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– SUMMARY –

THE IMPACT OF S&P 500 RESTRUCTURING ON STOCK MARKET PERFORMANCE AND STOCK PRICE INFORMATIVENESS

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TABLE OF CONTENTS

INTRODUCTION **1**
CHAPTER 1 – PORTFOLIO MANAGEMENT. THEORY AND PRACTICAL APPLICATION **7**
1.1. Strategies and instruments 9
1.1.1. Portfolio management methods and strategies 10
1.1.1.1. Active management 11
1.1.1.2. Passive management 18
1.1.1.3. Active vs passive portfolio management 23
1.1.2. Portfolio management and the allocation policy 26
1.1.2.1. Strategic allocation 27
1.1.2.2. Tactical allocation 33
1.1.2.3. Stock selection 36
1.2. Investment univers. Classification and characteristics. 37
1.2.1. Classification of traditional investments 39
1.2.1.1. Stocks 39
1.2.1.2. Bonds 40
1.2.1.3. Cash and cash equivalent 41
1.2.1.4. Financial derivatives 41
1.2.2. Alternative investments and financial investment vechicles 42
1.3. Stock market equilibrium 44
1.3.1. Efficient Market Hypothesis 44
1.3.2. Capital Asset Pricing Model (CAPM) 57
1.3.3. Arbitrage Pricing Theory (APT) 63
1.4. Evalutation of portfolio performance 66
1.4.1. The persistence of performance 66
1.4.2. Measures of portfolio performance 68
CHAPTER 2 – STOCK MARKET INDICES **77**
2.1. Functions 78
2.1.1. Indices as gauges for market sentiment 78
2.1.2. Indices as proxies for measuring and modelling returns, systematic risk, and risk-adjusted performance 80
2.1.3. Indices as proxies for asset classes in asset allocation models 82
2.1.4. Indices as benchmarks for actively managed portfolios 83
2.1.5. Indices as model portfolios for other investment producs 85
2.2. Classification 87
2.2.1. Equity indices 87
2.2.1.1. Broad market indices 87

2.2.1.2. Multi-market indices 88
2.2.1.3. Sector Indices 91
2.2.1.4. Style Indices 92
2.2.2. Fixed-income indices 93
2.2.3. Indices for alternative investments 94
2.3. Index construction 96
2.3.1. Index return 96
2.3.2. Security selection 97
2.3.3. Index weighting 98
2.3.3.1. Price weighted indices 98
2.3.2.2. Equal weighted indices 99
2.3.3.2. Market-capitalization weighted indices 100
2.3.3.3. Float-adjusted market-capitalization weighted indices 102
2.3.3.4. Fundamentally weighted indices 103
2.3.4. Index rebalancing and reconstitution 104
2.4. Critiques 107
CHAPTER 3 – THE IMPACT OF INDEX RECONSTITUTION ON STOCK PERFORMANCE 109
3.1. Introduction 109
3.2. Theories used to describe the addition and deletion effect on stock prices 112
3.2.1. Demand-based theories 112
3.2.1.1. Imperfect substitute hypothesis (downward sloping demand curve hypothesis) 112
3.2.1.2. Price pressure hypothesis 114
3.2.2. Information-based theories 115
3.2.2.1. Investor awareness hypothesis 115
3.2.2.2. Selection criteria hypothesis 116
3.2.2.3. Information hypothesis 117
3.2.2.4. Liquidity hypothesis 118
3.3. The impact of S&P 500 reconstitution upon the stock maket performance of the affected companies 120
3.3.1. The S&P 500 restructuring process and the working sample 120
3.3.2. Understanding the abnormal returns caused by the changes in S&P 500 124
3.3.2.1. The effect of stock addition on stock market performance 125
3.3.2.2. The effect of stock deletion on stock market performance 127
3.3.3. Hypothesis used to explain the abnormal return generation around index restructuring 131
3.3.3.1. Proxies used 131
3.3.3.2. Understanding variables' dynamic for the additions' sample 135
3.3.3.3. Understanding variables' dynamic for the deletions' sample 137
3.3.4. Main results 138

3.3.4.1. Additions 139
3.3.4.2. Deletions 156
3.4. Conclusions 162
CHAPTER 4 – THE IMPACT OF S&P 500 AFFILIATION ON STOCK PRICE INFORMATIVENESS 165
4.1. Introduction 165
4.2. Methodology and sample 167
4.2.1. The sample 167
4.2.2. The data 167
4.2.3. The methodology 168
4.3. Investigating the impact of index restructuring on price informativeness of stocks included in the S&P 500 index 170
4.3.1. Test for the randomeness of stock price changes 172
4.3.2. Price non-synchronicity and the company specific risk 178
4.3.3. Partial adjustement model by Amihud și Mendelson (1987) 179
4.4. The determinants of stock price informativeness 183
4.4.1. The determinants of informational efficienty dynamics in stock prices 183
4.4.1.1. Firm level factors 184
4.4.1.2. Market level factors 187
4.5. Empirical findings 191
4.5.1. Full sample results 192
4.5.1.1. Event window [t+1, t+260] vs estimation window [t-260, t-1] 192
4.5.1.2. Event window [t+31, t+260] vs estimation window [t-260, t-31] 193
4.5.1.3. Event window [t-30, t+30] vs estimation window [t-260, t-31] 198
4.5.2. Results for the pre-2000 sample 200
4.5.2.1. Event window [t+1, t+260] vs estimation window [t-260, t-1] 201
4.5.2.2. Event window [t+31, t+260] vs estimation window [t-260, t-31] 202
4.5.2.3. Event window [t-30, t+30] vs estimation window [t-260, t-31] 204
4.5.3. Main results for the post-2000 sample 205
4.6. Conclusions 209
CONCLUDING REMARKS AND FUTURE RESEARCH DIRECTIONS 211
REFERENCES 215
APENDIX 229

INTRODUCTION

The restructuring of the S&P 500 index presents arbitrage opportunities that result in substantial annual losses for passive investors, amounting to billions of dollars. However, the introduction of new regulations aimed at enhancing stock market transparency and reducing information asymmetry between informed and noisy traders can mitigate these losses. By improving the informational environment, these regulations contribute to increasing the efficiency of the stock market and minimizing the negative effects index restructuring has on passive investors.

Our analysis focuses on S&P 500 reconstitution events spanning 26 years, revealing a positive impact on stock performance. We measure stock performance through abnormal returns, calculated as the alpha coefficient using the market model, and validate our findings using the extended market and industry model, as well as the Fama-French 3 factor model. The study uncovers significant disparities in stock price behavior before and after the reconstitution event, highlighting a pronounced asymmetry between additions and deletions from the index. On average, daily abnormal returns amount to 0.2 percentage points for additions and 1.6 percentage points for deletions. Furthermore, these abnormal returns persist over a 30-day trading window, confirming the presence of an index anomaly.

Our study incorporates proxy estimators for stock liquidity and investor awareness, focusing on the changing nature of abnormal return determinants around index reconstruction events. Our findings highlight divergent investor perceptions of index additions and deletions. For additions, increased trading volumes correspond to higher abnormal returns. This can be attributed to a larger number of analysts following the stock after the addition announcement, increasing investor awareness, and potentially driving up demand. Conversely, deletions experience a negative impact on the value creation process due to higher trading volumes. The decision to retain excluded stocks may be perceived as a signal of trust in the companies' future performance, despite the S&P committee's decision.

