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The Growth of Index Mutual Funds and Their Effect on Price Discovery

A literature review

School of Accounting and Finance
Bachelor's thesis
Finance

Vaasa 2026

UNIVERSITY OF VAASA
School of Accounting and Finance
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Title of the Thesis: The Growth of Index Mutual Funds and Their Effect on Price Discovery : A literature review
Degree: Bachelor of Science in Economics and Business Administration
Programme: Finance
Supervisor: John Kihn
Year: 2026 **Pages:** 35

ABSTRACT:
The continuous shift from active investing to passive investing has brought up questions on its implications on market efficiency. Index funds have grown to be a dominant force in the asset management industry, thus bringing on concerns on whether this shift from active investing impairs the price discovery of stock prices which market efficiency depends on. This study examines the effects of index fund growth on market efficiency, with a focus on price discovery, via existing literature that focuses on the S&P 500 and the U.S. stock market. The literature review finds supporting evidence for multiple negative effects for market efficiency which are caused by passive investing, such as mispricing, herding, index inclusion effect, underreaction to fundamental information, and volatility and co-movement, which are all signs of impaired market efficiency. While there is broad support from the evidence, the literature is not unanimous, and some studies fail to find negative effects that passive investing has caused for market efficiency.

TIIVISTELMÄ:
Jatkuva siirtyminen aktiivisesta sijoittamisesta passiiviseen sijoittamiseen on herättänyt kysymyksiä siirtymän vaikutuksista markkinoiden tehokkuuteen. Indeksirahastoista on tullut hallitseva voima varainhoitoalalla ja tämä herättää huolia siitä, heikentääkö tämä siirtymä aktiivisesta sijoittamisesta hintojen tehokasta muodostamista, johon markkinoiden tehokkuus perustuu. Tässä tutkimuksessa tarkastellaan indeksirahastojen kasvun vaikutuksia markkinatehokkuuteen, keskittyen hinnanmuodostukseen, S&P 500-indeksiin ja Yhdysvaltain osakemarkkinoihin keskittyvän aikaisemman akateemisen kirjallisuuden avulla. Tämä kirjallisuuskatsaus löytää tukea useille markkinoiden tehokkuuteen vaikuttaneista passiivisen sijoittamisen haittavaikutuksista. Näitä ovat muun muassa virhehinnoittelu, laumasijoittaminen, indeksiin sisällyttämisefekti, alireagointi fundamentaaliseen informaatioon, sekä volatiliteetti vaikutukset ja osakkeiden hintojen yhteisliike. Nämä kaikki ovat merkkejä heikentyneestä markkinoiden tehokkuudesta. Vaikka todisteaineisto tukee laajasti johtopäätöksiä, aikaisempi kirjallisuus ei ole yksimielinen asian suhteen, eivätkä jotkut tutkimukset löydä todisteita passiivisen sijoittamisen negatiivisista vaikutuksista markkinoiden tehokkuuteen.

KEYWORDS: Index funds, Market efficiency, Passive investing, Efficient market hypothesis (EMH), S&P 500, Price discovery

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1 Introduction

In the year 2000 index mutual funds had $0.4t in assets under management which at the time was roughly 3% of the assets on the U.S. stock market, however by 2021 that 3% has grown to 16% and reaching 33.5% when other forms of index investing are considered (Chinco & Sammon, 2024, p. 1). The significant shift from active investing to passive investing raises questions about what implications it has on the financial markets from a market efficiency standpoint. Market efficiency has been a prominent part of financial theory ever since it was first introduced, and according to Fama (1970, p. 383) it considers that asset prices reflect all available information making them efficient. For markets to be efficient they rely on the incorporation of information into the prices, which is an effect of active investing. As index funds have become more popular the percentage of active investors has decreased which would hinder the informational efficiency of asset prices and raise questions about whether markets really are efficient as the theory would imply.

Passive investing relies on the concept of market efficiency where active investors can't consistently beat the market making it rational to try to replicate the market through index funds rather than trying to pick winners. However, since passive investing has become more popular the reduced number of active investors creates a paradox where less information is being gathered to keep the prices efficient.

The effects of index fund growth on market efficiency can be examined through many different mechanisms. Previous literature finds that the growth of index funds causes mispricing, disproportional overvaluing of larger firms, and underreaction to information as there are fewer active investors acquiring information. Passive investing has also been found to cause herding, price shocks around index additions and deletions and increased co-movement and volatility among stocks included in an index. These effects are caused by the structural nature of passive investing that comes from index fund managers having to react to index rebalancing.

The effects of index fund growth and the possible reduction in market efficiency are not only relevant in academic debate and could have real world implications. Markets play an essential role in allocating investments and if market efficiency suffers due to index fund growth it could mean that productive firms aren't receiving investments while less productive firms are.

1.1 Purpose of the study

The purpose of this study is to examine what effects index funds, and their growth have had on market efficiency with a focus on the U.S. stock market and more specifically the S&P 500. This study examines the mechanisms of passive investing that have influenced market efficiency through previous literature on mispricing, underreaction to information, herding, co-movement and the index inclusion effect, to evaluate whether the evidence in the literature indicates the claim that index funds reduce market efficiency. This study is done as a literature review, assessing evidence from existing academic literature and research.

