



The Influence of Perceived Undervaluation on the Duration of Share Repurchase Programmes

Lars Kiehne

Humboldt-Universität zu Berlin

Abstract

This thesis examines whether undervaluation—measured using eight market-based proxies—leads, *ceteris paribus*, to shorter share repurchase programme announcements and a higher probability of tender offers over open market repurchases. Using ordinary least squares and logistic regressions on 329 German repurchase announcements from 2016 to 2025, the analysis finds no significant link between undervaluation and either programme duration or repurchase method. Instead, repurchase size and trading volume emerge as the key drivers of programme design. These results suggest that, in Germany, repurchase structures are driven more by executional factors than by signalling undervaluation.

Keywords: share repurchases; undervaluation; open market repurchases; tender offers

1 Introduction

Since their effective legalisation in 1998, share repurchases have become a recurring component of corporate financial strategy in Germany. Between July 3, 2016, and March 20, 2025, listed firms announced buyback programmes totalling over 104 billion EUR, indicating a consistently active use of this mechanism in recent years. Several motives may underlie such programmes: buybacks can offer a tax-efficient method of returning capital to shareholders, help offset dilution from stock option plans or merger and acquisition (M&A) activity, serve as a defence against hostile takeovers, or be used to optimise a firm's capital structure.

Another widely discussed motivation for buybacks—and the primary focus of this thesis—is the belief that the company's stock is undervalued. According to the market timing hypothesis, supported by Chan et al. (2007) and Ben-Rephael et al. (2014), managers can use private assessments of intrinsic value to generate shareholder gains. By repurchasing undervalued shares, the ownership stake of remaining shareholders increases, and intrinsic value per share rises, as selling shareholders transact below true value (D. Ikenberry & Vermaelen, 1996).

Signalling theory offers a complementary explanation. As proposed by Dharmawan and Mitchell (2007), firms may use

repurchases to signal undervaluation to the market. Empirical evidence supports this, with studies documenting abnormal positive returns after repurchase announcements. In jurisdictions like Australia, where disclosure of motives is required, firms citing undervaluation experience larger abnormal returns (Akyol & Foo, 2013). In contrast, most countries—including Germany—do not require such disclosures. Investors must thus infer motivations from public information.

This thesis addresses that challenge by investigating whether the announced duration of a repurchase programme can serve as a signal of perceived undervaluation. Under European Union (EU) regulations introduced on July 3, 2016, firms must disclose the intended time frame of their buyback authorisation (The European Commission, 2016, Article 2, 1. Regulation (EU) 2016/1052). In line with signalling theory, this could form a communication channel: shorter durations may signal urgency and confidence in undervaluation, while longer durations might reflect opportunistic flexibility or other underlying motivations.

That firms consider market conditions when determining the duration of buyback programmes is evident from corporate statements:

"The Executive Board of Deutsche Börse AG informs, that the period, in which the adopted share buyback program with a volume of around EUR 200 million will be implemented, can extend until the end of the first half-year 2018. An extended implementation period as decided by the Executive Board today enables the company, to react more flexibly towards current

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developments and market conditions" (Deutsche Börse AG, 2017, p. 1).

Regarding buyback duration, Thomas Toepfer, CFO of Covestro AG, stated in a quarterly call:

"We always said that we would do this in an opportunistic and anti-cyclical way. So we do feel that the two year horizon gives us the flexibility to do exactly this. [...] Therefore, we do feel that both from a company, but more specifically from a shareholder perspective, this is the right approach to give us the time to really act flexibly and, as I said, opportunistically with respect to the share buyback" (Covestro AG, 2022, p. 12).

These statements indicate that programme duration is a strategic choice, tailored to anticipated market conditions rather than set arbitrarily.

A study by Gould (2019), based on Australian data, finds that firms may indeed use shorter repurchase durations to signal undervaluation. However, this finding stems from a regulatory environment where firms are obliged to disclose their motives—an advantage absent in most other markets.

This thesis extends the analysis to such a context. I construct eight different measures of perceived undervaluation: four based on deviations of valuation multiples from historical averages, three on peer-based comparisons, and one on prior share price performance. Given the difficulty of proving whether a stock is truly undervalued, the thesis focuses on "perceived undervaluation"—that is, management's belief that the firm is undervalued. This belief, rather than objective mispricing, is what shapes managerial decisions and market signals.

Using data from 299 open market repurchase (OMR) programmes and 30 tender offers, this thesis tests two hypotheses:

Hypothesis 1: Perceived undervaluation leads *ceteris paribus* to a shorter announced open market repurchase period.

Hypothesis 2: Companies that are perceived as undervalued are more likely to use a tender offer than a open market repurchase programme.

To test the first hypothesis, I employ ordinary least squares (OLS) regressions with repurchase duration as the dependent variable. For the second, I estimate logistic regressions, with the dependent variable equal to one for a tender offer and zero for an open market repurchase.

The empirical results show that none of the eight valuation proxies significantly influence either repurchase duration nor repurchase type. Consequently, both hypotheses are rejected. These findings suggest that programme length is not used as a credible signal of undervaluation, nor does perceived undervaluation influence the choice between tender offers and OMRs.

This study contributes to the literature on repurchase motivations by offering new evidence on the informational content—or lack thereof—of programme characteristics. The results imply that investors cannot rely on repurchase duration as a signal of management's valuation beliefs. These insights are relevant for both investors and regulators considering disclosure rules for corporate buybacks.

The thesis begins with an overview of institutional background and literature. This is followed by methodology and descriptive statistics. Chapter 5 presents the main empirical analysis, followed by robustness checks. The thesis concludes with limitations, future research directions, and final remarks.

2 Institutional Background

This chapter provides the institutional context for corporate share repurchases in Europe. It begins with an overview of EU regulations governing buyback programmes, including disclosure requirements and trading limitations. It then traces the development of German repurchase law and its key provisions. Finally, the chapter introduces the primary repurchase methods—open market repurchases, tender offers, and accelerated share repurchases—laying the foundation for the detailed analysis that follows.

2.1 European Union Repurchase Regulations

Under EU law, companies may repurchase their own shares without facing market manipulation charges, provided the buybacks serve one of the following purposes: "(a) to reduce the capital of an issuer; (b) to meet obligations arising from debt financial instruments that are exchangeable into equity instruments; or (c) to meet obligations arising from share option programmes, or other allocations of shares, to employees or to members of the administrative, management or supervisory bodies of the issuer or of an associate company" (European Parliament and the Council of the European Union, 2014, Article 5, 2. Regulation (EU) No 596/2014). Before initiating a repurchase programme, companies are required to disclose its maximum monetary amount, the maximum number of shares to be acquired, and the duration of the authorisation (The European Commission, 2016, Article 2(1), Regulation (EU) 2016/1052). The same paragraph further specifies that these conditions may subsequently be modified by the companies, provided that any changes are properly and publicly disclosed.

Buyback activity is also subject to trading restrictions. Specifically, companies are prohibited from repurchasing more than 25% of the average daily trading volume and from paying a price exceeding the last independent trade (The European Commission, 2016, Article 3, 2. & 3. Regulation (EU) 2016/1052).

All companies incorporated in the EU must comply with both EU regulations and relevant national laws governing repurchase activity.

2.2 Repurchase Regulations in Germany and Their Development over Time

Since 1998 German companies are able to repurchase their own shares without naming the motivation for such a programme (Pistor et al., 2003). For this, a German company needs the authorisation from its general shareholder meeting (Aktiengesetz §71, 1998, (1) 8.). This authorisation has a maximum validity of five years, during which the management board is granted the right—but not the obligation—to initiate a repurchase programme (Andres et al., 2016). Consequently, the five-year authorisation also constrains the duration of any individual buyback programme (Aktiengesetz §71, 1998, (1) 8.).

Some exceptions to this rule, already in place since 1965, include instances where the firm faces immediate danger or aims to incentivise employees (Pistor et al., 2003). In such cases, board approval suffices, and no resolution by the general meeting is required. However, in all cases, German companies are not permitted to repurchase more than 10% of their outstanding shares within a five-year period (Aktiengesetz §71, 1998, (2)).

As explained by Andres et al. (2016, p. 421), firms have two primary options for handling repurchased shares: "First, it can treat them as an asset on the asset side of the balance sheet. They can then be used to cover outstanding convertible bonds or executive stock options. The maximum number of shares a firm can hold on its balance sheet is 10% of the shares outstanding. Alternatively, the firm can retire the shares. In this case the firm's book equity is reduced accordingly."

2.3 Different Types of Repurchases

2.3.1 Open Market Repurchases

Open market repurchases are the most common form of share buyback programmes. This method provides companies with the flexibility to repurchase up to the announced number of shares—or none at all—on the stock exchange, allowing them to control both the timing and volume of the repurchases (Oded, 2011). However, acquiring a substantial volume of shares through the open market typically requires a longer time frame. The advantages and disadvantages of this method are discussed in detail in Section 3.4 of this thesis.

2.3.2 Tender Offers

Several forms of tender offers exist. The most common are fixed-price self-tender offers, in which a company announces the number of shares it intends to buy and the price it is willing to pay per share. Shareholders may then choose whether, and how many, shares to tender. If the total number of shares tendered exceeds the amount sought, the allocation is usually made on a pro rata basis (Kamma et al., 1992). To make the offer attractive, the company typically needs to offer a premium over the current share price (Oded, 2011).

Alternatively, companies may conduct what is known as a Dutch auction tender offer. In this case, shareholders may

submit bids within a pre-specified price range. When the offer concludes, the company pays a single clearing price to all shareholders who submitted offers at or below that price, allowing it to acquire the targeted number of shares (Kamma et al., 1992).

2.3.3 Accelerated Share Repurchases

Accelerated share repurchase (ASR) programmes allow companies to buy back large quantities of their shares almost immediately through a contract with a financial intermediary, who provides the agreed number of shares in exchange for payment (Bargeron et al., 2011). "The intermediary obtains the shares that it delivers to the repurchasing firm by borrowing them, typically from institutions. The intermediary then covers its short position by purchasing shares in the market over a specified time period, normally several months" (Bargeron et al., 2011, p. 69).

Although ASR programmes are common in jurisdictions such as the United States, they have not been implemented by European firms. Nevertheless, Schulz (2024) finds that such programmes are likely permitted under current EU and German legal frameworks.

3 Literature Review

This chapter reviews the existing literature on corporate share repurchases, with a focus on market reactions, underlying motivations, programme duration, and repurchase methods. It begins with empirical studies on abnormal returns following buyback announcements, then examines theoretical and empirical research on drivers such as undervaluation, managerial incentives, and capital structure considerations. Finally, common methodological approaches are discussed, and the key research gap this thesis addresses is identified.

3.1 Market Reaction to Repurchase Announcements

Numerous studies have examined both short-term and long-term market reactions to share repurchase announcements. An influential paper by D. Ikenberry et al. (1995) reports an abnormal four-year buy-and-hold return of 12.1% following the initial announcement of share buybacks in the US.

These results are supported by a comprehensive paper by Manconi et al. (2019), which looks at abnormal returns of 31 non-U.S. countries. In the vast majority of these countries, buyback announcements are followed by both short-term and long-term positive abnormal share price performance. The authors find a 4 year abnormal return of 20.79% for German repurchasing companies, significant at the 5% level.

Short-term abnormal returns are also evident in Germany, with announcement effects ranging from 2.32% (Andriosopoulos & Lasfer, 2015) to 3.58% (Lee et al., 2010).

However, the long-term positive market reactions seem not to occur gradually but rather stepwise, mainly driven by completion announcements, further announced buyback programmes and takeover attempts (Bargeron et al., 2017).

3.2 Motivations for Repurchase Programmes

There are many reasons why companies choose to repurchase their own shares. To understand why the market generally reacts positively to buyback announcements, it's important to distinguish between the different motives and their respective impact on shareholder value.

3.2.1 Profit Distribution

Share repurchases are the main alternative to dividends when it comes to distributing profits (Grullon & Michaely, 2002). While selling shareholders receive cash, remaining shareholders see their ownership stake increase. Brav et al. (2005) discuss how buybacks offer greater flexibility to companies than dividends, as reducing buybacks when cash is scarce causes less negative market reaction than cutting dividends. In addition, Grullon and Ikenberry (2005) notes that buybacks generally have a tax advantage over dividends at the individual shareholder level, because the remaining shareholders do not have to pay any immediate taxes for their ownership increase.

3.2.2 Employee Share Options

Some companies use buybacks to counter dilution from employee share options that would otherwise decrease the earnings per share (EPS) (Bens et al., 2003). However, the market recognizes this motivation, which leads to a lower announcement return for firms with many outstanding employee share options (Kahle, 2002).

3.2.3 Takeover Defence

Repurchases can serve as a defence against hostile takeovers by reducing the number of shares available to acquirers (Pearce & Robinson, 2004). In a comprehensive empirical analysis Billett and Xue (2007) provide empirical support, showing that firms facing takeover threats are more likely to initiate buybacks.

3.2.4 Misleading Investors

Chan et al. (2010) suggest that firms with poor earnings quality and aggressive accounting practices may use buybacks to mislead investors, benefiting from short-term abnormal returns that dissipate over time.

3.2.5 Capital Structure Adjustments

In addition, debt-financed buybacks can add shareholder value by optimizing the company's leverage to add a tax-shield and reduce agency costs of free cash flow (Lei & Zhang, 2016). That said, Bonaimé et al. (2014, p. 197) report "that the extent to which adjusting capital structure through a share repurchase creates value depends on the undervaluation of the firm." Further, Chan et al. (2004) find no evidence that the market rewards these capital structure adjustments over the long term.

3.2.6 Mergers and Acquisitions

Companies sometimes repurchase their shares to use them as acquisition currency (Andersson et al., 2007). This motivation for share repurchases is barely researched. However, the economic intuition is that companies buy back their shares either before or subsequent to the acquisition to offset the dilutive effect on their shareholders. Faccio and Masulis (2005) show that roughly 20% of acquisitions in Europe are at least partly financed by shares, which often has tax advantages for the seller and aligns the interest between the two parties.

3.2.7 Managerial Performance-Related Compensation

Several studies link repurchases to executive compensation. Cheng et al. (2015) show that managers with bonuses tied to EPS are more likely to initiate buybacks, especially when EPS is close to bonus thresholds. Cook and Zhang (2022) find that such incentives can lead to reduced investment in research and development and human capital.

3.2.8 Undervaluation

The positive short- and long-term price movements discussed at the beginning of this chapter appear to be partly driven by a motivation not yet examined: share repurchases initiated due to a belief that the firm's shares are undervalued. I find this motive particularly compelling and focus my research on it, as it provides management with an opportunity to leverage their internal valuation estimate of the company to enhance shareholder value. When a company repurchases undervalued shares, not only does each remaining shareholder's ownership percentage increase, but so does the intrinsic value of their holdings. This occurs because those who sell their shares to the firm do so at a price below what management believes to be their true value (D. Ikenberry & Vermaelen, 1996).

That undervaluation is indeed a key driver of positive abnormal returns following an announcement is consistent with findings from Australia, where companies have to state their motivation for a repurchase. Both Otchere and Ross (2002) and Akyol and Foo (2013) find that the market reacts especially positively to buybacks when undervaluation is cited as the reason for the buyback.

These market reactions appear justified, as firms that repurchase undervalued stock often outperform in the years following the announcement. Zhang (2005, p. 1887) reports from Hong Kong that "the market responds the most favorably to repurchases that are made by small and value (high book-to-market value) firms. Over a long horizon, there is some evidence that repurchases made by value firms show superior performance. The three-year buy-and-hold abnormal return, which is measured against a portfolio of control firms that are matched by size and book-to-market value ratios, is over 20%."