The addition of a stock to the S&P 500 index results in reduced price informativeness. This is primarily due to the increased co-movement between the stock and the index, leading to a noisier price-discovery process. However, the negative effects can be mitigated by changes in the informational environment, such as the adoption of new regulations aimed at enhancing informational transparency. These regulatory measures help improve market conditions and

reduce the impact of index reconstruction on price discovery. Before the 2000s, the addition of stocks to the S&P 500 index was associated with an increase in price informativeness driven by higher liquidity. However, with the adoption of the Regulation Fair Disclosure and the Sarbanes-Oxley Act in the early 2000s, along with the proliferation of algorithmic trading, the role of liquidity in the price discovery process diminished. Instead, new determinants such as investor awareness and market uncertainty became more prominent. As Peter Bernstein aptly stated, the majority opinion has the power to generate significant momentum, which can sustain a market movement in the same direction. This underscores the influence of prevailing market sentiment on driving and perpetuating price trends.

This paper focuses on examining the impact of the S&P committee's decisions on stock performance. We analyze how changes in the informational environment influence the price discovery process. Additionally, we investigate whether variations in price informativeness can be attributed to changes in investor awareness. By exploring these aspects, we aim to enhance our understanding of the relationship between the S&P committee's decisions, the information environment, and stock market dynamics.

The motivation behind this research is to understand the impact of external events, specifically index restructuring, on the dynamics of the price discovery process and how information is incorporated into stock prices. Despite existing research, there is a lack of consensus in the literature regarding the informational content of the S&P committee's announcement.We acknowledge the arguments presented by proponents of demand-based theories, which posit that the S&P committee's announcement contains no new information and is based solely on public information already embedded in stock prices well before the committee's announcement. Conversely, supporters of information-based theories provide evidence favoring the informational content of the announcement. They argue the inclusion or exclusion of a company can be perceived as a market-wide signal that the company became a sector leader, indicating the presence of valuable information in the announcement. Given these conflicting perspectives, our research aims to contribute to the ongoing discussion on the informational content of the S&P committee's announcement.

The objective of this research is to gain insights into the dynamics of the stock market's evolution by examining the changes that occur in the processes of value creation and price discovery in response to the restructuring of the S&P 500 index. To achieve this, we investigate the extent to which the the index restructuring event affects companies' ability to generate abnormal returns un- explained by conventional market models, such as the market model or the

three-factor model proposed by Fama and French (1992). Additionally, we analyze how it impacts the ability of stock prices to incorporate all relevant information. Overall, our research aims to provide a comprehensive understanding of the implications of the S&P 500 index restructuring on value creation and price discovery.

The research methodology encompasses various elements, including a thorough literature review and the application of empirical methods to validate the research hypotheses. Drawing upon the two primary theories (demand and information based) concerning the source of the index anomaly, we establish our working hypotheses, which are subsequently tested empirically. To achieve this, we employ a combination of individual stock-level regressions to calculate abnormal returns, conduct event study analysis to identify any changes in variables of interest around the event date, utilize multiple regressions, and employ difference-in-differences analysis to capture the underlying factors influencing the value creation process and the price discovery process. To ensure the robustness of our results, we subject them to rigorous robustness tests. Throughout the various stages of data processing and model estimation, we leverage statistical software such as eViews and Stata, as well as programming languages such as R and Python. By employing these research methodologies, we aim to provide a comprehensive analysis and empirical evidence to support our findings and contribute to the understanding of the dynamics of the stock market and the impact of index restructuring.

The originality of this paper lies in several key aspects. Firstly, it identifies and examines the changes in the price discovery process that occur as a result of increased transparency in the informational environment. By focusing on the impact of index restructuring and the subsequent changes in the informational content of stock prices, the paper sheds light on the evolving dynamics of the price discovery process. Secondly, the paper uses a set of proxy measures for assessing the informational efficiency of stock prices. These measures are specifically designed to capture and analyze the changes in the informational content of stock prices following their inclusion in the S&P 500 index. Lastly, the paper proposes new factors that contribute to describing the price discovery process in the post-2000 period. By considering the evolving market landscape and the impact of increased transparency, the paper offers novel insights into the factors that drive the price discovery process and contribute to the overall understanding of the stock market dynamics. Through these original contributions, the paper offers valuable perspectives on the relationship between index restructuring, the informational environment, and the price discovery process, contributing to the existing body of knowledge in the field.

The thesis is structured in a way that establishes a comprehensive framework to underscore the significance and relevance of the empirical studies conducted in the subsequent sections of the paper.

Chapter 1 of the thesis provides a comprehensive overview of portfolio management, covering various aspects such as methods, strategies, and their evolution over time. The chapter begins with a theoretical definition of portfolio management, highlighting its key principles and objectives. The chapter emphasizes the close relationship between the portfolio management process and the equilibrium on the stock market. It explores how portfolio management aims to optimize the risk-return trade-off by carefully selecting and allocating assets within a portfolio. The theoretical foundations of portfolio management, including modern portfolio theory and the Capital Asset Pricing Model (CAPM), are discussed to provide a solid understanding of the principles guiding portfolio construction. To illustrate the practical application of portfolio management, the chapter presents examples related to performance persistence and performance evaluation methods for portfolio managers. This discussion serves as a theoretical basis for conducting the event study analysis within the empirical study.

Chapter 2 focuses on the role of stock indices in modern portfolio theory, providing a detailed exploration of their functions and characteristics. The chapter begins by introducing the concept of stock indices and their significance in the financial markets. The chapter delves into the typology of stock indices, highlighting the various categories such as broad market indices, sector indices, and multi-market indices. It discusses the rationale behind the construction of these indices and the factors considered in their selection and weighting methodologies. The chapter also provides insights into the calculation methods employed to compute stock index values. The primary objective of this chapter is to create a suitable framework for analyzing the index anomaly.

Chapter 3 of the thesis focuses on the first empirical study, which investigates the impact of the index restructuring event on the companies directly affected by it. The chapter begins by presenting the construction of the sample used in the study, outlining the criteria and methodology for selecting the companies included in the analysis. The chapter also introduces the dependent variables used. Using an event study approach, the chapter demonstrates the presence of an asymmetric effect for companies added to and deleted from the S&P 500 index. To further validate the hypotheses, we employ a collection of alternative measures that capture different dimensions of stock liquidity and investor awareness. This approach allows for a comprehensive understanding of the multifaceted effects of index restructuring. The results of the study indicate that short-term abnormal returns are primarily driven by increased liquidity resulting from the

heightened demand for newly included securities or the surplus of excluded securities. The findings suggest that S&P 500 index restructurings have a positive temporary effect on the value creation process. However, the lack of an objective and transparent index reconstruction methodology can create arbitrage opportunities that result in value destruction for passive investors. This highlights the importance of developing a more transparent and consistent methodology for index reconstruction to avoid negative consequences.

