The Growth of Passive Investing and Its Impact on the Change Anomaly

Pascal Nuamah

A Thesis in The John Molson School of Business

Presented in Partial Fulfillment of the Requirements for the
Master of Science (Finance) at Concordia University
Montreal, Quebec, Canada

October 2023

CONCORDIA UNIVERSITY
School of Graduate Studies

This is to certify that the thesis prepared

By: Pascal Nuamah

Entitled: The Growth of Passive Investing and Its Impact on the Change Anomaly

And submitted in partial fulfilment of the requirements for the degree of

Master of Science (Finance)

Complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by final examining committee:

____________________________ Chair
David Newton, PhD

____________________________ Examiner
Kun Ho Kim

____________________________ Examiner
Rahul Ravi, PhD

____________________________ Thesis Supervisor
Lawrence Kryzanowski, PhD

____________________________ Thesis Supervisor
David Newton, PhD

Approved by ____
Nilanjan Basu, PhD Graduate Program Director

Approved by ____
Anne-Marie Croteau Dean of The John Molson School of Business

ABSTRACT

The Growth of Passive Investing and Its Impact on the Change Anomaly

Pascal Nuamah

This study examines the effects index changes have on securities that are added to or deleted from the S&P 500 Index from 2000 to 2019. Furthermore, it attempts to examine the relationship between the price movement of securities around index changes (as measured by abnormal returns) and the growth in indexing. I find that the increase in indexing diminishes the addition (deletion) effect, which seems to contradict the price pressure hypothesis. Vijh and Wang (2022) argued that the increased indexing or institutional ownership in the S&P 400 Index contributes to the diminishing addition (deletion) effects. Ultimately, multiple forces are clearly at work when it comes to index changes.

Table of Contents

THE GROWTH OF PASSIVE INVESTING AND ITS IMPACT ON THE CHANGE ANOMALY

1. Introduction

Bloomberg (Gittelsohn, 2019) reports that, after nearly fifty years of interest, passive equity investment strategies in the US have surpassed actively managed equity funds in terms of assets under management (AUM). According to the Morningstar estimates quoted in the Bloomberg release, assets in index-tracking US equity funds reached $4.271 trillion, compared to $4.246 trillion for actively managed US equity strategies. Whether it is because of the lower fees, or because of skepticism towards active portfolio managers' ability to outperform the markets over time, both retail and institutional investors have allocated more and more of their capital to passive products. Jack Bogle, late founder of Vanguard, is credited with launching the first passive strategy, the Vanguard 500 Index in the 1970s. Today, this fund is the largest mutual fund in terms of assets under management (AUM) in the United States. Furthermore, three of the five largest mutual funds in the US are passive strategies replicating the Standard & Poor's 500 (S&P 500) Index. In their annual survey of assets, S&P Dow Jones Indices (S&P DJI) estimates that approximately $4.6 trillion in assets aim to replicate the S&P 500 index as of the end of 2019.

A fundamental assumption backing passive investment is that markets are efficient. The strong form of the efficient market hypothesis (EMH) proposes that it is impossible to consistently outperform the market as publicly available share prices should reflect all salient information. If correct, attempting to beat the market is not value adding so investors should avoid expensive actively management investment strategies. However, the efficient market hypothesis has not achieved unanimous support. One of the ways some active portfolio managers have attempted to outperform their benchmarks is by exploiting market anomalies, or situations where a stock, or group of stocks, produces returns that contradict what market efficiency should allow.

Unlike actively managed investment strategies, passive mutual funds and exchange-traded funds mimic the holdings of the index using full or partial replication. Thus, when the index provider makes a change to the benchmark, the passively managed strategies must make or replicate the same change. Additions and deletions are therefore worth researching as they produce predictable supply and demand shocks for specific stocks.

Stock price movements surrounding securities that are being added to/deleted from major indices have been heavily researched, particularly the additions. The extensive literature on the subject includes tests of various possible explanations of the changes in market metrics around index changes. Some studies have looked at a variety of indices but given that the reconstruction process is not constant across all indices, and not all indices are as followed and replicated, one cannot assume that the findings discovered on the Nikkei Index (Takahashi and Xu, 2016) or the Russell 2000 (Akhigbe et al., 2022), necessarily apply to the S&P 500 Index. For these reasons, the literature reviewed here predominantly focuses on the index of interest.

In this thesis, I study the market response of securities being added/deleted from the S&P 500 Index. A large portion of the literature on the topic has attributed part of the abnormal price returns following the announcement of a stock's inclusion in an index to the price pressure hypothesis, which suggests stocks have a downward-sloping demand curve and that the inclusion (deletion) of a security in a major index creates a demand shock that shifts the demand curve, and therefore puts an upward (downward) price pressure on the added (deleted) stock's price. Beneish and Whaley (1996) refer to the ''S&P Game'' where the added stock is bought following the announcement of its inclusion ahead of index funds and subsequently sold once the index funds' demand for this security is filled.

The main purpose of this thesis is to study the relationship between the size of the inclusion (deletion) effect and the growth in popularity of passive strategies replicating the S&P 500 Index. Given that passive strategies need to buy (sell) securities that are being added (deleted) from the index they are replicating, it is hypothesized that as passive strategies make up a larger portion of the assets, the demand shock is larger and therefore triggers a larger abnormal return. Although the existence of this price pressure has been observed quite consistently in previous research, there is very little literature observing the relationship between the inclusion (deletion) effects and the growth in AUM of passive strategies replicating the S&P 500 Index.

The sample period of this study ranges from 2000 through 2019 and is broken down into four main series of tests: comovement, abnormal turnover, abnormal return, and the impact of indexing on the abnormal turnover and returns around index changes. In the first set of tests, I find increased comovement with the S&P 500 for stocks that are newly added to the index, but do not observe the opposite for deletions. Secondly, for abnormal volume, which I measured in terms of turnover, my results show an increased trading activity starting on the day an index change in announced that lasts for at least one week following the effective date of the changes for deletions and at least two weeks for additions. In both cases, the largest abnormal turnover can be observed on the day preceding the effective date of the change. Thirdly, I document positive (negative) abnormal returns on the first trading day following the announcement of an addition (deletion). My results suggest that the abnormal returns are sustained during the following trading month for additions, but not for deletions. For the last series of tests, I find that increased indexing, which I measure as the total assets indexed to the S&P 500 Index as a percentage of its market cap, is met with increased abnormal turnover on the day before the changes take place for additions. Lastly, I document that the growth in indexing decreases (increases) the initial positive (negative) abnormal returns observed for additions (deletions) on the day following the announcement of the change. In other words, it minimizes what is known as the addition (deletion) effect.

2. Literature Review

The ''inclusion effect'', which refers to the fact that a stock's inclusion in the index, as well as the announcement of its inclusion into the index, is associated with positive abnormal returns, has been thoroughly examined in the literature. Shleifer (1986), Harris and Gurel (1986), Lynch and Mendenhall (1997), Mork and Yang (2001), Chen et al. (2004), Cremers et al. (2010) and Petajisto (2011) find evidence supporting the inclusion effect. Although most studies do find a price increase in response to an inclusion in the S&P 500, the reason for the price movement, as well as whether the price change is permanent or temporary, has not yet reached a consensus.

Many authors who find evidence of an inclusion effect believe that this effect is partially explained by Shleifer's (1986) proposition that the demand curve for stocks is downward sloping and that their inclusion in a major index shifts their demand curve to the right, resulting in a higher price. Beneish and Whaley (1996), and Lynch and Mendenhall (1997) also find evidence supporting this price pressure hypothesis, sometimes referred to as the imperfect substitutes hypothesis.

Many researchers, including Harris and Gurel (1986), Woolridge and Ghosh (1986), Lamoureux and Wansley (1987), and Elliott and Warr (2003) find results consistent with the price pressure hypothesis. Furthermore, most researchers, including Pruitt and Wei (1989), refer to index fund managers as the reason for the increased demand and therefore upward price pressure on the stocks added to an index. A notable exception is Edmister et al. (1994) who report results inconsistent with this hypothesis. Using a future estimation period as opposed to a historic estimation period, Edmister et al. (1994) find that the positive abnormal returns following an index addition are not reversed. Other, more recent studies such as Chen et al. (2004) and Hrazdil (2009) find that the positive abnormal returns following the announcement of an inclusion are sustained and not reversed.

Other studies find empirical evidence supporting various versions of the information theory, sometimes referred to as the certification hypothesis*,* which suggests that being part of a major index like the S&P 500 has a positive influence on securities, as it lets investors know that they should expect better performance from those securities. The elevated performance expectations in turn lead to higher valuations, and ultimately to a higher stock price. Prior research finds that securities included in the S&P 500 benefit from a “value premium”. Cremers et al. (2010) find that the S&P 500 had an economically and statistically significant positive alpha of 0.82% per year model from 1980 to 2005 using the classic Carhart four-factor. Morck and Yang (2001) also find that relative to similar firms not included in the S&P 500 index, index members trade at an important value premium in terms of the average Tobin’s Q ratio. Somewhat similarly, Denis et al.’s (2003) findings also support the certification hypothesis. They find that relative to the benchmark, securities being added to the S&P 500 index experience “significant increases in EPS forecasts and significant improvements in realized earnings”. Hrazdil and Scott (2009) also find that index inclusions lead to a permanent price increase and higher-than-benchmark earnings but find that this improvement is to discretionary reporting. In their 2012 paper, however, Kamal et al. argue that although being added to the S&P 500 index conveys new information about the added firms, the information asymmetry has decreased following 2000 because of regulatory changes such as the Regulation Fair Disclosure, Sarbanes-Oxley Act, and the decimalization of the exchanges. Kamal (2014) extends their work and fail to find the same difference between the pre- and post-2000 period.

Barberis and Shleifer (2003), and Barberis et al. (2005) examine the effect that indexing may have on stock price comovement from habitat and category investing perspectives. In their 2003 paper, they describe category investing as the tendency of many investors to categorize securities and invest in a category as opposed to investing in the individual securities. Examples of categories could be large cap stocks, small cap stocks, technology stocks, government bonds, and so on. The habitat view, or the concept of habitat investing, comes from the idea that many investors prefer to trade only a subset of the full investment universe for a variety of reasons, such as trading costs, ease of transactions, international restrictions, or lack of information. Barberis et al. (2005) mention that an index is an example of habitat and category. They find that stocks included in the same habitats or categories tend to move more similarly. Building on their work, Claessens and Yafeh (2012) find that the betas of firms added to an index tend to converge towards one, meaning that the returns end up becoming more similar to those of the index they joined. More specifically, they find an increase in CAPM beta (0.18 increase on average) for stocks that had a pre-inclusion beta of less than one, and a decrease in beta (0.09 decrease on average) for stocks that had a pre-inclusion beta of more than one. They also find that the lower the pre-inclusion beta, the bigger the beta increase following the announcement of the inclusion in the index. This suggests that the more dissimilar a security is to the index it is about to join, the larger the price movement following the announcement. In addition, their study, which looked at index changes in 40 countries, documents that the increase in comovement following an addition is more pronounced in countries where there is a larger presence of "investors prone to index-based investments", which is consistent with the findings from Barberis and Shleifer (2003) and Barberis et al. (2005). Essentially, these studies suggest that similarity (or lack thereof) impacts the price movement following the announcement of an addition/deletion, and that the magnitude of this impact is, in turn, partially determined by how much assets is indexed to the benchmark to which the security is added/removed.

Other variables that are observed in many of the studies on index changes are liquidity and volume. Although the studies employ varying methodologies and examine the impact on volume differently, the majority, including Chen et al. (2004), Harris and Gurel (1986), Blume and Edelen (2004), Lynch and Mendenhall (1997), Beneish and Whaley (1996), Hedge and McDermott (2003) and Hrazdil (2009), find excess volume for companies being added to the S&P 500, especially on the day following the announcement, as well as on the effective day of the index change. For additions from 1973 to 1983, Harris and Gurel (1986) find that, on average, the volume on the first trading day following the announcement of stocks added to the S&P 500 is 1.89 times as large as the daily average volume over the 8 weeks prior to the announcement. Prior to 1989, S&P did not pre-announce index changes, so that the first trading day following the announcement was also the effective date. In more recent studies examining additions/deletions in the "pre-announcement era", many authors find that the largest excess volume occurs on the effective date, rather than on the announcement date, unlike what is usually found for excess returns. Chen et al. (2004) use share turnover instead of raw volume "so that unusually high volume in a few large stocks does not disproportionately affect the market volume". They find that share turnover was 11 times (15 times) higher than normal for additions (deletions) to the S&P 500 from 1989 to 2000. Harris and Gurel (1986) and Blume and Edelen (2004) posit that these large increases in volume are at least partially attributable to large trades coming from indexers, that are replicating the S&P 500. This explanation is consistent with the observation that the abnormal increase in volume or share turnover tapers off following the effective date.

Although some authors mention that one could expect the liquidity of added stocks to decrease due to a reduction in free float following purchases from large indexers, most studies find the opposite. Hedge and McDermott (2003), Ravi and Hong (2015), Schoenfeld (2017), Hrazdil (2009), Brockman and Chung (2006), and Chordia et al. (2000) find that the liquidity of stocks added to indices improves following their inclusion. Chordia et al. (2000) and Brockman and Chung (2006) find that this is explained by commonality, meaning that the liquidity of individual securities is partly determined by larger, index-wide factors. Others, including Schoenfeld (2017) and Hedge and McDermott (2003), find that the increased liquidity is a result of the liquidity/information cost hypothesis, which suggests that inclusion in an index, particularly the S&P 500, leads to more awareness from investors. In turn, this leads to more disclosure from the firms and an overall more extensive information environment, which reduce transaction costs, ultimately leading to higher liquidity and volume.

