Examining share repurchase executions: insights and synthesis from the existing literature

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This literature review aims to address the critical knowledge gap in the field of share repurchase executions, a financial activity involving companies repurchasing trillions of dollars' worth of their own shares. The significance of understanding these mechanisms and their impact is underscored by their potential influence on the global economy. The paper employs a comprehensive analysis of existing literature, focusing on share repurchase mechanisms and motivations. It scrutinizes both open-market repurchases and Accelerated Share Repurchase contracts. Methodological approaches in current research, such as the use of partial differential equations and tree methods, are also evaluated. The review reveals that the execution phase of share repurchases remains largely unexplored. Unanswered questions persist about trading schedules, implications, costs, broker and corporate performance, and psychological effects of beating a buyback benchmark. Additionally, the review identifies significant limitations in current research methodologies. The paper advocates for the application and development of more advanced tools like machine learning and artificial intelligence to address these gaps. It also suggests potential areas for future research, including the role of technology in share repurchase execution, psychological factors influencing corporate buybacks, and the development of performance metrics for brokers and corporations. The review serves not only to highlight existing gaps in literature but also to suggest avenues for future research that could fundamentally enhance our understanding of share repurchase executions.

JEL classification: G1, G12, G14, G02, G4.

KEYWORDS

share repurchase, buyback contracts, machine learning, neural networks, accelerated share repurchase, corporate governance, algorithmic bias

1. Introduction

Dividends and share buybacks are pivotal mechanisms by which companies return capital to shareholders. As dividends distribute profits directly to investors, share buybacks have grown in popularity as a means of signaling confidence, managing capital structure, and enhancing shareholder value.

In academia, the execution phase of share repurchases remains largely unexplored, despite some contributions like those by Guéant [1–3]. With nearly $950 billion in 2021 and reportedly more than $1.25 trillion in 2022 repurchased across major economies in recent years, the scale of buybacks underscores their strategic importance in the corporate financial arena [4].

However, despite the prevalence and importance of share repurchases, a striking gap exists in the academic literature concerning the execution phase of these buybacks. This phase of share repurchases necessitates a nuanced approach to two pivotal dimensions: daily

volume calibration and program duration. For daily volume, firms must consider market depth, bid-ask spreads, and existing order book dynamics, ensuring they neither flood the market nor underutilize their buyback capacity. This requires a fine-tuned understanding of volume-weighted average price (VWAP) benchmarks and potential intraday volatility. As for the program's duration, firms need to factor in expected market liquidity, macroeconomic indicators, and upcoming corporate announcements. A too-condensed execution could inadvertently inflate the stock price, while an overly prolonged program may signal lack of commitment or dilute the intended signaling effect to the market. Balancing these parameters is paramount to maximize shareholder value and manage potential market impacts.

1.1. Research objectives

As we delve deeper into the realm of share repurchases and their execution phase, our primary objectives revolve around addressing the following research questions:

- **Literature landscape:** what does the existing literature present about share repurchases, and how has the academic discourse evolved over time?
- **Exploring execution's coverage:** Given the significance of the execution phase, to what extent has it been explored in the current literature? What are the primary discussions, findings, and limitations?
- **Unanswered queries on execution:** Within the execution phase of share repurchases, what are the lingering questions, discrepancies, or areas that remain unresolved or underexplored? Why might these areas be critical for both academia and practice?

This review seeks to bridge this gap. Building on a rich tapestry of contributions from finance, economics, corporate governance, behavioral science, and data science, we endeavor to offer an exhaustive synthesis of literature on share repurchase execution. In doing so, we aim to provide a panoramic view of the topic, touching on financial implications, managerial incentives, decision biases, and the recent advancements introduced by data science and machine learning.

Beyond merely compiling existing knowledge, our ambition is to highlight areas that remain uncharted, thus sparking further inquiry. The modern financial landscape, ever-evolving in its regulatory and technological complexion, presents new challenges and questions around share buyback execution. By spotlighting these, we hope to set the stage for future research endeavors that push the boundaries of current understanding.

Given the vast implications for corporations, the pivotal information for investors, and the guidance for policymakers, understanding the intricacies of share repurchase execution becomes imperative. For corporate finance as a whole, delving deep into this subject promises richer insights into capital allocation strategies, shareholder value optimization, and broader market dynamics.

The subsequent sections will traverse from traditional to contemporary perspectives on share repurchase execution, shedding light on its multifaceted nature. We'll explore the interplay of market conditions, corporate governance, decision-making paradigms, and technological innovations in shaping the future of this pivotal financial strategy.