Chapter 4 of the thesis focuses on the second empirical study, which examines the impact of the index reconstruction event on the informational content of the included securities. The chapter begins by presenting the hypotheses put forth by proponents of information-based theories, which suggest that the inclusion in the S&P 500 index leads to changes in the information content of related securities' prices. To test these hypotheses, we calculate six different measures that are designed to capture the randomness of securities analyzed and assess changes in their information content. These measures provide insights into the extent to which the inclusion in the S&P 500 index affects the informational efficiency of stock prices. The analysis conducted allows for a comprehensive understanding of the dynamics of the changes that have taken place in the American stock market over time. It particularly emphasizes the impact of the increase in digitalization and transparency on the price discovery process. The findings reveal a shift in the factors that contribute to the informativeness of securities. While twenty years ago, increased liquidity resulting from the release of information about inclusion in the S&P 500 index played a significant role in enhancing informativeness, today, other factors have gained importance. Media sources and information availability have emerged as crucial factors in the price discovery process.

In the final chapter of the thesis, we summarize the main findings and draw overall conclusions based on the results of the empirical studies conducted throughout the research.

SUMMARY OF CHAPTER 1 – PORTFOLIO MANAGEMENT. THEORY AND PRACTICAL APPLICATION

In this chapter, we delve into the management of financial asset portfolios, specifically examining active and passive methods. We break down the distinctions between these approaches and provide a concise overview of their respective advantages and disadvantages. We highlight how each method suits different types of investors based on their risk tolerance and desired returns. Additionally, we emphasize the interplay between active and passive investors, as passive funds rely on active funds for price discovery while active funds benefit from the reduced volatility provided by passive funds. Ultimately, we conclude that passive managers can benefit from efficient stock markets while active managers perceive them as inefficient.

Passive strategies, in contrast to active approaches, aim to replicate the market rather than anticipate its movements through the market-timing skills of active managers. The foundation of passive management lies in stock market efficiency and the rapid price incorporation of new information. Consequently, attempting to outperform the market, which is the objective of active management, becomes irrelevant for proponents of passive management. This investment strategy traces its origins back to the Capital Asset Pricing Model (CAPM). Interestingly, Coles et al. (2022) argue that despite the rise in passive investing leading to a decrease in information generation, the level of price informativeness remains unchanged. This finding suggests that passive investment does not compromise the informational efficiency of the market.

Over the past few decades, a notable disparity has emerged between the ownership and control of financial capital. This trend has been facilitated by scientific advancements that have contributed to the development of modern portfolio theory, the improvement in stock market efficiency, and the growing complexity of financial instruments. As a result, an increasing number of investors have turned to professional portfolio managers for assistance. In this chapter, we examine two primary approaches to portfolio management: bottom-up strategies, which involve analyzing fundamental indicators, and top-down strategies, which focus on macroeconomic indicators. We delve into the portfolio management process and the allocation policy, highlighting the significance of each stage in managing portfolio risk.

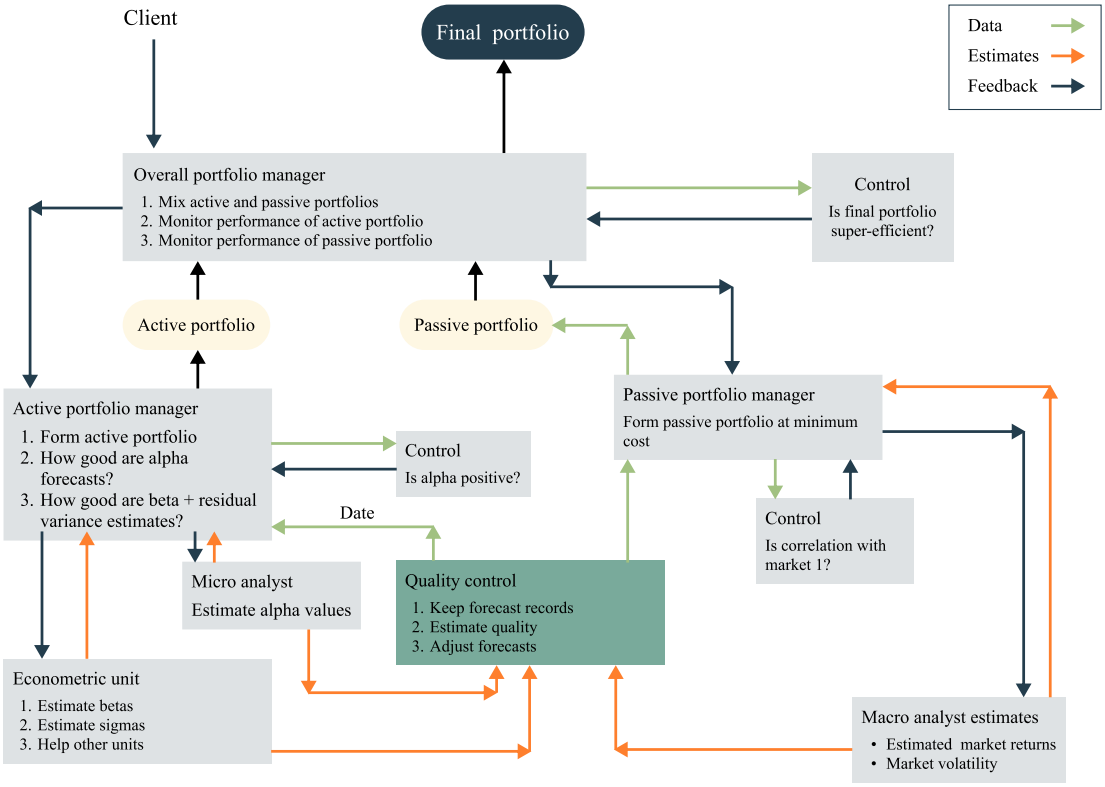
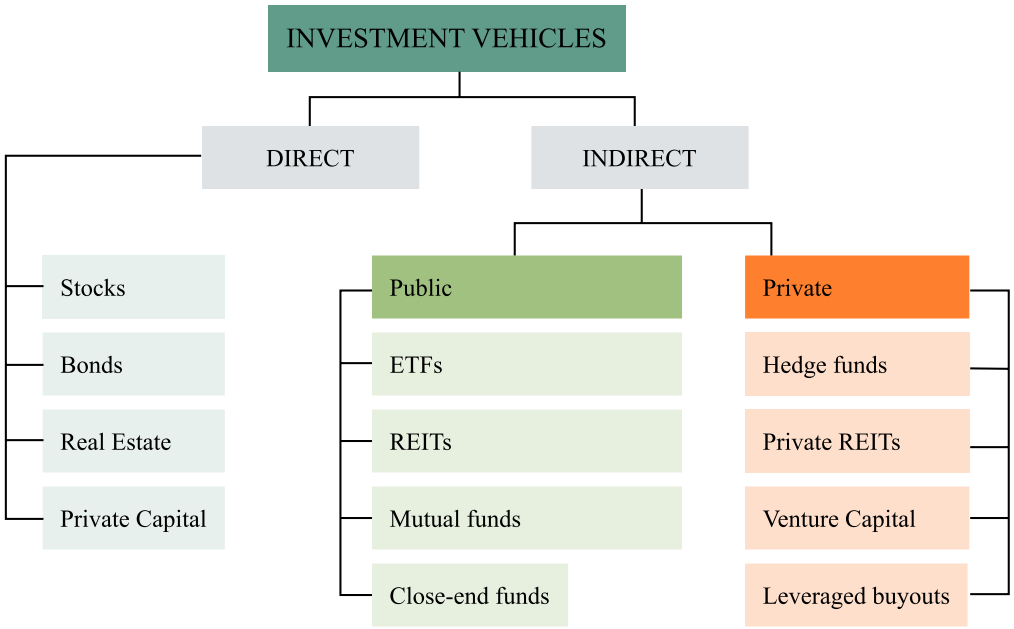