Similarly D. Ikenberry et al. (1995, p. 206) finds that "firms ranked in the top book-to-market quintile have four-year abnormal performance of 45.3% following the repurchase announcement. This occurs using a benchmark that

explicitly controls for size and book-to-market effects in stock returns."

Further support for this undervaluation hypothesis comes from evidence that managers are capable of timing the market. Dittmar and Field (2015) demonstrate that infrequent repurchasers—those presumed to be acting opportunistically—manage to repurchase shares at prices 6% to 8% lower than those paid by a naïve investor. This aligns with the findings of Stephens and Weisbach (1998), who show that firms tend to increase repurchase activity following declines in their share price, suggesting that management responds strategically to perceived market mispricing.

3.3 Share Repurchase Programme Duration

Gould (2019) finds that shorter repurchase programmes tend to have higher completion rates and higher announcement related stock returns, because they are seen as more credible. Furthermore, the results indicate that "if firms wish to signal the undervaluation of their shares then [...] investors evaluate this signal based on the intended program length indicated in an announcement" (Gould, 2019, pp. 242–243). The effect of the programme duration on the market reaction is therefore especially strong in cases where companies state undervaluation as their repurchase motive. However, in this Australian study undervalued is a "dummy variable which takes on the value of 1 if the program announcement indicates 'undervaluation' or 'good investment' as a motive." (Gould, 2019, p. 246) and not a market based valuation variable. This limits the application in most jurisdictions, but shows, that the duration on a programme is chosen consciously by the management. My research extends these findings, making them more applicable to other countries.

That the programme length matters is further supported by Ota et al. (2022), who show that to increase the credibility of an OMR programme, "managers of repurchasing firms increase the repurchase plan size and shorten the repurchase plan period with the magnitude of the simultaneously announced bad news" (Ota et al., 2022, p. 17). Furthermore, the authors find, that "the market reacts positively to the signal strength adjustments of both repurchase plan size and period" (Ota et al., 2022, p. 11).

Few other studies have specifically examined the duration of share repurchase programmes. However, Mietzner (2017) find that shorter programmes are more likely to be cancelled, and Akyol and Foo (2013) report that firms with shorter durations are more likely to repurchase no shares at all. These findings partially contradict the signalling hypothesis, which suggests that a shorter duration should reflect stronger managerial conviction about undervaluation and thus enhance the credibility of the signal.

3.4 Tender Offers Versus Open Market Repurchases

This section outlines the factors influencing the choice between tender offers and OMRs.

Banyi et al. (2008) show that between 1984 and 2004, OMRs outnumbered tender offers by nearly 13 to 1 in the US. This preference is likely due to the flexibility OMRs provide. While tender offers commit the firm to repurchase a specified number of shares at a fixed price, OMRs give management discretion to buy back fewer—or even no—shares (Oded, 2011).

However, this flexibility comes at a cost. Acquiring shares via the open market is typically slower, particularly for large repurchase volumes. Tender offers, by contrast, enable rapid execution, allowing firms to efficiently deploy idle cash (Oded, 2011) and act quickly on perceived undervaluation (Vermaelen, 1981). Because they are binding and often involve a premium, tender offers are also viewed as a stronger and more credible signal of undervaluation (Vermaelen, 1981).

Empirical evidence supports this signalling interpretation. Vafeas (1997) find that firms experiencing negative abnormal returns in the months leading up to a repurchase announcement are more likely to opt for an OMR, possibly to avoid the costs associated with a tender offer. Indeed, due to asymmetric information, tender offers often require a premium to induce shareholders to sell. The greater the information asymmetry, the higher this premium, and thus the greater the cost to remaining shareholders (Oded, 2011).

The role of ownership structure remains debated. Oded (2011) argue that firms with concentrated insider ownership may prefer OMRs, as high information asymmetry in such cases makes the premium for tender offers particularly costly. On the other hand, Vermaelen (1981) suggests that if insiders refrain from tendering their shares, it sends a credible undervaluation signal by aligning insider and outsider interests. Empirical findings favour the latter view: higher insider ownership is associated with a greater probability of using tender offers (Vafeas, 1997).

3.5 Research Gap

As outlined above, existing literature offers limited insights into determinants of announced share repurchase durations. More specifically, to the best of my knowledge, no prior study examines whether publicly available valuation metrics—used as proxies for perceived undervaluation—are systematically related to programme length. This remains an under-explored area in the broader discourse on corporate payout policy and signalling.

While most jurisdictions do not require firms to disclose their motives for initiating buybacks, signalling theory suggests that managers may convey private information—such as internal assessments of undervaluation—through observable actions (Vermaelen, 1981). One such indirect signal may lie in the design of the repurchase programme, including its duration and method.

A shorter announced duration may signal to investors strong confidence in current undervaluation and an intent to act swiftly before markets adjust. Conversely, longer durations can reflect a more flexible strategy or other underlying motivations.

Similarly, the choice of repurchase method may have signalling implications. Tender offers—requiring greater commitment and enabling the repurchase of a larger share volume over a shorter period—are often perceived as more credible signals of undervaluation than open market repurchases, which are more flexible and less binding (Comment & Jarrell, 1991).

These theoretical considerations motivate the central hypotheses tested in this study:

Hypothesis 1: Perceived undervaluation leads ceteris paribus to a shorter announced open market repurchase period.

Hypothesis 2: Companies that are perceived as undervalued are more likely to use a tender offer than a open market repurchase programme.

This thesis contributes to the literature by examining how structural features of repurchase programmes may act as valuation signals, and by developing an empirical framework linking observable valuation indicators to programme design.

4 Methodology

This chapter presents the empirical framework used to assess how various undervaluation metrics influence the length of share repurchase programmes among German-listed firms. The initial (pre-cleaning) sample includes all repurchases announced between July 3, 2016 and March 20, 2025. Following a description of the model specification and variable construction, I outline the data sources, cleaning procedures, and key descriptive statistics that underpin the analysis.

4.1 Model Specification

To test whether perceived undervaluation leads to a shorter announced repurchase period, I estimate the following OLS regression, where the dependent variable *Duration* represents the announced programme length in days:

$$\begin{aligned} \text{Duration} = & \alpha + \beta_1 * \ln(\text{Valuation}) + \beta_2 * \ln(\text{Size}) \\ & + \beta_3 * \ln(\text{Volume}) + \beta_4 * \ln(\text{Liquidity}) \\ & + \beta_5 * \ln(\text{EquityRatio}) + \beta_6 * \text{Dilution} \\ & + \beta_7 * \ln(1 + \text{Dividends}) \end{aligned}$$

To test the second hypothesis—that companies perceived as undervalued are more likely to implement a tender offer rather than an open market repurchase—I use a logistic regression model. The dependent variable *TenderOffer^P* indicates the probability that the repurchase programme is a tender offer. For greater interpretability, I also report the marginal effects. The logistic model is specified as follows:

$$\begin{aligned} \text{TenderOffer}^P = & \Lambda * (\alpha + \beta_1 * \ln(\text{Valuation}) \\ & + \beta_2 * \ln(\text{Size}) + \beta_3 * \ln(\text{Volume}) \\ & + \beta_4 * \ln(\text{Liquidity}) \\ & + \beta_5 * \ln(\text{EquityRatio}) \\ & + \beta_6 * \text{Dilution} \\ & + \beta_7 * \ln(1 + \text{Dividends}) \\ & + \beta_8 * \text{Ownership}) \end{aligned}$$

4.2 Choice of Independent Variables

1. *Valuation*: To capture firms' valuation levels at the time of a share repurchase announcement, I construct eight distinct variables, all based on publicly available data that may plausibly influence managerial perceptions of undervaluation (Jenter, 2005).

The first four variables assess each company's current valuation relative to its own historical average. Specifically, these are calculated as the ratio of the firm's market capitalisation at the announcement date to one of the following financial fundamentals: Earnings Before Interest, Tax, Depreciation and Amortization (EBITDA), net income, cash flow from operations (CFO)—each measured over the last twelve months (LTM) prior to the announcement—and book value of equity. These current valuation multiples are then benchmarked against their historical counterparts, computed as the average of the same multiples measured at each quarter-end over the preceding three years.

The next three variables measure relative valuation by comparing the announcing firm's current LTM multiples—based on EBITDA, net income, and CFO—to the contemporaneous average multiples of a selected peer group. These peer-relative ratios aim to identify valuation deviations from industry norms.

Finally, I include another market-based valuation proxy, following Stephens and Weisbach (1998) and Jagannathan et al. (2000): the firm's share price performance over the 365 days preceding the repurchase announcement. This backward-looking indicator captures market sentiment and performance trajectory, which may influence managerial perceptions of misvaluation as well.

The underlying assumption across these valuation measures is that lower current multiples—whether relative to historical norms, peer firms, or prior share price performance—signal a perception of undervaluation. Consistent with this, I hypothesise that firms will aim to repurchase shares more aggressively when they believe the stock is trading below its intrinsic value. Specifically, I expect firms to announce shorter buyback periods under such circumstances, reflecting a desire to execute repurchases while the stock remains undervalued.

For the second hypothesis, I anticipate a negative association between a firm's overall valuation and its probability of adopting a tender offer. Specifically, lower valuations are expected to increase the probability of a firm choosing a tender

offer, as this structure facilitates a swift and concentrated repurchase, signalling managerial confidence and capitalising on perceived market mispricing.

2. *Size*: The size of the repurchase programme in EUR relative to the market capitalisation at the time of announcement. I expect that the larger the proportion of shares to be repurchased, the longer the duration of the programme and the more likely the use of a tender offer.

3. *Volume*: This variable is defined as the ratio of the announced number of shares to be repurchased to the average daily trading volume on the relevant stock exchange during the 90 days prior to the announcement. A higher ratio indicates that the targeted repurchase volume represents a larger share of market activity, potentially making it more difficult to complete the programme quickly via open market transactions. As a result, I expect a higher *Volume* ratio to be associated with longer programme durations and to increase the likelihood of a tender offer, which facilitates faster execution despite lower market liquidity.

4. *Liquidity*: The quick ratio of the company, defined as $(\text{Cash} + \text{Accounts Receivable}) / \text{Current Liabilities}$. Higher liquidity should lead to a shorter programme because the company already has the cash available for repurchases. Accordingly, I expect a higher quick ratio to increase the likelihood of a tender offer rather than an open market repurchase.

5. *Equity Ratio*: This variable captures capital structure adjustments as a potential motivation. It is calculated as book equity divided by total assets, using the latest available data prior to the announcement. Bonaimé et al. (2014) demonstrate that both book and market values (market capitalisation as equity) are appropriate measures of equity ratio in such models. I expect a higher *Equity Ratio* to be associated with a shorter programme duration, ceteris paribus, and to increase the probability of a tender offer, as management might value the stronger signalling effect of such a programme.

6. *Dilution*: Shareholder dilution resulting from option plans or M&A activities, measured as the percentage increase in outstanding shares between the last annual report and the most recent one preceding the announcement. I expect that higher levels of *Dilution* will be associated with longer buyback periods and a preference for open market repurchases over tender offers. This is because such dilution is generally independent of the current share price, as is the intention to offset it—thereby reducing the urgency to repurchase shares swiftly or to signal undervaluation to the market.

7. *Dividends*: The average dividend payout yield over the past three years, calculated as total dividends paid over a calendar year divided by the firm's market capitalisation as of December 31st of the same year. *Dividends* indicate that the company has excess cash that it cannot invest at reasonable returns. I expect a higher dividend payout ratio to correlate with a longer buyback period, as profit distribution depends less on share price and more on cash generation. If distribution is the main motivation, companies are likely to prefer an OMR to avoid paying the tender premium.

8. *Ownership*: For the second hypothesis, I include this variable to control for ownership concentration, as discussed in Section 3.4. Based on Vafeas (1997), I expect larger insider ownership to decrease the probability of a tender offer.

4.3 Data Collection

To compile the underlying dataset on share repurchase announcements, I utilised the S&P Capital IQ Transactions database. Initially, this database identified 326 announcements within the specified period from July 3, 2016 (the effective date of Regulation (EU) 2016/1052) to March 20, 2025—the date on which data collection commenced. However, key information such as the programme start and end dates, as well as programme size, were not consistently populated. Consequently, I manually reviewed each transaction to extract the following details: announcement date, programme start and end dates, number of shares targeted, maximum monetary value, and the stated reason for the repurchase. In cases where multiple programme announcements were listed under a single transaction entry, each programme was separated and recorded individually. Following this step, the pre-cleaning dataset comprised 374 observations. Where specific data fields were missing, I referred directly to the original announcements published on companies' investor relations websites to complete the dataset.

For financial statement information, I used Capital IQ's Companies database, retrieving data for all firms incorporated and listed in Germany. The following financial variables were collected on a calendar-quarter basis: cash flow from operations, net income, EBITDA, total assets, book value of equity, current liabilities, accounts receivable, cash holdings, and ownership data. Additionally, using the same database and filters, I obtained annual data on shares outstanding, revenues, and dividends paid. Industry classifications used for constructing peer valuation benchmarks are based on Capital IQ's primary industry classification.

Lastly, for stock market data, I utilised LSEG's Datastream. From this source, I retrieved daily stock prices, trading volumes, and market capitalisation figures for all German companies identified by their ISINs beginning with "DE," as well as index data for the CDAX from 2015 onwards.

4.4 Data Preparation

To prepare the raw dataset for regression analysis, I employ custom Python routines that implement the variable constructions described in Section 4.2, along with several additional adjustments and assumptions, which I explain in this section.

For firms absent from the Datastream market-capitalisation series, I estimate daily market capitalisation by multiplying shares outstanding at the most recent calendar year-end by the closing price on the relevant trading day.

When repurchase announcements specify only the maximum number of shares to be acquired—without indicating a corresponding EUR value—I approximate the programme's monetary size by multiplying the announced share count by

the share price on the trading day preceding the announcement.

Additionally, because negative valuation multiples are not economically meaningful and extremely high positive multiples—often caused by small denominators—can unduly influence estimates, I exclude observations with negative multiples and winsorise the remaining values at the 95th percentile within each quarter.

To identify peer companies, each sample firm is matched with all other firms sharing the same primary industry classification, regardless of whether they conduct repurchases. For each peer group, I calculate the same financial metrics on the same dates as for the sample firm. The peer multiple is then defined as the average of these values across the peer group, with group sizes varying by firm.

To calculate the abnormal return of a stock following the share repurchase announcement, I subtract the absolute return of the CDAX index in the exact same time period from the total return of the company's stock. The CDAX index represents all German listed companies and is market capitalisation-weighted.

To enhance the interpretability of the descriptive statistics and ensure consistency across models, I exclude all announcements with at least one missing value for any control variable. This step reduces the dataset from 374 to 329 observations but does not materially affect the sample composition.

Finally, as part of the estimation procedure, I employ robust standard errors to improve the reliability of the regression results. Specifically, HC1 heteroskedasticity-consistent standard errors are used for the OLS regressions, while HC3 standard errors are applied for the logistic regressions. This adjustment mitigates potential biases caused by heteroskedasticity and small-sample distortions.

4.5 Repurchases in Germany: A Sector and Size Analysis

During the sample period, 117 German companies announce at least one share repurchase programme. Table 1 presents the industry distribution of these companies. The range of sectors is notably broad. Firms categorised under *Application Software* constitute the largest single group, accounting for nearly 6% of all repurchasing companies.

