On the Behavior of S&P 500 Index Premium Since the 2008 Recession

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Abstract

Prior research has indicated a clear relationship between index inclusion and stock returns; a phenomenon known as index premium. Various research papers have attributed inclusion in the S&P 500 index an additional price increase for the new member firms and a negative price return for the firms that are removed from the index. Index premium has been explained by the increasing share of passive investment management and index investing in the larger wealth management landscape. Upon the addition of the firm in the index ETFs and other funds that mimic the index start loading up the firm's stock which shifts the demand curve in the market and results in significant price changes.

The paper tries to provide an empirical analyses of index investing and the price impact of index investing on stocks. The paper finds that for the time period of 2008 to 2021, the index premium of S&P 500 index has been none-existent, meaning there is no clear relationship between index additions and abnormal price returns. This research focuses of the on the S&P 500 index additions following the 2008 crisis, thus index deletions have been left out.

Keywords: Index Premium, S&P 500, Index Investing, Passive Investment Management, Depression Discontinuity, CAPM, Efficient Market Hypothesis.

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All errors throughout this academic paper shall be attributed to the author and the author only.

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Introduction

Despite asset manager's enthusiasm regarding their own abilities the increasing share of passive investment management indicates that perhaps Warren Buffet was right about active management being a gamble that leads to worse than average returns. As of 2019, an astonishing 40% of total assets held by individual and corporate investors were managed by passive ETFs and passive Mutual Funds. This number was just 20% in 2010 (Anadu et al. 2018).

Several factors appear to be of significance when analyzing the rationale behind the drastic growth of passively managed funds. The most prominent theory unearthing the reason behind this growth seems to be the increasingly popular theory of efficient markets; the theory started gaining popularity in early 1970's; however given that the primary assumption of the theory is universally available information, the hypothesis did not hold well at the time (Flood et al. 2000). With the rise of information technology information asymmetry began to decline and the ability of fund managers to have an edge over the market eroded. Algo-trading accelerated the trend even further, achieving a whole new level of information symmetry along market participants through near-instantaneous information absorption. The new ways of the markets slowly took away the ability to gain the α [alpha] away and cast doubt on active asset management as a method to gain an edge over other market participants.

Other reasons behind the popularity of passive asset management are lower costs and evidence of underperformance of active managers. Passive investing has significantly lower operational costs due to fierce competition in the market and continually improving infrastructure (Rompotis and Georgiou 2005). There is statistical evidence of passive ETFs outperforming active ETFs over the long run (Malkiel and Burton 2003).

The rise of index investing has sprung interest towards ETFs and funds that try to mimic the composition of major stock market indexes. S&P 500 being the most prominent of all indexes has witnessed the effects of index investing in all its range (Malkiel and Burton 2003). As these ETFs and funds mimic the index they buy stocks that are added to the index and sell the stocks that leave the index (Malkiel and Burton 2003). Consequently following the firms' addition to the index a large chunk of its free float is bought by the passive managers. Such demand spikes are sometimes significant enough to shift the demand curve.

Funds under the management of passive managers have almost doubled since 2010 leaving the comprehensive study on the topic by Petajisto (2010) an outdated indicator that does not incorporate the specifics of the modern financial markets (Petajisto 2010). It is in a regular matter of things to ask whether incorporating recent market events along with increased index investing volumes into index premium calculations will have a drastic effect on the index premium of S&P 500 index. I will conduct a by-yearly analysis of the time series to draw a definitive conclusion. To answer these, I will conduct biyearly time-series analyses. Additionally, I will the long-run trends of the index premium to understand whether regression discontinuities have taken place during the observable time period.

CAPM, a neo-classical economical model highly publicized and studied among economists, indicates that the demand curve is steep and an unexpected demand shock shall not have any effect on the stock price (Wurgler et al. 2000). The demand shock may be the rapid buyup of the stock by passive indexers following its inclusion in the index. ATP, although not an equilibrium model, is another neo-classical theory that indirectly implies the flatness of the demand curve. One of the implications of this paper will be inferring the standing of the neo-classical theories in modern financial markets.