2.1 Deletions

The deletion effect is much less researched than the addition effect and has yielded less consistent results, both in terms of the existence of such an effect as well as the permanence of the price movements observed by some researchers. Chen et al. (2004) and Petajisto (2011) find that the negative abnormal returns associated with deletions completely reverses itself by 60 days after the effective date of the deletion. The price reversal observed following the initial price drop following the announcement of a deletion is consistent with the findings of Harris and Gurel (1986), Lynch and Mendenhall (1997), Dash (2002), Beneish and Whaley (2002), who all find partial or full reversal in price movements. Kamal (2014) also finds that the initial negative abnormal returns are reversed earlier in the post-2000 period. Many believe that the reversal is further proof of the price pressure hypothesis in the short run, resulting from the change in demand from index investors.

The literature, including Chan et al. (2013), suggests that the asymmetry of the inclusion and the deletion effects is a reflection that the differential effect of index changes on variables such as analyst coverage, investor awareness, trading volume, and liquidity. Chen et al. (2004) find that the changes in investor awareness are asymmetric and therefore lead to asymmetric price responses. In other words, the increase in awareness for a stock following its inclusion in the S&P 500 Index is much larger than the drop in awareness for a stock that gets removed from the index. Mase (2007) also finds asymmetric abnormal trading volume before the announcement date, suggesting uneven anticipatory trading between additions and deletions.

2.2 Index changes as a trading strategy

One of the goals of this thesis is to establish whether the price movements surrounding index changes may be economically exploitable in that the so-called "S&P Game" can still be profitably played. Chan et al. (2013) find that both additions and deletions outperform the market in the long-run based on cumulative market adjusted returns, using the CRSP Value-Weighted Index as the benchmark. They document an outperformance of 11% for additions and 54% for deletions over the five years following the event. Cai and Houge (2008) also find that stocks deleted from the Russell 2000 outperform stocks added to the index, as well as the benchmark. Kamal (2014) finds that "the negative abnormal returns after deletion from the S&P 500 Index are reversed earlier in the post-2000 period from the pre-2000 period". Although most of the literature agrees on the direction of the inclusion/deletion price effects, there is less consensus regarding both the magnitude and the longevity of the said effect. For instance, Harris and Gurel (1986) find that the short-term price increase following a stock's addition to the S&P 500 Index between 1973 and 1983 is nearly entirely reversed within two weeks, while Chen et al. (2004) find a sustained positive price effect for additions between 1976 and 1989.

According to the S&P DJI estimates mentioned earlier, there was $4.6 trillion in assets aiming to replicate the S&P 500 at the end of 2019, compared to only $1.1 trillion at the end of 2000. While the overall market capitalization of the S&P 500 grew at a compounded annual growth rate of 4.22% between 2000 and 2019, the annualized growth rate of the assets indexed to the S&P 500 was 7.31%. Thus, indexing strategies now represents a much larger proportion of overall market capitalization (17.2% as of 2019 versus 9.6% as of 2000). Furthermore, a larger number of shares outstanding are controlled by passively managed strategies indexed to the S&P 500 Index which are compelled to buy a security when the index adds a new stock and sell the security that is being replaced. If the demand curve for stocks is downward sloping as proposed by Shleifer (1986) and Kaul et al. (2000), a lateral shift in the demand curve of the added/deleted stocks will be wholly or partly responsible for the inclusion/deletion effect. In turn, an increase in assets aiming to replicate the S&P 500 index should increase the magnitude of the shift in the demand curve given that more and more shares have to be purchased/sold in order for indexers to fully replicate the indices being followed.

Morck and Yang (2001) report evidence that the ''index premium'' they observe ''grew in step with the growth on indexing''. However, their paper does not directly address performances around the time of index additions/deletions. While Scari (2016) conjectures that the growth of indexing should lead to a larger demand shift for the securities added to the S&P 500, he finds little support for this claim for stocks added to the S&P 500 between 1990 and 2015. He instead finds that the effect was not amplified by the growth in indexing, as the highest average excess returns between the announcement date and the effective date are observed in non-peak indexing years of 1997 and 1998. Petajisto (2011) also documents that the "index premium" which refers to stock's initial positive/negative abnormal return following its inclusion/deletion from the S&P 500 and Russell 2000 indices for the period from 1990 to 2005 is not associated with the growth in indexing, since the magnitude of the effect peaked in 2000. However, it is worth mentioning that the effects are significant but much larger on the S&P 500 than on the Russell 2000, which could potentially be partly explained by the fact that the S&P 500 is a much more replicated index.

3. Data

This thesis uses the Standard & Poor's 500 Index since it is the most replicated index. As stated in the introduction, the index provider estimated that there was approximately USD $4.6 trillion indexed to the S&P 500 at the end of 2019. To be included in the S&P 500, a company needs to meet the following criteria:

- Be a U.S. company.
- Have a market capitalization of at least USD 14.5 billion (as of July 31st, 2023).
- Be highly liquid in that the ratio of annual dollar value traded to float-adjusted market cap should be at least 0.75, and the stock should trade a minimum of 250,000 shares in each of the six months leading up to the evaluation date.
- Have a public float of at least 10% of its shares outstanding.
- Its most recent quarter's earnings and the sum of its trailing four consecutive quarters' earnings must be positive.

The index is comprised of the 500 largest companies (in terms of free float-adjusted market capitalization) that meet these criteria. Constituents of the index that no longer meet these requirements, or that are no longer part of the 500 largest corporations meeting these requirements (following a corporate event or because of market movement) get deleted from the index. Since October 1989, S&P pre-announces index changes on their website. They typically announce the change and its effective date after the market closes. The number of days between the announcement date (AD) and effective date (ED) varies.

The index changes data were obtained directly from Standard & Poor's Dow Jones Indices (S&P DJI), a division of Standard & Poor's Global, who is the provider of the S&P 500 Index. S&P provided the initial sample, which lists all additions and deletions, as well as their effective dates. The data cover all changes

(539 additions and 534 deletions) between January 1st, 2000, and December 31st, 2019. The small difference in number added and deleted stems from a decision made by the index provider in 2015 to include multiple share classes of certain corporations, which led the S&P 500 Index to include, at one point, 505 stocks. For each index change, I then manually retrieved the original press release from Factiva to identify the announcement date and verify the reason justifying the index change. The majority of index changes are the result of some sort of corporate event such as mergers, acquisitions, and spinoffs. Given that the analysis observes the price movement prior to and following the event, I removed firms involved in such corporate events during the year prior to and the year following the event. Furthermore, I also removed corporations that went bankrupt and those that stopped trading or that were delisted from the New York Stock Exchange (NYSE). I also filtered out other confounding events that largely influence the price of their security, such as companies receiving a takeover bid shortly after their deletion, being taken private, relocating to a foreign country, as well as firms getting bailed out by the government, such as Fannie Mae and Freddie Mac in 2008. Lastly, for the purpose of my analyses, I observe the returns for those firms for the period starting 273 days prior to the AD and ending 273 after ED. Companies that do not have data for the whole period are removed. The base-case sample includes 380 additions and 147 deletions. Table 1 provides a detailed list of the index changes, broken down by year in Panel A. Panel B summarizes how many index changes are removed from the samples for each type of corporate event or confounding events.

Given that my base-case sample excludes companies that do not have trading data for the 12 months following their inclusion or deletion to the S&P 500, the base-case tests are most likely affected by survivorship bias, especially for the deletions. The base-case tests also are more likely to be contaminated by confounding events as the relative time from AD lengthens, again especially for deletions. I use three subsamples to address these issues for the deletions. “Deletions subsample 1” uses all deletions from the base-case sample that have data from [AD-189, AD+189] after deleting confounding announcements identified during the window [AD-6, AD+63] using Factiva. “Deletions subsample 2” eliminates deletions from the base-case sample that have a macro-related confounding announcement during the window [AD-6, AD+63] identified using Factiva and “Deletions subsample 3” eliminates deletions from the base-case sample that have a firm-specific confounding announcement during the window [AD-6, AD+63] identified using Factiva. Table 8 categorizes the reasons and their frequencies for the removal of securities to create the three subsamples of deletions. Following the additional filtering, subsamples 1, 2, and 3 include 111 deletions, 131 deletions, and 127 deletions, respectively.

The information regarding the total amount of assets indexed to the S&P 500 as a percentage of the index' total market cap is obtained in multiple ways. I use three different proxies to test the impact of this variable on the addition/deletion effect. The first proxy (Proxy 1) uses the numbers from S&P DJI's annual surveys in which they estimate the total assets directly linked to its multiple indices, including the S&P 500 Index, as of the end of every calendar year. They define indexed assets as "assets in institutional funds, ETFs, retail mutual funds, and other investable products that seek to replicate or match the performance of the respective index". For the second proxy (Proxy 2), I use these annual numbers to extrapolate quarterly data. Using a third order polynomial regression, I obtain quarterly data based on the annual numbers from S&P DJI's annual survey used for Proxy 1. For the third proxy (Proxy 3) I use the www.activeshare.info database, which is maintained by Martijn Cremers, which provides information about the active share of funds in the US. Out of the entire database, I filtered for mutual funds and ETFs that have an active share of 10% or less relative to the S&P 500 Index. This filter left me with 34 investments vehicles. I then obtained the quarterly AUM of these 34 funds on Bloomberg and added them to build my proxy for total assets indexed to the S&P 500. In all three cases, I also divide by the S&P 500 Index's market capitalisation, which I obtained on YCharts. All three proxies are therefore quoted as a percentage of the index's market capitalisation. Throughout the thesis, this variable in referred to as 'indexed assets as a percentage of S&P 500 market cap''.

4. Methodology

4.1 Comovement/Similarity Measures

To observe the change in comovement, I employ a similar methodology to Barberis et al. (2005) and Claessens and Yafeh (2012). For each inclusion/deletion, I estimate the betas separately for the pre-event period and the period after the inclusion/deletion using the CAPM model (1) where $R_{i,t}$ is the return for the observed security i at time t, $R_{f,t}$ is the risk-free rate at time t, and $R_{SP500,t}$ is the contemporaneous return for the S&P 500 Index.

[1] $$R_{i,t} - R_{f,t} = \alpha_i + \beta_i(R_{SP500,t} - R_{f,t}) + \varepsilon_{i,t}$$

I also record the R^2 and adjusted R^2 to measure the extent to which the estimated betas explain the returns of the added/deleted firms. Like in Barberis et al. (2005), the pre-event window is the 12-month period ending one month prior to the announcement date and the post-event window is the 12-month period starting one month after the effective date. Given that there is an average of 21 trading days in each month, the pre-event period is AD-273 through AD-21 and the post-event period is ED+21 through ED+273. I measure the average change in betas, R^2 and adjusted R^2, which are reported in Panel A of Table 2. I test the average changes using the z-test and the changes in the median using the Wilcoxon signed rank test. To reduce the risk that findings are a product of model selection, I run a second analysis using the Fama-French 5-Factor model [2], where the variables added to [1] are SMB or the small-minus-big return, HML or the high-minus-low return, RMW or the robust-minus-weak return, and CMA or the conservative-minus-aggressive return. Those results, which are found in Panel B of Table 2 are based on:

[2] $$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,1}\left(R_{SP500,t} - R_{f,t}\right) + \beta_{i,2}SMB_{i,t} + \beta_{i,3}HML_{i,t} + \beta_{i,4}RMW_{i,t} + \beta_{i,5}CMA_{i,t} + \varepsilon_{i,t}$$

The daily returns for each firm in my sample are obtained from the Center for Research in Security Prices (CRSP), and the data for the factor returns and risk-free rate used in the regressions are obtained from the Kenneth R. French Data Library available at: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

4.2 Abnormal Turnover around index changes

As is generally the case with studies on the topic of index changes, I also study the changes in volume around inclusions/deletions to the S&P 500 Index to identify whether additional trading activity occurs around these events. The literature provides a variety of measures to capture volume. Beneish and Whaley (1996) measure abnormal volume by dividing the dollar trading volume each day by the average dollar trading volume of the 60 days prior to the announcement date. Others, including Lynch & Mendenhall (1997), use a volume measure based on turnover, which is found by dividing daily volume by the number of shares outstanding. As Chen et al. (2004) state, this deals with a problem where "unusually high volume in a few large stocks does not disproportionately affect the market volume". The measure used in this thesis is:

[3] $$AbTR_{i,t} = \frac{Turnover_{i,t}}{Average\ Turnover\ of\ stock\ i\ for\ period\ ranging\ from\ AD{-}65\ to\ AD{-}6} - 1$$

Where $AbTR_{i,t}$ is the abnormal turnover of stock *i* at time *t* and $Turnover_{i,t}$ is the turnover of stock *i* at time *t*. Previous literature suggests that periods of abnormal volumes are generally centered around the effective date, so for the inclusion and deletion samples I examine the abnormal volumes for the period ED-5 through ED+5. For each day between ED-5 and ED+5, I measure the average and median abnormal turnover for the securities in each sample. I then test the means using a t-test and the medians using the Wilcoxon signed rank test.