Fig. 1 Organizational chart for portfolio management | Source: Investments (Bodie, Kane, & Marcus, 2021, p. 915)

In *Section 1.2*, we explore the concept of the investment universe. Within the specialized and applied academic literature, various terms such as asset, investment, asset class, investment vehicle, financial intermediary, and investment strategy are used. While these concepts may appear similar, they actually refer to different aspects of the investment process. We demonstrate how investors utilize specific investment vehicles to invest in asset classes and rely on a set of investment strategies to achieve their objectives. Figure 2 provides a visual representation of the classifications of investment vehicles. We emphasize the critical role that understanding asset classes plays in constructing a diversified portfolio. An asset class represents a category of investments that share common characteristics. Each asset class exhibits unique traits and behaves differently based on market conditions. By comprehending the specific characteristics of each asset class and investing in multiple asset classes with a low degree of correlation, investors can mitigate risk and maximize expected long-term returns. Moving forward, we provide a concise description of the most significant direct and indirect investment vehicles to further enhance our understanding of the investment landscape.

Fig. 2 A classification of investment vehicles



In *Section 1.3*, we delve into the concept of stock market equilibrium. We begin by discussing the theoretical aspects of the efficient market hypothesis (EMH), which posits that financial markets efficiently incorporate all available informatio. We also explore stock market anomalies, which are deviations from the efficient markets hypothesis that challenge its assumptions. Within the context of anomalies, we specifically focus on the index anomaly, which will serve as a foundational for the empirical studies conducted in subsequent chapters. We introduce key concepts such as random walk, martingale, sub-martingale, and fair game, highlighting their distinctions and implications within the stock market context. We present two important asset pricing models: the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) model. While both models have their limitations and are based on different assumptions, they both stem from a fundamental concept in modern portfolio theory—the separation of risk into specific risk (related to individual assets) and systematic risk (related to the overall market). By exploring these theoretical foundations, we lay the groundwork for understanding the dynamics of stock market equilibrium and the subsequent empirical analyses.

In *Section 1.4*, we present the topic of portfolio performance associated with portfolio management. The central question addressed in many studies is the persistence of portfolio performance, while the underlying assumption is that in an efficient market it is unlikely to consistently outperform the market in the long run. We reference several influential studies conducted by Porter and Trifts (1998), Cuthbertson et al. (2008), Cornell (2009), Barras et al.

(2010), Liu (2018), Brown and Goetzmann (1995), Bhootra et al. (2015), and Cuthbertson et al. (2022). These studies collectively suggest that past performance is not a reliable predictor of future performance. The studies reviewed highlight the challenges in consistently generating superior returns and emphasize the difficulty in identifying reliable patterns or strategies for consistently outperforming the market. By examining these findings, we contribute to the understanding that the ability to predict future performance based on past performance is limited, supporting the notion that efficient market dynamics make it challenging for investors to consistently achieve above-average returns over time. Furthermore, we focus on portfolio performance evaluation methods. We discuss risk-adjusted performance measures such as the Sharpe ratio, M2, Treynor's measure, Jensen's alpha, information ratio, Morningstar risk-adjusted rating, and market timing measures. These measures provide insights into the risk-adjusted returns and skill of portfolio managers. We emphasize the importance of selecting an appropriate benchmark to avoid misinterpretation of results.

SUMMARY OF CHAPTER 2 – STOCK INDICES

In this chapter, we provide an overview of stock indices. Stock indices are commonly used to track the performance of a specific group of assets, such as stocks or bonds, and serve as benchmarks for comparing portfolio or investment instrument performance. We briefly discuss the historical development of stock indices and highlight their significance in the development of stock markets.

In Section 2.1, we discuss the functions of stock indices. We explore how market participants utilize indices as indicators of market sentiment. We emphasize the importance of proxies in measuring and modeling returns, risk, and risk-adjusted performance for investors, underscoring the need for selecting the appropriate proxy for accurate valuation. We distinguish between the asset class benchmark function and the proxy function, where the former guides capital allocation decisions and identifies investment opportunities, while the latter aids in evaluating the performance of existing investments. Additionally, we highlight how indices serve as supporting assets for constructing investment vehicles, facilitating the development of new investment strategies and enhancing transparency and consistency in performance measurement and evaluation.

Indices have a crucial role in modeling and analyzing the performance of asset classes. The extensive historical data provided by indices enables investors to make well-informed decisions regarding portfolio allocations. While the proxy function focuses on measuring and modeling risk-adjusted performance for individual managers and evaluating their performance, the benchmark function of asset classes looks ahead and assists in portfolio planning and decision-making regarding the overall portfolio structure. By utilizing indices, investors can effectively assess the past performance of individual managers and construct portfolios with a future-oriented perspective.

In *Section 2.2*, we examine the classification of indices that exist today, which aids in comprehending their role and facilitates navigation within the index universe. Based on the type of assets included in the index universe, we can categorize indices into three main classes: (a) stock indices, (b) bond indices, and (c) alternative instrument indices. This classification allows for a clearer understanding of the different types of indices and their respective purposes.

Defining an index is a lot like creating a portfolio. The index provider must choose (1) the market or the sector that will become the investment universe, (2) select the assets, (3) define the weights associated to each asset, (4) decide a rebalancing and a reconstitution schedule. In *Section 2.3*, we compare indices based on their calculation methods and weight determination, providing several examples. We also discuss the significance of index rebalancing and reconstruction. Rebalancing involves periodically adjusting the weights of assets in the index basket to maintain their initial proportions, while index reconstruction is akin to changing the composition of a portfolio. Reconstruction entails making decisions about which assets should be included or replaced in the index. We delve into the importance of selection criteria and establish a theoretical framework for future empirical studies. Finally, in *Section 2.4*, we address criticisms directed at stock indices.

SUMMARY OF CHAPTER 3 – EFECTELE RECONSTRUCȚIEI INDICIALE ASUPRA PERFORMANȚEI COMPANIILOR

In this chapter, our focus is on investigating the index anomaly, which refers to the occurrence of abnormal returns and/or abnormal volumes following the inclusion or exclusion of stocks from an index. Specifically, we analyze the impact of S&P 500 reconstruction on stock prices, both in the short term (during the event window) and in the longer term (one year after the event). To conduct our analysis, we gather data on 622 index restructuring events that took place over a 26-year period. These events occurred on an ad hoc basis, and we aim to understand the dynamics of the effects triggered by these restructuring events on the securities directly affected by them. Through our research, we aim to provide an alternative explanation for the observed asymmetry in the effects recorded on the samples of added and deleted stocks.