The growing significance of ensuring fairness in share buybacks, as aptly highlighted by Masters [5] in the Financial Times—"If companies are going to buy back shares, they should pay a fair price"—calls for a deeper exploration into the methodologies used in this realm.

To guide our readers, the review unfolds as follows: Section 2 lays down foundational theories and models. Section 3 delves into the role of market liquidity. Section 4 assesses the price impact. Sections 5 and 6 respectively explore managerial overconfidence and various repurchase strategies. Modern methodologies are scrutinized in Section 7. Finally, Section 8 encapsulates our findings, implications, and charters the path ahead.

2. Theory and models of share repurchase execution

2.1. Basics of share repurchase execution

Share repurchase, a corporate strategy employed to buy back its shares from the open market, has emerged as an integral part of financial management strategies over the years. To begin our literature review, it is imperative to delve into the rudimentary aspects of share repurchase execution.

The execution of share repurchases is a labyrinthine process requiring firms to make a multitude of nuanced decisions. Foremost, companies are tasked with discerning the optimal timing and volume for repurchases. This judgment is influenced by a constellation of variables, from the reservoir of surplus cash at their disposal, the current trajectory of the company's stock price, to the broader market ambiance [6]. In tandem with these considerations, firms must strategically determine the avenue for executing these repurchases. Two predominant pathways emerge: tender offers and open market repurchases (OMRs). Tender offers see the company broadcasting its intent to reacquire a specified volume of shares at a predetermined rate, often pitched above the prevailing market valuation. Conversely, OMRs adopt a more discreet approach, where companies incrementally purchase their shares on the open market over an elongated timeframe, potentially spanning several months to years [6]. Given the intricacies and extended duration associated with their execution, our discussion places a heightened emphasis on the mechanics and nuances of OMRs.

One of the central aspects that need to be understood regarding share repurchase execution is the role of regulatory requirements. These vary considerably across different jurisdictions. In the U.S., for instance, companies are under no obligation to disclose when they are trading, and only quarterly changes in shares outstanding are reported, resulting in limited transparency about the timing and execution of open market repurchases [6].

A critical yet understated aspect of share repurchase execution lies in its impact on market liquidity. Market liquidity, as elucidated by Holden et al. [7], refers to the ease with which investors can trade

securities in the market without causing a substantial change in the securities' prices. In this context, share repurchases often play a dual role. They can improve market liquidity by narrowing the bid-ask spread and reducing the price impact of order imbalances on days when repurchase trades are completed, thereby enhancing the efficiency of the market [6]. However, they can also lead to a decline in the number of shares available for trading in the market, thereby potentially reducing market liquidity. The bid-ask spread is the difference between the price a buyer is willing to pay (bid) and the price a seller is willing to accept (ask). Market impact refers to the change in a stock's price due to a specific trade, especially when large transactions shift prices.

In understanding the basics of share repurchase execution, it is also vital to consider the impact of managerial perspectives and firm-level corporate governance mechanisms. Overconfidence among managers can impact the intensity of share repurchasing, including the scale, execution, and frequency of the repurchases [8]. Moreover, firms with higher-quality corporate governance mechanisms may provide more credible signals during repurchase announcements, thereby affecting market reactions and post-repurchase insider shareholdings [9].

Finally, in the context of institutional investors, the investment horizon has a significant impact on the outcomes of stock repurchases. Firms with long-term institutional investors tend to experience more positive abnormal returns around repurchasing announcements and tend to buy back more shares during the execution period [10].

Having established a fundamental understanding of the basics of share repurchase execution, we will delve deeper into theories related to timing and execution styles, as well as models for optimal execution, in the following sections.

2.2. Theories related to timing and execution styles

2.2.1. Theories related to repurchase timing

Several theories have been proposed to understand the timing of share repurchases. Cook et al. [6] highlights that firms can adopt various timing strategies for their repurchase programs, but finds no evidence suggesting that repurchases are timed to coincide with, precede, or follow the release of certain information. Similarly, McNally et al. [11] demonstrates that firms executing repurchases have superior timing, with share prices showing abnormal losses before and gains after the repurchase trades.

Shu et al. [8] offers a slightly different perspective, stating that managerial overconfidence can affect the timing of share repurchases. This study finds a positive correlation between managerial overconfidence and the intensity of share repurchasing, as overconfident managers may perceive their firm as undervalued and thus, more likely to repurchase shares [8].

2.2.2. Theories related to repurchase execution styles

There are various execution styles adopted by firms when conducting open market repurchases, from immediate intense repurchasing to delayed and smoothed repurchasing [6]. Oded

[12] formalizes the intuition that the execution style depends on the trade-off between adverse selection (as the firm has inside information) and cash waste.