H1 = Index investing reduces market efficiency

The first hypothesis examines whether there is a link between index investing and reduced market efficiency, however it doesn't consider the significant growth passive investing has had over the decades. If index investing is shown to reduce market efficiency with aforementioned mechanisms, the effects very well could be amplified by the scale of index investing. Since passive ownership in the U.S. stock market has grown from 3% in 2000 to 33.5% by 2021, the mechanisms most affected by scale, such as structural herding and fewer active investors have amplified the effects from the first hypothesis, with their growth.

H2 = Increased index investing has amplified the reduction in market efficiency

1.2 Structure of the study

The structure of the study goes as follows: In the first chapter the topic, the purpose and hypothesis are introduced. The second chapter focuses on index funds and their growth in popularity, the reasons behind said popularity and some issues with them. The third chapter covers theory about market efficiency and critiques it has received. The fourth chapter covers the effects that index funds have on market efficiency with four subchapters: mispricing, the index inclusion effect, underreaction to fundamental information, and volatility and co-movement, additionally the fifth chapter briefly discusses the implications these effects have on the broader economy. The final chapter concludes the study with key findings and implications.

2 Index funds

Index funds are investment vehicles, which track an index and hold the assets included in that index. They provide investors with natural diversification as their investments are spread among all the assets in the index. In the words of Wilson (2019, p. 19) “Index funds are not in a competition with the market; they are, instead trying to be the market.” There are many different types of indexes that index funds are based on and some of the most common are equity, bond, real estate, commodity, and currency indexes however this study will mostly focus on index funds based on equity indexes such as the S&P 500.

In addition to being diversified, index funds have lower fees compared to other types of mutual funds due to the nature of them following an index thus generally requiring minimal upkeep from the portfolio manager. This is a significant advantage that index funds have over actively managed funds that require constant monitoring of the market and trading stocks. The low fees are a crucial part that makes index funds as competitive as they are since actively managed funds tend to have relatively high fees which eat into the profits that the funds have created.

2.1 Popularity

Within the last two decades the popularity of index funds compared to other mutual funds has risen astronomically. According to Gough (2017, p. 1) the popularity stems from the fact that actively managed funds have failed to meet the return expectations set by investors. According to the investment research and investment management firm, Morningstar, in 2016 alone actively managed U.S. equity funds saw $264.5 billion worth of outflows, while passive index funds and ETFs saw inflows of $236.1 billion. Furthermore, actively managed U.S. equity funds lost $30 billion, and passive funds gained $60 billion, during the first two months of 2017. (Gough, 2017, p. 1)

2.2 Index fund types

Index investing can be done through various financial instruments, but there are two that stand out, and those are the traditional index mutual funds and exchange-traded funds (ETFs) which track an index. Index mutual funds can be put in two categories: retail and institutional. Retail index mutual funds are designed for individual investors, while institutional index mutual funds are designed for much larger investors, such as pension funds, insurance companies and sovereign wealth funds. Institutional index mutual funds have higher minimum investment requirements but have the advantage of lower fees that come with larger investments. Both types of index mutual funds are used to mimic the performance of the benchmark index, but they have differences in structure, trading and their impact on the market.

2.2.1 Mutual funds

Index mutual funds hold the assets of the index that it's tracking, meaning that the fund holds a portfolio of stocks that represent the index. For example, a S&P 500 index fund holds the stocks that make up the S&P 500 index. Each mutual fund has a net asset value (NAV) which is based on the last recorded prices of the underlying assets and all transactions of mutual funds happen at the end of the day using NAV. This means that if the fund has had a net inflow of investments, it will then buy more shares of stock. (Lettau & Madhavan, 2018, pp. 137–138)

Mutual funds can either be closed-ended or open-ended. Open-end funds are the more common type, and index mutual funds are almost always open-ended. Open-end funds make transactions at the end of the day at NAV price, based on inflows and outflows of the fund, while closed-end funds only issue their shares once and are then fixed in supply. Those closed-end fund shares are then traded on the open market, and the prices of the shares can be different from the NAV. (Lettau & Madhavan, 2018, pp. 137–138)

2.2.2 ETFs

In the same way as mutual funds ETFs hold the assets of the benchmark index, but unlike mutual funds, they don't interact with the markets directly. The ETF manager instead makes a legal contract with one or more authorized participants (APs) who then interact with the markets. APs are usually large financial institutions or broker-dealers specialized in market-making. ETF managers work with APs to exchange cash or basket of securities for ETF creation units. When the ETF shares are issued investors can then buy them from APs. While mutual funds make their transactions at the end of the day using NAV, ETF shares are created and redeemed by APs throughout the day, and investors can sell or buy shares intraday since the shares work like stocks in the sense that they can be traded through a broker. (Lettau & Madhavan, 2018, pp. 137–138)

2.3 The S&P 500 Index

As the S&P 500 is discussed in many of the previous literature about the effects of index investing on market efficiency it's important to examine it more directly to better understand what it is, its economic significance and what are the criteria for a stock to be included.

The S&P 500 is an index that includes the 500 biggest U.S. equities based on their market cap and those 500 leading companies take up roughly 80% of available market capitalization (S&P Global). The index was originally created by the Standard Statistic Company in 1923 and at the time it consisted of only 233 companies and in 1941 the company merged with Poor's Publishing and on March 4, 1957, the index was expanded to include 500 companies (S&P Global; Reuters).