The methodology employed involves a comprehensive analysis of individual securities affected by the index restructuring events. To calculate abnormal returns, we use various regression models such as the market model, the market and industry model, and the Fama-French three-factor model. Additionally, event analysis techniques are employed to capture the changes occurring around the event day. Multifactor regressions are conducted to identify the determinants of abnormal returns over two estimation windows. Furthermore, difference-in-differences analysis is employed to investigate the extent to which changes in stock liquidity and investor awareness contribute to value creation during the event window. Our research findings complement the existing literature, focusing on index restructuring events that span from January 1994 to December 2019. We observe significant positive abnormal returns around the inclusion events, which aligns with the price pressure hypothesis proposed by previous studies (Chen, Noroha, & Singal, 2004; Arnott & Vincent, 1986; Harris & Gurel, 1986; Kappou, Brooks, & Ward, 2008). However, in the case of index deletions, we observe abnormal returns that are eight times higher than those for additions and exhibit a persistent nature, which differs from the findings of other studies. One plausible explanation for this discrepancy is the presence of survivorship bias and the subjective nature of stock selection criteria.

We also identify an asymmetry in the information environment between the pre-event period for additions and the post-event period for deletions. Although both situations involve companies that are not affiliated with the S&P 500 index, abnormal returns for future additions can be attributed to a reduction in illiquidity and lower trading costs. On the other hand, abnormal

returns for companies that have been excluded from the index are influenced by an increase in associated illiquidity. A similar pattern is observed during the event windows, where the change in abnormal returns for inclusions is driven by an increase in liquidity, as captured by turnover. This suggests an escalation in price pressures resulting from heightened demand from index funds. In contrast, abnormal returns for exclusions decrease due to a surge in trading volume caused by a significant supply of securities, potentially driven by institutional investors selling their holdings.

By highlighting these dynamics and exploring the factors influencing abnormal returns during index restructuring events, our study contributes valuable insights to the existing literature. We provide empirical evidence that supports the price pressure hypothesis, emphasizes the impact of liquidity, and unveils the asymmetrical nature of the information environment. These findings enhance our understanding of the index anomaly and offer valuable implications for market participants and investors.

In *Section 3.2* we provide a comprehensive classification of theories that aim to explain the impact of index additions and deletions. We begin by discussing demand-based theories, including *the imperfect substitute hypothesis* (Shleifer, 1986; Wurgler și Zhuravskaia, 2002; Jain, 1987; Erwin și Miller, 1998; Chen și alții, 2004; Biktimirov și Li, 2014) also called the downward sloping demand curve hypothesis. The imperfect substitute hypothesis suggests that changing index affiliation will have a permanent effect on prices and *the price pressure hypothesis (*Scholes, 1972; Harris și Gurel, 1986; Lamoreux și Wansley, 1987; Lynch și Mendelhalll, 1997; Edmister și Graham, 1994; Beneish și Whaley, 1996; Blume și Edelen, 2004; Chackrabarti și alții, 2005, Chen și alții, 2006). We then delve into information-based theories, which propose that index restructuring events carry significant information. One such theory is the *investor awareness hypothesis* (Merton, 1987; Denis și Alții, 2003; Chen și alții, 2004; Becker-Blease și Paul, 2010), which suggests that including companies in an index can increase investor awareness. Another theory is *the selection criteria hypothesis* (Edmeister și alții, 1994; Bechmann, 2004; Edmeister și alții, 1996; Petajisto, 2008), which argues that the index anomaly is influenced by the transparency or lack thereof in the selection criteria. The *information hypothesi*s (Jain, 1987; Denis și alții, 2003; Cai, 2007; Platikanova, 2008; Gygaxx și Otchere, 2010) is another perspective within this classification, positing that the decision to include a company in the index conveys information about its future performance. Finally, we discuss the *liquidity hypothesis* (Amihud și Mendelson, 1986; Chen și alții, 2004; Liu, 2011; Hedge și McDermott, 2003; Backer-Clease și Paul, 2006; Lin, 2010), which suggests that the inclusion of a company in the index leads to increased stock liquidity and subsequent price increases. By presenting and discussing these various theories, we

provide a comprehensive overview of the different explanations put forth in the literature regarding the index anomaly. This classification enhances our understanding of the underlying mechanisms driving the impact of index additions and deletions, providing valuable insights for investors, researchers, and market participants. We point out that there has been more attention to studying and confirming/disproving hypotheses regarding the impact of index additions compared to that of exclusions. Most research has focused on analyzing the effects of stock inclusion in the index, while the study of stock exclusion events has received relatively less attention. This asymmetry in the literature highlights the need for further investigation and empirical studies to better understand the implications and consequences of index exclusions.

In Section 3.3, we provide a detailed description of the S&P 500 restructuring process, highlighting its ad hoc nature and the selection criteria employed by the S&P committee. We then proceed to present our sample, discussing the analysis horizon and the filters applied to obtain the working sample. The variables were collected using Datastream and Eikon extensions provided by Refinitiv, as well as the database provided by Prof. Kenneth French.

Our sample consists of 522 index inclusions and 117 exclusions from the S&P 500 that occurred between 1994 and 2019. Following the definition of the external event (day of inclusion/exclusion from the S&P 500 index), we perform an event study analysis similar to the approaches used by Harris and Gurel (1986), Shleifer (1986), and Chen et al. (2004). Our study is closely related to the works of Chen et al. (2004), Becker-Blease and Paul (2006), Liu (2011), Baran and King (2012), and Chan et al. (2013), who also examine the impact of restructuring events on security prices. To estimate expected returns, we use the market model. To ensure cross-validity, we also use the extended market and industry model as well as the three-factor model proposed by Fama and French (1992). Two pre- and post-event estimation windows are employed, with a six-week buffer zone to allow index funds to readjust. The graphical representatio of the two estimation windows is presented in Figure 3. For robustness, we validate all results using a second set of windows starting after a readjustment period of 101 trading days.

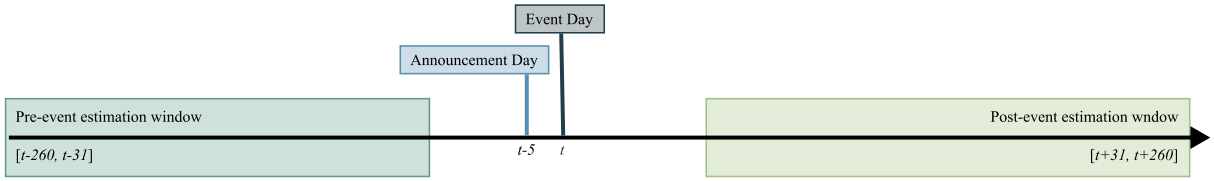


Fig. 3 Estimation windows (1)

Next, we calculate abnormal returns as the alpha coefficients from the models used for expected return estimation. The windows related to the calculation of average abnormal returns and cumulative average abnormal returns are defined based on the approach of Chakrabarti et al. (2005). The graphical representation of these windows can be seen in Figure 4.