Guéant et al. [1] and Jaimungal et al. [13] focus on the strategy related to accelerated share repurchases (ASR), where firms repurchase a significant portion of their shares immediately. Both studies provide models and numerical methods to determine the optimal execution strategies and stopping times for ASRs [1, 13].

On the other hand, Wu [9] emphasizes the role of corporate governance quality in determining the execution styles of open-market share repurchase programs. This research suggests that high-quality corporate governance lends credibility to a firm's repurchase announcement, thus influencing its execution style [9].

Guéant et al. [2] explores the use of machine learning methods in managing several types of buyback contracts, including accelerated share repurchase contracts and VWAP-minus profit-sharing contracts. The results reveal that these methods can lead to optimal management of these contracts [2].

In conclusion, both the timing and execution style of open-market share repurchase programs can be influenced by a variety of factors, such as information disclosure, managerial overconfidence, the adverse selection problem, and the quality of corporate governance. A number of models and strategies have been proposed to optimize these aspects, including the use of machine learning methods.

2.3. Models for optimal execution

The academic landscape encompassing share buybacks is vast, with a multitude of angles explored. Yet, the execution phase of buybacks remains a relatively uncharted domain. Osterrieder and Seigne have prolifically touched upon various facets of this arena. Their reviews on financial anomalies and the overarching complexities surrounding buybacks have paved the way for a more intricate understanding Osterrieder and Seigne [14]. Specifically, their insights into share repurchase executions and the synthesis of existing literature provide a comprehensive framework Osterrieder and Seigne [15]. They delve into the mysteries of buyback execution, shedding light on trading anomalies, benchmarks, and the psychological misconceptions that often cloud the real picture Osterrieder and Seigne [16].

However, their works go beyond mere observations. By venturing into the theoretical underpinnings of genetic algorithms and mathematical optionality, they unearth the potential of advanced computational techniques in understanding buybacks Osterrieder [17]; Osterrieder and Seigne [18]. This exploration deepens with their discussions on temporal optionality, empirical anomalies, and value optimization Osterrieder and Seigne [19, 20]. Furthermore, their musings on the "Free Lunch" hypothesis surrounding share buybacks hint at broader economic implications and the need for transparent execution strategies Osterrieder and Seigne [21, 22].

Masters brings a pertinent ethical and economic perspective to the discourse, contending that companies venturing into buybacks should ensure a fair price, underscoring the significance of the execution phase Masters [5].

On the technical side, Guéant offers a fresh perspective by melding the world of neural networks with buyback programs, probing deeper into the pricing and strategy of accelerated share repurchases [1–3].

In the dialogue surrounding share buyback execution strategies, Cook's research offers a salient perspective, positing that a broad, all-encompassing statement on execution strategy may be elusive [6]. While Cook provides compelling examples to substantiate this view, we find ourselves diverging from this standpoint. The modern financial landscape has witnessed the rise of sophisticated algorithmic execution strategies, offering precision and adaptability unparalleled by traditional approaches. In this light, what seems to be conspicuously absent is a unified theory and explanation of the execution phase, one that harmonizes the intricacies of algorithm-driven strategies with broader market dynamics. The nuances, strategies, considerations, and intricacies of executing buybacks, especially in fluctuating market conditions, are yet to be thoroughly charted. This existing gap, accentuated by the wide-ranging but somewhat tangential studies presented, indicates an exciting avenue for future research. It beckons for dedicated exploration that could reshape our understanding and revolutionize execution strategies.

3. Price impact of share repurchase execution

3.1. Intraday price impact of repurchase trades

The intricacies of the price impacts of open market repurchase trades have been meticulously explored. Drawing from a comprehensive dataset of over 60,000 individual repurchase trades on the Toronto Stock Exchange, McNally et al. [11] unveiled that these trades typically incur a negative intraday price impact. This is largely influenced by the prevalence of seller-initiated trades, which account for about 60% of the total, steered by certain execution rules.

Delving deeper into the nuances, the decline in prices following repurchase trades is less pronounced compared to matched non-repurchase trades. This disparity hints at repurchases serving as a stabilizing mechanism, sending signals of potential undervaluation to the market. Further reinforcing this viewpoint is the observed trend of abnormal losses prior to repurchase trades and subsequent gains, suggesting that firms initiating buybacks might indeed have adept market timing capabilities [11].

3.2. Abnormal price impacts and their implications

An abnormal price impact refers to the unusual effect on a security's price, typically caused by a significant occurrence or a drastic change in its issuer's financial outlook. This concept is aptly exemplified in the context of share repurchases, since repurchases seem to mitigate the price decrease following trades, creating an abnormal price impact [11].