A comparison between repurchasing and non-repurchasing firms reveals modest but observable industry differences. Notably, only 3.4% of the repurchasing companies operate as asset managers or custody banks, whereas this group comprises approximately 9.3% of the non-repurchasing firms. Conversely, healthcare equipment firms and industrial conglomerates each represent 3.4% of the repurchasing sample, but less than 1% of the non-repurchasing group. While these differences suggest some variation in industry participation, no clear structural pattern emerges in the overall industry distribution.

In contrast, the financial characteristics presented in Table 2 highlight more pronounced distinctions between

the two groups. A substantial number of holding companies with minimal operating activities skew the mean figures—particularly for the non-repurchasing firms—as evidenced by the high skewness values and large standard deviations reported in the table. As each firm is treated as a separate observation in the empirical analysis that follows, I place greater emphasis on median values when interpreting financial indicators.

Repurchasing firms tend to be significantly larger than their non-repurchasing counterparts, with median *Revenues* and *Market Capitalisation* exceeding the latter group by more than a factor of ten. Furthermore, repurchasing firms exhibit superior operational performance: both *Operating Income Margin* and *Return on Assets* are approximately twice as high as those of firms that do not repurchase shares. Taken together, these findings suggest that repurchasing companies are, on average, larger and more profitable than non-repurchasing firms.

4.6 Monthly and Annual Dynamics of Repurchase Activity

Figure 1 illustrates the distribution of share repurchase announcements across the sample period. The figures for 2016 and 2025 appear artificially low, as these years are only partially included in the observation window. Among the fully covered years, 2017 records the fewest announcements.

Between 2017 and 2020, repurchase activity increases gradually but steadily. This trend accelerates in 2021, with announcements rising from 35 in 2020 to 49 in 2021, and peaking at 53 in 2022. Thereafter, the number of announcements declines slightly, falling to 40 in 2024.

Interestingly, 2022—the year with the highest number of repurchase announcements—coincides with a year of negative returns in the German stock market. By contrast, other years with elevated repurchase activity, notably 2021, 2023, and 2024, correspond to periods in which the CDAX index registers positive annual returns (STOXX Ltd., 2025).

A forthcoming study by Dittmann et al. (2022) finds that share repurchase initiations are more frequent in the second, fifth, eighth, and eleventh months of the fiscal year—typically coinciding with earnings announcements—because trading restrictions such as blackout periods are least stringent during these intervals. The alignment of relaxed trading windows with the release of updated financial information facilitates increased repurchase activity and enables executive equity sales shortly after earnings disclosures.

In Germany, listed firms are required to publish annual earnings within 90 days of the fiscal year-end and to report quarterly or half-year financials within 45 days of the respective reporting period (Regierungskommission Deutscher Corporate Governance Kodex, 2022). Since the fiscal year coincides with the calendar year for most firms, annual earnings are usually disclosed in February or March, while quarterly results are published in May, August, and November.

Figure 2 displays the monthly distribution of repurchase announcement dates for the firms in my sample.

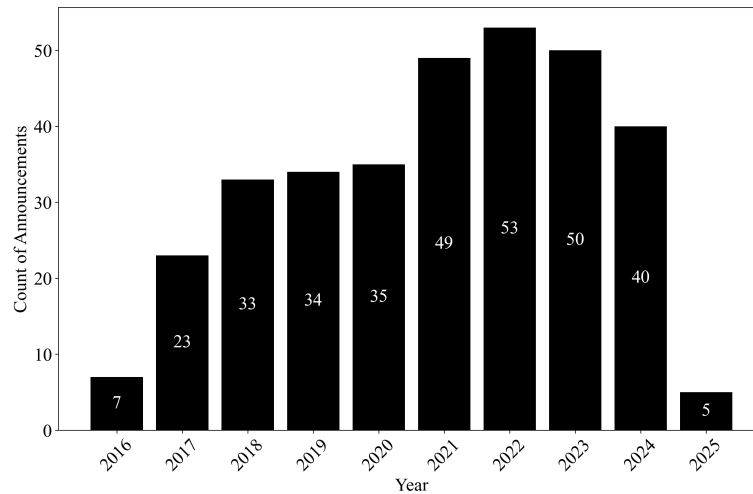


Figure 1: Distribution of Repurchase Announcements Over the Years

Source: Data sourced from Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The figure illustrates the annual distribution of share repurchase announcements made by German companies between July 3, 2016, and March 20, 2025. The X-axis represents calendar years within the sample period, while the Y-axis indicates the total number of repurchase announcements recorded each year. It is important to note that the figures for 2016 and 2025 are artificially low, as these years are only partially covered by the sample window—beginning mid-2016 and ending in early 2025—resulting in incomplete data for those periods.

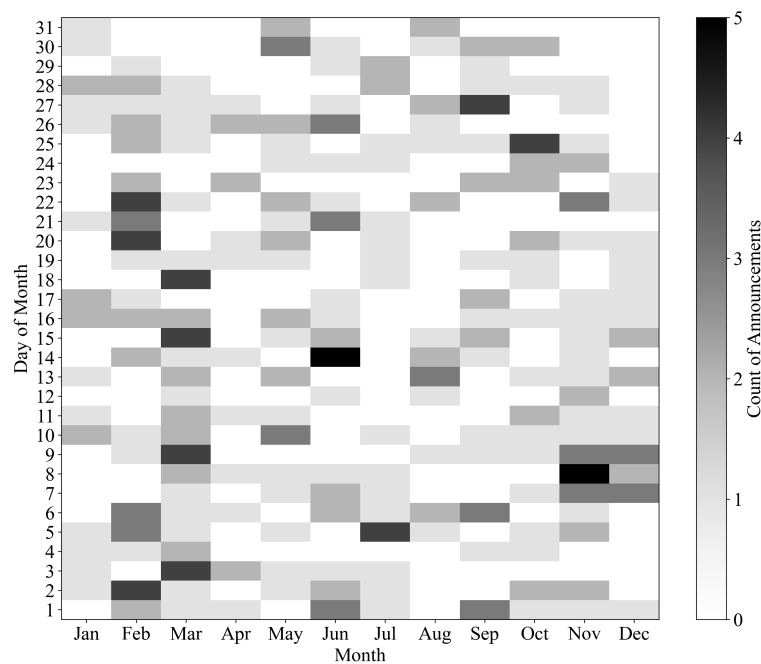


Figure 2: Calendar Year Distribution of Repurchase Announcements

Source: Data sourced from Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The figure displays the distribution of share repurchase announcements across the calendar year using a heatmap format. The X-axis represents the months from January to December, while the Y-axis denotes the days of each month. Each cell indicates the number of repurchase announcements made on a given day, with shading intensity corresponding to the count of announcements, as shown in the color bar on the right. Darker shades represent higher frequencies of announcements.

There is a noticeable concentration of announcements around 21 February and mid-March. In total, more than 12% of programmes are announced in both February and March each, and over 10% occur in November. These figures exceed

the 8.3% that would be expected if announcements were evenly distributed throughout the year. By comparison, May accounts for 8.8% of announcements, while August records only 6.1%.

Table 1: Distribution of German Companies by Primary Industry and Share Repurchase Activity

Primary Industry	Count		Percentage	
	(Rep.)	(Non-Rep.)	(Rep.)	(Non-Rep.)
Application Software	7	20	5.98	4.89
Industrial Machinery and Supplies and Components	5	26	4.27	6.36
IT Consulting and Other Services	5	15	4.27	3.67
Asset Management and Custody Banks	4	38	3.42	9.29
Electronic Equipment and Instruments	4	8	3.42	1.96
Health Care Equipment	4	4	3.42	0.98
Industrial Conglomerates	4	1	3.42	0.24
Construction Machinery and Heavy Transportation Equipment	4	9	3.42	2.20
Real Estate Operating Companies	4	22	3.42	5.38
Specialty Chemicals	3	7	2.56	1.71
Heavy Electrical Equipment	3	3	2.56	0.73
Multi-line Insurance	2	3	1.71	0.73
Systems Software	2	2	1.71	0.49
Specialized Finance	2	3	1.71	0.73
Semiconductors	2	2	1.71	0.49
Office Services and Supplies	2	2	1.71	0.49
Automobile Manufacturers	2	5	1.71	1.22
Investment Banking and Brokerage	2	9	1.71	2.20
Integrated Telecommunication Services	2	2	1.71	0.49
Apparel, Accessories and Luxury Goods	2	2	1.71	0.49
Health Care Technology	2	3	1.71	0.73
Diversified Support Services	2	2	1.71	0.49
Diversified Chemicals	2	0	1.71	0.00
Aerospace and Defense	2	3	1.71	0.73
Other	44	218	37.61	53.30
Total	117	409	100.00	100.00

Source: The presented data is obtained from Capital IQ. For more details, see Section 4.3.

Notes: This table presents the distribution of German companies across primary industries, categorized by whether they announced a share repurchase programme ("Rep.") or not ("Non-Rep.") between July 3, 2016, and March 20, 2025. Industry classifications follow Capital IQ's March 2025 taxonomy. Percentages indicate the share of companies within each repurchase status group that fall under the respective industry. Industries with fewer than two repurchasing companies are grouped into the *Other* category.

Table 2: Financial Analysis of German Repurchasing and Non-Repurchasing Companies

	Mean	Std. Dev.	Min.	25%	Median	75%	Max.	Skew
<i>Companies With at Least One Announced Repurchase Programme (n = 117)</i>								
Revenues (m EUR)	12,354.89	2,977.92	2.82	258.30	1,140.20	10,143.10	155,498.00	3.51
Operating Income Margin (%)	9.22	32.23	-167.92	3.45	9.40	13.78	81.42	-4.07
Return on Assets (%)	5.50	1.10	-10.82	2.16	4.89	7.97	29.11	0.57
Market Capitalisation (m EUR)	11,559.63	1,618.92	10.47	291.24	1,205.38	7,683.10	171,499.30	3.67
<i>Companies Without Announced Repurchase Programme (n = 409)</i>								
Revenues (m EUR)	27,446.71	18,340.40	0.00	18.20	103.40	613.70	322,284.00	13.96
Operating Income Margin (%)	22.27	3,540.02	-19,466.67	-3.22	4.21	10.83	66,796.12	15.93
Return on Assets (%)	5.84	12.97	-112.50	-1.25	2.60	6.83	46.48	-2.94
Market Capitalisation (m EUR)	26,996.58	6,261.94	0.90	23.71	102.17	486.88	72,898.19	7.54

Source: The presented data is obtained from Capital IQ and LSEG Datastream. For more details, see Section 4.3.

Notes: This table presents descriptive statistics for the financial profiles of German companies, categorized based on whether they announced at least one share repurchase programme between July 3, 2016, and March 20, 2025, or not. For each variable, the mean, standard deviation, minimum, 25th percentile, median, 75th percentile, maximum and skewness are reported. *Revenues* are reported in millions of EUR for the calendar year 2023. *Operating Income Margin* is calculated as operating income divided by revenues, expressed as a percentage. *Return on Assets* is defined as operating earnings divided by average total assets (2022–2023), also expressed as a percentage. *Market Capitalisation* is stated in millions of EUR as of December 31, 2023. Financial data from 2023 is used due to its greater availability at the time of writing compared to more recent figures.

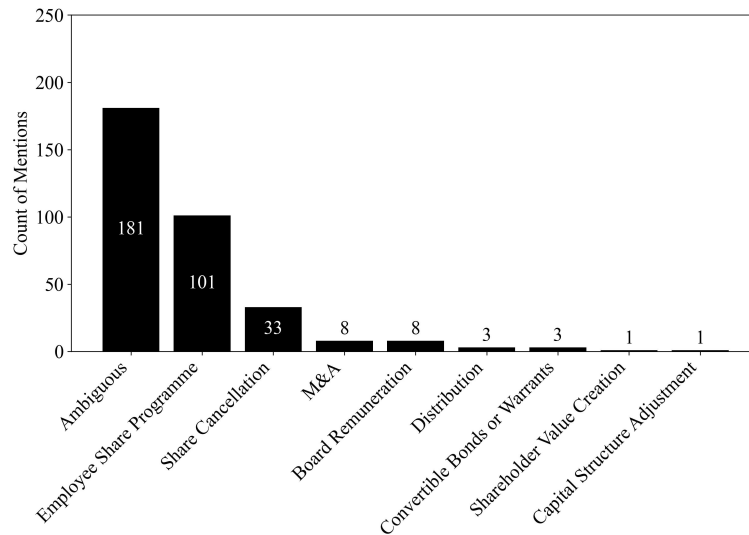


Figure 3: Stated Reasons for the Repurchase Programme

Source: The presented data is obtained from Capital IQ.

Notes: This chart presents the reasons companies state for their repurchase programmes announced between July 3, 2016 and March 20, 2025. The *Ambiguous* bar contains companies which either name no reason or state more than two reasons, since naming too many reasons makes it impossible for observers to identify the real underlying motivation behind a repurchase programme. Some companies publish two reasons, each of which is counted separately. The total number of reasons is therefore larger than the number of repurchase announcements. To improve the interpretability I combine reasons with the same underlying motivation but slightly different wording into one category.

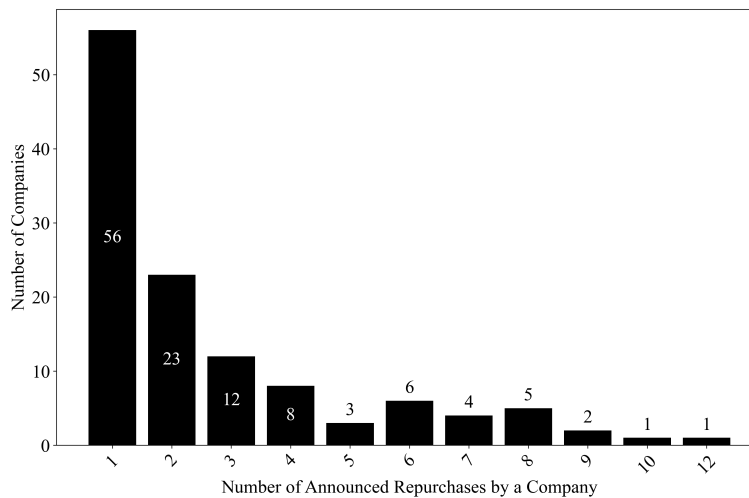


Figure 4: Number of Announced Repurchase Programmes by Company

Source: Data sourced from Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The figure illustrates the distribution of firms based on the number of share repurchase programmes they have announced between July 3, 2016, and March 20, 2025. The X-axis denotes the number of distinct repurchase announcements made by individual companies within the sample period. The Y-axis represents the corresponding number of companies that fall into each category. The data indicates that the majority of firms (56) announced only one repurchase programme, with progressively fewer firms engaging in multiple repurchase announcements.

Overall, the data suggest that firms are more likely to announce share repurchase programmes around the time of their annual earnings disclosures, but not necessarily in conjunction with quarterly announcements.

4.7 Repurchase Reasons and Number of Announced Repurchases by Company

Some companies in my sample voluntarily disclose the reasons for their share repurchase announcements, despite not being legally obliged to do so. Figure 3 presents the distribution of these stated motivations. The *Ambiguous* category includes firms that either provide no rationale or cite more than two distinct reasons, as listing multiple motives can obscure the primary driver behind the repurchase. In cases where two reasons are given, each is recorded separately. Consequently, the total number of reported reasons exceeds the number of individual repurchase announcements.

To facilitate interpretation, I group semantically similar justifications—albeit phrased differently—into broader categories based on their underlying intent. The majority of announcements fall into the *Ambiguous* category, highlighting the analytical challenges involved in inferring managerial motives from public disclosures alone.

Notably, 101 announcements explicitly mention the use of repurchased shares for employee share programmes, making this the most frequently cited reason. The second most common rationale is share cancellation. While this may signal managerial perceptions of undervaluation, it can also reflect a variety of strategic objectives, thereby limiting its informativeness from an investor's perspective.