For a firms' stock to be eligible to be included in the S&P 500, the firm must be domiciled in the U.S., it must have a market cap of $22.7 billion or more, and it must be listed on at least on of the following U.S. exchanges: NYSE, NYSE Arca, NYSE American, Nasdaq

Global Select Market, Nasdaq Global Market, Nasdaq Capital Market, Cboe BZX, Cboe BYX, Cboe EDGA or Cboe EDGX. (S&P Global, pp. 7–8)

The S&P 500 is regarded as the giant among indexes as there are $7.1 trillion of assets invested in index funds that are based on it and an additional $8.5 trillion worth of assets that are using it as a benchmark as of 31 December 2021. The S&P 500 is widely used as a benchmark by active fund managers together with hedge fund managers, who may also react to changes in the index the same way as an index fund. (Arnott et al., 2023, p. 77)

Since the S&P 500 uses the cap-weighted method it's subject to mechanically over-weighting more expensive stocks and underweighting cheaper stocks it can be tied to the problems discussed in chapter 4.1 (Arnott et al., 2023, p. 93). Additionally, the re-balancing schedule is public which is important for chapter 4.2 as the chapter discussed the effects of rebalancing of the index (S&P Global, p. 17).

2.4 Scale and Current Market Share

According to Chinco and Sammon (2024, p. 1) the market share of index funds has grown significantly throughout the years. More specifically, in 2000 index funds had a combined value of $0.4t in assets under management (AUM) which was roughly 3% of the U.S. stock market, however by 2021 the AUM of index funds had reached $7.2t which was 16% of the U.S. stock market at the time. These figures however represent the U.S. equity index mutual funds and exchange-traded funds and are not the only form of passive investing. When other forms of passive investing such as "internal indexing", "direct indexing" and "closet indexing" are considered, passive investors tracking five popular indexes would have owned 33.5% of the U.S. stock market, which can be seen on Figure 1. "Internal indexing" is a practice done by institutional investors and it is essentially managing an index-tracking portfolio for themselves. "Direct indexing" is investing through a separately managed index-like account, and finally "closet indexing" is done by active

fund managers that “secretly” track an index when managing their fund. (Chinco & Sammon, 2024, p. 1)

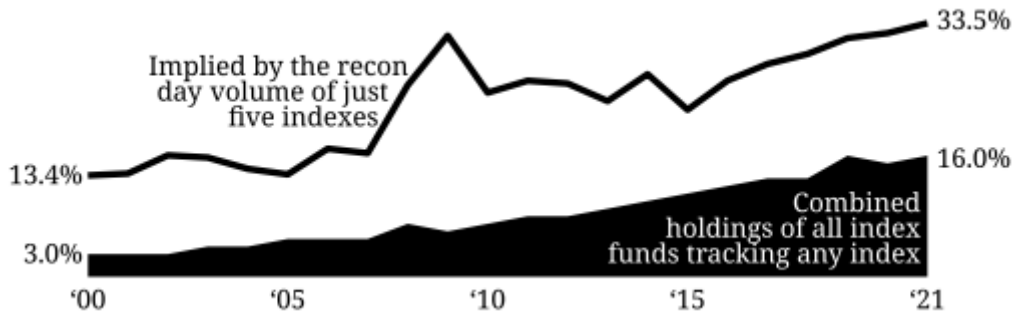

Figure 1. Index fund and other index investing ownership percentage of the U.S. stock market. (Chinco & Sammon, 2024, p.3)

The growth that passive investing has gained has been at the expense of the active management industry that has had significant outflows in investments. The shift from active to passive investing is a phenomenon that can be seen globally. The shift from active to passive investing has been partly caused by active managers underperforming when compared to passive funds who on top of better performance have lower costs associated with them. The market efficiency hypothesis has also played a part in the shift as according to it active investing can’t beat the market consistently, raising questions about the role of actively picking securities. (Anadu et al., 2020, pp. 24–25)

2.5 Big Three

The passive index fund industry is dominated by the “Big Three” which are Blackrock, Vanguard and State Street. The reason why they are called the big three is because they together are the largest shareholder in 88% of the firms in the S&P 500. Since the Big Three manage passive index funds they must follow index weights making them have permanent ownership positions, thus giving them relatively more influence than any other investor group in those 88% of S&P 500 firms. (Fichtner et al., 2017, pp. 322–323)

The asset management industry has seen increased concentration which the shift from active to passive investing has contributed to. As of December 2019, the Big Three made up of the 37% market share of all mutual fund and ETF managers (actively or passively managed). The reason for this stems from the fact that larger asset managers can spread their fixed costs over a larger asset base, making them a more competitive choice with their lower fees. The increased concentration has raised a concern on financial stability since an idiosyncratic event could lead to investors redeeming their investments from these big asset managers which would affect the whole asset management industry. (Anadu et al., 2020, pp. 31–32)

As permanent shareholders the Big Three have acquired significant voting power in the firms whose shares they own. The concentrated voting power has been acquired and held through their passive investing strategy. While active investors might sell their share when they expect future losses, passive managers must keep their investments even if they expect degrading performance as long as the firm stays on the index. (Fichtner et al., 2017, pp. 306, 308)

The concentration within the index fund industry that is seen in the Big Three has strong connections to market efficiency. Since the Big Three have semi-permanent ownership positions in most of the firms in the S&P 500 and they must react to index rebalancing simultaneously, their scale has an influence on the amplitude of the effects such as herding, index inclusion effect and co-movement which are discussed later in chapter 4.

3 Market efficiency theory

To examine the effects of index funds on market efficiency it is important to first understand the definition and theory of efficient markets. This part of the study investigates the efficient market hypothesis (EMH) which is the central part of the theory surrounding efficient markets, the random walk which is an important part of EMH and finally the chapter examines the joint hypothesis problem that comes up when testing market efficiency.