This abnormal price impact carries several implications. Firstly, it suggests that firms may be able to use repurchases as a strategic tool to support price levels and signal undervaluation to the market. Secondly, the negative intraday price impact of repurchases could be attributed to the market's initial adjustment to the increased supply of shares, potentially overshadowing the strategic value of these repurchases. Finally, the abnormal price impact underscores the superior timing abilities of repurchasing firms, with abnormal losses seen before and gains after repurchase trades [11].

3.3. Role of repurchases in providing price support

Share repurchases play a vital role in providing price support in the market. McNally et al.'s research [11] shows evidence that repurchases indeed offer price support. The implication is that firms may repurchase shares as a strategy to prevent prices from falling drastically during periods of market turbulence. Besides, such activities signal to the market about possible undervaluation, subsequently enhancing the credibility of the firm's stock.

Furthermore, Cook et al. [6] observes that open market repurchases can contribute to market liquidity, which indirectly provides price support. Specifically, firms that repurchase their shares can narrow bid-ask spreads and attenuate the price impact of order imbalances on the days when repurchase trades are completed. The increased liquidity reduces transaction costs and the potential price impact of large orders, thereby preventing significant fluctuations in the stock price and maintaining price stability.

These findings are consistent with the conclusions drawn by Holden et al. [7] in his comprehensive review of the empirical evidence on market liquidity. Holden asserts that various exchange designs and regulatory reforms improve market liquidity, which in turn facilitates large share repurchases. As a result, repurchases, by enhancing liquidity, indirectly support prices.

Hence, it is evident that the role of repurchases extends beyond mere capital allocation strategies to influencing market dynamics, especially the aspects of liquidity and price stability.

4. Interplay of managerial overconfidence, corporate governance, and share repurchase execution: an integrated perspective

4.1. Managerial overconfidence: beyond just a personal trait

Managerial overconfidence can significantly steer a firm's share repurchase activities. This trait, often rooted in a manager's conviction of their firm's undervaluation, tends to intensify share repurchasing. Such intensification is visible in the volume, speed, regularity of repurchases, and the gaps between announced and actual execution prices [8]. What's more, studies like "The Great Deception: a Comprehensive Study of Execution Strategies in Corporate Share Buy-Backs" have highlighted that repurchase

strategies under the helm of overconfident managers might not always yield the anticipated benefits and can even diminish post-announcement returns [23].

4.2. Corporate governance: a central pillar of share repurchase strategies

Robust corporate governance is paramount in directing open-market share repurchase announcements and the followthrough execution. Markets typically react positively to repurchase announcements from entities known for their rigorous corporate governance, especially if these are signaling undervaluation [9]. A surge in post-repurchase insider holdings reinforces the sincerity of these buyback announcements, particularly in firms with sound governance frameworks [9]. While the dynamics of repurchase execution predominantly lean on a firm's in-house governance system, external oversight—like affiliations with renowned audit firms, stock market regulations, and regulatory pricing guidelines—also shape the course of these repurchase schemes [9]. Such findings are further corroborated in studies such as "The Hidden Impact of the SEC's Share Repurchasing Disclosure Modernization on Corporate Governance," which underscores the role of transparency and governance in influencing buyback strategies Seigne and Osterrieder [24].

4.3. Synthesizing the disciplinary perspectives

While overconfidence and corporate governance might seem distinct in their nature—one being a psychological trait and the other a structural element—they both have direct implications on share repurchase execution. Overconfidence might lead to aggressive buybacks, sometimes overlooking essential metrics, while robust governance ensures that repurchases align with shareholder interests and corporate objectives. The studies by Seigne and Osterrieder provide a comprehensive lens to understand this intricate interplay and offer deep insights into how firms can strategically leverage both these elements to optimize share repurchase outcomes [23, 24].

4.4. Impact of internal and external monitoring factors on execution rate

As indicated above, both internal and external monitoring factors can substantially affect the execution rate of share repurchase programs. Internal corporate governance mechanisms can influence the execution of repurchase programs, along with the post-repurchase insider shareholdings [9]. On the other hand, external monitoring factors such as auditor quality, listing requirements, and regulatory preset buyback price ranges also impact the execution rate of these programs [9]. This underscores the need for good corporate governance mechanisms and robust regulatory frameworks to ensure the effective execution of share repurchase programs.

5. Share repurchase programs and strategies

5.1. Overview of different share repurchase programs

Share repurchase programs provide companies with a means of returning surplus cash to shareholders while potentially enhancing the value of their shares in the market. Firms can opt to execute these programs through different approaches, mainly determined by market conditions, corporate strategies, and regulatory constraints [6].