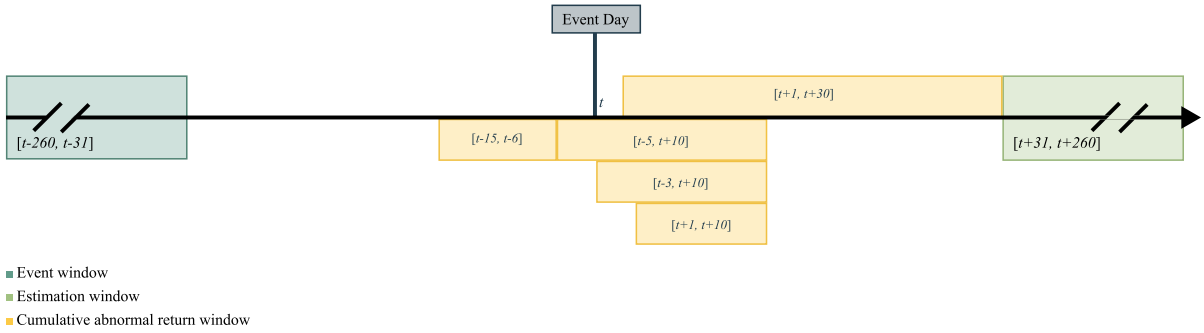


Fig. 4 Estimation windows (2)

We subsecvently present the results for index additions and index deletions. For inclusions, we observe significantly positive cumulative abnormal returns starting 15 days before the event, indicating investor anticipation prior to the actual event. Abnormal returns of about 0.2% are recorded on the announcement day (t-5), and interestingly, the abnormal return the day before the announcement is even higher and statistically significant, indicating the presence of speculative pressures. For the sample of index exclusions, the average abnormal returns on the exclusion day amount to 1.61%. The cumulative abnormal returns for the window including up to 10 days after the index reconstruction reach approximately 3.00% and continue to increase even after t+30 days following the exclusion. We attribute this dynamic to the construction method of the deletions sample, which tends to be susceptible to survivorship bias. The absence of statistically significant negative cumulative abnormal returns for exclusions suggests that the downward-sloping demand curve hypothesis does not hold for the S&P 500 during the period under review. This finding supports the notion that the drivers of value creation for index inclusions are not necessarily the same (or even opposite) for exclusions.

In the subsequent analysis, we test hypotheses regarding the determinants of abnormal returns, specifically the liquidity hypothesis and the investor awareness hypothesis. We employ a range of proxy measures for both hypotheses, capturing different aspects, along with control variables. We conduct separate analyses for the pre-event and post-event estimation windows and use a difference-in-differences approach to assess the changes between the two. We observe asymmetric behavior between index inclusions and exclusions. Companies included in the index

exhibit positive abnormal returns starting approximately 15 days before the restructuring, while companies being excluded experience negative cumulative abnormal returns. However, on the actual event day, both inclusions and exclusions register positive abnormal returns, with the returns for exclusions being higher. This pattern is maintained over a ~30-day window. Regarding the event windows for index inclusions, the abnormal returns are explained by an increase in liquidity captured by the Turnover measure. This result suggests an increase in price pressures due to heightened demand from index funds, supporting the short-term downward-sloping demand curve hypothesis. In contrast, for exclusions, the increase in trading volume leads to a decrease in abnormal returns due to the large supply of securities resulting from institutional investors selling their holdings.

In addition to the observed differences in abnormal returns, our analysis reveals contrasting information environments between the pre-event window for index additions and the post-event estimation windows for index deletions. Both situations involve companies that are not affiliated with the S&P 500 index. However, in the case of additions, the abnormal returns can be attributed to increased liquidity and decreased trading costs, indicating improved market conditions for these companies. On the other hand, for deletions, abnormal returns are characterized by an increase in associated illiquidity, suggesting a deterioration in market conditions for the excluded companies.

Examining the impact of the shadow cost, which serves as a proxy for testing the investor awareness hypothesis, we find that it does not significantly affect the abnormal returns for companies included in the index. However, for the excluded companies, the shadow cost has a negative impact, leading to larger price drops for well-known companies. This implies that investor awareness plays a role in the valuation of securities undergoing index restructuring.

Our analysis suggests that S&P 500 restructurings have a negative effect on the value creation process for the affected securities. The specific manner in which these restructurings take place creates arbitrage opportunities, which, when exploited, result in value destruction for ordinary investors. Chen et al. (2006) have demonstrated that these costs can reach several billion dollars per year.

SUMMARY OF CHAPTER 4 – IMPACTUL AFILIERII CU INDICELE S&P 500 ASUPRA INFORMATIVITĂȚII PREȚURILOR

This study aims to explore the influence of the S&P committee's decision to include a company in the S&P 500 index on price informativeness. While it is commonly believed that the index restructuring event for the S&P 500 index does not convey new information, recent research by Li et al. (2021) challenges this notion. Their study, titled "Is Stock Index Membership for Sale?", states that the S&P committee's decisions are not transparent and can indeed carry information. Even Shleifer (1986) acknowledged that index additions can capture analysts and investors' attention, thereby increasing the volume of public information available in the market. We posit that heightened investor attention, coupled with other external events such as media publications or social media posts, can influence investors' purchasing decisions, particularly among retail investors (Sicherman, Loewenstein, Seppi, & Utkus, 2015). This increased investor attention and potential amplification of information can enhance stock liquidity, subsequently leading to higher price informativeness.

In our study, we sought to address two key questions related to the impact of the S&P committee's decision to include a company in the index and its effect on the information content of stock prices, as well as the factors that determine this change: (1)To what extent does the S&P committee's decision to include a company in the index influence the information content of its stock prices? (2)What factors contribute to the change in price informativeness?

In Section 4.2 of the study, we provide an overview of the methodology employed and describe the data sample used. The analysis covers the period from January 1994 to December 2019, focusing specifically on the sample of companies that were included in the S&P 500 during this time that meet the eligibility criteria imposed. In regard to the information content, the addition announcement can be interpreted in two ways. Firstly, it can be viewed as a market-wide signal from the S&P 500 committee, akin to that of an analyst, expressing optimism about the prospects of the company (Jain, 1987; Denis et al., 2003). This perspective suggests that the committee's decision carries valuable information and influences market participants' expectations regarding the company's performance. Alternatively, the committee's decision can be seen as a short-term reorganization signal when viewed through the lens of the S&P 500 inclusion and exclusion methodology. In this context, the market perceives the committee's decision as an indication of changes in the composition of the index, which may have implications for investment strategies, index-related trading activities, and short-term market dynamics.

We designate the actual day of inclusion as the event day and notice that using the announcement day instead does not yield significantly different results. This is likely because our sample encompasses a 26-year period and includes various inclusion events, making it heterogeneous in nature. To ensure the robustness of our findings, we employ a second set of estimation windows, labeled as F2, which consists of two long-term windows: [t-260, t-31] and [t+31, t+260], a pre- and post-inclusion buffer of six weeks allows us to control for passive fund reconstructions. Additionally, we use a 12-week window, [t-30, t+30], centered around the event day, to capture changes in price informativeness resulting from speculative actions by market participants, as well as increased demand stemming from the restructuring of passive funds. By incorporating these different windows, we aim to capture both the short-term and long-term effects of inclusion events, taking into account market anticipation, index fund restructuring, and speculative behaviors. To aid in visualizing the various windows employed in our analysis, we provided a graphical representation in Figure 5, which showcases the two pairs of long-term windows and the short-term window. This visualization helps to illustrate the temporal scope of our analysis and the specific periods considered for assessing changes in price informativeness.