3.1 Efficient market hypothesis (EMH)

The primary role of the capital market is to allocate the economy's capital and for a market to be called "efficient" the prices need to "fully reflect" available information. According to EMH the available information on the markets is incorporated into the prices near instantaneously. EMH assumes that all market participants have access to information without costs and that investors don't face transaction costs while trading. In an efficient market it is impossible for an investor to consistently beat the market because the price would always reflect all available information. There are three different forms of efficiency which are weak form, semi-strong form and strong form. In weak form efficiency the market prices are based on historical prices and follow the random walk model. In semi-strong form efficiency prices are based on all information that is publicly available and that information is incorporated too quickly for investors to be able to beat the market. Finally, in strong form efficiency the prices are based on all information regardless of whether it's private or public, where not even the firms' insiders are able to beat the market consistently since even insider information is already included in the prices. (Fama, 1970, pp. 383–387)

In the context of market efficiency, it's important to distinguish fundamental and nonfundamental information. Fundamental information is information that is tied to the underlying value of the firm, such as earnings, dividends, and broader macroeconomic factors. Nonfundamental information on the other hand is information that is not directly

tied to the underlying value of the asset, such as investor sentiment, trading patterns, or supply and demand shocks without changes in fundamental information. The information that market efficiency is focused on is the fundamental information and the incorporation of it. The incorporation of nonfundamental information goes against the theory of market efficiency.

It's worth highlighting that EMH uses many assumptions such as no transaction costs, all information is available without cost and that all agree on the implications of said information. So, it can be said that EMH with all its assumptions creates a frictionless market that does not describe the real markets. (Fama, 1970, p. 387)

3.2 Three forms of EMH

3.2.1 Weak form

As previously mentioned in weak form efficiency the current prices only reflect all past prices or return sequences, and thus future prices can't be predicted using technical analysis because past prices are not indicative of future prices. Since under weak form efficiency technical analysis can't be used to generate excess returns, a buy and hold strategy should outperform strategies that try to pick stocks. Fama (1970, pp. 390, 395) examines weak form efficiency with empirical evidence from serial correlation tests and filter studies that are in support of the theory that price changes are independent and follow the random walk theory and that technical analysis on historical price data doesn't provide traders with excess returns. (Fama, 1970, pp. 390–396, 414)

The random walk theory is a central part of weak form efficiency. The "random walk" implies that future stock prices can't be predicted using historical information of the stock as they do not follow a predictable pattern which by no means suggests that the markets are chaotic but rather, they react to new information quickly, so recurring patterns don't form. The best tool to use for predicting tomorrow's prices is today's prices where the expected return is considered. The price changes are random in a sense that

markets react near instantaneously to new information and new information tends to be unpredictable. This theory favours passive investment strategies such as index funds which have a target of imitating the market. It also implies that passive investments and time on the market are better alternatives to trying to pick winning stocks or to time the market. (Fama, 1995, pp. 76–79)

3.2.2 Semi-Strong form

Semi-strong form efficiency is the middle ground between weak form and strong form efficiency, where prices reflect all publicly available information, which means investors can't use technical nor fundamental analysis to achieve consistent excess returns. The reason for this is that it is thought that information is incorporated into the prices near instantaneously thus making analysis pointless as the information that would be gained from the analysis would already be reflected in the prices. According to Fama (1970, p. 404) these claims are supported by evidence, however it's limited to a few major types of information generating events, and that the evidence shows that at least sometimes insiders have important information that is not yet available for the public and not reflected in the prices. (Fama, 1970, 408–409)

3.2.3 Strong form

Strong form efficiency is the most extreme of the three forms as in this form all information is reflected in the prices even the information, which is only available to the insiders, which would mean not even insider information can be used to gain consistent excess returns. Fama (1970, pp. 409, 414) states that the strong form is an extreme example of market efficiency, and that there are at least corporate insiders and specialists who have monopolistic access to information. Rather strong form efficiency is better to be considered a benchmark from which to examine the deviations from market efficiency. (Fama, 1970, pp. 409–416)

3.3 Joint hypothesis

Since market efficiency usually can't be tested individually and it needs a model to be tested, there is a joint hypothesis problem where the hypothesis of market efficiency and the model are being tested simultaneously. The implication of the joint hypothesis is that when a test fails, it's not possible to determine if the failure is caused by inefficiency in the markets or by a flawed model, thus it's not possible to confidently prove that markets are inefficient using a model. Since this study examines the effects of index funds on market efficiency and therefore is testing for market efficiency the joint hypothesis problem is important to bring up. (Fama, 1991, pp. 1575–1576)

3.4 Critiques of EMH

One core critique is the previously discussed joint hypothesis problem. It is a core critique since the problem implies that market efficiency is not testable directly (Fama, 1991). Fama (1970, p. 384) brings up that the claim of efficient market prices "fully reflecting" all available information is too general to have empirically testable implications. Since the claim is too general, it requires a clearer definition and one possible definition could be equilibrium prices or expected returns which rely on theoretical models and assumptions that are not reflective of real market conditions (Fama, 1970, p. 384).