A prevalent approach is open-market share repurchases, where firms buy back their shares directly from the open market. The timing and execution of these transactions are generally undisclosed, and reports typically reveal only the quarterly changes in shares outstanding [6]. The repurchasing behavior varies from immediate intense buying to a more gradual and smoothed approach. Despite these variations, it has been observed that repurchases do not necessarily align with information release days. Companies executing open-market repurchases may improve market liquidity by narrowing bid-ask spreads and tempering the price impact of order imbalances?

Alternatively, companies may choose to repurchase their shares through accelerated share repurchase (ASR) contracts. These contracts are typically arranged with banks and allow firms to repurchase a substantial portion of their shares immediately, transferring the trade's impact and uncertainty to the intermediary [1].

5.2. Accelerated share repurchase (ASR) contracts and strategies

ASR contracts involve intricate execution strategies due to their blend of option pricing and optimal execution aspects [1]. In an ASR, the firm pays a fixed notional amount to the bank and receives shares corresponding to the ratio of this amount to the average stock price over the purchase period. The duration of this period, determined by the bank, can range from a few days to several months [3].

In the realm of ASR contracts, intermediaries grapple with a multifaceted task: delicately moderating their trade's influence on the market dynamics, all while adeptly navigating the American option intricately woven into the contract. This embedded option offers a strategic advantage, granting the intermediary the discretion to designate the repurchase's culmination. Subsequently, the firm and intermediary reconcile any variance between the preliminary disbursement and the time-weighted average price spanning the trade duration, inclusive of a designated spread [13].

Pioneering strategies tailored for ASR contracts increasingly harness the potency of advanced mathematical models, synergized with machine learning techniques. These methodologies are particularly poised to disentangle the intricate nexus between trade execution challenges and the nuanced art of option hedging, amplifying efficiency and precision in contract management [2].

5.3. Impact of institutional investment horizons on repurchase outcomes

Institutional investors' investment horizons significantly influence the outcomes of share repurchase programs. Firms backed by long-term institutional investors typically experience favorable abnormal returns around repurchase announcements and tend to buy back more shares during the execution period [10].

The credibility of the repurchase signal is enhanced by the presence of long-term institutional investors who certify and monitor these transactions, providing valuable insights into the firm's true value. Moreover, these firms perform better over a subsequent three-year period compared to firms with short-term institutional investors [10]. This suggests that share repurchases, when supported by long-term institutional investors, are more likely to provide beneficial outcomes.

6. Modern approaches and innovations in share repurchase execution

6.1. Neural networks and machine learning in share repurchase execution

The realm of share repurchases has been profoundly impacted by the advent and application of advanced technologies like neural networks and machine learning. Guéant et al. [2] highlights a growing reliance on complex buyback contracts that entwine execution and option hedging problems, presenting a challenge to traditional Greek-based risk hedging. The paper presents a machine learning method for optimally managing several types of buyback contracts. This method circumvents the curse of dimensionality that plagues traditional grid or tree methods, enabling the management of contract types previously untenable [2].

6.2. Novel contract types and execution strategies

Novel strategies have evolved in the execution of share repurchases. One of the modern approaches involves the use of Accelerated Share Repurchase (ASR) contracts. Firms increasingly turn to banks for these contracts that contain option components, which make the management of these contracts difficult and distinct from classic option books [2]. Guéant et al. [1, 3] discusses the optimal execution problem related to ASR contracts, which involves determining optimal stopping time and the optimal buying strategy of the bank. The method put forward takes into account both option pricing and optimal execution problems [1, 3]. Jaimungal et al. [13] extends this by addressing the intermediary's optimal execution and exit strategy, which considers the impact that trading has on the market. The study developed an efficient numerical scheme to compute these strategies [13].

Another modern strategy includes the use of firm-level corporate governance mechanisms. Wu [9] notes that such mechanisms can affect managers' buyback behavior following open-market share repurchase announcements. The quality of corporate governance can also influence the market reaction to such announcements and subsequent insider shareholdings [9].

These new strategies and technological advancements have substantially altered the landscape of share repurchase execution, making it a dynamic and rapidly evolving field.

7. Literature gap

In the landscape of share repurchases, the execution phase remains considerably underexplored. Though several studies have investigated the initiation of share buybacks, there is a dearth of literature that thoroughly examines the intricacies of actual execution. This significant gap poses several challenges in the development of effective strategies for share repurchase.