Less frequently cited motivations include M&A activity, capital distribution, and adjustments to capital structure. However, each of these categories is mentioned in eight announcements or fewer, indicating that they are not primary drivers for most repurchase decisions.

Figure 4 illustrates the distribution of repurchase activity by firm over the sample period. A total of 56 companies announce only one programme, while 23 firms initiate two. In aggregate, 274 repurchase programmes are launched by companies that conduct multiple buybacks, and 228 announcements originate from firms that repurchase shares on three or more occasions over the nearly nine-year window.

At the upper end of the distribution, Allianz SE announces share repurchase programmes ten times, while IVU Traffic Technologies AG does so on twelve occasions—demonstrating a recurring use of repurchases as part of their corporate financial strategy.

4.8 Descriptive Statistics

4.8.1 Open Market Repurchase Programmes

Table 3 presents summary statistics for the 299 open market share repurchase programmes announced between July 3, 2016 and March 20, 2025. On average, firms announce programmes with a potential duration of 236 days, although this figure conceals substantial variation. The standard deviation is high (298.5 days), and the distribution is heavily right-skewed, ranging from zero to 1,815 days. The median duration of 150 days indicates that most programmes are relatively short, with only a few long-duration announcements extending the upper tail.

The descriptive statistics for the valuation multiples suggest that, at the time of announcement, firms typically trade

slightly below their historical norms. The median values for the *EBITDA*, *Net Income*, *CFO*, and *Price to Book Value Multiples* are all below one—ranging from 0.89 to 0.96—indicating mild undervaluation on a historical basis. However, the distribution is broad: minimum values fall well below 0.5, and the upper quartile values exceed 1.1 in all cases. This suggests that while a typical firm may be modestly undervalued, there exists substantial heterogeneity, with a non-trivial share of firms trading at significantly depressed levels relative to their historical averages.

Valuation ratios relative to peer firms also display considerable variation. The median peer-relative valuation multiples are 0.80 for *EBITDA*, 0.78 for *Net Income*, and 0.76 for *CFO*, reinforcing the impression that many firms are undervalued not only in absolute terms but also compared to their industry peers. The interquartile ranges for these metrics are wide, especially for *CFO Peer Valuation*, which ranges from 0.42 at the 25th percentile to 1.51 at the 75th. These findings point to significant dispersion in perceived relative value across firms at the time of repurchase announcements.

Figures 5 and 6 illustrate the relationship between programme duration and valuation ratios, but no clear pattern emerges. While some firms with high valuation multiples—relative to historical averages or peers—appear as outliers, the data do not consistently associate low valuations with shorter programme durations. Notably, there is a concentration of announcements with a duration of exactly 365 days, which likely reflects a standard one-year time frame adopted for reasons of administrative convenience rather than strategic responses to valuation signals.

The average *Prior Share Performance* over the 365 days preceding the announcement is modestly positive at 4.5%, but the distribution is highly dispersed. The standard deviation exceeds 37 percentage points, with returns ranging from –80% to +207%. The median is slightly negative (–0.02%), and the 25th percentile stands at –18.1%. Figure 7 illustrates the relationship between *Prior Share Performance* and programme duration; again, no clear trend emerges, suggesting that *Prior Share Performance* does not systematically influence the length of repurchase programmes.

Regarding control variables, the *Size* of the announced programme relative to market capitalisation is generally modest, with a mean of 3.2% and a median of 1%. Most firms aim to repurchase a relatively small proportion of their outstanding shares. The *Volume* variable—defined as the number of shares targeted relative to average daily trading volume—shows high variability, with a mean of 23.02 and a standard deviation of 45.36.

Liquidity, proxied by the quick ratio, has a median value of 0.82, indicating that more than half of the firms lack sufficient liquid assets to meet short-term liabilities. A median *Equity Ratio* of 38.3% suggests that firms are predominantly debt-financed. *Dilution* is negligible, with a median of zero, implying that recent share count changes have been limited. *Dividend* yields are modest but common, with a median of 1.6%. Finally, *Ownership*—measuring the proportion of shares held by publicly disclosed investors—is relatively

Table 3: Descriptive Statistics – Market Repurchase Programmes (n = 299)

	Obs	Mean	Std. Dev.	Min.	25%	Median	75%	Max.
Announced Programme Duration	299	236.237	298.516	0.000	29.500	150.000	355.000	1,815.000
EBITDA Multiple	284	0.950	0.322	0.291	0.756	0.909	1.132	2.773
Net Income Multiple	276	0.975	0.461	0.088	0.712	0.911	1.162	3.798
CFO Multiple	273	0.976	0.496	0.131	0.689	0.890	1.156	4.282
Price to Book Value Multiple	296	0.963	0.242	0.372	0.796	0.958	1.135	2.175
EBITDA Peer Valuation	253	1.050	1.068	0.055	0.491	0.803	1.272	10.972
Net Income Peer Valuation	241	1.028	0.903	0.032	0.531	0.779	1.149	6.449
CFO Peer Valuation	236	1.312	1.815	0.018	0.420	0.760	1.507	15.047
Prior Share Performance	298	4.511	37.187	-79.933	-18.065	-0.019	23.225	206.542
Size	299	0.032	0.095	0.000	0.003	0.010	0.031	1.000
Volume	299	23.017	45.355	0.002	2.580	9.926	23.169	446.230
Liquidity	299	5.070	33.794	0.010	0.599	0.819	1.285	429.545
Equity Ratio	299	0.369	0.198	-0.080	0.224	0.383	0.500	0.971
Dilution	299	0.007	0.071	-0.188	-0.005	0.000	0.000	0.866
Dividends	299	0.022	0.018	0.000	0.009	0.016	0.035	0.111
Ownership	299	0.625	0.203	0.003	0.514	0.658	0.786	1.000

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table provides descriptive statistics for companies that announced at least one share market repurchase programme within the period from July 3, 2016, to March 20, 2025. For each variable, the table presents the number of observations, mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum. *Announced Programme Duration* measures the number of days between the announced starting date of the repurchase and the latest possible programme end date. The three variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Multiple*, *Net Income Multiple*, and *CFO* (Cash-Flow from Operations) *Multiple*—represent the ratio of the current LTM valuation multiple to the average LTM valuation multiple over the past three years. *Price to Book Value (PB) Multiple* is a ratio of the current PB multiple divided by the average PB multiple of the last three years. *EBITDA Peer Valuation*, *Net Income Peer Valuation*, and *CFO Peer Valuation* are defined as the ratio of a firm's current LTM valuation multiple to the average current multiple of its peer group. *Prior Share Performance* is the company's share price performance over the last 365 days before the announcement multiplied by 100. The control variables are defined as follows: *Size* measures the maximum monetary value of the repurchase programme relative to the company's market capitalisation; *Volume* represents the ratio of the number of shares sought to the average daily trading volume; *Liquidity* corresponds to the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* captures the change in outstanding shares between the two most recent annual reports; and *Dividends* reflects the company's average dividend yield over the three years prior to the repurchase announcement. *Ownership* denotes the percentage of publicly known owners of the company. For more detailed definitions of the variables, see Section 4.2.

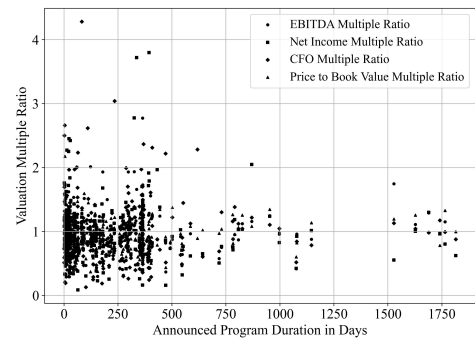


Figure 5: Valuation Multiple Ratio vs. Announced Programme Duration

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The X-axis shows the *Announced Programme Duration in Days* measured by the number of days between the announced starting date of the repurchase and the latest possible programme end date. The Y-axis shows four variables. Three of the four main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Multiple*, *Net Income Multiple*, and *CFO* (Cash-Flow from Operations) *Multiple*—represent the ratio of the current LTM valuation multiple to the average LTM valuation multiple over the past three years. Similarly, the *Price to Book Value Multiple* is defined as the ratio of the current market capitalization to the current book value of equity, divided by the average of this multiple over the past three years.

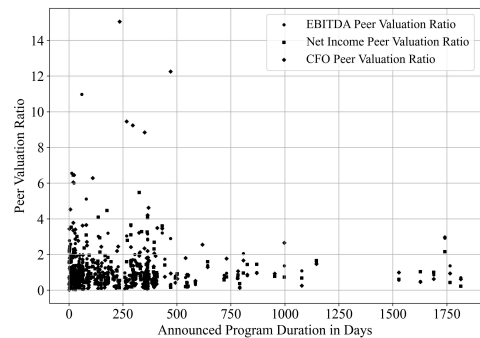


Figure 6: Peer Valuation Ratio vs. Announced Programme Duration

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The X-axis shows the *Announced Program Duration in Days* measured by the number of days between the announced starting date of the repurchase and the latest possible programme end date. The Y-axis shows three variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Peer Valuation*, *Net Income Peer Valuation*, and *CFO* (Cash-Flow from Operations) *Peer Valuation*, which represent the ratio of a firm's current LTM valuation multiple to the average current multiple of its peer group.

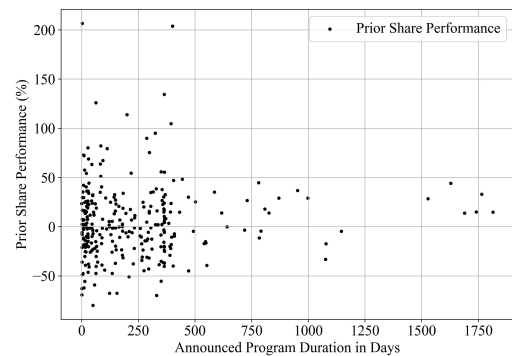


Figure 7: Prior Share Performance vs. Announced Programme Duration

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The X-axis shows the *Announced Programme Duration in Days* measured by the number of days between the announced starting date of the repurchase and the latest possible programme end date. The Y-axis shows the variable *Prior Share Performance*, which is the company's share price performance over the last 365 days before the announcement multiplied by 100.

high, with a mean of 62.5%.

4.8.2 Tender Offer Programmes

Table 4 presents descriptive statistics for the 30 firms in the sample that announced at least one tender offer pro-

gramme between July 3, 2016 and March 20, 2025. On average, firms conducting tender offers exhibited valuation multiples that were below their historical norms. The mean *EBITDA Multiple* relative to the three-year historical average is 0.895, with a median of 0.800. Similarly, the average *Net Income Multiple* is 0.844 (median: 0.775), indicating that firms tended to be trading at a discount based on their earnings metrics at the time of the announcement. The picture is less clear for the *CFO Multiple* where the mean is 1.131 but the median is below 1 at 0.859.

The average *Price to Book Value Multiple* relative to its three-year historical average is 0.836, with a median of 0.789, again pointing to a valuation below historical benchmarks.

Relative to peer firms, valuation ratios are also generally lower. The mean *EBITDA Peer Valuation* is 0.776, with a median of 0.468, and the mean *Net Income Peer Valuation* is 0.617 (median: 0.353), further reinforcing the perception of relative undervaluation. Notably, the *CFO Peer Valuation* shows a higher mean of 1.557, though accompanied by substantial dispersion (standard deviation: 2.276); the median stands at 0.644, indicating considerable skewness and variation across firms in the sample.

The mean *Prior Share Performance* of firms announcing tender offers is -10.5%, with a median of -14.3% and a wide range from -79.7% to +47.1%. The negative average and median returns suggest that many firms experienced notable price declines in the year preceding the announcement. This aligns with the broader theme of tender offer announcements being associated with perceived undervaluation in both absolute and relative terms.

Regarding the control variables, the median *Size* is 5.3%, with a median of 4.5%, meaning that companies on average plan to repurchase around 5% of their outstanding shares via a tender offer.

The average *Volume* is 380, with a median of 77, indicating that tender offers often represent significant interventions in the firm's trading activity compared to companies that use OMRs. The average *Liquidity*, measured by the quick ratio with a median of 1.38, suggests that these firms generally maintain relatively healthy short-term solvency positions.

The median *Equity Ratio* stands at 0.566, indicating a generally conservative capital structure. *Dilution* is close to zero for most firms, with a mean of 0.024 and a median of 0.000, implying that firms engaging in tender offers did not typically expand their share base prior to announcement. *Dividend* yields are modest, with a median of 1.3%. *Ownership* has a mean of 56.2% and a median of 68.4%, suggesting a lower average but higher median ownership concentration than for OMRs.

4.8.3 Skewness

Table 5 reports the skewness of the variables used in this thesis. Skewness is a measure of distributional asymmetry. A distribution is said to be right-skewed (positively skewed) when the majority of values are concentrated near

the lower end, with a long tail extending towards higher values. This pattern typically arises when a few extreme observations inflate the mean. Conversely, a left-skewed (negatively skewed) distribution is characterised by a concentration of higher values and a tail that stretches towards the lower end.

Only four variables in the dataset display approximate symmetry, with skewness values less than 0.5. One variable—*Ownership*—is moderately left-skewed, with a skewness of -0.846, indicating that publicly disclosed ownership levels are generally high, but a minority of firms exhibit notably lower levels. Three additional variables are moderately right-skewed (skewness between 1 and 2), while the remaining 13 variables exhibit severe right skewness, with values well above 2. Notable examples include *Size*, *Volume*, and *Liquidity*, with skewness values of 8.698, 11.406, and 10.315, respectively. Similarly, several valuation metrics demonstrate substantial right skewness, indicating the presence of extreme observations that are far removed from the majority of the sample, as can be seen in Figures 5, 6, and 7.

To address these distributional characteristics and better satisfy the assumptions of classical linear regression, I apply logarithmic transformations to most of the skewed variables. However, I retain some variables in their raw form. Specifically, *Prior Share Performance* and *Dilution* are not transformed, as their values may be either negative or positive, making log transformation inappropriate. Likewise, all abnormal return variables are kept in their original form for the same reason. *Ownership* is also retained in its raw form, as a logarithmic transformation of its moderate left skewness would exacerbate the results. The variable *Dividends*, which can take on zero values, is transformed using a log-plus-one specification in order to retain all observations while reducing skewness.

All other continuous variables, including valuation multiples, peer-relative valuations, and financial ratios such as *Size*, *Volume*, *Liquidity*, and the *Equity Ratio*, were log-transformed to mitigate the effects of extreme values and improve the interpretability of the regression results. This approach allows for more robust statistical analysis in the empirical sections that follow, as discussed in the next chapter.

5 Analysis Results

This chapter first presents the results for the two hypotheses. It then offers a comprehensive discussion, highlighting that operational factors—not alternative motives—are the primary drivers of buyback programme design.