Past Research and Literature Review

Interest in the relationship between index inclusion and stock price have has existed for decades and research on the topic has been dated back to 1960s (Geske et al. 1983). During this timeframe, researchers in both theoretical and applied fields have concentrated on finding the relationship between index inclusion and equity price fluctuations connected with the event. The phenomenon of index premium is of tremendous importance for financial market participants, and thus continuous research is necessary to provide up to date data.

Lynch and Mendenhall (1997) aimed to calculate the index premium of the most acknowledged index at the time: the S&P 500. The research used fundamental analysis techniques to obtain a definite percentage change stemming from the inclusion in the index. Findings concluded that inclusion in the S&P 500 index pumped up the stock price by 3% on average for the period of 1990-1995. Additionally, based on conclusive empirical evidence, the research found out that exclusions have a weaker effect on the stock's price; exclusion from S&P index in the same period of 1990 to 1995 yielded a 1.5% decline in the stock's price.

To further elucidate the topic, Petajisto (2010) conducted a similar research 13 years after. Given the drastic changes in financial markets during those years it was fairly reasonable that the index premium would have changed along with the evolution of the financial markets in the overly complex and intertwined world of finance. Petajisto (2010), over and above that, analyzed the index premium of Russell 2000; however, this index will not be discussed as the concentration of my paper is on S&P 500. Petajisto (2010) run his statistical model on data falling in the period from 1990 to 2005 to have a more evenly distributed dataset reflecting a wider range of seasonality. Additionally, such choice of data selection should have decreased the effect of regression discontinuities in the market. Using a linear statistical model Petajisto (2010) concluded that index premium of S&P 500 averaged at 8.8%. Such drastically different results as from Lynch and Mendenhall might be explained in terms of the increased market volatility during the period of early 2000s and the robust market growth in the following years up until 2005.

One thing is obvious, index premium is subject to visible changes and can change significantly in a matter of years, a timeframe not so significant in the world of economics. Thus, it is necessary to include recent data when calculating index premiums as changes in the premium can be tremendous as the case of Petajisto (2010) and Lynch and Mendenhall (2007) proves.

Matters pertaining to S&P 500 index premium have been analyzed from various angles using different methodologies. Denise and others have analyzed the premise that the demand curve for stocks slopes downward (Denise et al. 2003). Looking at the change in the analyst's forecasted EPS ratio (earnings per share) ratio the group of researchers has tried to empirically assess the long-term effect in the S&P 500 index on the stock performance. It has been observed that when a company is added to the S&P 500 index some analysts change the expected future EPS ratio. Given that this phenomenon has been systematic throughout years it can be inferred that it is connected with index inclusion rather than with other fundamental factors (Geske et al. 1983).

Denise at alia (2003) find that relative to various benchmarks, new additions to the index experience an asymmetrically significant increase in expected EPS forecasts as well as notable improvements in realized earnings. These findings imply that being added to the S&P 500 index is not an information-free event, and thus the hypothesis of downward sloping curve does not stand.

Kamal, Lawrence, McCabe, and Prakash (2012) argue that markets are inefficient and there is information asymmetry that cannot be neglected. Additions and deletions draw additional spotlight on firms and take them back into the shadows accordingly. The research found that deletions and additions have marginal effect after the year 2000; this could be explained by the aftermath of Regulation Fair Disclosure, Decimalization of the Exchanges, and the Sarbanes-Oxley Act. Uninformed investors have gained an edge due the rapid rise of information technologies. (Cremers and Petajisto 2007). Additional findings, imply decreased liquidity after deletions from S&P 500 index. The paper then looks at the matter through the lenses of behavioral economics to explain this phenomenon; authors believe that the declining liquidity can be explained by the outflow of capital from mutual funds and index mimicking funds in the long-term.

Overwhelming majority of researchers while having different views on the size of S&P 500 index premium and have different estimates of the magnitude of the premium, agree that the variable changes rapidly in response to countless micro and macro factors. Estimates vary anywhere from negative numbers to double digits; however, given that the premium indeed changes based on the time period one analyzes, it is fair to conclude that to have a correct understanding of the current index premium, it is necessary to incorporate up to date data.

In addition to having the end of the observed period as close to the current moment as possible, it is also tremendously important to choose the correct starting data for the time period. Short timeframes might lead to misleading results due to impaired accountability for seasonality and abnormal market events. An overly long timeframe might lead to obtaining a premium close to historical averages while missing the effect of recent regression discontinuity events that might have shifted changed the number from its historical average values.