4.3 Event Study on the abnormal returns around index changes

I use an event-study methodology, similar to Lynch and Mendenhall (1997) and Chen et al. (2004), to measure abnormal returns and abnormal volumes during various time periods surrounding each index change. I compute the abnormal returns for each inclusion and deletion in the base-case samples using two factor models and a market-adjusted return model. The first model is a slightly modified CAPM model (3), where I use two market sensitivity betas to be cognizant of the potential change in a stock's beta following its addition/deletion to the index, which is addressed in the previous section. Specifically, the following model is estimated over a window of two years centered on AD (i.e., [AD-252, AD+252]:

[4] $R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,1}\left(R_{SP500,t} - R_{f,t}\right)(1 - D_1) + \beta_{i,2}\left(R_{SP500,t} - R_{f,t}\right)D_1 + \sum_{t=AD-6}^{AD+63} \gamma_{i,t} D_2 + \varepsilon_{i,t}$

Where the dummy variable D_1 takes the value of one on and after the event date and zero otherwise; the dummy variable D_2 takes the value of one for the days [AD-6, AD+63] where the ending date is consistent with Chen et al. (2004) and Petajisto (2011); and all other terms are as previously defined. $\beta_{i,1}$ and $\beta_{i,2}$ are the sensitivity of inclusion/deletion *i* to the market prior to and following the event, respectively. The abnormal return for security *i* at time *t* is represented by $\gamma_{i,t}$. The cumulative abnormal return (CAR) for each inclusion/deletion over various periods are measured by adding the abnormal returns, as follows:

[5] $\sum_{\tau=T1}^{T2} \gamma_{i,\tau}$ where T1 and T2 are periods relative to an event's AD.

The second model is an augmented Fama-French 5-Factor model, where I also use two market sensitivity betas, and add a term to capture the impact that changes in liquidity may have on returns, like Chung and Kryzanowski (1998). I use the Florackis et al. (2011) price impact ratio as the liquidity term, which is very similar to the Amihud (2002) illiquidity ratio but with turnover instead of volume in the numerator. The Florackis et al. (2011) price impact ratio is defined as:

[6] $RtoTR_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} \frac{\left|R_{i,d,t}\right|}{TR_{i,d,t}}$

Where $R_{i,d,t}$ is the daily return of security *i* on day *d,* $TR_{i,d,t}$ is the turnover ratio, which is volume divided by shares outstanding of stock *i* on day *t*; and D_{it} is the number of valid trading days of security *i* during month *t.* The reason for choosing a measure using share turnover as opposed to volume is the same as the one explained in section 4.2. The second regression model is:

[7] $R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,1}(R_{SP500,t} - R_{f,t})(1 - D_1) + \beta_{i,2}(R_{SP500,t} - R_{f,t})D_1 + \sum_{t=AD-6}^{AD+63} \gamma_{i,t} D_2 + \beta_{i,3}SMB_{i,t} + \beta_{i,4}HML_{i,t} + \beta_{i,5}RMW_{i,t} + \beta_{i,6}CMA_{i,t} + \beta_{i,7}RtoTR_{i,t} + \varepsilon_{i,t}$

Where the terms at time *t* not included in model [4] are $SMB_{i,t}$ (small-minus-big), $HML_{i,t}$ (high-minus-low return), $RMW_{i,t}$ (robust-minus-weak return), $CMA_{i,t}$ (conservative-minus-aggressive return), $RtoTR_{i,t}$ (the price impact ratio), and the error term $\varepsilon_{i,t}$.

The third model is based on market-adjusted returns. The model implicitly assumes a market beta of 1 for all the firms in the samples examined in the abnormal-return analysis.

The daily returns, volume and shares outstanding data for each firm in the sample were obtained from the Center for Research in Security Prices (CRSP), and the data for the risk-free rate and the factor returns are retrieved from the Kenneth R. French Data Library. Since the S&P started pre-announcing the index changes in October 1989, announcements always are at the market close. Thus, I am using AD+1 as the event date as is common in the literature. I record the abnormal returns for each index change on AD, AD+1, and look at AD-6 through AD-1 to test for abnormal returns prior to the announcement, which could provide evidence of news leakage. To account for the potential longevity of the price effect, I also test for abnormal returns during the month [AD+1 : AD+21], and well as during the quarter [AD+1 : AD+63] following the announcement, similar to Chen et al. (2004) amongst others.

4.4 Impact of indexing on additions/deletions

I use simple linear regressions to observe the relationship between indexing, which I measure as total assets indexed to the S&P 500 Index as a percentage of its market capitalization, and the abnormal turnover and returns observed with the tests described in sections 4.2 and 4.3. I use the abnormal turnover numbers measured using equation [3] as the dependent variable to be regressed over indexed assets as a percentage of market cap by using the following formula:

[8] $AbTR_{i,t} = \gamma_{i,INDEXED} Indexed\ Assets\ as\ a\ \%\ of\ Market\ Cap_{i,t-1} + \varepsilon_{i,t}$

Where $AbTR_{i,t}$ is the abnormal turnover of stock *i* at time *t*, $\gamma_{i,INDEXED}$ is the sensitivity of the abnormal turnover of inclusion/deletion *i* at time *t* to the total assets indexed to the S&P 500 Index as a percentage of its market cap as of the end of the previous calendar year or quarter, using one of the three proxies described in the data section. The results from the tests described in section 4.2 indicate that the abnormal turnover is very centralized around ED, so I run the above regression for ED-1 through ED+1.

I use a similar methodology to test the relationship between indexing and abnormal returns. I use the abnormal returns measured in my previous tests using equations [4] and [7] as the dependent variable to be regressed over indexed assets as a percentage of market cap, as follows:

[9] $$AbRet_{i,t} = \gamma_{i,INDEXED} Indexed\ Assets\ as\ a\ \%\ of\ Market\ Cap_{i,t-1} + \varepsilon_{i,t}$$

Where $AbRet_{i,t}$ is the abnormal return of stock *i* at time t, $\gamma_{i,INDEXED}$ is the sensitivity of the abnormal turnover of inclusion/deletion *i* at time *t* to the total assets indexed to the S&P 500 Index as a percentage of its market cap as of the end of the previous calendar year or quarter, using one of the three proxies described in the data section. The results from the tests described in section 4.3 indicate that the abnormal turnover is very centralized around AD, so I run the above regression for AD-1 through AD+2.

5. Results and Discussion

5.1 Analysis of changes in similarity/comovement

Table 2 presents the summary statistics of the effects that an inclusion/deletion to the S&P 500 has on market sensitivity, measured by beta, R^2 and adjusted R^2. One of the main observations is that all the changes in these measures are positive and highly statistically significant for inclusions but not for deletions. Using the CAPM for the regressions, I find that the mean market beta for additions increases by 0.0844, and that the mean R^2 and mean-adjusted R^2 increase by 0.0678 and 0.0681, respectively. All the increases in the means are highly statistically significant, using both the t-test and the Wilcoxon signed-rank test. Only the negative change in the median beta for deleted firms from 1.3029 to 1.2027 is weakly significant at the 10% significance level.

Panel B contains the summary statistics using the Fama-French 5-Factor Model instead of the CAPM. I find for the additions sample that the change in the mean beta of 0.081 and in the median beta from 1.0041 pre-inclusion to 1.0893 post-inclusion are both highly significant for the additions sample. Similarly, all the mean and median changes in R^2 and adjusted R^2 are statistically significant. There are no statistically significant changes in mean or median beta, R^2 or adjusted R^2 for the deletions sample. The initial findings suggest that, on average, the betas of the stocks added to the S&P 500 Index increase following their inclusion. The changes in R^2 and adjusted R^2 provide evidence that, on average, a larger proportion of a security's returns can be explained by the return of the index it is joining.

As a sensitivity test, the above study is repeated using a shorter estimation window for both the pre- and post-event periods. The estimation periods become AD-80 through AD-21 for the pre-event period and ED+21 through ED+80 for the post-event period. Table 3 contains the summary statistics of this robustness test. Although I also observe positive mean changes for the additions sample, none are statistically significant. Like with the initial test, the changes in median daily beta, median R^2 and median adjusted R^2 continue to be positive and statistically significant, both when using the CAPM and the Fama-French 5-factor model. Once again, however, none of the observed changes were statistically significant for the deletions sample.

The observed increases in the betas following firm additions to the S&P 500 Index are consistent with the findings of Vijh (1994) and Barberis et al. (2005). At first glance, the changes in betas shown in Tables 2 and 3 could suggest that following their inclusion to the S&P 500 Index, stocks behave less like this index as their betas move away from one. This conclusion would go against the category and habitat effects described in Barberis et al. (2005) or the similar microstructure effect described in Vijh (1994). Inspired by Claessens and Yafeh (2012), I separate the additions samples based on their pre-inclusion daily betas to test whether they converge towards one following their inclusion in the S&P 500. The split is based on whether the pre-inclusion beta is below or above one. The results of this additional test are shown in Table 4, with Panels A and B showing the results based on the betas calculated initially, and Panels C and D containing the results based on the betas measured with the new test and the shorter estimation window. It is very apparent that the overwhelming majority of the observations that have a pre-inclusion daily beta of less than one experience an increase in beta following their inclusion, and that the majority of the observations with a pre-inclusion daily beta of more than one experience a decrease in beta following their inclusion. Taking Panel A as an example, one can see that when using the CAPM with AD-273 through AD-21 as the pre-event window and ED+21 through ED+273 as the post-event window, similar to Claessens and Yafeh (2012), 201 of the 380 observations in the additions sample have a pre-inclusion daily beta greater than one, and the remaining 179 observations have a pre-inclusion daily beta of less than one. On average, those with a beta of more than one prior to their inclusion experience an insignificant change of -0.016 in beta following their addition, while those with a beta of less than one prior to their inclusion experience a highly statistically significant change of 0.1966 in beta once they are added to the S&P 500 Index. The results are the same directionally in the other panels. However, unlike Panel A, the average changes are statistically significant for stocks with pre-inclusion betas of less and more than one in the other panels. In summary, the results provide evidence that the daily betas of firms added to the S&P 500 Index converge towards one.

The overall findings in this section of the thesis are consistent with the literature, specifically a stock's comovement with the index increases after it is added to that index. This phenomenon might be explained by the category view described by Barberis et al. (2005), which claims that investors have the tendency to allocate funds to a category, such as an index, as opposed to buying individual securities, and that the "coordinated demand induces common factors in the returns of assets that happen to be classified into the same category, even when these assets' cash flows are uncorrelated." (p. 284).

5.2 Abnormal Turnover around index changes

The abnormal turnover (AbTR) results are presented in Table 5 and depicted in Figure 1 around the effective inclusion/deletion dates. We observe the most pronounced abnormal turnover on ED-1 of 18.91 for additions and 12.59 for deletion. The AbTR for additions/deletions is almost 19/13 times larger than its average during the estimation window. Furthermore, 376 of the 380 additions and all 147 deletions had positive abnormal turnovers on ED-1. Only a small positive abnormal turnover occurs in the days leading up to ED-1, and the turnover very quickly returns to levels that are much closer to the turnover observed during the estimation window after ED-1.

Although the peak in AbTR is quickly reversed, the results from both the z-test and Wilcoxon signed rank test imply that the mean and median AbTR are significantly different from zero for the days in the window [ED-5, ED+5]. As robustness check, I examine the mean and median AbTR for a larger window, [ED-10, ED+10]. To avoid an overlap of the observation and estimation windows, I use the average turnover of stock *i* for the window AD-70 through AD-11 as the denominator in equation [3]. The results reported in Table 6 are again very centered around ED and the rapid increase in turnover is rapidly reversed. Interestingly, none of the days ranging from ED-10 through ED-6 for both additions and deletions have both a mean and a median that is statistically different from zero at the 1% significance level. This provides some support for starting the test window at ED-5. As shown in Figure 2, nearly 80% of the stocks included in the samples have a gap of 6 trading days or less between AD and ED. Given that the announcements are made after the market closes, any actions taken following the announcement would be executed at ED-5 for the index changes that have 6 trading days between AD and ED. Although the mean and median AbTR are positive but considerably reduced following ED-1 for the longer test window, they remain statistically different from zero at the 1% significance level for the additions sample. In contrast, while all the mean AbTR for deletions are positive and significant at the 1% level from ED-5 through ED+10, the median AbTR medians are positive but only statistically different from zero at the 1% significance level for days in the test window [ED-5, ED+4] and day ED+7. The observed asymmetry in AbTR between inclusions and deletions is consistent with the findings of Chen et al. (2004) but suggests that price pressure is unlikely to be the only force affecting the market reactions to index additions/deletions.

5.3 Event Study on the abnormal returns around index changes

The average abnormal returns (AAR) for the single and multi-factor model and market-adjusted return model for our base-case samples are presented in Table 7, and their cumulative average abnormal returns (CAAR) for the event window AD-6 through AD+63 are depicted in Figure 3. A highly statistically significant positive (negative) average abnormal return (AAR) is observed on the day following the addition (deletion) of a security to the S&P 500 Index. More specifically, one can observe an AAR of 2.695% (-2.727%) for firms added to (deleted from) the index based on the results obtained using the CAPM model, and an AAR of 2.523% (-3.191%) when using the multi-factor model [7]. The results provide evidence of potential information leakage and/or anticipation from market participants. The results are particularly statistically significant for the deletion sample, with a cumulative average abnormal return of -2.639% (-3.416%) for the period AD-6 through AD-1 when using the CAPM (multi-factor model). Based on Figure 3, one observes that despite somewhat symmetrical price movements on AD+1, the longer-term price movements show very different patterns for the additions and deletions samples. As reported in Table 7, the observed CAARs of 3.130% (1.490%) when using the CAPM (Multi-Factor) model for the additions sample for the period AD+1 through AD+21 are statistically significant but are not statistically significant for the longer period [AD+1, AD+63]. I find the opposite in the deletions sample where the CAARs for the period AD+1 through AD+21 are not statistically significant, but those for the AD+1 through AD+63 are. Furthermore, the three models show similar CAARs up until AD+1, but that the longer-term CAARs differ, especially when using the CAPM.