Shleifer and Vishny (1997, p. 42) show in their study that mispricing can appear on the market even with rational investors due to the traders not being able to or being unwilling to correct the mispricing. The inability to correct mispricing comes from capital constraints and the unwillingness from risk aversion (Shleifer & Vishny, 1997, p. 42). Market efficiency relies on arbitrageurs to correct mispricing so the prices can reflect the information, and since arbitrageurs are unable or unwilling to correct mispricing, it would imply that the markets aren't fully efficient. This critique of EMH is particularly important for this study as it can be linked to passive investing which much like market efficiency relies on active arbitrageurs to correct mispricing in the market.

Grossman and Stiglitz (1980) argue that the existence of informationally efficient markets is impossible, and they propose a model to prove their point. The model considers two types of investors: uninformed investors and informed investors. The informed investors pay to acquire information on the true value of an asset while the uninformed investors get their information from the price itself hence avoiding the cost of information. If the markets were efficient then uninformed investors could gather all the information that they need from the prices, which would mean there wouldn't be a reason for informed investors to pay for information. If there is no reason for paying to acquire information, then no rational informed investors would do so and if informed investors don't acquire information, then the prices can't contain information either. Thus, the model can't have a solution of prices being efficient or inefficient, rather it implies that the markets are somewhere between complete efficiency and inefficiency where informed investors can still gain an edge over uninformed investors. (Grossman & Stiglitz, 1980, pp. 393–395)

4 The effects of index funds on market efficiency

According to Qin and Singal (2015, p. 900) the indexed investment sector had at the time grown to account for more than 7% of the total equity market and more than 29% of the U.S. equity mutual fund sector due to index funds and indexed investing being promoted by academics and practitioners for the last 50 years. While the benefits of index trading are considerable, index trading poses negative effects for other market participants and the economy by making stock prices less efficient. This is caused by the fact that passive investors don't produce information and contribute to market efficiency in the same way as active investors do. The reduced price efficiency that indexing imposes is most likely caused by the reduced information that comes with passive investing. Sushko and Turner (2018, p. 119) add to this by mentioning that passive investors are essentially free-riding as passive investing wouldn't be possible without active investors who devote resources to acquire information. This claim is in line with the theory established by Grossman and Stiglitz (1980, pp. 393-395) which implies that informationally efficient markets aren't possible, since prices fully reflecting all available information would make acquiring information on the prices redundant. The growth of passive investing reduces the fraction of active investors, which moves the markets away from the partial efficiency described by Grossman and Stiglitz (1980, pp. 393-395). It can also be argued that indexed investors can reduce the incentive for informed investors to arbitrage thus indirectly lowering price efficiency. Passive indexing can also cause investors to herd which is known to reduce market efficiency by increasing their prices away from the fundamental prices. (Qin & Singal, 2015, pp. 899–900)

4.1 Mispricing

The growth of passive funds has led to a situation where the prices of the economy's largest firms have risen disproportionately. According to the theory created by Jiang et al. (2025, p. 3462) passive investing reduces the financing costs of the largest firms and skews the size distribution of the firms because larger firms have lower financing costs. This also makes larger firms' stock prices more sensitive to demand shocks, since in-

creased demand proportional to the firms' market capitalisation causes their stock prices to increase the most. They also show using their model that this is a separate phenomenon from the index inclusion effect. The model also showcases that idiosyncratic volatility of larger firms is increased more by passive flows compared to smaller firms. Moreover, the theory and model are consistent with the largest firms in the S&P 500 index where this increase in prices and idiosyncratic volatility can be seen. (Jiang et al., 2025, p. 3494)

Jaquart et al. (2023, p. 27) find in their simulation study that a high proportion of passive investment can lead to failure of the market and create technical pricing bubbles, impairing fundamental market efficiency. In standard market settings there is lower relative fundamental price deviation when the proportion of active investors is higher. In a market setting where there are no active investors on average the market prices deviate from the fundamental prices by 55.17 percent and in a market setting where there are no passive investors the market prices deviate from the fundamental prices by 25.86 percent, as seen in Figure 2. (Jaquart et al., 2023, pp. 16–17)

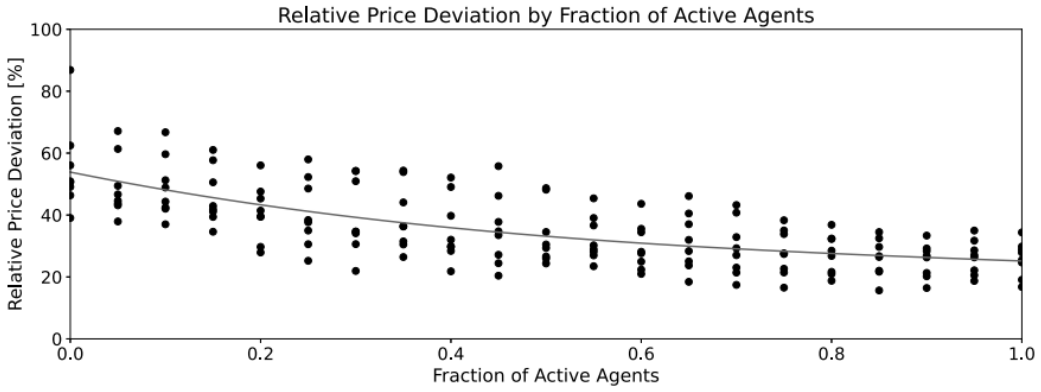

Figure 2. Fundamental price deviation by fraction of active investors in a standard setting. (Jaquart et al., 2023, p. 16)

The mispricing caused by passive investing remaining uncorrected is due to the key reason of weak arbitrage forces. Wurgler and Zhuravskaya (2002, p. 584) explain that stocks don't have perfect substitutes which implies that arbitrageurs aren't able to benefit from

the mispricing without taking on arbitrage risk. This means that risk-averse arbitrageurs aren't able to lock in risk-free profits using a perfect substitute and correct the mispricing caused by passive investing. Thus, arbitrageurs' inability to correct mispricing is directly related to the theory by Shleifer and Vishny (1997) discussed in chapter 3.4 that explains why the mispricing isn't corrected. The reason is that it's too risky for rational arbitrageurs rather than the mispricing being unnoticed.