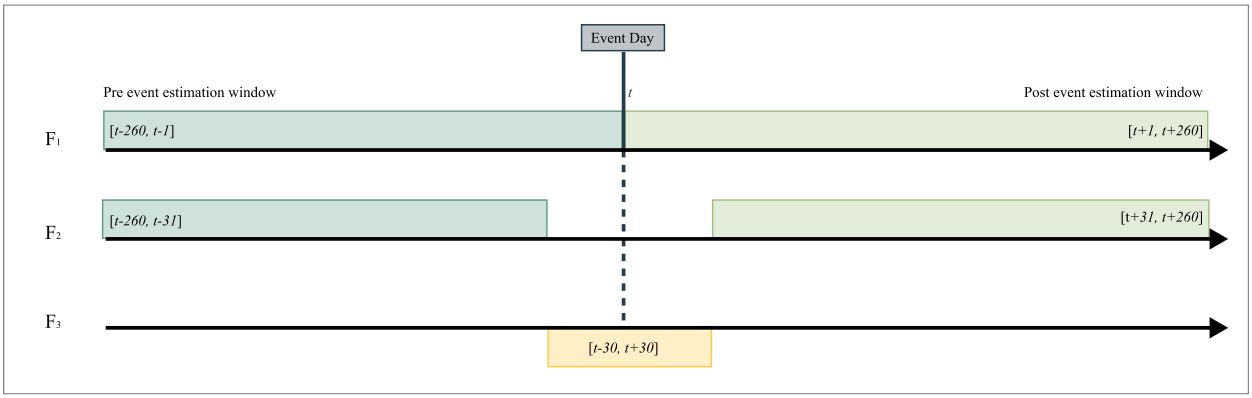


Fig. 5 Estimation windows (3)

In Section 4.4, we delve into investigating the impact of S&P 500 index affiliation on price informativeness. To assess the randomness of stock price movements and evaluate price efficiency, we employed several tests. These tests include the abnormal runs test (Fama, 1965), the first-order autocorrelation test (Fama, 1965), the Wald-Wolfowitz abnormal runs test, price non-synchronicity (Roll, 1988), and the partial adjustment model proposed by Amihud and Mendelson (1987). However, the results were not conclusive. The abnormal runs test suggested an improvement in efficiency over the F2 window, indicating a more random and unpredictable pattern in stock price movements. Yet, for the same sample and the same period, we observed an increase in inefficiency based on the Wald-Wolfowitz test and the price inefficiency measure proposed by Amihud and Mendelson (1987).

The lack of consistency highlights the heterogeneous nature of our sample and underscores that the chosen measures capture different facets of price informativeness. It is worth noting that the abnormal runs test assumes that the analyzed dataset is independently and identically distributed and generated by a random walk process. If these assumptions are not met, it may lead to misinterpretation of the results. The contrasting outcomes highlight the complexity of assessing price informativeness.

We follow with a the classification of determinants of price informativeness at the company level, including factors such as liquidity, volatility, specific risk, and fundamental characteristics of the company. We also consider determinants at the market level, such as the information environment and investor awareness. We focus on examining the changes that occur in these variables between the estimation windows outlined in Figure 5.

To assess the extent to which changes in these factors contribute to changes in price informativeness proxies, we employ a difference-in-differences analysis in *Section 4.5*. This analysis allows us to compare the changes in price informativeness between two estimation windows capturing the effects of both the potential determinants and the control variables. In addition to the determinants of price informativeness, we include a set of control variables. These control variables include the age of the company at the time of index addition, the industry to which the company belongs, and the size of the company. By controlling for these factors, we can better isolate the effects of the variables of interest and gain a clearer understanding of their impact on price informativeness. By conducting this analysis, we aim to uncover the factors that drive changes in price informativeness following S&P 500 index affiliation. By considering both company-specific and market-level factors, as well as controlling for relevant variables, we can provide a comprehensive assessment of the determinants of price informativeness in the context of index restructuring.

In the concluding section of Chapter 4, we summarize the key findings of our analysis. We notice that, in the long run, increasing illiquidity and firm-specific risk have a negative influence on the price discovery process. This suggests that as liquidity decreases and firm-specific risk increases, the market becomes less efficient in incorporating the new information. However, we fail to find evidence to support Shleifer's (1986) hypothesis that an increase in the number of analysts leads to a positive diffusion of information and an improved price informativeness.

For the short window surrounding index addition, we find that increased illiquidity, as captured by both the Amihud and the Turnover measures, has a positive effect on price efficiency.

This implies that right around addition companies with lower liquidity levels benefit from a more accurate market valuation. The reduction abnormal returns, as indicated Wald-Wolfowitz test, suggests that the market adjusts more quickly and accurately to new information for these illiquid firms. These findings highlight the complex relationship between liquidity, risk, and price informativeness within the context of index restructuring. While long-term effects point to a negative impact of illiquidity and firm-specific risk on price information incorporation, the short-term dynamics demonstrate a beneficial effect of increased illiquidity on price efficiency during the event window.

In the case of additions to the S&P 500 that occurred before the introduction of Regulation Fair Disclosure, decimal pricing, and the Sarbanes-Oxley Act, an increase in stock illiquidity resulted in lower price informativeness over longer estimation windows. Specifically, more illiquid companies that were added to the index tended to have their prices incorrectly valued to a greater extent. Notwithstanding, prior to the dot-com bubble, larger and more mature companies experienced a more efficient price discovery process, suggesting that their stock prices were more accurately reflective of their underlying fundamentals.

Taking into account the new stock market realities, such as increased informational efficiency, faster dissemination of information, and easier access to digital resources and social media, it is evident that the explanatory factors used in the pre-2000 period are insufficient to describe the changes in price informativeness observed in the post-2000 sample. After 2000, company-specific risk and investor uncertainty emerge as crucial factors in the process of post-addition price discovery. Higher levels of specific risk and/or increased investor uncertainty result in greater price inefficiency, while increased investor awareness, as indicated by the number of shareholders and Google searches of the company's RIC code, enhances price informativeness.

These findings imply that alongside the overall reduction in information asymmetry over the past two decades, there have been notable shifts in how stock prices respond to new information. With the decreasing time required for research, and information flow, the Internet and information technologies have assumed a more significant role in the price discovery process. Additionally, liquidity, which is now primarily driven by algorithmic trading, no longer contributes as extensively to the price discovery process.