For robustness and to test for survivorship bias, I run the same regressions using the three subsamples described in section 3. The results of this robustness check are provided in Table 9 and Figure 4 shows the cumulative average abnormal returns from AD-6 through AD+63. The main observation from the initial study, which was the highly statistically significant negative ARs on AD+1, also apply for all subsamples. However, this is the only result that is statistically significant in each iteration of my regressions. Similar to the test results using the initial deletions sample, there are in some cases statistically significant and negative cumulative excess returns for the period from AD-6 through AD-1, again suggesting the presence of information leakage and/or anticipation from market participants. Although all three subsamples show a reversal and positive CAAR for the event window

AD+1 through AD+63, these results are only statistically significant with the deletions subsample 3, which is the one where I excluded the deletions with firm-specific confounding events. Using this subsample, I find a statistically significant CAAR of 7.002% when using CAPM and 5.619% when using the multi-factor regression for the period [AD+1, AD+63].

The initial price movement observed here is consistent with the findings of Harris and Gurel (1986), Lynch and Mendenhall (1997), Dash (2002), Beneish and Whaley (2002), and Chen et al. (2004). It is worth mentioning, however, that relative to these authors, the initial price movements documented in this thesis are less pronounced. This may not be surprising since, as mentioned in the literature review, the length and magnitude of the reversal has not reached a consensus. The reversal observed for the additions in this sample is most consistent with Ravi and Hong (2015), as well as Hrazdil (2009), who finds complete reversal in the months that follows the announcement of an addition to the S&P 500 from 1989 through 2004, but contradicts Chen et al. (2004) and Petajisto (2011), who find that the positive abnormal returns are sustained in the months following AD for the additions. The reversal observed with my deletions sample are, however, consistent with their findings, since they both observed a large reversal in the 30 and 60 days following the announcement date. Ultimately, the reversal observed is also consistent with the price pressure hypothesis, as mentioned in the literature review.

5.4 Impact of indexing on additions/deletions

The results of the regressions using abnormal turnover as the dependent variable are shown in Table 10. For the additions sample, the most economically significant day is ED-1, or $AbTR_{i,ED-1}$. The results show that it is the day where the impact of indexing is the most prominent and the most statistically significant. More specifically, the regression coefficient $\gamma_{i,INDEXED}$ is 149.36 for Proxy 1, 157.609 for Proxy 2, and 198.323 for Proxy 3, with p-values of 0.000 in all three cases. It is also the day where I observe the highest, although still very low, R-Square for the additions sample. The positive and statistically significant coefficient, which suggest that the abnormal turnover increases as indexing increases is consistent with Harris and Gurel (1986) and Blume and Edelen's (2004) belief that the large increases in volume are at least partly attributable to large trades coming from indexers. The results for the deletions sample, shown in Panel B of Table 10, offer two main differences. The first one being that the regression coefficient $\gamma_{i,INDEXED}$ is negative for all three proxies and for all three days observed. The second important difference is that the coefficients are the furthest from zero on ED, not ED-1. I find negative and highly statistically significant gamma coefficients on both ED and ED+1, across all three proxies. These findings suggest that the magnitude of the abnormal turnover for deletions on ED-1 is not influenced by indexing. Furthermore, they also suggest that as total assets indexed to the S&P 500 as a percentage of its market cap increases, the abnormal turnover on ED and ED+1 for deletions decreases. One plausible explanation for that could be that as more investors replicate the index and focus solely on the stocks included in the S&P 500, the less likely they are to trade securities that are no longer in the index, hence leading to a decreased volume and turnover. This possibility somewhat contradicts the asymmetrical change in awareness described by Chen et al. (2004).

The results of the regressions using abnormal return as the dependent variable are shown in Tables 11 and 12. The only difference between the two tables is that I used the abnormal returns calculated using equation [4] for the regressions in Table 11, and the abnormal returns calculated using equation [7] for the regressions in Table 12. The general findings of this test are the same for both the CAPM (Table 11) and the Multi-Factor Model (Table 12) regressions. The first major observation is that for both additions and deletions, AD+1 is the only day for which I obtain statistically significant gamma coefficients, based on all three proxies. Another observation is that those highly statistically significant $\gamma_{i,INDEXED}$ coefficients are negative for the additions sample, and positive for the deletions sample. Moreover, they are considerably larger for the deletions sample in terms of absolute numbers. The test results discussed in section 5.3 showed that I obtained positive abnormal returns on AD+1 for the additions sample, but this test suggests that these positive abnormal returns get smaller as indexing increases, and that the opposite is true for the deletions sample. In other words, these findings suggest that contrary to my hypothesis, the growth in assets indexed to the S&P 500 as a percentage of its market cap reduces the addition (deletion) effect. A possible explanation for this phenomenon is that, as argued by Vijh and Wang (2022), additions (deletions) are for the most part, stocks that were previously (subsequently) included in the S&P Midcap 400 Index, and that the increasing total institutional ownership of this index lessens the addition (deletion) effect.

6. Conclusion

This study examines the effects index changes have on securities that are added to or deleted from the S&P 500 Index from 2000 to 2019. More specifically, this paper looks at the changes in comovement (as measured by the change in market beta), the abnormal volume (as measured by the abnormal turnover) around index changes, as well as the abnormal returns of stocks being added to or deleted from the index. Furthermore, it attempts to examine the relationship between the price movement of securities around index changes (as measured by abnormal returns) and the growth in indexing. I find evidence of increased comovement with the index for the stocks that are entering the S&P 500 Index, but do not find significant decreases in comovement for those being removed. Part of the increased comovement is purely mathematical, meaning that given that the added stock's returns are now included in the market returns, it is it to be more similar, but if this was the only reason for the increased similarity, we should observe the opposite for deletions, which is not the case. The results are, however, consistent with Barberis and Schleifer (2003) theory that investors tend to invest in category, such as an index. The absence of symmetry in the results, can potentially be explained by the asymmetrical change in awareness described by Chen et al. (2004). In other words, they claim that many investors are unfamiliar with certain stocks until they get included in a major index such as the S&P 500, so the additions lead to an important increase in awareness. Their study found that the drop in awareness for deleted stocks was "much smaller or nonexistent", which makes sense since we would not expect investors to completely forget about a certain security once it gets deleted from the S&P 500.

Additionally, the tests for abnormal volume, which I measured in terms of turnover, show that the increased trading activity starts on the announcement date of index changes and lasts for at least one week following the effective date of the changes for deletions and at least two weeks for additions. I also find that the trading activity drastically surge on the day prior to the effective date, which is when most indexing strategies replicating the S&P 500 buy (sell) the added (deleted) security. Again, the effects were found to be more pronounced for additions than for deletions.

As for abnormal returns, I find evidence of a positive (negative) abnormal return on the first trading day following the announcement of an addition (deletion). In the case of index additions, the abnormal returns are sustained during the following trading month, but I fail to find consistently significant results suggesting that the initial price reaction is sustained for index deletions. Moreover, the abnormal returns observed for the one-week period leading up to the announcement is suggestive of potential information leak and/or anticipation from some market participants. As argued by Harris and Gurel (1986), the abnormal turnovers and returns, which suggest a shift in demand, are consistent with the price pressure hypothesis, but the asymmetry in the results is not.

The last series of tests, which aims to find evidence of a relationship between the growth in indexing, measured by the aggregate assets indexed to the S&P 500 as a percentage of its market capitalization also provide evidence that do not entirely support the price pressure hypothesis. I do find that the abnormal turnover observed on ED-1 increases with indexing for additions, which is consistent with the hypothesis, but fail to find the same for deletions. Furthermore, when looking at the relationship between abnormal returns on specific days and indexing, I find that the increase in indexing diminishes the addition (deletion) effect, which seems to contradict the price pressure hypothesis. Vijh and Wang (2022) argued that the increased indexing or institutional ownership in the S&P 400 Index contributes to the diminishing addition (deletion) effects. Ultimately, multiple forces are clearly at work when it comes to index changes, and although some of my results support the price pressure hypothesis such is not the case, especially for deletions.

References

Afego, P. N. (2017, July). Effects of changes in stock index compositions: A literature survey. *International Review of Financial Analysis, 52*, 228-239.

Akhigbe, A., Martin, A. D., Newman, M., & De Souza, A. (2022, May). Russell index reconstitutions and short interest. *The Quarterly Review of Economics and Finance, 84*, 577-588.

Amihud, Y. (2002, January). Illiquidity and stock returns: cross-section and time-series effects. *Journal of Financial Markets, 5*(1), 31-56.

Barberis, N., & Shleifer, A. (2003, May). Style Investing. *Journal of Financial Economics, 68*(2), 161-199.

Barberis, N., Shleifer, A., & Wurgler, J. (2005, February). Comovement. *Journal of Financial Economics, 75*(2), 283-317.

Beneish, M. D., & Whaley, R. E. (1996, December). An Anatomy of the "S&P Game": The Effects of Changing the Rules. *The Journal of Finance, 51*(5), 1909-1930.

Beneish, M. D., & Whaley, R. E. (2002). S&P 500 index replacements: A new game in town. *Journal of Portfolio Management, 29*(1), 51-60.

Blume, M. E., & Edelen, R. M. (2004). S&P 500 Indexers, Tracking Errors, and Liquidity. *Journal of Portfolio Management, 30*(3), 37-46.

Brockman, P., & Chung, D. Y. (2006). Index inclusion and commonality in liquidity: Evidence from the Stock Exchange of Hong Kong. *International Review of Financial Analysis, 15*(4-5), 291-305.

Cai, J., & Houge, T. (2008). Long-Term Impact of Russell 2000 Index Rebalancing. *FInancial Analysts Journal, 64*(4), 76-91.

Chan, K., Kot, H. W., & Tang, G. Y. (2013, December). A comprehensive long-term analysis of S&P 500 index additions and deletions. *Journal of Banking & Finance, 37*(12), 4920-4930.

Chen, H., Noronha, G., & Singal, V. (2004, August). The Price Response to S&P 500 Index Additions and Deletions: Evidence of Asymmetry and a New Explanation. *The Journal of Finance, 59*(4), 1901-1930.

Chordia, T., Roll, R., & Subrahmanyam, A. (2000, April). Commonality in liquidity. *Journal of Financial Economics, 56*(1), 3-28.

Chung, R., & Kryzanowski, L. (1998). Are the Market Effects Associated with Revisions to the TSE300 Index Robust? *Multinational Finance Journal, 2*(1), 1-36.

Claessens, S., & Yafeh, Y. (2013, January). Comovement of Newly Added Stocks with National Market Indices: Evidence from Around the World. *Review of Finance, 17*(1), 203-227.

Cremers, M., Petajisto, A., & Zitzewitz, E. (2012). Should Benchmark Indices Have Alpha? Revisiting Performance Evaluation. *Critical Finance Review, 2*(1), 1-48.

Dash, Srikant, 2002, Price changes associated with S&P 500 deletions: Time variation and effect of size and share prices, Standard & Poor's (New York, NY), July 9. http://www.spglobal.com

Denis, D. K., McConnell, J. J., Ovtchinnikov, A. V., & Yu, Y. (2003, October). S&P 500 Index Additions and Earnings Expectations. *The Journal of Finance, 58*(5), 1821-1840.

Edmister, R. O., Graham, S. A., & Pirie, W. L. (1994). Excess Returns of Index replacement stocks: Evidence of liquidity and substitutability. *The Journal of Financial Research, 17*(3), 333-346.

Elliott, W. B., & Warr, R. S. (2003). Price Pressure on the NYSE and Nasdaq: Evidence from S&P 500 Index Changes. *Financial Management, 32*(9), 85-99.

Florackis, C., Gregoriou, A., & Kostakis, A. (2011, December). Trading frequency and asset pricing on the London Stock Exchange: Evidence from a new price impact ratio. *Journal of Banking & Finance, 35*(12), 3335-3350.

French, K. R. (n.d.). *Kenneth R. French - Data Library*. Kenneth R. French - Data Library. Retrieved March 8, 2022, from https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Gittelsohn, J. (2019, September 11). *Bloomberg Markets*. Retrieved from Bloomberg: https://www.bloomberg.com/news/articles/2019-09-11/passive-u-s-equity-funds-eclipse-active-in-epic-industry-shift

Harris, L., & Gurel, E. (1986, September). Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures. *The Journal of Finance, 41*(4), 815-829.

Hedge, S. P., & McDermott, J. B. (2003, May). The liquidity effects of revisions to the S&P 500 index: an empirical analysis. *Journal of Financial Markets, 6*(3), 413-459.

Hrazdil, K. (2009). The price, liquidity and information asymmetry changes associated with new S&P 500 additions. *Managerial Finance, 35*(7), 579-605.

Hrazdil, K., & Scott, T. (2009). S&P 500 Index Revisited: Do Index Inclusion Announcements Convey Information about Firms' Future Performance? *Quarterly Journal of Finance and Accounting, 48*(4), 79-113.

Kamal, R. (2014). New Evidence from S&P 500 Index Deletions. *The International Journal of Business and Finance Research, 8*(2), 1-10.

Kamal, R., Lawrence, E. R., McCabe, G., & Prakash, J. A. (2012). Additions to S&P 500 Index: not so informative any more. *Managerial Finance, 38*(4), 380-402.

Kaul, A., Mehrotra, V., & Morck, R. (2000, April). Demand Curves for Stocks Do Slope Down: New Evidence from an Index Weights Adjustment. *The Journal of Finance, 55*(2), 893-912.

Lamoureux, C. G., & Wansley, J. W. (1987, February). Market Effect of Changes in the Standard & Poor's 500 Index. *The Financial Review, 22*(1), 53-69.

Lynch, W. A., & Mendenhall, R. R. (1997, July). New Evidence on Stock Price Effects Associated with Changes in the S&P 500 Index. *The Journal of Business, 70*(3), 351-383.

Mase, B. (2007, August). The Impact of Changes in the FTSE 100 Index. *The Financial Review, 42*(3), 461-484.

Mork, R., & Yang, F. (2001). The Mysterious Growing Value of S&P 500 Membership. *NBER Working Paper Series*.

Petajisto, A. (2011, March). The index premium and its hidden cost for index funds. *Journal of Empirical Finance, 18*(2), 271-288.