4.2 Index inclusion effect

Lakonishok et al. (1992, p. 1) define herding as money managers buying or selling the same stock as other managers at the same time. While Lakonishok et al. (1992) talk about herding that is caused by behavioural reasons such as trend chasing, the herding mechanism behind index investing is purely structural. The herding done by index fund managers is caused by stocks being added and dropped from an index which the index fund managers need to react to this rebalancing by buying or selling at the same time as other index fund managers that are tracking the same index. This synchronised trading caused by the herding mechanism can drive prices away from the fundamental prices (Qin & Singal, 2015, pp. 899–900).

The most significant effects that this structural herding causes are the supply and demand shocks, which then result in price shocks that occur when a stock is added or deleted from an index. Wurgler and Zhuravskaya (2002, p. 591) state that when a stock is added to an index it faces significant demand shock caused by index funds who are trying to buy the stock as soon as possible after the index inclusion to avoid any tracking errors. Harris and Gurel (1986, p. 821) find that on average the price of stocks rise on average by roughly 3% on the first day after being added to the S&P 500 index. Additionally, Harris and Gurel (1986, p. 828) state that it's unlikely that the addition of a stock to the S&P 500 indicates any new information but it still increases the demand for the stock thus increasing its price. Wurgler and Zhuravskaya (2002, p. 596) add to these findings by demonstrating that the severity of the price shock depends on the availability of a close substitute for the examined stock. The stocks that don't have close substitutes see higher

price shocks at the time of inclusion to an index (Wurgler & Zhuravskaya, 2002, p. 596). According to EMH the prices should be reflective of information but in this case, there isn't new information, but the price still changes, indicating a direct violation of market efficiency.

Greenwood and Sammon (2025, pp. 665–667, 695–696) find that while still present the abnormal returns of a stock that is added to the S&P 500 index have decreased throughout the years. In their study they calculate the cumulative abnormal returns for stocks affected by S&P 500 additions and deletions from 1980 to 2020. Their study examines the abnormal returns over three different windows: around the index inclusion announcement date, around the date the index inclusion becomes effective, and the total period from index inclusion announcement to it becoming effective. All windows show the same downward trend of the index inclusion effect, which can be seen in Figure 3. This suggests that due to the regular and repeated nature of the effect the markets have adapted over time to minimize the index inclusion effect. Additional reasons as to why the index inclusion effect is less severe are the market's improved ability to provide liquidity to the index changes, and the increased predictability of the index changes. The studies regarding the index inclusion effect are summarised in Table 1.

Figure 3. Average index effect by year. (Greenwood & Sammon, 2025, p. 667)

Table 1. Summary of studies on the index inclusion effect.

Study	Sample	Focus	Method	Key Findings
Harris & Gurel (1986)	S&P 500 additions (1978-1983)	Price pressures	Event study	Stock prices rise without new fundamental information
Wurgler & Zhuravskaya (2002)	S&P 500 additions (September 22, 1976 - September 30, 1989)	Supply and demand effects	Event study	Stock prices without close substitutes experience larger price impacts
Greenwood & Sammon (2025)	S&P 500 additions (1980-2020)	Evolution of the index inclusion effect	Analysis of cumulative abnormal returns	Index inclusion effect has weakened over time

4.3 Underreaction to fundamental information

According to Morck and Yavuz (2023, pp. 12, 27) stocks that are included in the S&P 500 index do not react to idiosyncratic shocks as much as stocks outside of the index, while also finding that the stocks included in the index react to relevant idiosyncratic information by half compared to the stocks outside of the index. The findings indicate that the information is not incorporated into the prices with a delay, rather the effect is permanent and is damped. Furthermore, they state that this underreaction of stock prices grows with total indexed investments, which would imply that informational efficiency is reduced by growing index investing. Importantly the underreaction effect is negligible before 1990 when indexing levels weren't significant, which further supports that increased indexing reduces informational efficiency. The tests where the underreaction effect can be observed were not only done with foreign currency shocks but also idiosyncratic commodity price shocks and both showcased similar signs of underreaction to fundamental information, indicating that the effect is not only present in specific scenarios.

The cause behind the underreaction lies in the nature of passive investing, as passive investors don't analyse firm-specific information and only hold assets according to an index, regardless of firm performance or exterior shocks that influence the firm. Active investors are the ones gathering information and incorporating that information into the prices, and passive investors are free-riding on active investors' efforts (Morck & Yavuz, 2023, p. 1). Along with the growing share of passive investors, there are fewer active investors to carry out the incorporation of information into asset prices, which is in line with the model and theory predicted by Grossman and Stiglitz (1980) that claims that markets become less efficient when there are fewer informed investors taking part in those markets.