5.1 Empirical Analysis

5.1.1 Hypothesis 1: Influence of Undervaluation on Programme Duration

Table 6 and 7 present the results of testing Hypothesis 1: that perceived undervaluation leads, *ceteris paribus*, to shorter announced repurchase durations. I conduct eight

Table 4: Descriptive Statistics – Tender Offer Programmes (n = 30)

	Obs	Mean	Std. Dev.	Min.	25%	Median	75%	Max.
EBITDA Multiple	28	0.895	0.422	0.364	0.654	0.800	1.028	2.472
Net Income Multiple	27	0.844	0.458	0.072	0.596	0.775	1.005	2.247
CFO Multiple	25	1.131	1.081	0.218	0.651	0.859	1.005	5.699
Price to Book Value Multiple	30	0.836	0.254	0.199	0.716	0.789	0.952	1.449
EBITDA Peer Valuation	24	0.776	0.771	0.214	0.359	0.468	0.995	3.907
Net Income Peer Valuation	23	0.617	1.045	0.036	0.279	0.353	0.530	5.258
CFO Peer Valuation	22	1.557	2.276	0.097	0.384	0.644	1.584	10.400
Prior Share Performance	29	-10.534	25.611	-79.721	-25.926	-14.286	7.207	47.059
Size	30	0.053	0.035	0.008	0.023	0.045	0.081	0.136
Volume	30	379.526	782.326	11.355	40.901	77.021	289.157	3,850.544
Liquidity	30	1.750	1.239	0.014	0.999	1.377	2.014	5.386
Equity Ratio	30	0.580	0.175	0.317	0.446	0.566	0.732	0.899
Dilution	30	0.024	0.150	-0.067	0.000	0.000	0.000	0.813
Dividends	30	0.014	0.014	0.000	0.000	0.013	0.019	0.048
Ownership	30	0.562	0.325	0.009	0.381	0.684	0.773	1.000

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table provides descriptive statistics for companies that announced at least one share tender offer within the period from July 3, 2016, to March 20, 2025. For each variable, the table presents the number of observations, mean, standard deviation, minimum, 25th percentile, median, 75th percentile, and maximum. The three variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Multiple*, *Net Income Multiple*, and *CFO* (Cash-Flow from Operations) *Multiple*—represent the ratio of the current LTM valuation multiple to the average LTM valuation multiple over the past three years. *Price to Book Value* (PB) *Multiple* is a ratio of the current PB multiple divided by the average PB multiple of the last three years. *EBITDA Peer Valuation*, *Net Income Peer Valuation*, and *CFO Peer Valuation* are defined as the ratio of a firm's current LTM valuation multiple to the average current multiple of its peer group. *Prior Share Performance* is the company's share price performance over the last 365 days before the announcement multiplied by 100. The control variables are defined as follows: *Size* measures the maximum monetary value of the offer relative to the company's market capitalisation; *Volume* represents the ratio of the number of shares sought to the average daily trading volume; *Liquidity* corresponds to the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* captures the change in outstanding shares between the two most recent annual reports; *Dividends* reflects the company's average dividend yield over the three years prior to the tender offer announcement; and *Ownership* denotes the percentage of publicly known owners of the company. For more detailed definitions of the variables, see Section 4.2.

ordinary least squares regressions to examine this assumption. Table 6 contains results based on the four historic multiple approaches described in Section 4.2, while Table 7 covers the peer valuation and prior share price performance approaches.

None of the main independent variables used to measure perceived undervaluation are statistically significant. Their p -values range from $p = 0.182$ for *Prior Share Performance* to $p = 0.819$ for $\ln(\text{Net Income Multiple})$. Four of the main variables have positive coefficients, and four have negative coefficients. These results provide no empirical support for Hypothesis 1.

The R^2 values of the regressions range from 0.603 to 0.630, indicating that the variables in the models explain roughly 60% of the variance in the dependent variable. This explanatory power stems mainly from the two control variables, $\ln(\text{Size})$ and $\ln(\text{Volume})$, which are statistically significant at the $p < 0.001$ level in all eight regressions. Both variables have positive coefficients.

To illustrate the interpretation of these coefficients, consider $\ln(\text{Size})$ in the first regression of Table 6: the *Announced Programme Duration in Days* is, ceteris paribus, 0.4018 percent higher on average for observations with one percent higher repurchase size ratios. This kind of interpretation applies to all log-transformed variables in these regressions.

Raw variables, such as *Prior Share Performance*, can be interpreted differently. For example, in the fourth regression

of Table 7: the *Announced Programme Duration in Days* is, ceteris paribus, 0.22 percent higher on average for observations with a one percentage point increase in the *Prior Share Performance*. However, due to the lack of statistical significance, the raw coefficient values should not be used to assert influence over the dependent variable.

Interestingly, the variable $\ln(\text{Equity Ratio})$ is significant at the $p < 0.05$ level in regressions one, three, and four of Table 6, and regressions two and four of Table 7. It is also significant at the $p < 0.01$ level in models one and three of Table 7. These results suggest that firms with higher equity ratios, ceteris paribus, tend to announce shorter repurchase durations, as indicated by the negative coefficients.

5.1.2 Hypothesis 2: Tender Offer Versus Open Market Repurchase

Tables 8 to 11 present the results for Hypothesis 2, which posits that perceived undervaluation increases the likelihood of a tender offer relative to an open market repurchase programme. However, the data does not provide strong support for this hypothesis. Of the eight regression models, only one undervaluation proxy— $\ln(\text{EBITDA Peer Valuation})$ —is statistically significant, and only marginally so ($p = 0.040$). The remaining proxies yield p -values ranging from $p = 0.081$ for *Prior Share Performance* to $p = 0.975$ for $\ln(\text{CFO Multiple})$, offering no compelling evidence that undervaluation meaningfully influences the choice of repurchase method.

Table 5: Skewness of Variables

Variable	Skewness
Announced Programme Duration	2.928
EBITDA Multiple	1.279
Net Income Multiple	2.118
CFO Multiple	3.205
Price to Book Value Multiple	0.319
EBITDA Peer Valuation	4.647
Net Income Peer Valuation	2.674
CFO Peer Valuation	4.039
Prior Share Performance	1.431
Size	8.698
Volume	11.406
Liquidity	10.315
Equity Ratio	0.146
Dilution	7.390
Dividends	1.142
Ownership	-0.846
Abnormal Announcement Return (3 Days)	0.436
Abnormal Return (30 Days)	0.336
Abnormal Return (180 Days)	13.200
Abnormal Return (365 Days)	2.825
Abnormal Return (730 Days)	2.082
Abnormal Return (1095 Days)	2.479

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.
Notes: This table reports the skewness of the variables used in this thesis.

Four variables are relatively symmetric ($|skew| < 0.5$). *Ownership* is moderately left skewed, meaning that a larger proportion of observations are concentrated on the higher end of the scale, with a long tail toward lower ownership values. Three more variables are highly right skewed ($1 < |skew| < 2$). The remaining 13 variables are severely right skewed ($|skew| > 2$), meaning that most observations are clustered near the lower end of the distribution, with a small number of extreme values pulling the mean upward. These distributions require transformation to satisfy normality assumptions in statistical analyses. For detailed definitions of the variables, see Section 4.2 or Tables 3 and 15.

As in previous analyses, most of the explanatory power stems from $\ln(\text{Volume})$, which is highly significant across all models. The variable $\ln(\text{Equity Ratio})$ also shows consistent significance at the $p < 0.01$ level in all regressions. Additionally, $\ln(1 + \text{Dividends})$ is statistically significant in three models ($p < 0.05$), while $\ln(\text{Liquidity})$ reaches significance in one model.

Given the use of logistic models to test this hypothesis, the coefficients in Tables 8 and 10 indicate only the direction of effects and not their magnitude. The marginal effects reported in Tables 9 and 11 allow for quantitative interpretation. For example, in the first model of Table 9, a 1% increase in the volume ratio is associated with an average increase of approximately 0.0567 percentage points in the likelihood of a tender offer, holding other factors constant.

Overall, the models exhibit good fit, as indicated by their Pseudo R^2 and log-likelihood values. However, this is largely attributable to $\ln(\text{Volume})$, with limited contribution from the undervaluation proxies. Other variables with modest signifi-

cance will be discussed further in the subsequent sections.

5.2 Discussion

5.2.1 Hypothesis 1: Influence of Undervaluation on Programme Duration

Hypothesis 1 predicts that perceived undervaluation shortens the announced duration of share repurchase programmes. However, the empirical analysis provides no support for this proposition. Across eight model specifications, undervaluation—measured using a range of market-based proxies—does not significantly influence programme duration. Consequently, Hypothesis 1 is rejected: perceived undervaluation, as defined in this study, does not appear to affect the length of announced repurchase programmes.

These findings contrast with those of Gould (2019) and Ota et al. (2022), as discussed in Section 3.3. One plausible explanation is that German managers do not use programme duration as a signalling mechanism for undervaluation, in contrast to their counterparts in other jurisdictions. Alternatively, differences in research design may account for the discrepancy. While the present study employs continuous, market-based valuation metrics, the aforementioned studies rely on dummy variables based on firms' stated repurchase motives.

Notably, the only motivation-related variable that exhibits a consistent influence on programme duration is the equity ratio. Given that the models already control for liquidity, the most plausible explanation is that firms with higher leverage face covenant-based constraints on cash outflows, including share repurchases. In contrast, firms with stronger equity positions are less restricted and can execute buybacks more swiftly.

The role of the equity ratio is particularly striking, considering that only one firm explicitly cites capital structure optimisation as the primary motive for their repurchase activity (see Figure 3). Beyond this, programme duration appears to be largely determined by operational factors, as reflected in the significance of the control variables $\ln(\text{Size})$ and $\ln(\text{Volume})$. These capture logistical constraints in executing large repurchase volumes within the open market.

In sum, the announced duration of repurchase programmes in Germany conveys limited information about managerial perceptions of undervaluation, and appears to reflect practical implementation considerations rather than strategic signalling.

5.2.2 Hypothesis 2: Tender Offer Versus Open Market Repurchase

A similar pattern emerges for Hypothesis 2. Although the variable $\ln(\text{EBITDA Peer Valuation})$ is statistically significant at the $p < 0.05$ level in one model specification, undervaluation does not consistently influence the choice between tender offers and open market repurchase programmes. Accordingly, Hypothesis 2 is rejected.

Instead, the primary determinant of repurchase method appears to be the *Volume* ratio. This result is intuitive, as

Table 6: Hypothesis 1 - Historic Multiple Ratio Approach

Dependent Variable:	ln(Announced Programme Duration in Days)			
	(1)	(2)	(3)	(4)
ln(EBITDA Multiple)	-0.0819 (0.172)			
ln(Net Income Multiple)		0.0314 (0.137)		
ln(CFO Multiple)			0.0550 (0.103)	
ln(Price to Book Value Multiple)				0.1802 (0.260)
ln(Size)	0.4018*** (0.069)	0.4126*** (0.067)	0.3996*** (0.074)	0.3372*** (0.086)
ln(Volume)	0.2523*** (0.061)	0.2594*** (0.060)	0.2649*** (0.068)	0.3075*** (0.073)
ln(Liquidity)	-0.0355 (0.040)	-0.0268 (0.038)	-0.0491 (0.049)	-0.0312 (0.039)
ln(Equity Ratio)	-0.1972* (0.085)	-0.1441 (0.083)	-0.2286* (0.091)	-0.1997* (0.084)
Dilution	0.0032 (1.474)	-0.3410 (1.455)	0.0775 (1.410)	-1.6315 (1.788)
ln(1+Dividends)	-0.5330 (3.426)	-0.1211 (3.386)	-1.2328 (3.345)	-0.7567 (3.197)
Constant	5.8939*** (0.430)	5.9948*** (0.407)	5.8530*** (0.452)	5.4793*** (0.553)
Estimator	OLS	OLS	OLS	OLS
Observations	284	276	272	296
R ²	0.624	0.622	0.627	0.620
Adjusted R ²	0.614	0.612	0.617	0.610

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of four OLS regressions, with the natural logarithm of the announced programme duration as the dependent variable and valuation multiples and control variables as independent variables. *Announced Programme Duration in Days* measures the number of days between the announced starting date of the repurchase and the latest possible programme end date. Log transformations are applied to all independent variables except

Dilution. The natural log (ln) is used to reduce skewness. Coefficients on log-transformed variables represent approximate percentage changes in the dependent variable for a 1% increase in the independent variable. *Dilution* is included in its original scale. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. Three of the four main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Multiple*, *Net Income Multiple*, and *CFO* (Cash-Flow from Operations) *Multiple*—represent the ratio of the current LTM valuation multiple to the average LTM valuation multiple over the past three years. Similarly, the *Price to Book Value Multiple* is defined as the ratio of the current market capitalisation to the current book value of equity, divided by the average of this multiple over the past three years. The control variables are defined as follows: *Size* measures the maximum monetary value of the repurchase programme relative to the company's market capitalisation; *Volume* represents the ratio of the number of shares sought to the average daily trading volume; *Liquidity* corresponds to the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* captures the change in outstanding shares between the two most recent annual reports; and *Dividends* reflects the company's average dividend yield over the three years prior to the repurchase announcement. For more detailed definitions of the variables, see Section 4.2. Robust standard errors of the type HC1 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variables for these OLS regressions have the following p-values: *ln(EBITDA Multiple)*: $p = 0.634$, *ln(Net Income Multiple)*: $p = 0.819$, *ln(CFO Multiple)*: $p = 0.592$, *ln(Price to Book Value Multiple)*: $p = 0.489$.

companies are generally restricted to repurchasing no more than 25% of the average daily trading volume (The European Commission, 2016, Article 3, Paragraphs 2–3, Regulation (EU) 2016/1052). Firms constrained by this limit may resort to a tender offer when seeking to repurchase a substantial number of shares within a short time frame.

As with programme duration, a higher *Equity Ratio* is positively associated with the likelihood of opting for a tender offer. This supports the earlier interpretation: firms with lower leverage face fewer constraints, giving them greater flexibility to carry out repurchases via tender offers.

Additionally, the significance of the *Dividends* variable in three out of eight model specifications suggests that payout policy may influence the choice of repurchase method. Specifically, firms with higher dividend distributions are

more likely to favour OMR programmes over tender offers. This finding aligns with expectations, as dividends typically indicate a commitment to regular, ongoing shareholder returns—an approach that complements the incremental nature of open market repurchases.

6 Robustness Checks

This chapter validates the models and conclusions from earlier chapters using robustness checks. It assesses multicollinearity, then re-examines the drivers of tender offers versus short-term open market repurchases, confirming that undervaluation is not a primary factor. Finally, it explores the link between repurchase duration and subsequent share

Table 7: Hypothesis 1 - Peer Valuation & Share Price Performance Approaches

Dependent Variable:	ln(Announced Programme Duration in Days)			
	(1)	(2)	(3)	(4)
ln(EBITDA Peer Valuation)	-0.1022 (0.084)			
ln(Net Income Peer Valuation)		-0.0929 (0.112)		
ln(CFO Peer Valuation)			-0.0215 (0.060)	
Prior Share Performance				0.0022 (0.002)
ln(Size)	0.4239*** (0.069)	0.4228*** (0.067)	0.4502*** (0.070)	0.3414*** (0.083)
ln(Volume)	0.2962*** (0.063)	0.2779*** (0.061)	0.2966*** (0.061)	0.3041*** (0.071)
ln(Liquidity)	-0.0586 (0.041)	-0.0672 (0.042)	-0.0668 (0.053)	-0.0329 (0.038)
ln(Equity Ratio)	-0.2698** (0.102)	-0.2474* (0.098)	-0.3028** (0.103)	-0.1988* (0.083)
Dilution	-0.0384 (1.402)	0.0331 (1.491)	0.3741 (1.361)	-1.5247 (1.813)
ln(1+Dividends)	-3.6175 (3.304)	-2.1342 (3.497)	-4.8385 (3.193)	-0.4498 (3.150)
Constant	5.8502*** (0.415)	5.8956*** (0.407)	5.9789*** (0.425)	5.4768*** (0.529)
Estimator	OLS	OLS	OLS	OLS
Observations	253	241	235	295
R ²	0.628	0.603	0.630	0.621
Adjusted R ²	0.617	0.591	0.619	0.612

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of four OLS regressions, with the natural logarithm of the announced programme duration as the dependent variable and measures of undervaluation and control variables as independent variables. *Announced Programme Duration in Days* measures the number of days between the announced starting date of the repurchase and the latest possible programme end date. Log transformations are applied to all independent variables except *Dilution* and *Prior Share Performance*. The natural log (ln) is used to reduce skewness. Coefficients on log-transformed variables represent approximate percentage changes in the dependent variable for a 1% increase in the independent variable. *Dilution* and *Prior Share Performance* are included in their original scale. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. Three of the four main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Peer Valuation*, *Net Income Peer Valuation*, and *CFO* (Cash-Flow from Operations) *Peer Valuation*—represent the ratio of a firm's current LTM valuation multiple to the average current multiple of its peer group. The fourth main independent variable: *Prior Share Performance* is the company's share price performance over the last 365 days before the announcement multiplied by 100. The control variables are defined as follows: *Size* measures the maximum monetary value of the repurchase programme relative to the company's market capitalisation; *Volume* represents the ratio of the number of shares sought to the average daily trading volume; *Liquidity* corresponds to the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* captures the change in outstanding shares between the two most recent annual reports; and *Dividends* reflects the company's average dividend yield over the three years prior to the repurchase announcement. For more detailed definitions of the variables, see Section 4.2. Robust standard errors of the type HC1 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variables for these OLS regressions have the following p-values: *ln(EBITDA Peer Valuation)*: $p = 0.226$, *ln(Net Income Peer Valuation)*: $p = 0.405$, *ln(CFO Peer Valuation)*: $p = 0.721$, *Prior Share Performance*: $p = 0.182$.

price performance and whether announcement returns differ for initial versus repeated repurchase programmes.