Data Set and Methodology

Methodology

This paper takes a technical perspective on calculating index premiums. Despite empirical research showing the success of fundamental analysis models this paper will utilize a statistical model to calculate the index premium of S&P 500 for the years 2008 to 2021 (NBER 2021). Both methodologies have been widely used in prior research, such as by Denise and others (2003) and Petajisto (2010), and have shown successful implementation trials. Both, fundamental and technical analyses each incorporate a set of smaller research methods.

The hypothesis to be tested is whether the index premium has remained significant throughout the years, and if so, what are its numerical representations. Certainly, given the textbook definitions of financial markets and arbitrage-free theories such as CAPM, it can be reasonable to assume that the hypothesis will hold. However, the reality is much more complex and market inefficiencies might arise from time to time. Rejecting or failing to reject the null hypothesis will not prove the source of index premium. Correlation does not mean causation, and there might be infinite reasons behind the existence of market premiums, and we can only guess on the matter since controlled experiments are nearly impossible.

Technical analysis mostly revolves around mathematical modeling and incorporates a set of research methods that are based on historic data and applied mathematics. On the contrary, fundamental analysis bases its conclusions on economic behavioral circumstances and macro trends. Often when calculating a variable such as an index premium fundamental and technical analyses yield dramatically different results since underlying assumptions can be different for both methods.

This research uses data from 2008 to 2021 to exclude the anomaly crises of 2008 behind and capture the realities of the post crises financial markets. Additionally, since 2008 passive index mimicking funds and mechanical indexers have grown drastically it is logical to assume that markets have changed in the meantime. Research similar to mine has been carried out by Wurgler and Zhuravskaya (2002). The authors find a connection between idiosyncratic risk and price impact after index additions. However, there is a need to redo the research to understand the standing of the hypothesis in the *current* financial markets.

This paper takes a comparable approach to be easily compared to relatable research in the future. I take daily closing stock prices of stocks for a period of two years prior to their addition to S&P 500 index. The data set of two years with daily increments will allow to create a statistical distribution that presumably will coincide with a normal distribution with its mean around the annual growth rate of S&P 500 index. The reason behind this assumption lies in the fact that the average weighted growth of all the stocks is equal to the annual growth of the index itself. Of course, given that different firms have differing weights in index composition we can still neglect this for mean calculation as the large sample of 500 firms gives an evenly distributed function.

By analyzing the distribution of the daily stock price changes of S&P 500 index additions prior to their addition to the index then comparing this statistical distribution with the daily stock price change on the first trading day as an index member we will be able to establish whether index premium is significant enough. If the distribution of closing stock prices is normal, then it by calculating the standard deviation of the distribution and comparing it with the closing price of the day after the addition, it will be possible to establish whether index addition has a significant effect on the prices. In case the distributions are not normal in the vast majority of cases a different approach for analyzing outliers should be used depending on the specific distribution that I have to work with.

Comparing the closing prices after the addition should provide statistically sufficient sample to draw conclusions. For statistical purposes, confidence intervals of 0.90 and 0.95 will be used to compare the mean of the distribution to the next day's closing price.

To minimize idiosyncratic risk, the adjusted closing price will be used. Adjusted closing prices provide a better understanding of real stock prices since the adjusted stock price incorporates material events such as stock splits, dividends and M&A that would otherwise be left out of the scope and distort the data (Frino and Gallagher 2001).

There might be cross-correlation between stocks within the index however, given that the causation of the phenomenon is irrelevant and that this occurrence will continue well into the future, this will be left out of the analysis. Having stocks in the dataset with similar β [Beta] is inevitable in a pool of 500 firms.

From a technical perspective, z-scores for all the added stocks price on the first day of inclusion will be calculated when compared to the previous two-year closing prices. If the average z-score obtained for all the additions is below our threshold of 1.96 it can be concluded with certainty that the price change on the first trading day is not significant.

Data: Data will cover a two year period prior to ticker's addition to the index to account for time trends and seasonality in the index premium. The daily adjusted closing prices of all the stocks have been downloaded from *Yahoo Finance* using data scraping methods; in particular *yfinance*- an open-source library for finance related operations in *Python*, has been used. The data has around 510 data points for each stock addition. Stock prices are provided by precision of two decimal places as that is the smallest increment allowed for trading activities on most major stock exchanges.