Although there is limited research on this particular aspect, Guéant's work provides some notable exceptions [1–3]. Guéant's research offers a valuable contribution to understanding Accelerated Share Repurchases and proposes a machine learning method for optimal management of different types of buyback contracts. However, despite these breakthroughs, his work cannot fill the entire gap alone. The complexity and diversity of share repurchase executions demand a broader range of studies to provide comprehensive insights.

The absence of a wide literature base results in a lack of clarity regarding several aspects of share repurchase executions. The ideal trading schedule, implications, costs, performance metrics for the broker and the corporation, as well as the psychological aspects of beating a buyback benchmark, all remain shrouded in uncertainty due to this literature gap.

The limitations of existing research also impact our understanding of different share repurchase programs' practicalities. In the absence of comprehensive knowledge, corporations and brokers may be unable to optimally manage their share buybacks. This lack of insight could potentially result in financial inefficiencies or other adverse implications for stakeholders.

Furthermore, the gap in the literature also impacts the theoretical framework that informs our understanding of share repurchases. The scarce research available provides a limited theoretical basis, hindering our ability to fully comprehend and predict the dynamics of share repurchases. Presently, grid or tree methods stand as prominent techniques in the research realm, but they come with inherent challenges, particularly the curse of dimensionality [2]. To the uninitiated, this "curse" refers to the exponential increase in computational complexity as the number of dimensions (or variables) in a problem grows. Essentially, as more variables are added to a model, the volume of the computation space increases rapidly, requiring significantly more data and computational power to yield accurate results.

In the context of grid or tree methods, the curse manifests prominently. These methods typically involve partitioning the problem space into discrete sections (like the cells of a grid or branches of a tree). As the dimensionality rises, the number of these partitions multiplies exponentially, making computations increasingly unwieldy and time-consuming. For instance, a simple 10×10 grid in two dimensions has 100 cells, but in three dimensions, a 10×10×10 grid has 1,000 cells, showcasing the

rapid escalation in complexity. The large research gap in the execution phase of share repurchases clearly underscores the urgent need for comprehensive and diverse studies in this area. This gap in knowledge presents an exciting opportunity for future research to contribute significant insights that can facilitate a more nuanced understanding of share repurchase executions. Future research should aim to illuminate the ideal trading schedule, explore the various implications and costs, and provide performance metrics for brokers and corporations involved in share repurchase programs. Moreover, research should seek to enhance our theoretical understanding of share repurchases and develop methodologies that effectively overcome the limitations of current methods.

7.1. Implications and justification of the literature gap

The considerable gap in the literature concerning the execution phase of share repurchases presents both profound implications and a pressing need for its justification. While it's clear that this gap signals an underrepresentation of knowledge in this pivotal realm of corporate finance, understanding its direct consequences and its importance for various stakeholders deepens the gravity of the issue.

For companies, the absence of thorough insights on the execution phase constrains their ability to strategize effectively for share repurchases. The looming questions surrounding optimal trading schedules can undermine the timing and, consequently, the financial efficiency of repurchases. This might mean companies are leaving potential value on the table, harming both their performance and shareholder value.

Brokers, who act as the middlemen in these transactions, find themselves navigating the murky waters of managing complex buyback contracts without a solid research foundation. This dearth of knowledge might be propagating suboptimal management strategies, diminishing the potential value delivered to client companies and potentially eroding trust.

Investors and traders, key market participants, also feel the effects of this literature gap. The dearth of insights on the psychological nuances involved in surpassing a buyback benchmark can influence their behaviors and strategies, potentially creating inefficiencies or missed opportunities in the market.

From a regulatory perspective, the gap poses challenges too. Policymakers require a holistic understanding of share repurchases, inclusive of the execution phase, to craft effective guidelines. Without this, there's the potential for oversight or misdirection in policy, which could inadvertently foster environments where malpractices or abuses flourish.

In essence, the justification for addressing this literature gap is clear: its presence affects a multitude of stakeholders, from companies and brokers to investors and policymakers. The direct and indirect impacts of the gap emphasize the need for comprehensive research in this domain. Ensuring a well-rounded understanding of the execution phase is imperative for informed decision-making, value creation, and effective regulation in the realm of share repurchases.

7.2. Current methodological approaches and their limitations

While the research on share repurchase executions has been limited, the current methodological approaches adopted within the field present their own set of challenges and constraints. Understanding these methodological limitations is critical for realizing the full potential of future research and identifying the best avenues for further exploration.

A notable portion of the existing research in the area, such as the studies conducted by Guéant et al. [1–3], employ quantitative approaches involving mathematical models, partial differential equation methods, and machine learning techniques. Effectively, they are trying to find the optimal trading schedule, given the price path and the remaining risk. While these approaches have contributed valuable insights, they also present limitations.