6.1 Multicollinearity

To assess the validity of my models, I test them for multicollinearity. Table 12 presents the Variance Inflation Factors (VIFs), which measure how much the variance of a regression coefficient is inflated due to multicollinearity among the independent variables. Most variables exhibit VIFs slightly above 1, indicating no multicollinearity concerns. However, *ln(Size)* and *ln(Volume)* show VIFs ranging from 3.375 to 5.226. These values approach or slightly exceed the commonly used threshold of 5, which suggests moderate multicollinearity.

The observed correlation between these two variables is expected, as *Size* reflects the total number of shares (or market capitalisation) targeted in the repurchase, while *Volume* is defined as the ratio of the same number of shares to the average daily trading volume (see Section 4.2). Thus, both variables share the same numerator, inherently linking them.

Despite this moderate multicollinearity, both variables are retained in the models, as they capture distinct dimensions of repurchase programmes. Specifically, *Size* reflects the overall scale of the intended buyback, whereas *Volume* provides a measure of its executational feasibility within the constraints of market liquidity. Their inclusion thus enhances the explanatory power of the models without compromising their interpretability.

Table 8: Hypothesis 2 - Historic Multiple Ratio Approach (Coefficients)

Dependent Variable:	Tender Offer Probability			
	(1)	(2)	(3)	(4)
ln(EBITDA Multiple)	-0.4802 (0.895)			
ln(Net Income Multiple)		-0.5098 (0.334)		
ln(CFO Multiple)			0.0216 (0.681)	
ln(Price to Book Value Multiple)				-1.1793 (0.872)
ln(Size)	0.1404 (0.266)	0.1239 (0.273)	0.0292 (0.253)	0.0965 (0.234)
ln(Volume)	1.1474*** (0.233)	1.1585*** (0.211)	1.2061*** (0.243)	1.1334*** (0.222)
ln(Liquidity)	0.2675 (0.302)	0.3416 (0.282)	-0.0076 (0.382)	0.2010 (0.310)
ln(Equity Ratio)	2.0025** (0.585)	1.9740** (0.612)	1.8252** (0.585)	2.0089** (0.594)
Dilution	-0.4811 (3.716)	2.4601 (2.085)	-2.7592 (3.853)	-0.1235 (1.795)
ln(1 + Dividends)	-27.2398 (15.903)	-24.6936 (17.103)	-33.7171* (15.494)	-36.5734 (17.730)
Ownership	-0.2272 (1.077)	-0.5473 (1.100)	0.0354 (1.089)	-0.2334 (1.005)
Constant	-3.6533* (1.846)	-3.7610* (1.610)	-4.3370* (1.792)	-3.7470* (1.657)
Estimator	Logit	Logit	Logit	Logit
Observations	312	303	297	326
Log-Likelihood	-52.257	-47.799	-49.449	-54.790
Pseudo R ²	0.4453	0.4750	0.4236	0.4529

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of four logistic regressions, with the probability of a tender offer as the dependent variable and valuation multiples alongside control variables as independent variables. *Tender Offer Probability* is a binary variable equal to one if the firm announces a tender offer share repurchase, and zero if it announced a market repurchase programme. Log transformations are applied to all independent variables except *Dilution* and *Ownership*. The natural log (ln) is used to reduce skewness. Coefficients on log-transformed variables represent changes in the log-odds of the outcome associated with a 1% increase in the independent variable. *Dilution* and *Ownership* are included in their original scale. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. Three of the four main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Multiple*, *Net Income Multiple*, and *CFO* (Cash-Flow from Operations) *Multiple*—represent the ratio of the current LTM valuation multiple to the average LTM valuation multiple over the past three years. Similarly, the *Price to Book Value Multiple* is defined as the ratio of the current market capitalisation to the current book value of equity, divided by the average of this multiple over the past three years. The control variables are defined as follows: *Size* measures the maximum announced repurchase volume relative to the company's market capitalisation; *Volume* captures the number of shares sought relative to the average daily trading volume; *Liquidity* is measured by the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* reflects the change in outstanding shares between the two most recent annual reports; and *Dividends* represents the company's average dividend yield over the three years preceding the repurchase announcement. *Ownership* denotes the percentage of publicly known owners of the company. For more detailed definitions of the variables, see Section 4.2. Robust standard errors of the type HC3 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variables for these logistic regressions have the following p-values: $\ln(\text{EBITDA Multiple})$: $p = 0.592$, $\ln(\text{Net Income Multiple})$: $p = 0.127$, $\ln(\text{CFO Multiple})$: $p = 0.975$, and $\ln(\text{Price to Book Value Multiple})$: $p = 0.176$.

6.2 Tender Offers Versus Short-Term Open Market Repurchases

Tables 13 and 14 further test the second hypothesis—that perceived undervaluation increases the probability of a tender offer—using the same model specifications as in the main analysis. In this robustness check, however, only OMR programmes with an announced duration of 90 days or less are included. The rationale for this restriction is that, under conditions of perceived undervaluation, firms may prefer to repurchase shares quickly—before the market corrects the mispricing—rather than commit to a longer programme, which may be less effective if the valuation gap is expected to close over time. Including longer OMR programmes could there-

fore distort the analysis by incorporating cases unlikely to reflect undervaluation-driven repurchase decisions.

Despite this adjustment, the results are broadly consistent with those from the full sample (Tables 8 to 11). None of the undervaluation proxies reaches conventional levels of statistical significance, with p -values ranging from 0.058 to 0.985. While $\ln(\text{Volume})$ shows slightly reduced significance compared to the full sample, it remains the primary explanatory variable. In addition, $\ln(\text{Size})$ is statistically significant at the $p < 0.05$ level in two models, and $\ln(\text{Equity Ratio})$ is significant in one. These findings reinforce the earlier conclusion that the choice between tender offers and OMR programmes is not primarily driven by undervaluation, but rather by struc-

Table 9: Hypothesis 2 - Historic Multiple Ratio Approach (Marginal Effects)

Dependent Variable:	Tender Offer Probability			
	(1)	(2)	(3)	(4)
ln(EBITDA Multiple)	-0.0237 (0.043)			
ln(Net Income Multiple)		-0.0234 (0.015)		
ln(CFO Multiple)			0.0011 (0.033)	
ln(Price to Book Value Multiple)				-0.0589 (0.042)
ln(Size)	0.0069 (0.013)	0.0057 (0.013)	0.0014 (0.012)	0.0048 (0.012)
ln(Volume)	0.0567*** (0.009)	0.0532*** (0.008)	0.0585*** (0.009)	0.0567*** (0.009)
ln(Liquidity)	0.0132 (0.015)	0.0157 (0.013)	-0.0004 (0.019)	0.0100 (0.015)
ln(Equity Ratio)	0.0989** (0.030)	0.0906** (0.030)	0.0886** (0.032)	0.1004** (0.030)
Dilution	-0.0238 (0.183)	0.1129 (0.098)	-0.1339 (0.182)	-0.0062 (0.090)
ln(1 + Dividends)	-1.3456 (0.762)	-1.1333 (0.764)	-1.6367* (0.731)	-1.8281 (0.829)
Ownership	-0.0112 (0.053)	-0.0251 (0.050)	0.0017 (0.053)	-0.0117 (0.050)
Estimator	Logit (ME)	Logit (ME)	Logit (ME)	Logit (ME)
Observations	312	303	297	326

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the average marginal effects from four logistic regressions, with the probability of a tender offer as the dependent variable and valuation multiples alongside control variables as independent variables. *Tender Offer Probability* is a binary variable equal to one if the firm announces a tender offer share repurchase, and zero if it announced a market repurchase programme. Log transformations are applied to all independent variables except *Dilution* and *Ownership*. The natural log (ln) is used to reduce skewness. The marginal difference for an independent variable is the average difference in the probability of the programme being a tender offer, that corresponds to a one unit difference in the independent variable. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. Three of the four main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Multiple*, *Net Income Multiple*, and *CFO* (Cash-Flow from Operations) *Multiple*—represent the ratio of the current LTM valuation multiple to the average LTM valuation multiple over the past three years. Similarly, the *Price to Book Value Multiple* is defined as the ratio of the current market capitalisation to the current book value of equity, divided by the average of this multiple over the past three years. The control variables are defined as follows: *Size* measures the maximum announced repurchase volume relative to the company's market capitalisation; *Volume* captures the number of shares sought relative to the average daily trading volume; *Liquidity* is measured by the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* reflects the change in outstanding shares between the two most recent annual reports; and *Dividends* represents the company's average dividend yield over the three years preceding the repurchase announcement. *Ownership* denotes the percentage of publicly known owners of the company. Robust standard errors of the type HC3 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

tural and operational considerations.

6.3 Repurchase Duration and Subsequent Share Price Performance

If undervaluation were to lead to shorter repurchase programmes, firms announcing shorter open market repurchase programmes should exhibit abnormally positive share price performance as markets close the valuation gap. Table 15 presents descriptive statistics of these abnormal returns across various time horizons from 30 to 1,095 days (three years).

Abnormal returns are calculated as the difference between a stock's total return and the performance of the broad German CDAX index over each horizon, starting on the announcement date. To ensure adequate data coverage, only repurchase announcements made sufficiently prior to

the dataset cut-off date of March 20, 2025 are included. As a result, observation counts decline with longer horizons.

The mean abnormal return is mostly positive across the windows, but the median is only positive for the 30-day OMR window and turns negative thereafter. This divergence reflects outliers with strong positive performance, evident in high maximum values. These are partly due to the post-COVID-19 rally, during which some stocks rebounded sharply from depressed levels.

Figure 8 illustrates share price developments following repurchase announcements over a 365-day period. The effect of outliers is especially evident in the mean abnormal return line, notably around the 150-day mark. Overall, the figure does not reveal a clear or consistent pattern in abnormal returns over time.

Table 16 reports five OLS regressions, with abnormal return as the dependent variable and $\ln(\text{Program Duration})$ as

Table 10: Hypothesis 2 - Peer Valuation & Share Price Performance Approaches (Coefficients)

Dependent Variable:	Tender Offer Probability			
	(1)	(2)	(3)	(4)
ln(EBITDA Peer Valuation)	-0.8034* (0.391)			
ln(Net Income Peer Valuation)		-0.7760 (0.695)		
ln(CFO Peer Valuation)			-0.0404 (0.306)	
Prior Share Performance				-0.0158 (0.009)
ln(Size)	0.2826 (0.290)	0.2283 (0.272)	0.1787 (0.256)	0.1107 (0.208)
ln(Volume)	0.9230** (0.265)	1.0231*** (0.254)	0.8766*** (0.246)	1.1746*** (0.228)
ln(Liquidity)	0.5184* (0.261)	0.4334 (0.272)	0.2427 (0.364)	0.0981 (0.318)
ln(Equity Ratio)	2.3531** (0.692)	2.0481** (0.671)	1.9214** (0.670)	2.0315** (0.608)
Dilution	0.0423 (3.689)	1.9659 (2.139)	1.1867 (1.566)	0.2132 (1.624)
ln(1 + Dividends)	-42.3661 (22.263)	-41.8897 (22.133)	-40.8611* (20.614)	-42.8331* (18.145)
Ownership	-0.9093 (1.154)	-0.6418 (1.077)	-0.6962 (0.999)	-0.0625 (1.011)
Constant	-0.6938 (2.207)	-1.7397 (2.057)	-2.0791 (1.945)	-3.7837* (1.483)
Estimator	Logit	Logit	Logit	Logit
Observations	277	264	257	324
Log-Likelihood	-45.640	-40.943	-46.175	-52.806
Pseudo R ²	0.4409	0.4758	0.3852	0.4592

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of four logistic regressions, with the probability of a tender offer as the dependent variable and valuation multiples alongside control variables as independent variables. *Tender Offer Probability* is a binary variable equal to one if the firm announces a tender offer share repurchase, and zero if it announced a market repurchase programme. All independent predictors except *Dilution*, *Ownership* and *Prior Share Performance* are natural-log transformed to reduce skewness. Coefficients on log-transformed variables represent changes in the log-odds of the outcome associated with a 1% increase in the independent variable. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. The main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Peer Valuation*, *Net Income Peer Valuation* and *CFO* (Cash-Flow from Operations) *Peer Valuation*—are the ratios of a firm's current LTM multiple to the peer-group average, while *Prior Share Performance* is the percentage change in share price over the 365 days before the announcement. The control variables are defined as follows: *Size* measures the maximum announced repurchase volume relative to the company's market capitalisation; *Volume* captures the number of shares sought relative to the average daily trading volume; *Liquidity* is measured by the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* reflects the change in outstanding shares between the two most recent annual reports; and *Dividends* represents the company's average dividend yield over the three years preceding the repurchase announcement. *Ownership* denotes the percentage of publicly known owners of the company. For more detailed definitions of the variables, see Section 4.2. Robust standard errors of the type HC3 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variables for these logistic regressions have the following p-values: *ln(EBITDA Peer Valuation)*: $p = 0.040$, *ln(Net Income Peer Valuation)*: $p = 0.264$, *ln(CFO Peer Valuation)*: $p = 0.895$, and *Prior Share Performance*: $p = 0.081$.

the main independent variable, plus three control variables. Only *ln(Liquidity)* is significant at the $p < 0.05$ level in one model. Additionally, the models exhibit very low explanatory power, as reflected in the low R^2 values.

These findings suggest that abnormal returns following repurchase announcements are not systematically related to programme duration. This aligns with the conclusions drawn in Chapter 5, which indicate that undervaluation does not result in shorter repurchase programmes. Furthermore, the control variables intended to capture the conditions under which firms announce repurchases do not exhibit a significant effect on abnormal returns, consistent with their role as non-value-adding logistical controls.

6.4 Announcement Return: Initial vs. Repeated Repurchase

This section investigates whether credibility potentially earned through prior repurchase programmes positively influences the abnormal return of new repurchase announcements.

The first row for both repurchase types in Table 15 reports *Abnormal Announcement Returns*, calculated over a three-trading-day event window. These returns are based exclusively on repurchase announcements made on or after July 3, 2018. Due to this 2 year shorter period, this subsample contains fewer observations than the one used for the 30-day abnormal return analysis.