In theory mispricing caused by passive investing could be corrected by arbitrageurs, but due to the limits of arbitrage the correction isn't happening. Shleifer and Vishny (1997, pp. 35-37) show how textbook arbitrage that doesn't have capital requirements and has

no risk, doesn't represent realistic arbitrage. Arbitrage has capital requirements and is risky, and arbitrageurs who manage other investors' money can have their investors withdraw due to performance issues when mispricing is at its greatest and the arbitrage is expected to pay off. Further proof that arbitrageurs aren't willing to identify and correct mispricing based on fundamental information comes from evidence that shows only a small fraction of investors analyse publicly available fundamental information. Loughran and McDonald (2017, p. 232) find that investors request the annual report of the average publicly traded firm only 28.4 times per day on the day of the filing, which shows how there is a lack of investors willing to gather and analyse firm specific fundamental information. Thus, the findings by Morck and Yavuz (2023) of underreaction to fundamental information and impaired price discovery are reinforced.

4.4 Volatility and co-movement

According to Sullivan and Xiong (2012, pp. 70–71) the growth in index trading has led to increased and converged betas in equity which increases the systematic market risk. The increased trading commonality among index constituents then allows a rise in systematic fluctuations in overall demand, which have a fundamental impact on the overall market and investors' portfolios. The growth in index trading popularity has decreased investors' ability to diversify risk by holding otherwise a well-diversified U.S. equity portfolio. (Sullivan & Xiong, 2012, pp. 82–83)

Barberis et al. (2005, p. 312) have similar findings in their study that examines co-movements through additions to the S&P 500. The findings indicate that a stock's inclusion to the index increases its beta while the exact opposite effect can be seen on stocks that are deleted from the index. They also find that the stock prices of index members have increased correlation creating so-called co-movements where a stock's price could increase or decrease without any fundamental changes.

Figure 4 shows the co-movement and trading activity related effects when a stock is added to an index. The graphs show data from 462 stocks that were added to the S&P

500 from January 2000 to September 2017. The left graph shows how the correlation of a stock between other stocks in the S&P 500 is affected when it's added to the index, giving a visual aspect to the evidence of increased co-movement. The middle graph shows how the daily trading volume abruptly increases after index inclusion which is in line with the demand shocks and structural herding discussed in previous chapters. The right graph shows how the bid-ask spread tightens after the index inclusion, hinting at improved liquidity, which is a positive effect to slightly balance the negative effects. Most importantly Figure 4 highlights the increased correlation between stock prices that indicates a deviation from market efficiency. (Sushko & Turner, 2018, p. 120)

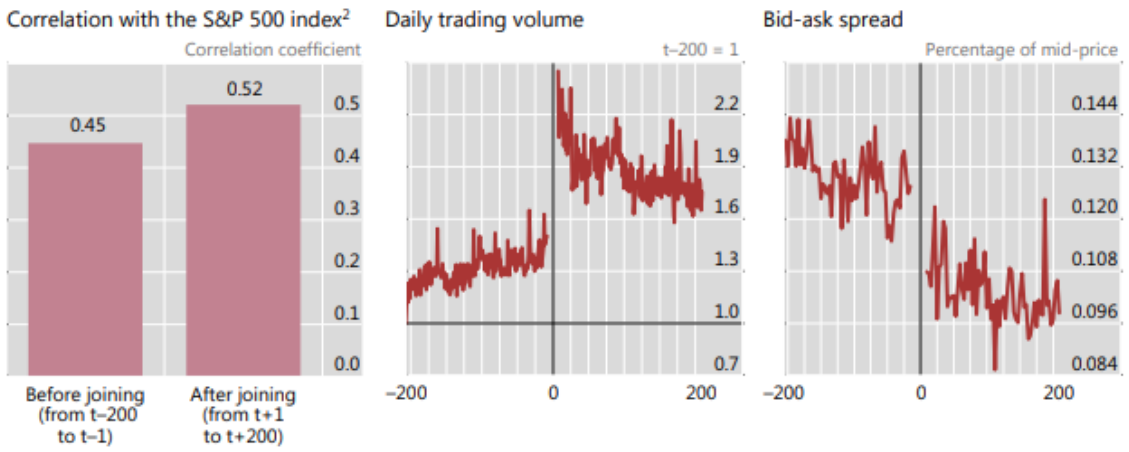

Figure 4. Correlation, Daily trading volume and Bid-ask spread of stock before and after index inclusion. (Sushko & Turner, 2018, p. 120)

The mechanism that is causing the increased co-movement and volatility among stocks included is the portfolio-wide trading behaviour of passive investors. Sushko and Turner (2018, pp. 119–120) explain the mechanism by describing the trading behaviour of passive fund managers who react to their fund inflows and outflows by buying or selling the entire basket of index constituents, which then creates correlated price changes for all stocks included in the index. The mechanism is structural, and the reason it happens isn't due to changes in fundamental information of the stock but because the mechanisms of index funds themselves require them to trade the entire basket of index constituents at the same time according to inflows or outflows of the fund. However, Anadu et al. (2020,

p. 34) bring up the mixed evidence across previous literature on whether the increased passive investing has increased co-movement. Some studies find correlation between increased co-movement and increased passive indexing while others find no evidence of the trend. Despite mixed evidence on if increased passive indexing further amplifies co-movement, the structural mechanism explained by Sushko and Turner (2018, pp. 119–120) has solid proof of occurring, thus making stock prices move without new firm specific information.