Pruitt, S. W., & Wei, J. C. (1989, June). Institutional Ownership and Changes in the S&P 500. *The Journal of Finance, 44*(2), 509-514.

Ravi, R., & Hong, Y. (2015). Information asymmetry around S&P 500 index changes. *REview of Accounting and Finance, 14*(2), 106-127.

Scari, C. (2016). On the Changes to the Index Inclusion Effect with Increasing Passive Investment Management. *Joseph Wharton Scholars. University of Pennsylvania.*

Schoenfeld, J. (2017, February). The effect of voluntary disclosure on stock liquidity: New evidence from index funds. *Journal of Accounting and Economics, 63*(1), 51-74.

Scholes, M. S. (1972, April). The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices. *The Journal of Business, 45*(2), 179-211.

Shleifer, A. (1986, July). Do Demand Curves for Stocks Slope Down? *The Journal of Finance, 41*(3), 579-590.

Takahashi, H., & Xu, P. (2016, January). Trading activities of short-sellers around index deletions: Evidence from the Nikkei 225. *Journal of Financial Markets, 27*, 132-146.

Vijh, A. M. (1994). S&P 500 Trading Strategies and Stock Betas. *The Review of Financial Studies, 7*(1), 215-251.

Vijh, A. M., & Wang, J. (2022). Negative returns on addition to the S&P 500 index and positive returns on deletion? New evidence on the attractiveness of S&P 500 versus S&P 400 indexes. *Financial Management, 51*(4), 1127-1164.

Woolridge, J. R., & Ghosh, C. (1986). Institutional Trading and Security Prices: The Case of Changes in the Composition of the S&P 500 Index. *The Journal of Financial Research, 9*(1), 13-24.

Wurgler, J., & Zhuravskaya, E. (2002, October). Does Arbitrage Flatten Demand Curves for Stocks? *The Journal of Business, 75*(4), 583-608.

APPENDIX: Variable Definitions

Variable	Definition
Announcement Date (AD)	The date at which a stock addition/deletion gets announced.
Effective Date (ED)	The date at which a stock officially gets added/deleted from an index. In our case, the index of interest in the S&P 500.
Indexed Assets as a % of Market Cap	Total indexed assets divided by the S&P 500's market capitalization. S&P Down Jones defines indexed assets as "assets in institutional funds, ETFs, retail mutual funds, and other investable products that seek to replicate or match the performance of the respective index”.
Abnormal Return (AR)	The difference between the actual return of a security and its forecasted returns. When considering a multi-day period, we refer to it as the cumulative abnormal return (CAR).
Risk-Free Rate (R_f)	The rate of return one can expect on an investment that carries no risk. The interest rate paid on short term treasury bills are the generally accepted risk-free rate.
Market Return (R_m)	The market return referring to the observed benchmark, which is the S&P 500 Index in our case.
Small Minus Big Factor (SMB_i)	One of the factors included in the Fama-French multi-factor models. It is measured by subtracting the average return on three large cap portfolios from the average return on three small cap portfolios.
High Minus Low Factor (HML_i)	One of the factors included in the Fama-French multi-factor models. It is measured by subtracting the average return on two growth portfolios from the average return on two value portfolios.
Robust Minus Weak (RMW_i)	One of the factors included in the Fama-French multi-factor models. It is measured by subtracting the average return on two portfolios with weak operating profitability from the average return on two portfolios with robust operating profitability.

Conservative Minus Agressive (CMA_i)	One of the factors included in the Fama-French multi-factor models. It is measured by subtracting the average return on two aggressive portfolios from the average return on two conservative portfolios.
Share Turnover (ST_i)	The percentage of outstanding share getting traded on a specific day. Obtained by dividing the daily volume of a security by the number of shares outstanding.
VIX Average Daily Closing Level	The average daily closing level of the Chicago Board Options Exchange's CBOE Volatility Index (VIX), which is a widely used measure of the stock market's expectation of volatility based on S&P 500 index options.
Average Daily Volume	Average daily volume on the S&P 500 Index. The volume is a measure of the total number of shares traded each day.

Figures

Figure 1 – Mean Abnormal Turnover around Index inclusion/deletion effective dates

The figure shows the frequency distributions of the daily mean abnormal turnover for the additions and deletions samples around the effective dates of their inclusion/deletion. The abnormal turnover (AbTR) is measured for each observation relative to their average turnover during the estimation period ranging from AD-65 through AD-6. The additions and deletions samples contain 380 and 147 observations, respectively.

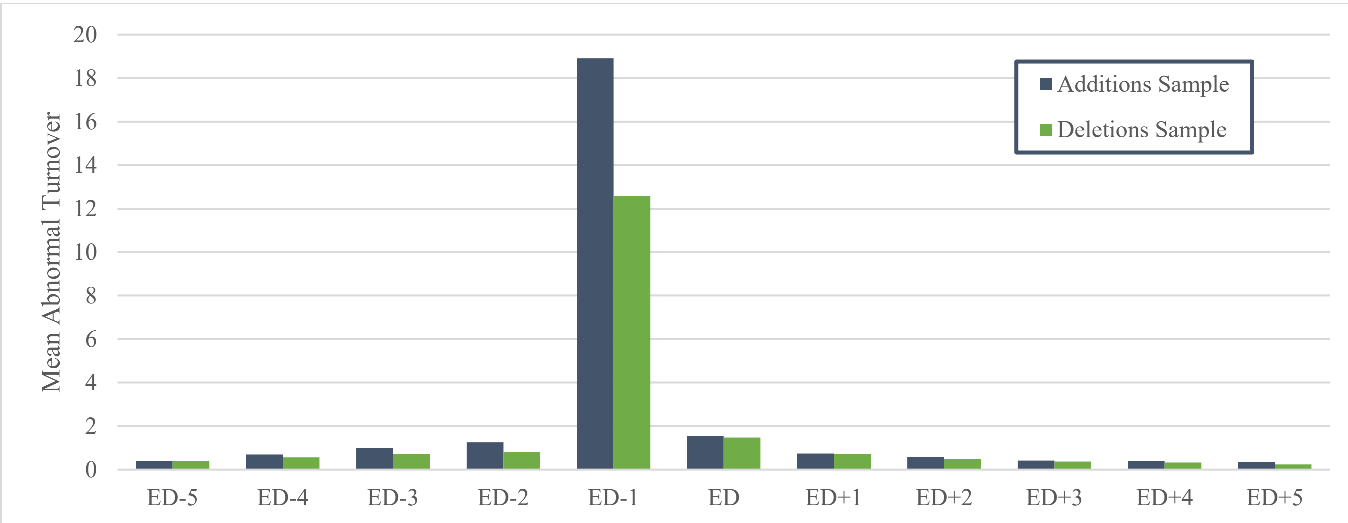


Figure 2 – Mean Abnormal Turnover around Index inclusion/deletion effective dates

The figure shows the frequency distributions for the number of trading days between the announcement date (AD) of the S&P 500 Index inclusions/deletions and the effective date (ED) of their entry into/deletion from the index. The additions and deletions samples contain 380 and 147 observations, respectively.

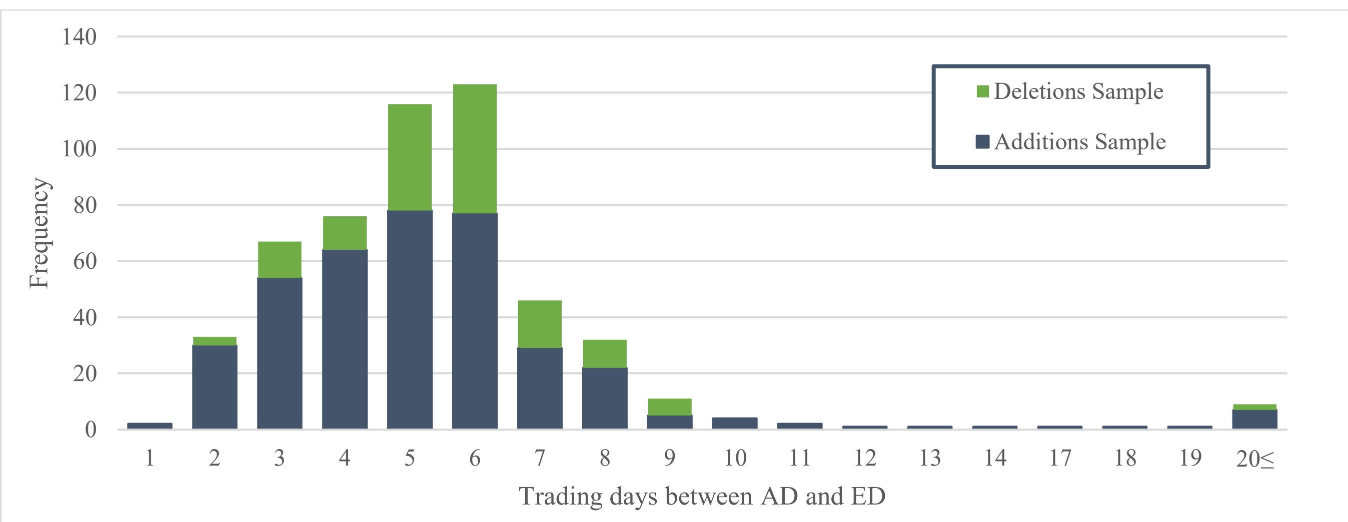
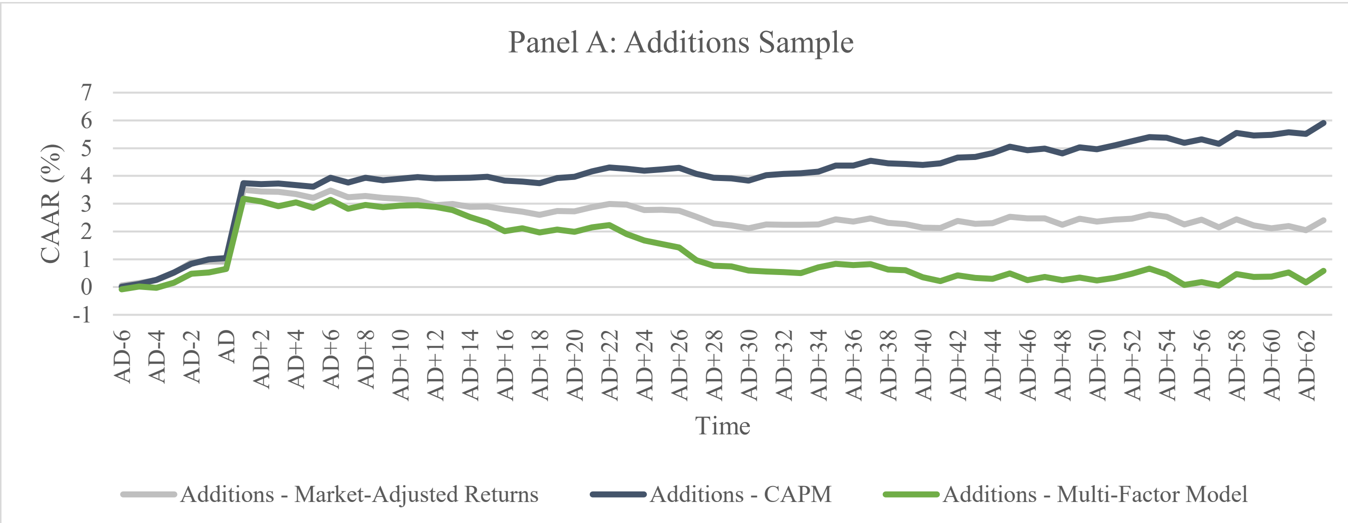


Figure 3 – Cumulative Abnormal Returns for Base-case Sample: Additions and Deletions (2000-2019)

This chart provides the cumulative average abnormal returns for the additions and the deletions samples based on the regression models described in equations [4] and [7], as well as based on the market-adjusted returns, assuming a market beta of 1 for each stock in the samples. Panel A provides the results for the additions sample and Panel B shows the results for the deletions samples.



