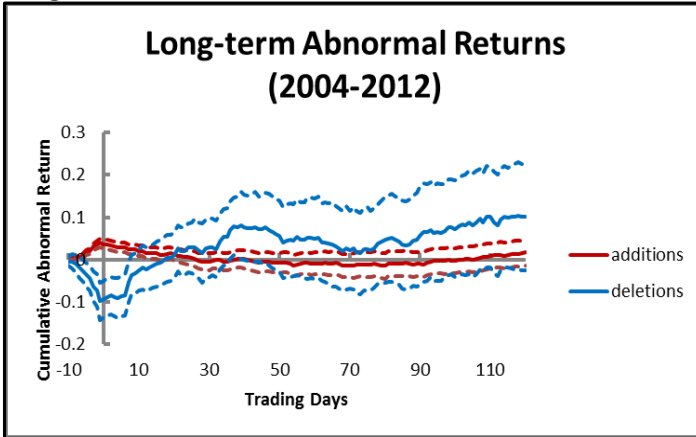
Figure 7
Long-Term Trends from Petajisto Research (1990-2005)

We are using price-pressure and downward-sloping demand curve to interpret the abnormal return. Due to the fast-growing ETF market and other indexing funds, more and more additions are mechanically bought and more and more deletions are mechanically sold. This leads to a huge trading volume for the index changes before the effective date. In Figure 8, we can see that 1 day before the effective day, about 20% of the additions shares outstanding are traded and about 15% of the deletions are traded on average from 2004 to 2012.[4] The reason for that is indexing fund managers track the index as close as possible to minimize the tracking error. They will have no tracking error on the effective day if they buy and sell securities one day before the effective day.

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[4] Unlike in Petajisto's work, we find the largest trading volume actually happens on day -1 instead of effective day. This difference is due to the different definition of effective day.

Figure 8
Trading Volume of Added and Deleted Firms
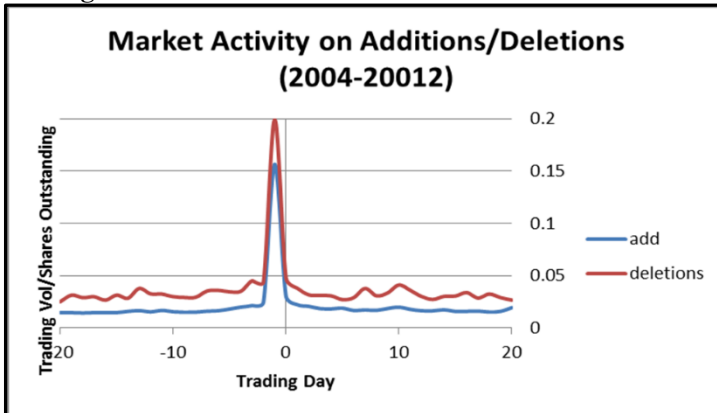
V. CONCLUSION

We update the index premium from 2004 to 2012 and find that index premium is declining from 2004 to 2012. We document that CARs due to additions appear to be diminishing compared to 1990-2004 and CARs due to deletions appear to be held at 1990-2004 levels. We also conclude that long-term abnormal returns for additions appear to decline at a faster rate in the 2004-2012 period and the abnormal returns due to deletions rebound at a faster rate but appear more volatile. There appears to be a premium effect for deletions before the announcement date due to information leakage or speculations. We find the market becomes more efficient in pricing additions and deletions evidenced by non-significant additions and deletions CAR for 2004-2012.

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