When co-movement among stock prices happens, and a stock that hasn't had any changes in fundamental information sees a price change that is caused by price movements of other stocks in an index, that price change violates the core idea of market efficiency of all information being incorporated into the prices. Table 2 summarises each mechanism, key finding, and implication from this and the previous subchapters.

Table 2. Summary of key findings and implications of each mechanism.

Mechanism	**Key findings**	**Implications**
Mispricing	Passive investing overvalues larger firms disproportionately, which arbitrageurs can't correct due to lack of perfect substitutes.	Prices deviate from fundamental values.
Index inclusion effect	Stock prices experience a demand shock upon index inclusion causing a price shock. The effect has declined over time.	Stock prices react to non-fundamental demand, creating price distortions.
Underreaction to fundamental information	Indexed stocks react to idiosyncratic information by half, and the effect grows with the scale of passive investing.	The incorporation of fundamental information to indexed stocks is impaired.
Volatility and co-movement	Index inclusion increases correlation with other stocks in the index.	Portfolio-wide trading related to passive investing creates non-fundamental correlated price movements among indexed stocks.

5 Economic implications

For capital to be allocated efficiently, investments need to be directed towards sectors that are expected to generate high returns and directed away from sectors that are expected to perform poorly. Countries that most efficiently allocate capital are the countries that best incorporate information into the stock prices. Wurgler (2000, pp. 209–210) finds that more efficient capital allocation can be seen in countries with more efficient markets. Countries with smaller and less developed financial markets are worse at allocating capital towards the right investments than countries with larger and well-developed financial systems. (Wurgler, 2000, pp. 188, 209–210)

Mechanisms discussed in the previous chapters which reduce informational efficiency through passive investing directly affects the efficiency of capital allocation. As briefly mentioned before Jiang et al. (2025, p. 3462) find that size distribution of firms is skewed towards larger firms due to passive investing, showing that capital is being misallocated toward firms that are already overvalued. As discussed in chapter 4.3, Morck and Yavuz (2023) show that increased passive investing does reduce the information incorporated into stock prices which then makes corporate resource allocation less efficient.

The consequences of less efficient capital allocation are not limited to the returns of investors, rather they include implications for the whole economy. When inefficient stock prices impair the efficient allocation of capital economic growth and productivity is affected negatively (Wurgler, 2000, p. 190). Capital markets are a vital part for any economy, and their primary function is to allocate capital to where it’s needed. This chapter has discussed how the reduced market efficiency caused by increased passive investing poses a risk to that function, which implies that there is a link that goes beyond the financial markets, affecting the broader economy.

6 Conclusion

This study has examined the effects that the growth of index funds has had on market efficiency, focusing on the U.S. stock market and the S&P 500. With a review of existing literature on the topic, the study examined five recognised effects and mechanisms which affect market efficiency and are caused by passive investing. Mispricing, herding, the index inclusion effect, underreaction to fundamental information, and volatility and co-movement have all been shown to be a caused by passive investing, which were examined alongside implications on capital allocation efficiency to assess whether the hypotheses of the study are supported by evidence.

The evidence found from previous literature extensively supports both hypotheses. H1 of index investing reducing market efficiency has support across multiple pieces of literature providing consistent evidence on multiple mechanisms and effects. The evidence shows that passive investing causes stock prices to be mispriced and size distribution of firms to be skewed toward larger firms, while the structural nature of passive investing causes structural herding which creates price shocks around index additions and deletions without fundamental information changes. Stocks included in an index have been shown to underreact to fundamental information by half when compared to stocks outside the index. Together these findings imply that index investing does indeed lead to deviations from market efficiency. The evidence is also supportive of H2, where increased index investing amplifies the effects, but it comes with some nuance. Morck and Yavuz (2023, pp. 12, 27) show that before 1990 when index investing wasn't as common the underreaction to fundamental information was negligible, and that the underreaction became more severe with increased index investing, which implies a link between increased index investing and reduced market efficiency. However, as discussed in the co-movement chapter the evidence is mixed on whether there is correlation between increased index investing and stock price co-movements. Some effects show that increased index investing does reduce market efficiency even further while others don't show relation, hence H2 is supported, though with some nuance. The consequences of these effects are not limited to just reducing the efficiency of the markets, since the re-

duced market efficiency has implications for capital allocation efficiency, the fundamental function of capital markets is impaired as they aren't able to direct capital where it's needed. The findings in this study have implications for both passive and active investors and arbitrageurs. Passive investors need to be aware of the free-rider problem as there are fewer active investors doing the work of price discovery that passive investing relies on. Since mispricing persists in the markets, active investors and arbitrageurs with enough capital might be able to identify and exploit them, but it's unlikely due to the limits of arbitrage. Active investors could however try to predict index rebalances and place their investments in stocks that are likely to be added to the S&P 500 for example since its rebalancing schedule is public.

From the findings of the study, a few topics emerge for future research. As several studies support passive investing reducing market efficiency and the correlation with said reduction and the scale of passive investing, literature is yet to establish whether there is a threshold for the scale of passive investing where the market efficiency is impaired critically. Since passive investing seems to continue its growing trajectory research for this topic could be important, to establish whether such a threshold exists or if it has been passed already. Finally, as the study focused on the S&P 500 and the U.S. stock market, comparative studies on other markets could provide insight whether the effects are similar across markets of varying quality.

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Appendix

Use of AI in the thesis

Anthropic. (2026). Claude Sonnet 4.6 (February 17, 2026 version). Claude has been used for proofreading and language editing, in the role of correcting grammar mistakes and making the text more fluent.