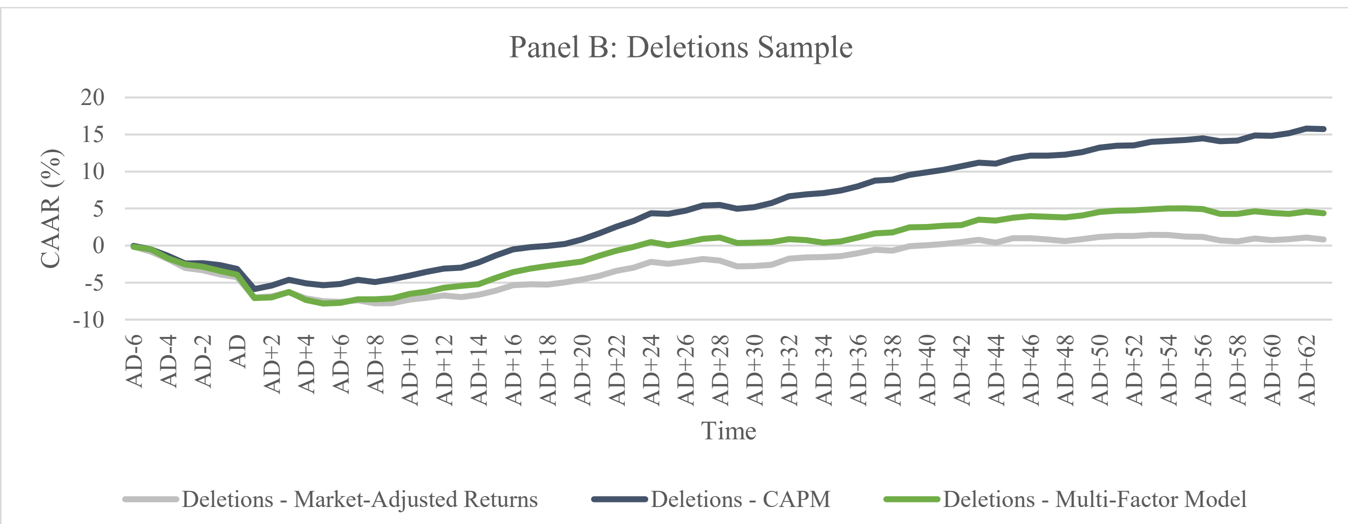
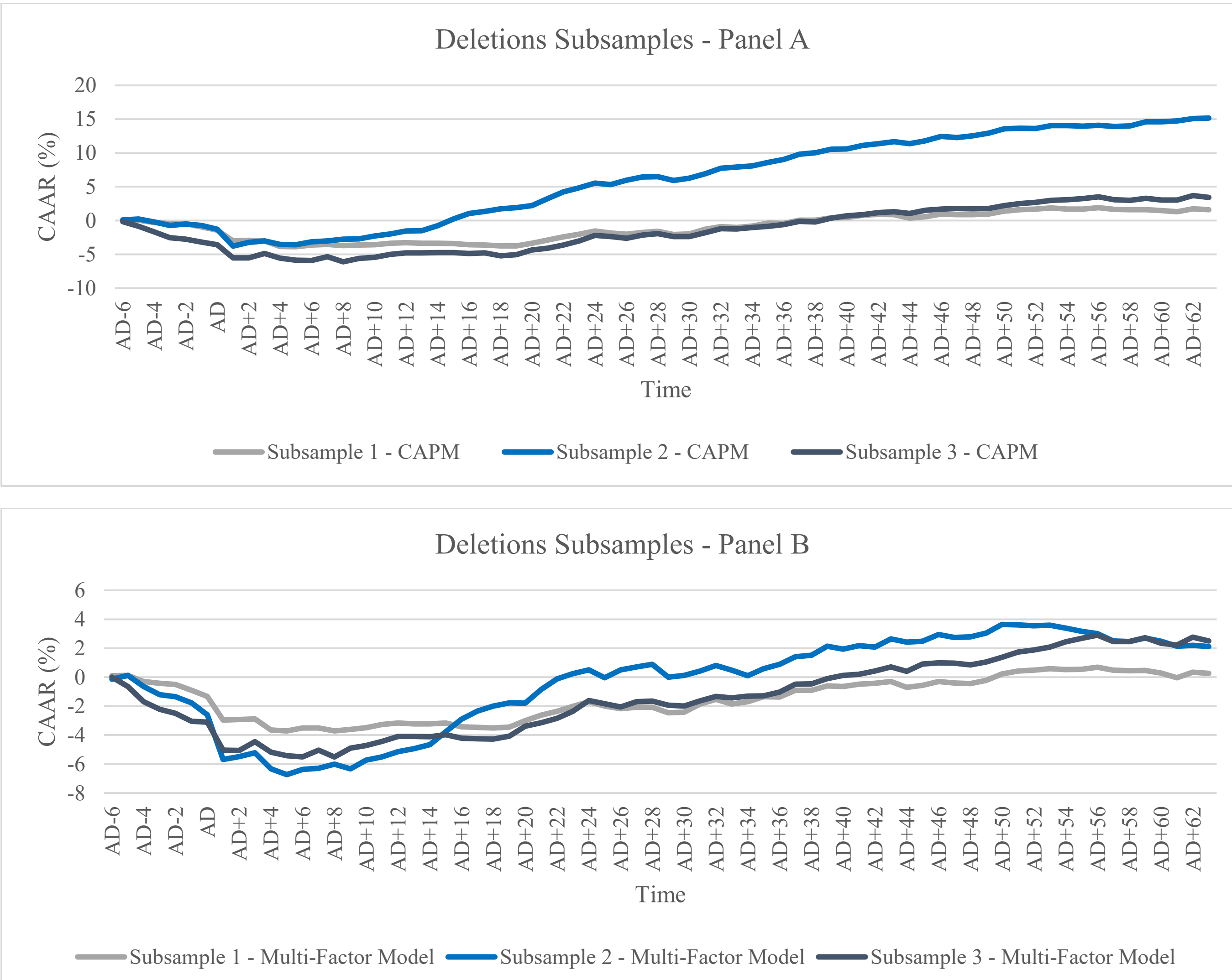


Figure 4 – Robustness Check: Cumulative Abnormal Returns for Deletions for Various Subsamples

Similar to Figure 3, this chart provides the cumulative average abnormal returns (CAARs) for each of the deletions subsamples. Panel A provides the CAARs for the three subsamples when using the CAPM described in equation [4], and Panel B provides the CAARs when using the multi-factor model described in equation [7].



Tables

Table 1 – Sample construction of S&P 500 index changes from 2000 to 2019

Panel A of this table describes a list of changes to the S&P 500 index from 2000 through 2019, after removing confounding events such as mergers, spinoffs, acquisitions, bankruptcies, and other corporate restructuring. Panel B gives the breakdown of how many changes were removed from the base-case samples for each corporate event occurring in the two-year window centered around the announcement date of the index change. The index change information was provided by Standard & Poor's Dow Jones Indices, a division of Standard & Poor's Global.

Panel A: Breakdown by year

YEAR	Initial Samples		Base-case Samples		% Of initial samples	
	Additions	Deletions	Additions	Deletions	Additions	Deletions
2000	57	57	39	15	68.42%	26.32%
2001	31	31	23	5	74.19%	16.13%
2002	25	25	16	9	64.00%	36.00%
2003	9	9	7	2	77.78%	22.22%
2004	20	20	14	6	70.00%	30.00%
2005	16	16	13	1	81.25%	6.25%
2006	32	32	25	6	78.13%	18.75%
2007	41	41	32	5	78.05%	12.20%
2008	35	35	28	8	80.00%	22.86%
2009	29	29	26	9	89.66%	31.03%
2010	16	16	14	2	87.50%	12.50%
2011	20	20	13	8	65.00%	40.00%
2012	18	18	10	7	55.56%	38.89%
2013	19	19	14	9	73.68%	47.37%
2014	16	14	9	8	56.25%	57.14%
2015	28	26	18	9	64.29%	34.62%
2016	38	37	23	8	60.53%	21.62%
2017	35	35	21	14	60.00%	40.00%
2018	28	28	20	7	71.43%	25.00%
2019	26	26	15	9	57.69%	34.62%
TOTAL	539	534	380	147	70.50%	27.53%

Panel B : Breakdown by reason for removal from initial sample

Additions		Deletions	
Corporate Event	Count	Corporate Event	Count
Made an acquisition	28	Got acquired	242
Merged	20	Spinning of subsidiary(ies)	33
Redomiciled	1	Spun off from S&P 500 constituent	28
Spun off	100	Merged	23
Recent IPO	6	Taken Private	21
New share class of a company already in the S&P 500 Index	4	Bankruptcy	18
		Redomiciled	10
		Delisted from NYSE	4
		Accounting Scandal	3
		Government Bailout	2
		Reverse Stock Split	1
		Re-entered the S&P 500 shortly after	1
		Converted to Closed-end Mgmt Fund	1

Table 2 – Changes in similarity: Sample Statistics

The table below provides the average beta for each newly included/deleted firms in the sample by using the CAPM (Panel A) and the Fama-French 5-Factor model (Panel B). For each firm, I calculate the pre-event beta, using daily data for the 12-month period ending one month before the announcement date and a post-event beta, using the 12-month period starting one month after the effective date. In addition to beta, I also observe the corresponding R^2 and adjusted R^2 and how it changes following the inclusion/deletion. I also test the significance of the change using the Wilcoxon signed rank test, which is shown in the last column. The inclusion and the deletion samples include 380 and 147 observations, respectively. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Using the Capital Asset Pricing Model (CAPM)					
Variable	Mean	Δ	Standard Deviation	Median	Wilcoxon signed rank test
Pre-inclusion daily β	1.1223	0.0844***	0.7247	1.0340	-4.476***
Post-inclusion daily β	1.2067	(0.0064)	0.5978	1.0853	(0.0000)
Pre-inclusion R^2	0.2672	0.0678***	0.1511	0.2540	-7.357***
Post-inclusion R^2	0.3350	(0.0000)	0.1705	0.3243	(0.0000)
Pre-inclusion Adjusted R^2	0.2642	0.0681***	0.1517	0.2511	-7.357***
Post-inclusion Adjusted R^2	0.3323	(0.0000)	0.1712	0.3216	(0.0000)
Pre-deletion daily β	1.3068	0.0617	0.6511	1.3029	-1.766*
Post-deletion daily β	1.3685	(0.1897)	0.6118	1.2027	(0.0776)
Pre-deletion R^2	0.2300	-0.0109	0.1557	0.1944	0.770
Post-deletion R^2	0.2191	(0.3634)	0.1579	0.1816	(0.4432)
Pre-deletion Adjusted R^2	0.2269	-0.0109	0.1563	0.1912	0.770
Post-deletion Adjusted R^2	0.2160	(0.3632)	0.1586	0.1783	(0.4432)

Panel B: Using the Fama-French 5-Factor Model					
Variable	Mean	Δ	Standard Deviation	Median	Wilcoxon signed rank test
Pre-inclusion daily β	1.0191	0.0810**	0.7777	1.0041	-3.409***
Post-inclusion daily β	1.1001	(0.0438)	0.3441	1.0893	(0.0006)
Pre-inclusion R^2	0.3300	0.0647***	0.1532	0.3159	-7.025***
Post-inclusion R^2	0.3947	(0.0000)	0.1706	0.3710	(0.0000)
Pre-inclusion Adjusted R^2	0.3164	0.0661***	0.1563	0.3020	-7.025***
Post-inclusion Adjusted R^2	0.3825	(0.0000)	0.1741	0.3583	(0.0000)
Pre-deletion daily β	1.2068	-0.0098	0.3994	1.2136	-0.195
Post-deletion daily β	1.1970	(0.8688)	0.7165	1.1669	(0.8464)
Pre-deletion R^2	0.3005	-0.0050	0.1675	0.2807	0.095
Post-deletion R^2	0.2955	(0.6992)	0.1733	0.2772	(0.9255)
Pre-deletion Adjusted R^2	0.2863	-0.0050	0.1709	0.2661	0.095
Post-deletion Adjusted R^2	0.2813	(0.6992)	0.1768	0.2626	(0.9255)

Table 3 – Robustness Check: Changes in similarity: Sample Statistics

The table below provides the average beta for each newly included/deleted firm in the sample by using the CAPM (Panel A) and the Fama-French 5-Factor model (Panel B). For each firm, I calculate the pre-event beta, using daily data from AD-80 through AD-21 and the post-event beta, using ED+21 through ED+80. In addition to beta, I also observe the corresponding R^2 and adjusted R^2 and how it changes following the inclusion/deletion. I also test the significance of the change using the Wilcoxon signed rank test, which is shown in the last column. The inclusion and the deletion samples include 380 and 147 observations, respectively. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Using the Capital Asset Pricing Model (CAPM)

Variable	Mean	Δ	Standard Deviation	Median	Wilcoxon signed rank test
Pre-inclusion daily β	1.1269	0.0594	0.6579	1.0478	-2.113**
Post-inclusion daily β	1.1863	(0.2468)	0.7070	1.0974	(0.0345)
Pre-inclusion R^2	0.2823	0.0419	0.1821	0.2591	-3.321***
Post-inclusion R^2	0.3242	(0.4145)	0.2100	0.2952	(0.0009)
Pre-inclusion Adjusted R^2	0.2700	0.0426	0.1853	0.2463	-3.321***
Post-inclusion Adjusted R^2	0.3125	(0.4065)	0.2136	0.2831	(0.0009)
Pre-deletion daily β	1.3391	0.0467	0.8002	1.2473	-1.052
Post-deletion daily β	1.3858	(0.5715)	0.7539	1.2409	(0.2942)
Pre-deletion R^2	0.2308	-0.0036	0.1878	0.1717	0.259
Post-deletion R^2	0.2272	(0.9654)	0.1829	0.2073	(0.7969)
Pre-deletion Adjusted R^2	0.2175	-0.0036	0.1910	0.1574	0.259
Post-deletion Adjusted R^2	0.2139	(0.9648)	0.1861	0,1936	(0.7969)

Panel B: Using the Fama-French 5-Factor Model

Variable	Mean	Δ	Standard Deviation	Median	Wilcoxon signed rank test
Pre-inclusion daily β	1.0153	0.0703	0.5011	0.9914	-2.712***
Post-inclusion daily β	1.0856	(0.1703)	0.5983	1.0132	(0.0066)
Pre-inclusion R^2	0.3938	0.0391	0.1775	0.3916	-3.460***
Post-inclusion R^2	0.4329	(0.4461)	0.1948	0.4181	(0.0005)
Pre-inclusion Adjusted R^2	0.3377	0.0427	0.1940	0.3352	-3.460***
Post-inclusion Adjusted R^2	0.3804	(0.4051)	0.2128	0.3642	(0.0005)
Pre-deletion daily β	1.1921	0.0334	0.6804	1.1594	-1.042
Post-deletion daily β	1.2255	(0.6854)	0.7120	1.1637	(0.2987)
Pre-deletion R^2	0.3582	-0.0175	0.1957	0.3419	1.064
Post-deletion R^2	0.3407	(0.8321)	0.1835	0.3172	(0.2889)
Pre-deletion Adjusted R^2	0.2987	-0.0191	0.2138	0.2809	1.064
Post-deletion Adjusted R^2	0.2796	(0.8169)	0.2005	0.2539	(0.2889)