Table 1 contains a fragment from the raw data gathered from Yahoo Finance for the dates 2019.03.22 to 2019.03.28 for CZR, Ceasers Entertainment.

Date	Open	High	Low	Close	Adjusted Close	Volume
3/22/19	49.95	50.15	48.49	49.66	49.66	1,032,600
3/25/19	49.66	50.68	49.11	49.66	49.66	641,400
3/26/19	50.02	51.05	48.59	49.66	49.66	659,100
3/27/19	49.11	49.11	46.66	49.66	49.66	703,700
3/28/19	48.29	49.92	46.74	49.66	49.66	1,221,700

Table 1: CZR stock prices fragment

To find the addition dates of stocks to S&P 500 index, as no readily available functions or packages were available manual data scraping was deployed in *Python.* Bloomberg terminal and S&P 500 announcements have been sufficient to generate the necessary data containing all additions to the S&P 500 from March 1st, 2009 to March 31, 2021. Overall there have been 181 additions during this time period and they have been all included in the dataset. A custom-made algorithm has been able to extract the necessary information from the upper mentioned sources and arrange it in a readable and usable manner.

Ticker	Addition - 2 Years	Addition	First Trading Day After Addition
HRL	03/04/07	03/03/09	03/04/09
VTR	03/05/07	03/04/09	03/05/09
ARG	09/29/07	09/28/09	09/29/09
PLCN	04/11/07	04/10/09	04/11/09
V	12/19/07	12/18/09	12/19/09

Table 2: An extract from the date list of S&P 500 additions

Table 2 presents an extract from data gathered on dates of addition with two additional analytical steps. First, after the dates of addition are gathered in a column, two years are subtracted from the date of addition of each firm to know what date range to use for calculations- this yields a different number of trading days for each stock for two years since each year has a different working calendar. Additionally, a day is further added to the addition date to get the day of first trading as an S&P 500 index member firm.

Results

The hypothesis posed in this paper is that there is statistical evidence that the concept of index premium has been applicable to the S&P 500 index since the end of 2008 recession. In particular, the paper implements statistical modeling to calculate the size of the index premium and analyze the seasonality and essence of the phenomena.

According to the obtained data, the average z-score for price changes on the day of addition for 181 stocks that were added to S&P 500 index during the observed period is 0.02. This implies that there is no index premium whatsoever for the period of 2008 to 2021. The sample size of over 150 stocks has enough statistical significance to provide a conclusive inference that the null hypothesis is rejected.

Figure 1 indicates a distribution of adjusted price changes with low z-scores when compared to the two year trading period prior to index addition. With the exception of five outliers all stocks have their z-score scattered around zero, thus creating an average z-score of 0.02. Additionally, there are no signs of an irregularly shaped distribution for the data.