Firstly, the mathematical models used to understand optimal execution strategies often rely on a variety of assumptions about market behavior, corporate decision-making, and other factors. These assumptions may not always hold true in the complex and often unpredictable real-world market scenario. Furthermore, these models sometimes neglect elements such as market liquidity, transaction costs, and other microstructural issues, which can significantly affect execution strategies and outcomes.

Secondly, the partial differential equation and recombinant tree methods used in these studies can suffer from the curse of dimensionality. This means that as the complexity of the buyback contracts increases, the computational resources required for these methods can increase exponentially, making them less feasible.

Lastly, the application of machine learning methods to this field is still in its infancy. Although promising, these methods are data-hungry and require large amounts of high-quality data for optimal performance. As such, their application is limited by the availability and quality of relevant data. Additionally, machine learning models can sometimes act as "black boxes," with their decision-making processes being difficult to interpret. This lack of transparency can be problematic when trying to understand and explain the underlying mechanisms of share repurchase executions.

Overall, the current methodological approaches to studying the execution phase of share repurchases have their own set of limitations, which may impede the development of a comprehensive understanding of the process. There is a clear need for a diversification of methodologies and a consideration of alternative research methods to expand our understanding of this essential area.

7.3. Quantifying and understanding the literature gap

While the broader realm of share repurchases has been a subject of interest in corporate finance, a disconcerting lacuna exists specifically around its execution phase. To quantify, the current body of literature boasts a scanty 15 papers addressing this topic, with a striking 73% (or 11 papers) emerging only recently, attributed to the concerted efforts of Osterrieder and Seigne. This stark disproportion underscores the relative novelty and under-exploration of this crucial domain.

For companies navigating the intricate maze of share repurchase strategies, this paucity of research potentially hampers their ability to make informed decisions. Without empirical insights or theoretical frameworks drawn from a robust set of literature, they're often left to rely on anecdotal evidence or fragmentary knowledge, leading to potential inefficiencies in execution.

Brokers, tasked with bridging the gap between companies and the market, might find themselves operating without the benefit of well-researched strategies. Given that the majority of insights come from just two researchers, Osterrieder and Seigne, there's a pressing need for diversified viewpoints and methodological approaches to enrich the understanding further.

Investors and market analysts, too, are left in a quandary. Without sufficient research dissecting the nuances of execution strategies and their implications, there's a lack of clarity on how repurchases influence market dynamics, stock valuations, and investor sentiments.

Regulators and policymakers, aiming to ensure a fair and transparent marketplace, might be missing critical insights that would allow them to craft more precise and effective guidelines. The limited literature could be leaving blind spots in regulatory frameworks, which, if not addressed, might expose the market to unforeseen risks.

In light of this, the justification for delving deeper into this literature gap is compelling. Its limited scope impacts a vast array of stakeholders, from corporations to individual investors. A more robust exploration of the execution phase, drawing from diverse research perspectives, is not just beneficial—it's essential for the evolution of effective share repurchase strategies and practices.

7.4. Potential areas for future research

7.4.1. Trading schedule

The construction of an ideal trading schedule during share repurchases remains largely uncharted territory in the literature. Future research can focus on determining the optimal timing and pace of share buybacks, considering factors like market conditions, company's financial position, and regulatory constraints. Investigating the potential benefits and drawbacks of different trading schedules could yield significant insights into how companies can optimize their share repurchase initiatives.

7.4.2. Implications

Understanding the broader implications of different execution strategies is another critical area that needs further exploration. This includes studying the impact on stock prices, corporate valuation, and investor sentiment. The effects of share repurchases on market dynamics, such as liquidity and volatility, are also worth investigating.

7.4.3. Costs and performance metrics

Future studies could develop a more nuanced understanding of the costs associated with different execution strategies, including transaction costs and opportunity costs. Moreover, developing performance metrics for brokers and corporations could be beneficial. How are brokers performing in their roles in terms of speed, cost-effectiveness, and value delivery? How well are corporations managing their share repurchases? Are there standard measures of success, and how are they benchmarked?

7.4.4. Psychological factors

The impact of psychological factors on share repurchase executions has been largely overlooked in current literature. The "herding" behavior of investors during a buyback, the perceived value of the share by both the corporation and the investors, and the influence of corporate announcements on investor sentiment are just a few of the areas that could be probed. Understanding these factors could provide a more holistic view of the market dynamics during share repurchases.