Table 4 – Comparison of beta change between firms based on pre-event beta

The table below provides a comparison of the beta changes between two sub-groups of the additions sample: the first group being the observations with a pre-inclusion daily beta above one, the second group is composed of the observations with a pre-inclusion daily beta below one. The results in Panels A and B relate to the betas measured in the initial similarity study, which used AD-273 through AD-21 as the pre-event estimation window and ED+21 through ED+273 as the post-event estimation window. Panel C and D relate to the betas measured in the similarity robustness test which used AD-80 through AD-21 as the pre-event estimation window and ED+21 through ED+80 as the post-event estimation window. The significance of the mean (median) changes is tested using the standard t-test (Wilcoxon signed rank test), whose results are shown in the last two columns. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Using the Capital Asset Pricing Model (CAPM)

Number of observations	$\Delta\beta > 0$	$\Delta\beta < 0$	Mean Δ	Wilcoxon signed rank test
Pre-inclusion daily $\beta > 1$	97	104	-0.016	0.240
			(0.7708)	(0.8107)
Pre-inclusion daily $\beta < 1$	132	47	0.196***	-7.414***
			(0.0000)	(0.0000)
Total	229	151		

Panel B: Using the Fama-French 5-Factor Model

Number of observations	$\Delta\beta > 0$	$\Delta\beta < 0$	Mean Δ	Wilcoxon signed rank test
Pre-inclusion daily $\beta > 1$	72	121	-0.143***	4.181***
			(0.0008)	(0.0000)
Pre-inclusion daily $\beta < 1$	149	38	0.312***	-9.151***
			(0.0000)	(0.0000)
Total	221	159		

Panel C: Robustness Test - Using the Capital Asset Pricing Model (CAPM)

Number of observations	$\Delta\beta > 0$	$\Delta\beta < 0$	Mean Δ	Wilcoxon signed rank test
Pre-inclusion daily $\beta > 1$	88	115	-0.076*	1.956*
			(0.0755)	(0.0504)
Pre-inclusion daily $\beta < 1$	112	65	0.215***	-5.572***
			(0.0000)	(0.0000)
Total	200	180		

Panel D: Robustness Test - Using the Fama-French 5-Factor Model

Number of observations	$\Delta\beta > 0$	$\Delta\beta < 0$	Mean Δ	Wilcoxon signed rank test
Pre-inclusion daily $\beta > 1$	74	111	-0.153***	3.032***
			(0.0029)	(0.0023)
Pre-inclusion daily $\beta < 1$	136	59	0.2820***	-6.828***
			(0.0000)	(0.0000)
Total	210	170		

Table 5 – Abnormal Turnover Analysis

This table shows the mean and median values of the stocks' abnormal turnover (AbTR) for the days prior and subsequent to their inclusion to, or deletion from the S&P 500 Index. The AbTR for each security is defined by equation [3]. Panel A provides the results for the additions sample, which contains 380 observations and Panel B provides the results for the deletions sample, which contains 147 observations. The significance of the mean (median) is tested with a standard z-test (Wilcoxon signed rank test); * denotes significance from 0 at the 1% level.

Panel A: Additions Sample

Variable	Mean	Median	Wilcoxon signed rank test
AbTR(ED-5)	0.3842* (0.0000)	0.0475	3.971* (0.0001)
AbTR(ED-4)	0.6948* (0.0000)	0.2351	8.617* (0.0000)
AbTR(ED-3)	1.0038* (0.0000)	0.4486	11.637* (0.0000)
AbTR(ED-2)	1.2590* (0.0000)	0.7230	14.448* (0.0000)
AbTR(ED-1)	18.9092* (0.0000)	15.8411	16.888* (0.0000)
AbTR(ED)	1.5347* (0.0000)	1.1477	16.400* (0.0000)
AbTR(ED+1)	0.7429* (0.0000)	0.5218	13.966* (0.0000)
AbTR(ED+2)	0.5750* (0.0000)	0.3765	12.028* (0.0000)
AbTR(ED+3)	0.4172* (0.0000)	0.2329	9.723* (0.0000)
AbTR(ED+4)	0.3894* (0.0000)	0.2077	8.707* (0.0000)
AbTR(ED+5)	0.3338* (0.0000)	0.1492	7.298* (0.0000)

Panel B: Deletions Sample

Variable	Mean	Median	Wilcoxon signed rank test
AbTR(ED-5)	0.3885* (0.000)	0.1652	4.117* (0.0000)
AbTR(ED-4)	0.5563* (0.000)	0.1758	5.155* (0.0000)

AbTR(ED-3)	0.7284* (0.000)	0.2705	6.782* (0.0000)
AbTR(ED-2)	0.8104* (0.0000)	0.4366	7.944* (0.0000)
AbTR(ED-1)	12.5879* (0.0000)	10.4967	10.518* (0.0000)
AbTR(ED)	1.4765* (0.0000)	0.8520	9.965* (0.0000)
AbTR(ED+1)	0.7117* (0.0000)	0.3579	6.774* (0.0000)
AbTR(ED+2)	0.4825* (0.0000)	0.2173	5.324* (0.0000)
AbTR(ED+3)	0.3712* (0.0000)	0.1318	3.802* (0.0001)
AbTR(ED+4)	0.3280* (0.0000)	0.0453	3.019* (0.0024)
AbTR(ED+5)	0.2319* (0.0006)	0.0602	2.127 (0.0332)

Table 6 – Robustness Check - Abnormal Turnover Analysis

This table shows the mean and median values of the stocks' abnormal turnover (AbTR) for the days prior and subsequent to their inclusion in, or deletion from the S&P 500 Index. The AbTR for each security is defined by a modified version of equation [3], where I used a longer estimation period for the pre-event volume. For the robustness check, I used AD-70 through AD-11 for the pre-event average volume estimation window and calculated the mean and median AbTR for each day in the ED-10 through ED+10 interval. Panel A provides the results for the additions sample, which contains 380 observations and Panel B provides the results for the deletions sample, which contains 147 observations. The significance of the mean (median) is tested with a standard z-test (Wilcoxon signed rank test); * denotes significance from 0 at the 1% level.

Panel A: Additions Sample (N = 380)			
Variable	Mean	Median	Wilcoxon signed rank test
AbTR(ED-10)	0.0143 (0.6323)	-0.1394	-2.987* (0.0028)
AbTR(ED-9)	-0.0110 (0.7918)	-0.1181	-4.091* (0.0000)
AbTR(ED-8)	0.0978 (0.0109)	-0.0629	-1.163 (0.2452)
AbTR(ED-7)	0.1304* (0.0088)	-0.0591	-0.779 (0.4366)
AbTR(ED-6)	0.1980* (0.0009)	-0.0687	-0.726 (0.4686)
AbTR(ED-5)	0.3798* (0.0000)	0.0413	4.052* (0.0000)
AbTR(ED-4)	0.6941* (0.0000)	0.2329	8.583* (0.0000)
AbTR(ED-3)	1.0086* (0.0000)	0.4440	11.473* (0.0000)
AbTR(ED-2)	1.2584* (0.0000)	0.7263	14.362* (0.0000)
AbTR(ED-1)	18.8931* (0.0000)	16.0091	16.888* (0.0000)
AbTR(ED)	1.5347* (0.0000)	1.0989	16.389* (0.0000)
AbTR(ED+1)	0.7452* (0.0000)	0.5340	13.838* (0.0000)
AbTR(ED+2)	0.5772* (0.0000)	0.3829	11.755* (0.0000)
AbTR(ED+3)	0.4162*	0.2252	9.554*

	(0.0000)		(0.0000)
AbTR(ED+4)	0.3911*	0.1905	8.430*
	(0.0000)		(0.0000)
AbTR(ED+5)	0.3359*	0.1285	7.060*
	(0.0000)		(0.0000)
AbTR(ED+6)	0.2202*	0.0961	5.529*
	(0.0000)		(0.0000)
AbTR(ED+7)	0.2340*	0.0873	5.007*
	(0.0000)		(0.0000)
AbTR(ED+8)	0.1856*	0.0234	3.394*
	(0.0000)		(0.0007)
AbTR(ED+9)	0.2901*	0.667	5.489*
	(0.0000)		(0.0000)
AbTR(ED+10)	0.3318*	0.1226	5.844*
	(0.0000)		(0.0000)

Panel B: Deletions Sample (N = 147)

Variable	Mean	Median	Wilcoxon signed rank test
AbTR(ED-10)	-0.1021	0.0747	-0.526
	(0.1211)		(0.6006)
AbTR(ED-9)	0.0466	-0.1396	-2.357
	(0.4361)		(0.0181)
AbTR(ED-8)	0.1657	-0.0990	-0.891
	(0.0443)		(0.3743)
AbTR(ED-7)	0.1688	-0.0590	0.166
	(0.0122)		(0.8691)
AbTR(ED-6)	0.1684	-0.0766	0.265
	(0.0180)		(0.7924)
AbTR(ED-5)	0.3970*	0.1970	4.154*
	(0.0000)		(0.0000)
AbTR(ED-4)	0.5691*	0.2003	5.275*
	(0.000)		(0.0000)
AbTR(ED-3)	0.7360*	0.2835	6.803*
	(0.000)		(0.0000)
AbTR(ED-2)	0.8256*	0.4652	7.988*
	(0.0000)		(0.0000)
AbTR(ED-1)	12.6896*	10.4563	10.518*
	(0.0000)		(0.0000)

AbTR(ED)	1.4938*	0.9000	9.985*
	(0.0000)		(0.0000)
AbTR(ED+1)	0.7263*	0.3692	6.801*
	(0.0000)		(0.0000)
AbTR(ED+2)	0.5045*	0.2236	5.378*
	(0.0000)		(0.0000)
AbTR(ED+3)	0.3876*	0.1370	3.854*
	(0.0000)		(0.0001)
AbTR(ED+4)	0.3451*	0.0710	3.063*
	(0.0000)		(0.0021)
AbTR(ED+5)	0.2470*	0.0431	2.216
	(0.0004)		(0.0265)
AbTR(ED+6)	0.2663*	0.0699	2.402
	(0.0001)		(0.0161)
AbTR(ED+7)	0.3415*	0.0313	2.761*
	(0.0000)		(0.0055)
AbTR(ED+8)	0.2472*	-0.0130	1.290
	(0.0000)		(0.1981)
AbTR(ED+9)	0.2393*	0.0797	2.547
	(0.0000)		(0.0106)
AbTR(ED+10)	0.2145*	0.0289	2.009
	(0.0000)		(0.0444)

Table 7 – Abnormal Returns Analyses

This table reports the abnormal returns and tests of their significance for the Additions Sample in Panel A and Deletions Sample in Panel B. The abnormal returns are measured by using the CAPM model, the multi-factor model and market-adjusted model in subpanels A, B and C, respectively. For each observed date or interval, the mean AR across my sample is taken to obtain the average abnormal return (AAR) or the cumulative average abnormal return (CAAR) for the multi-day intervals observed. The significance of the AAR and CAAR are tested with a standard *t-test*, with the *p-values* reported in parentheses. The medians are also tested using the Wilcoxon signed rank test. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Additions Sample (N = 380)									
	Subpanel A: CAPM			Subpanel B: Multi-Factor Model			Subpanel C: Market-adjusted Model		
Interval	AAR/ CAAR	Median	Wilcoxon	AAR/ CAAR	Median	Wilcoxon	AAR/ CAAR	Median	Wilcoxon
AD	0.049	-0.076	-0.728	0.128	-0.016	0.147	0.008	-0.097	-0.621
	(0.7168)		(0.4674)	(0.4852)		(0.8834)	(0.9538)		(0.5350)
AD+1	2.695***	2.371	12.191***	2.523***	2.256	12.082***	2.582***	2.369	12.079***
	(0.0000)		(0.0000)	(0.0000)		(0.0000)	(0.0000)		(0.0000)
[AD-6, AD-1]	0.992**	0.434	2.146**	0.528	0.201	0.959	0.913***	0.690	4.040***
	(0.0355)		(0.0318)	(0.2447)		(0.3383)	(0.0042)		(0.0000)
[AD+1, AD+21]	3.130**	0.544	1.103	1.490**	0.879	2.146**	1.951***	1.424	3.387***
	(0.0373)		(0.2703)	(0.0449)		(0.0318)	(0.0000)		(0.0007)
[AD+1, AD+63]	4.865	-1.171	-1.671*	-0.075	-0.553	-0.576	1.480	2.300	2.500**
	(0.2751)		(0.0948)	(0.9585)		(0.5652)	(0.1146)		(0.0123)

Panel B: Deletions Sample (N = 147)									
	Subpanel A: CAPM			Subpanel B: Multi-Factor Model			Subpanel C: Market-adjusted Model		
Interval	AAR/ CAAR	Median	Wilcoxon	AAR/ CAAR	Median	Wilcoxon	AAR/ CAAR	Median	Wilcoxon
AD	-0.505	0.159	0.373	-0.496	0.175	0.663	-0.387	-0.037	-0.520
	(0.4062)		(0.7105)	(0.3750)		(0.5089)	(0.5136)		(0.6046)
AD+1	-2.727***	-1.518	-5.533***	-3.191***	-1.487	-5.571***	-2.718***	-1.513	-5.173***
	(0.0000)		(0.0000)	(0.0001)		(0.0000)	(0.0000)		(0.0000)
[AD-6, AD-1]	-2.639**	-1.948	-3.146***	-3.416***	-1.364	-3.048***	-3.896***	-1.720	-3.752***
	(0.0457)		(0.0015)	(0.0004)		(0.0022)	(0.0005)		(0.0001)
[AD+1, AD+21]	4.785	-0.580	-0.203	2.513	1.506	0.358	0.170	-2.496	-1.396
	(0.1920)		(0.8403)	(0.1993)		(0.7220)	(0.9277)		(0.1634)
[AD+1, AD+63]	18.878*	4.402	2.058**	8.265**	4.212	1.667*	5.097	0.556	0.723
	(0.0771)		(0.0395)	(0.0179)		(0.0958)	(0.1270)		(0.4713)

Table 8 – Sample Construction for Deletions subsamples

To create Deletions Sample 2, a total of 36 stocks were removed from the initial deletions sample because they went through confounding events during the AD-6 through AD+63 event window. This table breaks down the reasons for each removal and separates the event type between macro-related confounding events and firm-specific confounding events, as indicated by the last column. Deletions removed from the base-case sample for macro-related reasons are excluded from subsamples 1 and 2 but included in subsample 3, and deletions removed for firm-specific reasons are excluded from subsample 1 and 3 but included in subsample 2.