To classify repurchase announcements as either initial or

Table 11: Hypothesis 2 - Peer Valuation & Share Price Performance Approaches (Marginal Effects)

Dependent Variable:	Tender Offer Probability			
	(1)	(2)	(3)	(4)
ln(EBITDA Peer Valuation)	-0.0389* (0.019)			
ln(Net Income Peer Valuation)		-0.0343 (0.029)		
ln(CFO Peer Valuation)			-0.0021 (0.016)	
Prior Share Performance				-0.0008 (0.000)
ln(Size)	0.0137 (0.015)	0.0101 (0.012)	0.0093 (0.014)	0.0054 (0.010)
ln(Volume)	0.0447** (0.011)	0.0452*** (0.012)	0.0456*** (0.012)	0.0571*** (0.008)
ln(Liquidity)	0.0251* (0.012)	0.0191 (0.012)	0.0126 (0.019)	0.0048 (0.015)
ln(Equity Ratio)	0.1138** (0.034)	0.0905** (0.030)	0.1000** (0.038)	0.0988** (0.030)
Dilution	0.0020 (0.179)	0.0868 (0.099)	0.0617 (0.082)	0.0104 (0.079)
ln(1 + Dividends)	-2.0497 (1.023)	-1.8501 (0.918)	-2.1259* (1.002)	-2.0832* (0.793)
Ownership	-0.0440 (0.056)	-0.0283 (0.047)	-0.0362 (0.051)	-0.0030 (0.049)
Estimator	Logit (ME)	Logit (ME)	Logit (ME)	Logit (ME)
Observations	277	264	257	324

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the average marginal effects from four logistic regressions, with the probability of a tender offer as the dependent variable and valuation multiples alongside control variables as independent variables. *Tender Offer Probability* is a binary variable equal to one if the firm announces a tender offer share repurchase, and zero if it announced a market repurchase programme. Log transformations are applied to all independent variables except *Dilution*, *Ownership* and *Prior Share Performance*. The natural log (ln) is used to reduce skewness. The marginal difference for an independent variable is the average difference in the probability of the programme being a tender offer, that corresponds to a one unit difference in the independent variable. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. Three of the four main variables—*EBITDA* (Earnings Before Interest, Tax, Depreciation and Amortization) *Peer Valuation*, *Net Income Peer Valuation*, and *CFO* (Cash-Flow from Operations) *Peer Valuation*—represent the ratio of a firm's current LTM valuation multiple to the average current multiple of its peer group. The fourth main independent variable: *Prior Share Performance* is the company's share price performance over the last 365 days before the announcement multiplied by 100. The control variables are defined as follows: *Size* measures the maximum announced repurchase volume relative to the company's market capitalisation; *Volume* captures the number of shares sought relative to the average daily trading volume; *Liquidity* is measured by the quick ratio; *Equity Ratio* is calculated as book equity divided by total assets; *Dilution* reflects the change in outstanding shares between the two most recent annual reports; and *Dividends* represents the company's average dividend yield over the three years preceding the repurchase announcement. *Ownership* denotes the percentage of publicly known owners of the company. Robust standard errors of the type HC3 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

repeated, a two-year look-back window from July 3, 2016 to July 3, 2018 is employed. Announcements made within this window are excluded to reduce the probability of misclassifying firms with regularly recurring repurchase activity as first-time repurchasers due to incomplete observable history. This adjustment helps mitigate classification bias, albeit at the expense of a reduced sample size.

However, this approach does not fully eliminate the risk of misclassification. Specifically, firms that conducted repurchase programmes prior to July 2016 and resumed them after July 3, 2018 are still categorised as initial repurchasers, owing to the absence of earlier data. This limitation arises from left-censoring in the dataset. While this constraint cannot be entirely resolved given the available data, the two-year look-back window represents a conservative compromise aimed at improving classification accuracy.

Table 17 tests whether the abnormal announcement re-

turn differs significantly depending on whether the repurchase programme is classified as repeated, as indicated by the binary variable *Repeated Repurchase*. The regression model also includes the standard set of control variables discussed previously.

The coefficient for *Repeated Repurchase* is statistically insignificant, with a p-value of 0.368, indicating no discernible effect on the abnormal announcement return. Similarly, none of the included control variables are statistically significant. Moreover, the model exhibits a very low R^2 , reinforcing the conclusion that it possesses limited explanatory power in predicting abnormal announcement returns. These results suggest that markets do not appear to reward firms for a history of repurchase activity when a new programme is announced, implying that the signalling effect of credibility gained through past repurchases may be limited or already priced in.

Table 12: Multicollinearity Across OLS and Logit Models

Variable:	EBITDA Multiple	Net Income Multiple	CFO Multiple	Price to Book Value Multiple	EBITDA Peer Valuation	Net Income Peer Valuation	CFO Peer Valuation	Prior Share Performance
<i>OLS Models</i>								
ln(EBITDA Multiple)	1.016							
ln(Net Income Multiple)		1.023						
ln(CFO Multiple)			1.010					
ln(Price to Book Multiple)				1.047				
ln(EBITDA Peer Valuation)					1.106			
ln(Net Income Peer Valuation)						1.078		
ln(CFO Peer Valuation)							1.143	
Prior Share Performance								1.021
ln(Size)	5.044	4.091	5.173	4.097	4.756	3.835	3.808	4.088
ln(Volume)	4.979	3.982	5.226	4.124	4.653	3.733	3.750	4.131
ln(Liquidity)	1.177	1.137	1.241	1.153	1.171	1.111	1.241	1.153
ln(Equity Ratio)	1.276	1.245	1.299	1.304	1.281	1.216	1.243	1.292
Dilution	1.088	1.094	1.050	1.033	1.098	1.105	1.047	1.031
ln(1 + Dividends)	1.181	1.170	1.152	1.176	1.249	1.248	1.185	1.178
<i>Logit Models</i>								
ln(EBITDA Multiple)	1.016							
ln(Net Income Multiple)		1.032						
ln(CFO Multiple)			1.011					
ln(Price to Book Value Multiple)				1.118				
ln(EBITDA Peer Valuation)					1.103			
ln(Net Income Peer Valuation)						1.062		
ln(CFO Peer Valuation)							1.131	
Prior Share Performance								1.037
ln(Size)	4.394	3.672	4.608	3.835	4.205	3.375	3.537	3.814
ln(Volume)	4.292	3.594	4.651	3.813	4.076	3.414	3.544	3.819
ln(Liquidity)	1.155	1.129	1.260	1.150	1.134	1.084	1.238	1.144
ln(Equity Ratio)	1.309	1.277	1.348	1.362	1.313	1.263	1.302	1.339
Dilution	1.087	1.046	1.049	1.079	1.097	1.053	1.036	1.044
ln(1 + Dividends)	1.200	1.192	1.181	1.222	1.271	1.251	1.223	1.228
Ownership	1.067	1.086	1.053	1.096	1.063	1.063	1.059	1.088

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The table reports Variance Inflation Factors (VIFs) for all independent variables across the 16 model specifications. All VIF values are below the threshold of 6, suggesting that multicollinearity is not a serious concern in any of the models. The intercept term is excluded from the table for clarity. For detailed definitions of the variables, see Table 4 or Section 4.2.

Table 13: Tender Offer vs. Short Term Open Market Repurchase - Historic Multiple Ratio Approach (Coefficients)

Dependent Variable:	Tender Offer Probability			
	(1)	(2)	(3)	(4)
ln(EBITDA Multiple)	-0.1473 (1.575)			
ln(Net Income Multiple)		-0.2005 (0.881)		
ln(CFO Multiple)			0.2317 (0.990)	
ln(Price to Book Value Multiple)				-3.3219 (2.029)
ln(Size)	1.0861* (0.529)	0.8088 (0.602)	0.9662 (0.564)	0.6277 (0.389)
ln(Volume)	1.0061*** (0.279)	1.1478** (0.343)	1.0529** (0.347)	1.3563** (0.393)
ln(Liquidity)	-0.5304 (0.860)	-0.2595 (0.769)	-0.7015 (0.931)	-0.2801 (0.794)
ln(Equity Ratio)	3.1254 (1.648)	3.0370 (1.679)	3.0294 (1.841)	1.7709 (1.185)
Dilution	14.7811 (8.032)	17.2954 (9.345)	15.5674 (10.175)	1.0362 (11.402)
ln(1+ Dividends)	-24.9041 (29.037)	-10.6636 (37.114)	-22.3816 (33.867)	-11.2204 (29.568)
Ownership	-1.4744 (1.510)	-1.0595 (1.586)	-1.6821 (1.876)	-1.5190 (1.259)
Constant	4.1643 (3.408)	1.7475 (4.318)	3.6194 (3.432)	-0.6197 (3.305)
Estimator	Logit	Logit	Logit	Logit
Observations	140	134	134	149
Log-Likelihood	-20.210	-18.867	-19.680	-20.629
Pseudo R ²	0.6923	0.7005	0.6711	0.7074

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of four logistic regressions, with the probability of a tender offer as the dependent variable and valuation multiples alongside control variables as independent variables. *Tender Offer Probability* is a binary variable equal to one if the firm announces a tender offer share repurchase, and zero if it announced a market repurchase programme. Open market repurchase programmes are only included if their duration is shorter than or equal to 90 days. Log transformations are applied to all independent variables except *Dilution* and *Ownership*. The natural log (ln) is used to reduce skewness. Coefficients on log-transformed variables represent changes in the log-odds of the outcome associated with a 1% increase in the independent variable. *Dilution* and *Ownership* are included in their original scale. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. For detailed definitions of the variables, see Table 4 or Section 4.2. Robust standard errors of the type HC3 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variables for these logistic regressions have the following p-values: $\ln(\text{EBITDA Multiple})$: $p = 0.925$, $\ln(\text{Net Income Multiple})$: $p = 0.820$, $\ln(\text{CFO Multiple})$: $p = 0.815$, $\ln(\text{Price to Book Value Multiple})$: $p = 0.102$.

7 Limitations and Future Research

This chapter discusses the key limitations of the thesis and their impact on the results. Additionally, it offers suggestions for future research.

7.1 Limitations

1. Choice of variables: The primary limitation of this research concerns the validity of the main independent variables intended to measure undervaluation. In this study, publicly available information is used to infer whether management perceives the firm's shares to be undervalued at the time of the repurchase announcement. However, the multiple-based and peer valuation ratios may be outdated at the point of the repurchase decision—up to six months old for firms

reporting semi-annually, or approximately 90 days old for quarterly reporters. By contrast, management has access to current internal data and superior foresight regarding future business performance. As a result, all key valuation metrics employed here are inherently backward-looking, despite the fact that forward-looking expectations—especially regarding future earnings and cash flows—are more relevant in assessing true valuation. Additionally, the historic multiple variables may be misleading in scenarios where, for instance, a firm's growth rate has declined, making a lower multiple justifiable compared to historical levels. Similarly, the peer valuation approach is based solely on primary industry classification, which overlooks other crucial comparative factors such as size, growth trajectory, margins, and specific business models. While the industry classifications used are de-

Table 14: Tender Offer vs. Short Term Open Market Repurchase - Peer Valuation & Share Price Performance Approaches (Coefficients)

Dependent Variable:	Tender Offer Probability			
	(1)	(2)	(3)	(4)
ln(EBITDA Peer Valuation)	-1.6458 (0.867)			
ln(Net Income Peer Valuation)		-0.6424 (0.616)		
ln(CFO Peer Valuation)			-0.0111 (0.607)	
Prior Share Performance				-0.0251 (0.016)
ln(Size)	1.3315 (0.704)	0.8118 (0.618)	0.9304 (0.546)	0.6483* (0.318)
ln(Volume)	0.8121* (0.321)	1.0839** (0.350)	0.9122** (0.306)	1.3095*** (0.300)
ln(Liquidity)	-0.3838 (0.882)	-0.0972 (0.932)	-0.2416 (0.782)	-0.3162 (0.753)
ln(Equity Ratio)	3.4638* (1.533)	2.4671 (1.619)	2.4807 (2.079)	1.8260 (1.325)
Dilution	19.1307 (10.573)	19.9882 (12.066)	13.6754 (9.619)	-3.2008 (2.843)
ln(1+ Dividends)	-53.0128 (35.736)	-19.9751 (34.271)	-27.3065 (33.306)	-15.9716 (31.099)
Ownership	-1.5951 (1.434)	-1.7113 (1.604)	-1.7937 (1.876)	-1.2171 (1.535)
Constant	5.8742 (4.207)	1.5620 (3.916)	3.4764 (3.750)	-0.1306 (2.245)
Estimator	Logit	Logit	Logit	Logit
Observations	122	111	109	147
Log-Likelihood	-17.151	-17.287	-18.914	-20.635
Pseudo R ²	0.7021	0.6789	0.6360	0.6992

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of four logistic regressions, with the probability of a tender offer as the dependent variable and valuation multiples alongside control variables as independent variables. *Tender Offer Probability* is a binary variable equal to one if the firm announces a tender offer share repurchase, and zero if it announced a market repurchase programme. Open market repurchase programmes are only included if their duration is shorter than or equal to 90 days. Log transformations are applied to all independent variables except *Dilution*, *Ownership* and *Prior Share Performance*. The natural

log (ln) is used to reduce skewness. Coefficients on log-transformed variables represent changes in the log-odds of the outcome associated with a 1% increase in the independent variable. *Dilution*, *Ownership* and *Prior Share Performance* are included in their original scale. *Dividends* is transformed as $\ln(1 + \text{Dividends})$ to accommodate zero values. For detailed definitions of the variables, see Table 4 or Section 4.2. Robust standard errors of the type HC3 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variables for these logistic regressions have the following p-values: *ln(EBITDA Peer Valuation)*: $p = 0.058$, *ln(Net Income Peer Valuation)*: $p = 0.297$, *ln(CFO Peer Valuation)*: $p = 0.985$, *Prior Share Performance*: $p = 0.119$.

financed narrowly to ensure firms operate in similar domains, this does not guarantee true comparability from the perspective of investors.

The variable *Prior Share Performance* presents further challenges. Macroeconomic events—such as the COVID-19 pandemic—may have significantly altered firms' business prospects in ways accurately reflected in their stock prices. As a result, price movements may coincide with management's internal valuation estimates, potentially obscuring signs of undervaluation. Additionally, firms may experience substantial improvements in intrinsic value without corresponding increases in share price, leading to undervaluation not captured by this variable.

Due to these challenges, accurately measuring either true

undervaluation or management's perception thereof is inherently difficult. However, the use of the aforementioned variables represents standard academic practice. Each of these proxies has individual limitations, but in combination they likely provide a realistic approximation of undervaluation. This is particularly relevant given the uniform findings across regression analyses, which consistently show that undervaluation does not influence either the duration of repurchase programmes or the choice between open market repurchases and tender offers.