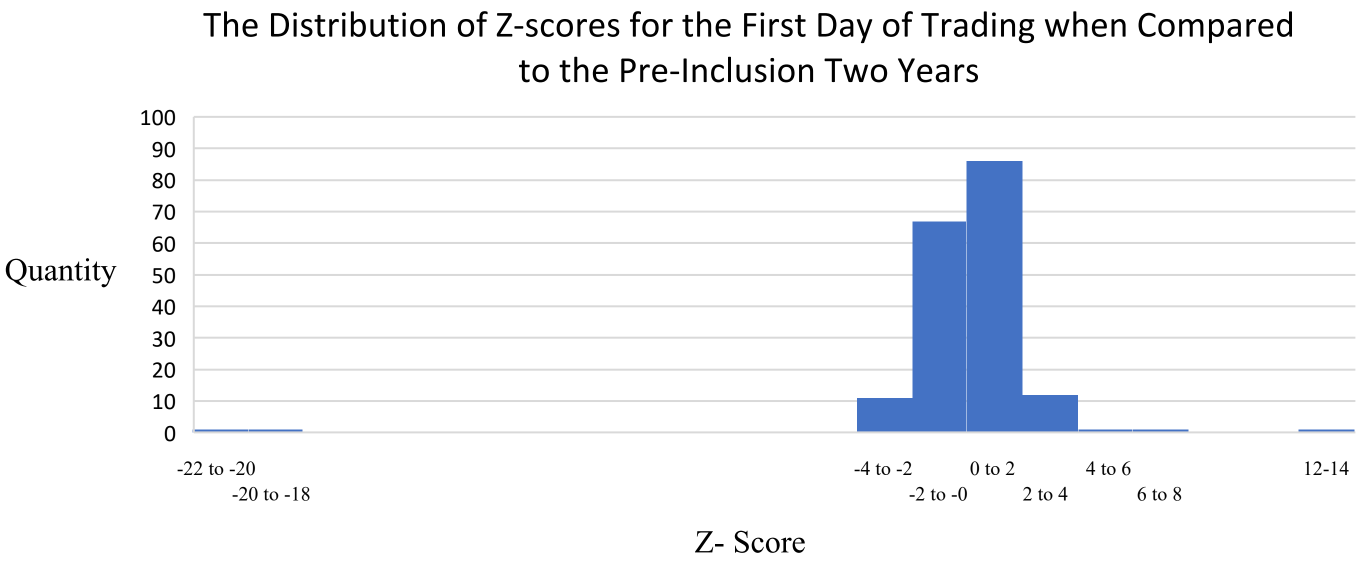

Figure 1. Z-Score Distribution of the Adjusted Price of new Additions on the First Trading Day

Despite prior empirical research providing evidence of the existence of the index premium, it seems market efficiency theories describe index premium phenomenon's better (Fama and French 1992). In general, given the prolonged timespan of this paper and the significant data size, it can be concluded that the results are definitive and that S&P 500 index premium has indeed declined over time with the spread of fintech.

Research findings by Wurgler and Zhuravskaya (2002) have remained consistent with this paper's dataset proving that the demand curve remains steep and events that regression discontinuities have no effect on the stock price.

There can be a number of reasons for the observable decline in index premium, however, giving an exact correlation and creating a cause and effect sequence would be difficult given the scope of this research.

Implications & Future Considerations

This study, being of interpretive and descriptive nature, raises certain theses and questions for future exploratory research. Such research shall appear in terms of both theory validation and concept development.

First, while this research establishes the decline of S&P 500 index premium it would be of utmost practical use to establish the rationale between the correlation and causation of market efficiency theory and index premiums. In particular, if the index premium is absorbed by traders during the days after the announcement of a new addition but before the actual addition further research will be able to draw empirical conclusion on the matter. It is quite reasonable to assume, given the findings of this paper, that with new technologies and declining information asymmetry passive index mimicking funds load up with the stock that has been announced as the new addition to the S&P 500 well before the actual addition date.

S&P 500, being the most widely recognized and traded index in the world might have serious differences when compared to other indexes in terms of trading patterns and the behavior of index mimicking funds, which would in turn create noteworthy differences between index premiums of different indexes.

I would strongly suggest indexes of emerging markets and small-capitalization indexes for future research. What regards the first, emerging markets lag behind Wall Street in terms of the availability of financial infrastructure and are abundant in capital flows. Markets behave differently due to macroeconomic differences of their host countries meaning that index premiums could be observed to have drastically different values for the same time period in London and New York City.

Small-cap indexes would also provide valuable information in terms of their index premiums as prior research has mostly covered S&P 500, which is a large-cap index. Small-cap indexes such as VBR (Vanguard Small-Cap Value ETF) and SCHA (Schwab U.S. Small-Cap ETF) due to them being largest by AUM and they have a satisfying level of liquidity (which most small-cap indexes do not have).

Researching the index premium of small-cap and emerging market ETFs could bring paradigm shifts to algo-trading as the less developed and researched a market is the less efficient it is due to lagging infrastructure and capital adequacy levels. Additionally, when researching these index premiums slight moderations to the current methodology could improve the accuracy of the research findings in terms of their numerical values. In particular, Wilcoxon test and Permutation tests could replace the t-test and z-test as in the case of larger data they are mathematically superior given the specifications our research topic.

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Annex

For calculations and data scraping, *Python* has been used. Given the size of the data and the process of data scraping necessary to obtain the data a machine with a dual 2.8 GHz Quad-Core Intel Core i7 and 16 Gb of RAM has been used.