Confounding Event	Count	Type
Severely affected by the 2008-2009 Global Financial Crisis (within one year prior to/past trough)	12	Macro
Severely affected by the early 2000's dot com bubble (within one year prior to/past trough)	2	Macro
Severely affected by the 2020 Covid-19 pandemic (within one year prior to/past trough)	2	Macro
Drawdown due to bankruptcy concerns/threats or rally once concern/threat is removed	11	Firm
Announcement of potential divestiture/spinoff/acquisition or takeover	5	Firm
Accounting scandal or important lawsuit against firm	4	Firm

Table 9 – Robustness Check – Abnormal Returns Analysis: Deletions subsamples

This table shows the average abnormal returns (AAR) for the three deletions subsamples, which are created to control for confounding events during the studied event window. The average abnormal returns are measured by using the CAPM model and the multi-factor model shown in equations [4] and [7], respectively. For each observed date or interval, I took the mean AR across my sample to obtain the average abnormal return (AAR) or the cumulative average abnormal return (CAAR) for the multi-day intervals observed. The significance of AAR and CAAR are tested with a standard *t-test*, with the *p-values* reported in brackets. The median difference is tested with the Wilcoxon signed rank test. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Subsample 1 (N = 111)	CAPM			Multi-Factor Model		
Variable/Interval	AAR/CAAR	Median	Wilcoxon signed rank test	AAR/CAAR	Median	Wilcoxon signed rank test
AD	-0.480 (0.2474)	-0.042	-0.365 (0.7174)	-0.420 (0.2861)	-0.069	0.003 (0.9988)
AD+1	-1.593*** (0.0006)	-1.276	-3.746*** (0.0001)	-1.637*** (0.0002)	-1.305	-4.007*** (0.0000)
[AD-6, AD-1]	-0.923* (0.0961)	-0.856	-1.274 (0.2040)	-0.911 (0.1083)	-0.703	-0.947 (0.3456)
[AD+1, AD+21]	-1.488 (0.2177)	-0.674	-1.015 (0.3121)	-1.288 (0.3182)	1.341	-0.462 (0.6464)
[AD+1, AD+63]	2.989 (0.1725)	3.490	1.171 (0.2432)	1.590 (0.4626)	3.166	0.830 (0.4090)

Subsample 2 (N = 131)	CAPM			Multi-Factor Model		
Variable/Interval	AAR/CAAR	Median	Wilcoxon signed rank test	AAR/CAAR	Media n	Wilcoxon signed rank test
AD	-0.582 (0.3221)	0.039	-0.122 (0.9043)	-0.824 (0.1516)	-0.069	-0.250 (0.8038)
AD+1	-2.491*** (0.0000)	-1.490	-4.815*** (0.0000)	-3.088*** (0.0002)	-1.347	-5.072*** (0.0000)
[AD-6, AD-1]	-0.712 (0.5260)	-1.115	-2.001** (0.0453)	-1.780** (0.0.119)	-1.150	-1.895* (0.0580)
[AD+1, AD+21]	4.543 (0.2543)	-0.674	-0.691 (0.4912)	1.752 (0.3452)	1.341	0.057 (0.9553)
[AD+1, AD+63]	16.456 (0.1634)	3.814	1.296 (0.1962)	4.728 (0.1554)	3.237	0.903 (0.3684)

Subsample 3 (N = 111)	CAPM			Multi-Factor Model		
Variable/Interval	AAR/CAAR	Median	Wilcoxon signed rank test	AAR/CAA R	Median	Wilcoxon signed rank test
AD	-0.377 (0.4569)	1.017	0.350 (0.7284)	-0.078 (0.8543)	0.185	1.103 (0.2713)
AD+1	-1.965*** (0.0009)	-1.492	-4.602*** (0.0000)	-1.927*** (0.0005)	-1.321	-4.621*** (0.0000)
[AD-6, AD-1]	-3.185** (0.0039)	-1.191	-2.725*** (0.0062)	-3.035*** (0.0.119)	-1.188	-2.428** (0.0149)
[AD+1, AD+21]	-0.540 (0.7190)	-0.627	-0.564 (0.5750)	0.039 (0.9812)	1.423	-0.114 (0.9104)
[AD+1, AD+63]	7.002** (0.0179)	3.888	1.862* (0.0626)	5.619* (0.0508)	3.691	1.501 (0.1341)

Table 10 – Impact of Indexing on Abnormal Turnover

This table relates abnormal turnover to indexing, measured as the total assets indexed to the S&P 500 Index, as a percentage of its market cap. The regression formula is specified as follows:

$$AbTR_{i,t} = \gamma_{i,INDEXED} Indexed\ Assets\ as\ a\ \%\ of\ Market\ Cap_{i,t-1} + \varepsilon_{i,t}$$

The abnormal turnover ($AbTR_{i,t}$) numbers were calculated in previous tests and can be found in Table 5. Three proxies are used to measure the independent variable. I ran the regression for each day during the window [ED-1, ED+1]. The *p-value* of the coefficients are provided, as well as the r-square of the regressions. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Additions Sample			
Subpanel A: ED-1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	149.36***	157.609***	198.323***
	(0.000)	(0.000)	(0.003)
Constant	1.117	0.486	12.370***
	(0.748)	(0.876)	(0.000)
Observations	380	380	380
R-Square	0.0668	0.0887	0.0549
Subpanel B: ED			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-9.321**	-2.878	-19.150***
	(0.016)	(0.417)	(0.001)
Constant	2.644***	1.871***	2.167***
	(0.000)	(0.000)	(0.000)
Observations	380	380	380
R-Square	0.0054	0.0017	0.0301
Subpanel C: ED+1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-1.247	-0.272	-4.480
	(0.634)	(0.910)	(0.244)
Constant	0.891***	0.775	0.891***
	(0.005)	(0.007)	(0.000)
Observations	380	380	380
R-Square	0.0006	0.0000	0.0036

Panel B: Deletions Sample			
Subpanel A: ED-1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)

Indexed Assets as a % of S&P 500 Market Cap	-48.649	-32.302	-135.936***
	(0.165)	(0.348)	(0.007)
Constant	18.548***	16.535***	17.509***
	(0.000)	(0.000)	(0.000)
Observations	147	147	147
R-Square	0.0133	0.0061	0.0488

Subpanel B: ED

Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-31.586***	-25.405***	-59.303***
	(0.000)	(0.000)	(0.000)
Constant	5.345***	4.579***	3.625***
	(0.000)	(0.000)	(0.000)
Observations	147	147	147
R-Square	0.1508	0.1030	0.2509

Subpanel C: ED+1

Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-17.994***	-13.524***	-31.663***
	(0.000)	(0.001)	(0.000)
Constant	2.916***	2.363***	1.859***
	(0.000)	(0.000)	(0.000)
Observations	147	147	147
R-Square	0.1154	0.0688	0.1687

Table 11 – Impact of Indexing on Abnormal Returns – CAPM Model

This table relates abnormal turnover to indexing, measured as the total assets indexed to the S&P 500 Index, as a percentage of its market cap. The regression formula is specified as follows:

$$AbRet_{i,t} = \gamma_{i,INDEXED} Indexed\ Assets\ as\ a\ \%\ of\ Market\ Cap_{i,t-1} + \varepsilon_{i,t}$$

The abnormal return (*AbRet*$_{i,t}$) numbers were calculated in previous tests using equation [4].Three proxies are used to measure the independent variable. I ran the regression for each day during the window [AD-1, AD+2]. The *p-value* of the coefficients are provided, as well as the r-square of the regressions. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Additions Sample			
Subpanel A: AD-1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	0.994	-1.424	3.096
	(0.872)	(0.800)	(0.729)
Constant	0.033	0.317	0.049
	(0.964)	(0.635)	(0.879)
Observations	380	380	380
R-Square	0.0001	0.0002	0.0003
Subpanel B: AD			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-6.661	-4.706	-11.124
	(0.285)	(0.409)	(0.220)
Constant	0.841	0.598	0.416
	(0.264)	(0.378)	(0.205)
Observations	380	380	380
R-Square	0.0030	0.0018	0.0040
Subpanel C: AD+1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-66.530***	-57.868***	-102.430***
	(0.000)	(0.000)	(0.000)
Constant	10.608***	9.440***	6.072***
	(0.000)	(0.000)	(0.000)
Observations	380	380	380
R-Square	0.1328	0.1202	0.1487
Subpanel D: AD+2			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)

Indexed Assets as a % of S&P 500 Market Cap	-11.700*	-9.285	-14.816
	(0.085)	(0.136)	(0.134)
Constant	1.365*	1.056	0.462
	(0.097)	(0.154)	(0.197)
Observations	380	380	380
R-Square	0.0078	0.0059	0.0059

Panel A: Deletions Sample

Subpanel A: AD-1

Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	3.853	-15.058	-3.736
	(0.803)	(0.320)	(0.869)
Constant	-0.727	1.587	-0.120
	(0.706)	(0.400)	(0.893)
Observations	147	147	147
R-Square	0.0004	0.0068	0.0002

Subpanel B: AD

Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	16.201	17.057	27.417
	(0.542)	(0.513)	(0.482)
Constant	-2.490	-2.591	-1.496
	(0.453)	(0.425)	(0.330)
Observations	147	147	147
R-Square	0.0026	0.0030	0.0034

Subpanel C: AD+1

Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	122.984***	120.067***	206.080***
	(0.000)	(0.000)	(0.000)
Constant	-17.795***	-17.412***	-10.176***
	(0.000)	(0.000)	(0.000)
Observations	147	147	147
R-Square	0.1458	0.1444	0.1907

Subpanel D: AD+2

Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-16.438	-29.092	-31.-19
	(0.443)	(0.165)	(0.322)

Constant	2.469	4.013	1.576
	(0.355)	(0.124)	(0.202)
Observations	147	147	147
R-Square	0.0041	0.0133	0.0068

Table 12 – Impact of Indexing on Abnormal Returns – Multi-Factor Model

This table relates abnormal turnover to indexing, measured as the total assets indexed to the S&P 500 Index, as a percentage of its market cap. The regression formula is specified as follows:

$$AbRet_{i,t} = \gamma_{i,INDEXED} Indexed\ Assets\ as\ a\ \%\ of\ Market\ Cap_{i,t-1} + \varepsilon_{i,t}$$

The abnormal return (*AbRet*$_{i,t}$) numbers were calculated in previous tests using equation [7].Three proxies are used to measure the independent variable. Regressions are estimated for each day during the window [AD-1, AD+2]. The *p-value* of the coefficients are provided, as well as the r-square of the regressions. ***, **, and * denote significant differences from zero at the 1%, 5%, and 10% levels in two-sided tests, respectively.

Panel A: Additions Sample			
Subpanel A: AD-1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	2.495	-0.012	3.758
	(0.623)	(0.998)	(0.611)
Constant	-0.250	0.048	-0.077
	(0.684)	(0.930)	(0.774)
Observations	380	380	380
R-Square	0.0006	0.0000	0.0007
Subpanel B: AD			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-0.218	2.708	0.937
	(0.979)	(0.726)	(0.939)
Constant	0.154	-0.187	0.097
	(0.880)	(0.839)	(0.827)
Observations	380	380	380
R-Square	0.0000	0.0003	0.0000
Subpanel C: AD+1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	-64.019***	-55.013***	-97.735***
	(0.000)	(0.000)	(0.000)
Constant	10.137***	8.935***	5.745***
	(0.000)	(0.000)	(0.000)
Observations	380	380	380
R-Square	0.1408	0.1243	0.1551
Subpanel D: AD+2			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)

Indexed Assets as a % of S&P 500 Market Cap	-10.109*	-8.059	-12.530
	(0.081)	(0.128)	(0.137)
Constant	1.104	0.841	0.314
	(0.115)	(0.182)	(0.302)
Observations	380	380	380
R-Square	0.0080	0.0061	0.0058

Panel A: Deletions Sample			
Subpanel A: AD-1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	12.388	0.510	12.254
	(0.378)	(0.971)	(0.552)
Constant	-2.074	-0.619	-0.100
	(0.237)	(0.719)	(0.219)
Observations	147	147	147
R-Square	0.0054	0.0000	0.0092
Subpanel B: AD			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	25.373	28.149	41.405
	(0.299)	(0.239)	(0.247)
Constant	-3.604	-3.939	1.992
	(0.236)	(0.186)	(0.157)
Observations	147	147	147
R-Square	0.0074	0.0095	0.0092
Subpanel C: AD+1			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	145.407***	153.247***	253.453***
	(0.000)	(0.000)	(0.000)
Constant	-21.006***	-21.935***	-12.352***
	(0.000)	(0.000)	(0.000)
Observations	147	147	147
R-Square	0.1249	0.1442	0.1768
Subpanel D: AD+2			
Variables	Coefficients (Proxy 1)	Coefficients (Proxy 2)	Coefficients (Proxy 3)
Indexed Assets as a % of S&P 500 Market Cap	4.207	-2.996	10.618
	(0.853)	(0.893)	(0.749)

Constant	-0.405	0.477	-0.273
	(0.886)	(0.863)	(0.834)
Observations	147	147	147
R-Square	0.0002	0.0001	0.0007