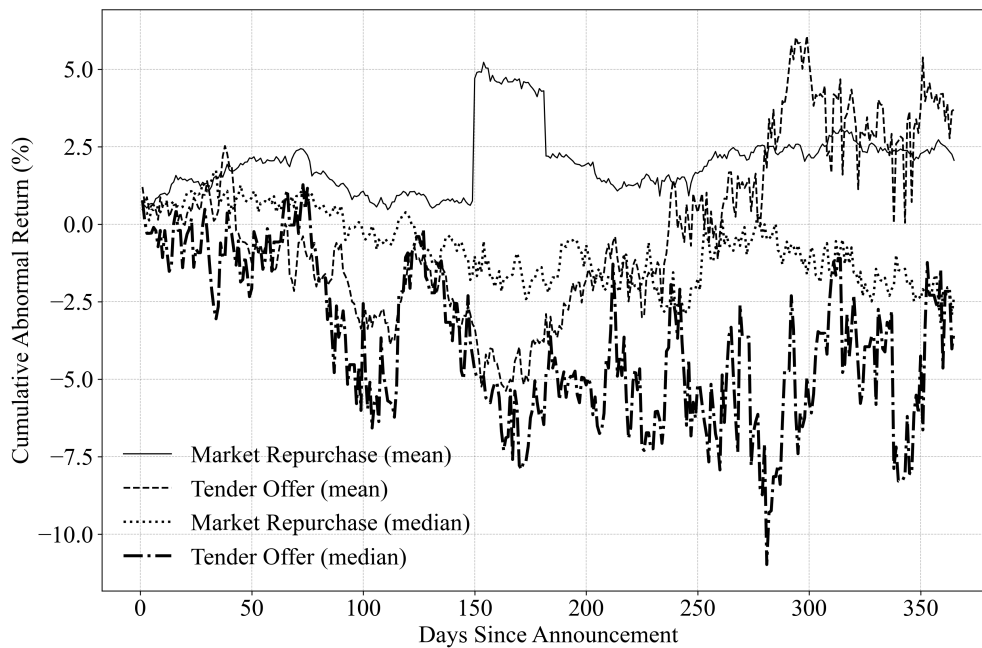
Some control variables in this study are designed to capture alternative motivations for repurchases. However, due to measurement limitations, they may only approximate their intended effects. For instance, publicly disclosed ownership

Table 15: Descriptive Statistics of Abnormal Returns Following the Announcement

	Obs	Mean	Std. Dev	Min.	25%	Median	75%	Max.
<i>Open Market Repurchase (n = 296)</i>								
Abnormal Announcement Return (%)	257	0.495	4.026	-17.189	-1.470	0.367	2.393	21.274
Abnormal Return Over 30 Days (%)	296	1.139	9.559	-46.715	-3.631	0.938	5.349	38.869
Abnormal Return Over 180 Days (%)	285	3.248	60.162	-89.920	-11.857	-2.476	10.223	923.787
Abnormal Return Over 365 Days (%)	273	2.060	42.158	-106.549	-20.126	-2.322	17.404	336.166
Abnormal Return Over 730 Days (%)	227	0.239	56.094	-93.402	-35.371	-9.601	22.451	306.881
Abnormal Return Over 1095 Days (%)	184	1.093	75.896	-107.888	-42.184	-10.806	25.946	493.664
<i>Tender Offer (n = 28)</i>								
Abnormal Announcement Return (%)	25	0.931	3.761	-6.349	-1.238	0.433	1.896	10.431
Abnormal Return Over 30 Days (%)	28	1.667	9.192	-12.395	-5.375	-0.231	7.757	25.785
Abnormal Return Over 180 Days (%)	28	-5.635	20.726	-48.307	-17.814	-6.109	5.703	30.996
Abnormal Return Over 365 Days (%)	23	3.707	42.896	-51.463	-27.845	-3.458	20.926	146.346
Abnormal Return Over 730 Days (%)	18	17.039	88.013	-85.973	-30.379	-13.031	46.043	279.958
Abnormal Return Over 1095 Days (%)	13	-2.042	75.740	-88.582	-48.205	-13.099	4.496	198.181

Source: The presented data is obtained from Capital IQ, LSEG Datastream and is partly hand-collected. For more details, see Section 4.3.

Notes: This table presents descriptive statistics for abnormal share price performance following share repurchase announcements. All return variables are rescaled to percentage-point units by multiplying the raw values by 100. Abnormal returns are computed as the difference between a stock's total return and the corresponding performance of the CDAX index over the specified time horizon, beginning on the announcement date. To ensure sufficient data coverage, abnormal return measures include only those announcements made sufficiently prior to the dataset cut-off date of March 20, 2025. The *Abnormal Announcement Return* (3-day window) is calculated using only announcements dated July 3, 2018 or later. This restriction ensures sufficient data to determine whether a repurchase programme was repeated and aligns with the focus of Table 17 on repeated repurchases. Announcements from the two-year period between July 3, 2016 and July 3, 2018 are excluded for this reason.

**Figure 8:** Abnormal Returns for 365 Days following the Repurchase Announcement

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: The figure presents the cumulative abnormal returns of companies' stock prices over a 365-day period following the announcement of share repurchase programmes, categorized by repurchase method. The X-axis indicates the number of days since the repurchase announcement, while the Y-axis shows the cumulative abnormal return in percentage terms. The graph compares the mean and median cumulative abnormal returns for two types of repurchase mechanisms: market repurchases and tender offers. Mean returns are represented by solid (market repurchase) and dashed (tender offer) lines, while median returns are shown using dotted (market repurchase) and dash-dotted (tender offer) lines.

data may not perfectly reflect true ownership concentration. Similarly, the *Dilution* variable attempts to capture a com-

bination of factors—including stock option schemes and the use of equity in M&A—but also includes the offsetting effect

Table 16: Abnormal Return by Holding Period Dependent on the Programme Duration

Dependent Variable:	Abnormal Return (%)				
	(30 Days)	(180 Days)	(365 Days)	(730 Days)	(1095 Days)
	(1)	(2)	(3)	(4)	(5)
ln(Programme Duration)	-0.5208 (0.535)	-4.7893 (6.944)	-1.6003 (2.820)	-4.2396 (5.067)	-5.0443 (7.373)
ln(Size)	0.4296 (0.611)	1.5354 (3.062)	-0.4718 (3.140)	5.4350 (5.835)	7.0984 (6.693)
ln(Volume)	0.3719 (0.554)	0.0501 (1.752)	3.4057 (2.957)	1.7624 (4.648)	3.5712 (5.376)
ln(Liquidity)	0.6442 (0.341)	-2.4020 (2.942)	-4.3556* (2.004)	-4.1785 (3.875)	-2.4801 (4.475)
Constant	5.1202 (4.833)	32.1211 (49.360)	0.5700 (24.692)	42.4668 (48.660)	52.8289 (60.048)
Estimator	OLS	OLS	OLS	OLS	OLS
Observations	295	284	272	226	183
R ²	0.019	0.011	0.021	0.032	0.045
Adjusted R ²	0.006	-0.003	0.006	0.014	0.023

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of five OLS regressions. They differ in the time span for which the dependent variable was observed. The abnormal return is calculated by subtracting the overall performance of the CDAX index from the overall share price performance of the stock in the relevant time period starting immediately after the announcement multiplied by 100. Log transformations are applied to all independent variables. The natural log (ln) is used to reduce skewness. Coefficients on log-transformed independent variables indicate that the dependent variable is approximately $\beta / 100$ units higher, on average, for a 1% increase in the independent variable. The main independent variable of the models is the variable *Programme Duration* which is the amount of days between the announced start of the repurchase programme and its announced end date. The control variables are defined as follows: *Size* measures the maximum monetary value of the repurchase programme relative to the company's market capitalisation; *Volume* represents the ratio of the number of shares sought to the average daily trading volume; *Liquidity* corresponds to the quick ratio. For more detailed definitions of the variables, see Section 4.2. Robust standard errors of the type HC1 are used. Standard errors are shown in parentheses. The asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The main variable *ln(Programme Duration)* for these OLS regressions has the following p-values: (1): $p = 0.331$, (2): $p = 0.490$, (3): $p = 0.570$, (4): $p = 0.403$, (5): $p = 0.494$

of past repurchases, potentially complicating interpretation.

2. Abnormal returns: To calculate abnormal returns, the CDAX index is used as a benchmark. This index is the most appropriate choice as it encompasses all publicly listed German companies. However, it is market capitalisation-weighted, which results in an under-representation of small-cap firms—many of which feature prominently in the sample. This may bias abnormal return calculations, given that larger firms outperformed smaller ones during the sample period (Deutsche Börse AG, 2025a, 2025b).

3. Research setting: The restriction of this study to German firms limits the generalisability of the findings to other jurisdictions, particularly those with different regulatory frameworks or managerial cultures. Nonetheless, this focus contributes to a relatively homogenous and unbiased research setting, reducing confounding variation and increasing internal validity.

4. Subsequent announcements: The analysis does not account for official increases to repurchase programmes that may be announced subsequent to the initial programme declaration. These follow-up announcements can influence market perceptions and, in particular, may affect the abnormal returns following the initial announcement.

5. Calendar year: Unlike standard academic practice, this study relies on Capital IQ's calendar year classification rather

than fiscal years. This decision was necessitated by frequent inconsistencies or unavailability of fiscal year data for smaller German firms. This choice is unlikely to materially affect the results for two reasons. First, the fiscal and calendar years align for the majority of firms in the sample. Second, Capital IQ's classification reallocates fiscal year data to the appropriate calendar quarter if the fiscal year ends within that quarter, thereby preserving temporal accuracy. More broadly, using calendar-based data was essential for aligning financial and stock market data, which is critical for producing consistent and interpretable results.

6. Sample Concentration in frequent repurchasers: As illustrated in Figure 4, a significant share of repurchase announcements originate from a relatively small number of firms. These firms appear multiple times in the sample, meaning their specific characteristics exert a disproportionate influence on the findings. This may be especially problematic if their repurchase conditions remain constant across announcements and differ from the sample median. Furthermore, repeated announcements by the same firm on the same date each year may have contributed to the clusters in the distributional pattern observed in Figure 2.

7. Class imbalance in logistic models: In the logistic regressions testing the second hypothesis (Tables 8–11), a notable class imbalance exists: OMRs occur approximately ten

Table 17: Announcement Return: First or Repeated Repurchase

Dependent Variable:	Abnormal Announcement Return (3 Days, %)
	(1)
Repeated Repurchase	0.4467 (0.496)
ln(Size)	0.1722 (0.299)
ln(Volume)	-0.0450 (0.241)
ln(Liquidity)	-0.1754 (0.197)
Constant	1.2246 (2.017)
Estimator	OLS
Observations	257
R ²	0.008
Adj. R ²	-0.007

Source: Data sourced from LSEG Datastream, Capital IQ and supplemented with hand-collected information. For further details, refer to Section 4.3.

Notes: This table presents the results of one OLS regression. The *Abnormal Announcement Return* is calculated by subtracting the overall performance of the CDAX index from the overall share price performance of the stock in the in the three trading days immediately after the announcement multiplied by 100.

Log transformations are applied the independent variables *Size*, *Volume* and *Liquidity*. The natural log (ln) is used to reduce skewness. Coefficients on log-transformed independent variables indicate that the dependent variable is approximately $\beta / 100$ units higher, on average, for a 1% increase in the independent variable. The variables *Abnormal Announcement Return* and *Repeated Repurchase* are included in their original form. The main independent variable in the models is the binary indicator *Repeated Repurchase*, which equals one if the company has previously announced repurchase programs and zero otherwise. Its effect can be interpreted as follows: a repeated repurchase, on average and holding other factors constant, is associated with a 0.4467 percentage point higher announcement return compared to an initial repurchase. However, the *Repeated Repurchase* has the following p-value: (1):

$p = 0.368$ and is therefore not statistically significant. The sample period runs from July 3, 2018 through the end of the dataset; any repurchase announcements before July 3, 2018 are used solely to identify whether a firm is a "repeat" repurchaser and are then excluded from the estimation sample.

Among the 257 repurchase announcements analysed in this regression, 89 are classified as repeated repurchases, while 168 are initial repurchases. The control variables are defined as follows: *Size* measures the maximum monetary value of the repurchase programme relative to the company's market capitalisation; *Volume* represents the ratio of the number of shares sought to the average daily trading volume; *Liquidity* corresponds to the quick ratio. For more detailed definitions of the variables, see Section 4.2. Robust standard errors of the type HC1 are used. Standard errors are shown in parentheses. The

asterisks indicate two-sided significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

times more frequently than tender offers. This raises concerns about potential bias in model estimation, favouring the majority class. To assess the robustness of these results, comparisons are made with additional logistic models presented in Tables 13 and 14, where the imbalance is less pronounced (a ratio of roughly four to one). As the substantive findings are consistent across both sets of models, it appears unlikely that the class imbalance significantly distorts the results.

7.2 Future Research

Several areas offer promising avenues for further investigation. One notable gap is the lack of a comprehensive overview of global repurchase regulations and their influence on the use and structure of such programmes. A systematic cross-country comparison of legal frameworks would enhance understanding of share repurchases as a global phenomenon and improve the design of future research settings.

Further work on the duration of repurchase programmes could also be valuable. Studies in other countries or cultural contexts may clarify the factors influencing programme length. Additionally, using alternative proxies for undervaluation or incorporating qualitative approaches such as management interviews could help address some limitations

highlighted in this study—especially those linked to the indirect nature of valuation metrics.

The relationship between capital structure and repurchase duration merits closer attention, as it was the only motivation-related variable to show statistical significance in this analysis. A more targeted investigation into how repurchase strategy aligns with capital structure goals could yield useful insights.

Lastly, future research should explore the regulation and adoption of accelerated share repurchase programmes outside the United States. ASRs appear to shift the dynamics of timing and signalling in share buybacks. Understanding their use and regulatory treatment across countries would help build a more complete picture of global repurchase strategies.

8 Conclusion

Drawing on signalling theory and evidence from disclosure-based regulatory environments, this thesis investigates whether German firms use the duration of announced share repurchase programmes to signal undervaluation. I construct eight market-based undervaluation proxies. These

include four measures comparing current valuation multiples to historical averages, three relative to industry peers, and one based on prior share price performance. The analysis is using in a dataset of 329 repurchase announcements between July 3, 2016 and March 20, 2025, covering 299 open market repurchases and 30 tender offers.

Despite the theoretical plausibility of a link between perceived undervaluation and repurchase programme design, the empirical evidence from my dataset does not support this relationship. Across eight OLS regressions, none of the undervaluation proxies show statistical significance. Their p-values remain far from conventional thresholds, and the direction of coefficients is inconsistent. This suggests that firms do not shorten programme duration in response to undervaluation, contrary to the signalling interpretation.

Instead, the duration of buyback programmes appears primarily influenced by two operational factors: *Size* and *Volume*. Both variables are highly statistically significant across all OLS regressions. These results indicate that logistical constraints and execution feasibility play a more substantial role than valuation considerations in determining programme length.

The second hypothesis, which posits that undervaluation increases the probability of a tender offer relative to an OMR, is also not supported by the data. Only one undervaluation proxy—peer-relative *EBITDA Valuation*—shows marginal significance in a single logistic regression. The remaining measures do not meaningfully affect the choice of repurchase method. As with programme duration, *Volume* again emerges as the most important predictor: companies are more likely to use tender offers when the intended number of shares to be repurchased is high in comparison to daily trading volumes, making market-based execution impractical.

Robustness checks further support the validity of the main findings. Restricting the sample to tender offers and short-term open market repurchases (≤ 90 days) does not alter the core results. Additional analyses examining post-announcement stock performance—over horizons ranging from 30 days to three years—reveal no evidence that programme duration influences subsequent share price development. Furthermore, the data does not support the notion that repeated repurchase announcements yield higher abnormal announcement returns, which would be expected if market participants viewed such programmes as more credible.

In summary, this study finds no evidence that firms in Germany use either repurchase duration or method as a signal of perceived undervaluation. Instead, programme design reflects operational and financial constraints—particularly the scale of the intended buyback and prevailing market liquidity. These insights challenge the assumption that repurchase announcements inherently convey informational value about firm valuation and suggest that, in the German context, repurchase structure is driven more by implementation practicality than by signalling strategy.

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