7.4.5. Role of technology

Lastly, in an age where technology is increasingly shaping trading practices, the role of technology in share repurchase execution is an area ripe for exploration. What role do algorithms and high-frequency trading play in share repurchases? How can technology be leveraged to optimize the execution process? What are the implications of technological advancement for the regulatory landscape?

These potential areas for future research, while not exhaustive, highlight the significant opportunities that exist to deepen our understanding of share repurchase executions and guide the formulation of more effective and efficient practices.

8. Conclusion
8.1. Summary of findings

Despite the extensive academic coverage on share buybacks, a conspicuous lacuna persists around the execution phase of buybacks. Distinctively, the contributions of Osterrieder and Seigne emerge as exceptions, offering a comprehensive understanding of this relatively overlooked area. They have highlighted key insights on the nuances of financial anomalies in buybacks, intricacies surrounding trading benchmarks, and potential psychological biases affecting market perceptions. Their notable exploration into the potential of advanced computational techniques, such as genetic algorithms and mathematical optionality, further underscores the depth of their work. The discussions around temporal optionality, empirical anomalies, and the "Free Lunch" hypothesis emphasize the complexity and breadth of considerations within the buyback execution domain. Additionally, the ethical and economic standpoint posited by Masters emphasizes the imperative for companies to engage in buybacks at fair prices. Complementing these insights, Guéant's work accentuates the convergence of neural network methodologies with buyback strategies, offering a novel lens on pricing and strategic nuances in accelerated share repurchases.

8.2. Implications for practice and policy

The profound inefficiencies in share repurchase executions, as elucidated in this paper, have far-reaching implications for both the practical realms of the corporate world and the overarching policy frameworks that govern them.

8.2.1. For practitioners

Understanding these inefficiencies is paramount. Financial institutions, particularly banks and investment firms, need to be cognizant of the latent pitfalls and challenges embedded in the current execution paradigms. The lack of exhaustive literature and insights on optimal execution strategies means that many entities might inadvertently be leaving value on the table or even exacerbating market distortions. This is not just a theoretical concern; in real-world scenarios, it translates to significant financial repercussions, impacting shareholders' wealth, corporate reputations, and the broader market sentiment. It's thus incumbent upon these institutions to either proactively seek solutions or partner with academic and research bodies to bridge this knowledge gap.

8.2.2. For policymakers

The under-representation of the execution phase in academic literature hints at a potential oversight in regulatory frameworks. Policymakers need to grasp the nuances of these inefficiencies to draft, adapt, or modify guidelines that ensure fairness, transparency, and efficiency in the market. Regulations need to be dynamic, evolving in tandem with market needs. As this paper suggests, there's a pressing requirement to revisit and potentially overhaul policies surrounding share repurchase executions. This becomes even more crucial when one considers the rapid technological advancements and the increasing integration of machine learning and neural networks in financial strategies.

8.3. Directions for future research

The exploration into the intricacies of share repurchase execution remains nascent, with many avenues still untouched. As we've observed, there is a pressing need to delve deeper into this domain. The directions that future research could take include:

- **Evaluating technological impacts:** While the integration of machine learning and neural networks into share repurchase execution promises enhanced efficiency, its longer-term impacts remain speculative. There's a need to systematically evaluate how these technological applications influence the accuracy, timeliness, and overall efficiency of repurchase strategies, especially in comparison to traditional methods.
- **Algorithmic development:** Given the highlighted inefficiencies in current share repurchase executions, there's an imperative to design more sophisticated algorithms. These should not only manage complex buyback contracts but also adapt dynamically to market conditions, ensuring optimal execution timing and pricing.

- **Corporate governance and buybacks:** The interplay between corporate governance structures and share repurchase behaviors is an under-explored domain. Understanding how governance mechanisms influence or are influenced by repurchase decisions could unravel insights into the broader corporate decision-making landscape. This could pave the way for governance structures that are more attuned to market realities, ensuring both shareholder value maximization and ethical financial practices.
- **Practical implications of recent advancements:** Osterrieder and Seigne have introduced us to the complexities surrounding buybacks. Expanding on their groundwork, it would be invaluable to investigate how these complexities translate into real-world challenges and opportunities for corporations. What are the tangible benefits or pitfalls that entities experience when navigating these complexities?
- **Ethical considerations:** Masters' perspective on the ethical imperative for companies to ensure fair pricing during buybacks throws light on a dimension that warrants deeper exploration. The ethical implications of repurchase executions, especially in the context of the broader economic environment and shareholder rights, deserve comprehensive academic scrutiny.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

JO: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing—original draft, Writing—review & editing. MS: Conceptualization, Data curation, Methodology, Project administration, Supervision, Writing—review & editing.

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MS was employed by Candor Partners Limited.

The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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