CONCLUDING REMARKS AND FUTURE RESEARCH DIRECTIONS

The index anomaly has captivated the attention of researchers. It revolves around the intriguing phenomenon of abnormal returns and abnormal trading volumes exhibited by companies included in the S&P 500 index. This anomaly has spurred a surge of studies exploring various hypotheses to unravel the underlying causes. Liquidity (Amihud & Mendelson, 1986; Chen, Noroha, & Singal, 2004; Liu, 2011), selection criteria (Edmeister & Graham, 1994; Bechmann, 2004; Petajisto, 2008), and investor awareness investitor (Merton, 1987; Denis, McConnell, Ovtchinnikov, & Yu, 2003; Chen, Noroha, & Singal, 2004) have emerged as key factors that contribute to the creation of excess value during external index restructuring events. With a growing body of research, the quest to understand the index anomaly continues to fascinate scholars and investors alike.

This study sheds light on the dynamic nature of the stock market, emphasizing the shifting dynamics in the factors that contribute to the generation of abnormal returns and the price discovery process. Through empirical analysis, we observe how these factors undergo continuous change. Notably, our findings indicate that variables related to investor uncertainty (sentiment), measured through media searches, have gained significance in the process of price assimilation and the accurate valuation of securities, particularly since the year 2000. This phenomenon is closely correlated with the growing digitization and enhanced transparency of the analyzed stock market, signifying the influence of technological advancements on market dynamics.

Our findings reveal interesting dynamics in the short-term and long-term reactions to index exclusions and inclusions. We observe a significant positive reaction for index exclusions, with daily abnormal returns approximately eight times higher compared to inclusions. However, over the longer period, we observe a price reversal for inclusions, indicating the dissipation of abnormal returns and suggesting efficient assimilation of new information by the market. These findings provide support for the Semi-Strong form of the Efficient Market Hypothesis (EMH). In the case of exclusions, companies that remain actively traded one year after the event experience post-event abnormal positive returns. These returns can be attributed to factors such as illiquidity and increased investor awareness. The asymmetric nature of investor awareness is one possible explanation for the observed asymmetry between inclusions and exclusions. Additionally, survivorship bias strongly manifests among the sample of excluded companies. The likelihood of superior performance and efficient management is higher for companies that continue to be listed despite the negative external event.

To ensure the robustness of our conclusions, we employed various measures for abnormal return, liquidity, and investor awareness, as well as additional control variables and dummy variables. Non-parametric tests were also conducted to test the equality of means between different observation windows. These robustness tests confirmed our findings. Furthermore, our analysis reveals an asymmetric effect of liquidity and investor awareness on index additions and deletions. The impact of index deletions is more pronounced, particularly in terms of investor awareness. The decision to add a company may go unnoticed among retail investors, who view the newly affiliated company as a new player in the market. In contrast, the exclusion event may exacerbate any existing negative results for the company, leading to a more significant decrease in abnormal returns when liquidity increases. Overall, our study provides insights into the dynamics of index exclusions and inclusions, shedding light on the role of liquidity, investor awareness, and market efficiency.

Our analysis of the price discovery process reveals a significant shift in the informational environment after the year 2000. This shift can be attributed to various factors, including the adoption of regulations aimed at increasing stock market transparency and improving the quality of public reporting. These regulatory efforts have contributed to enhancing the efficiency of the stock market. Specifically, we find that changes in the price informativeness of companies added to the S&P 500 before 2000 can be partly explained by variations in liquidity. However, post-2000, we observe that the increase in price informativeness is primarily driven by changes in investor awareness levels and investor uncertainty. This suggests that the importance of mass media has significantly increased in influencing the price discovery process. The rise in investor awareness and the impact of media on price discovery highlight the evolving dynamics of information dissemination in today's financial markets. Investors are increasingly relying on media sources for market-related information, making media coverage an important determinant of the price discovery process. Overall, our findings emphasize the importance of market transparency, investor awareness, and media impact in shaping the price discovery process, particularly in the post-2000 period. These insights contribute to a deeper understanding of the evolving informational landscape and its implications for market efficiency.

In our study, we employ multiple measures of price informativeness to capture different aspects and nuances of this concept. We recognize that each measure may offer unique insights and be more suitable for isolating specific effects within their respective contexts. By adopting this approach, we ensure a comprehensive analysis that accounts for the multidimensionality of

price informativeness. To ensure the validity and reliability of our findings, we have taken several steps to address potential biases and confirm the robustness of our results. Firstly, we have limited the number of variables included in the analysis, thereby reducing the risk of spurious correlations or overfitting. This approach allows us to focus on the key factors and avoid unnecessary complexity. Additionally, we have provided a thorough argumentation for the inclusion of control variables, carefully justifying their relevance and contribution to the research framework. This ensures that our analysis remains focused and transparent, enabling a more accurate interpretation of the relationship under investigation. Furthermore, we have conducted sensitivity analyses by employing alternative measures for liquidity and investor awareness. This serves as a robustness check, verifying the consistency and stability of our results across different metrics. By demonstrating the robustness of our findings under various scenarios, we enhance the credibility and reliability of our conclusions. By implementing these methodological strategies, we minimize the susceptibility to biases such as p-hacking and enhance the transparency and integrity of our study. This allows us to provide a more rigorous analysis of the relationship between price informativeness, liquidity, and investor awareness, thus contributing to the overall strength of our research findings.

While the empirical approaches used throughout this thesis provide valuable insights, it is important to acknowledge their limitations. One such limitation is the potential bias introduced by the use end-of-day data, which may conceal certain price inefficiencies. Recent studies have highlighted the advantages of incorporating intraday data in price informativeness studies. To address this limitation, future research could replicate our study using intraday data for the sample of post-2000 additions. By employing intraday measures, authors could capture more granular and timely information, thus gaining a more accurate understanding of price inefficiencies and their underlying dynamics. This could to uncover additional insights that might be missed when relying solely on end-of-day adjustments.

We acknowledge the presence of survivorship bias in our sample of index deletions. The exclusion of companies from an index may be associated with negative performance or other unfavorable factors, which can lead to a biased representation of the overall impact of index exclusions. Therefore, caution must be exercised when interpreting the results.To address this limitation, future research could adopt a more comprehensive approach by considering a broader range of companies that were excluded from the index, including those that did not "survive" in the market. By including a wider spectrum of excluded companies, we can obtain a more complete understanding of the effects of index exclusions on performance and other relevant factors.

Additionally, expanding the study to incorporate alternative measures of investor sentiment, such as sentiment analysis of social media posts (e.g., Twitter sentiment), news sentiment, or sentiment extracted from annual performance reports, could provide valuable insights into the role of investor sentiment around the index anomaly. These additional measures can enrich our understanding of the market dynamics surrounding index exclusions and provide a more comprehensive analysis of the impact of investor sentiment on post-exclusion performance.

This thesis makes a contribution to the ongoing debate on the index anomaly by shedding light on the factors influencing value creation and price discovery processes. Our findings provide empirical support for the price pressure hypothesis, the liquidity hypothesis, and the informativeness hypothesis, emphasizing the significance of changes in the information environment, liquidity, and company-specific risk.

As for future research directions, there are numerous avenues worth exploring. One important aspect to consider is the impact of index restructuring events on price informativeness, particularly in light of the evolving informational landscape and the increasing accessibility of the Internet. Given the potential implications of index restructuring events and the information they convey, it is crucial to be vigilant regarding the quality and reliability of information entering the market. Future research could delve deeper into assessing the effects of speculative behavior and the potential risks associated with low-quality or misleading information.

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