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TIMING OF ACTUAL SHARE REPURCHASES

THE MANAGERIAL ABILITY TO TIME THE MARKET IN REPURCHASING DECISIONS

ABSTRACT

This study provides empirical evidence on the managerial ability to time the market in repurchasing decisions for 2,323 U.S. listed firms and 8,645 repurchasing firm-years between 2011 and 2018. The empirical results are obtained by re-examining and extending the study of Dittmar and Field (2015), using a newly collected data set of actual monthly U.S. share repurchases. This thesis finds results that are similar to Dittmar and Field's (2015), which suggest that managers are still timing the market when conducting share repurchases. The average firm is timing the market by attaining significantly lower prices for their repurchased stock compared to the average market price over various comparison periods of months surrounding the repurchase. Firms that repurchase infrequently, firms in which insiders are net buyers of shares, and firms that experience an aggregate market downturn in the months before the repurchase are able to obtain significantly lower repurchase prices. Moreover, I find that the magnitude with which firms repurchase shares is presumably followed by increases in abnormal stock price returns in future months. Lastly, this study demonstrates that by controlling for market risk, the long-term performance of repurchasing firms can persevere for horizons of up to three years. Additionally, firms that repurchase infrequently significantly outperform the abnormal returns of frequently repurchasing firms on all return horizons.

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Contents

1. Introduction

In the fourth quarter of 2018, listed companies in the United States spent more than $220bn on repurchasing their shares, which represents the most money spent on repurchasing on record (Financial Times, 2019). Companies increasingly opt for the flexibility of a buyback program over a higher dividend since committing to a dividend can be difficult to reverse. Reducing the share count of a listed company improves its per-share earnings, which is one of the main metrics that investors gauge when evaluating stocks. Additionally, reducing the share count boosts the pay packets of managers, who are rewarded by increasing earnings per share (EPS). Lately, the large amounts of these buybacks[1] have drawn the attention of politicians. For example, U. S. Democratic candidate and senator Bernie Sanders called for companies to spend money on property, plants, equipment and personnel instead of buying back stock. In October 2019, he introduced a plan to ban stock buybacks and called the practice nothing more than stock price manipulation (Financial Times, 2019). The substantial attention buybacks are receiving lately in the US indicates the relevance of this topic. Discovering whether managers can time the market when buying back stock could particularly explain why buybacks are on the rise.

Many of the authors of the extensive literature on stock repurchases have questioned whether firms can time the market. Timing the market can be defined as firms deciding to buy back stock when they perceive their shares to be undervalued in the market. Several researchers have found evidence that favours the hypothesis concerning market timing of share buybacks (Ikenberry, Lakonishok, & Vermaelen, 1995; Brockman & Chung, 2001; Graham & Harvey, 2001; Baker & Wurgler, 2002; Cook, Krigman & Leach, 2004; Brav, Graham, Harvey, & Michaely, 2005; De Cesari, Espenlaub, Khursed & Simkovic, 2012; Ben-Rephael, Oded, & Wohl, 2013). A study conducted by Dittmar and Field (2015) examined managers' market timing abilities as they relate to repurchasing stock and uncovered evidence consistent with the market timing hypothesis. Throughout the study, Dittmar and Field constructed an extensive dataset, which enabled them to provide more reliable insights on repurchasing activities. To examine the market timing abilities of managers, the authors utilized the relative repurchase price (REP) variable. This measure is calculated as the percentage difference between the monthly average price paid for repurchasing hares and the average daily closing price of various horizons surrounding the repurchase. They discovered that the average U.S. firm pays, on average, significantly lower prices for their repurchased stock in comparison to the average market price of these shares in months surrounding the transaction. Based on this information, Dittmar and Field suggest that the manager of an average firm can time the market according to the context of stock repurchases by identifying undervaluation.

This thesis addresses the findings observed in the current literature regarding managers' abilities to time the market when buying back stock and attempts to contribute to these findings by examining a newly collected data set consisting of monthly U.S. actual repurchase data collected between 2011 and

[1] This thesis uses the terms "buyback" or "buying back stock" in an interchangeable way with "repurchase" or "repurchasing".

2018. This paper is the first to examine the monthly stock repurchases for the most current time-frame up until 2018. The studied sample period is particularly interesting since it could be viewed as a decade of low interest rates. The persistently low interest rates made it inexpensive for firms to borrow, which was supposed to boost the economy by increasing firm investments. Instead, firms are taking on more debt to fund buybacks. Keeping this information in mind, I chose this period to examine the timing ability of managers regarding share buybacks. The objective of this study is to exhaustively address the following research question:

Are firms able to time the market in making repurchasing decisions and what factors affect this ability?

To answer the research question, this thesis re-examines and the results from Dittmar and Field's study (2015) and tests whether firms can obtain significantly lower prices when they repurchase stock. This is accomplished by addressing four different hypotheses that test the relationship between the repurchase price and the market price, as well as the relation between the relative repurchase price and repurchasing frequency, aggregate market returns, and insider trading activity. In addition, this thesis extends the study by Dittmar and Field (2015) by developing a fifth hypothesis, in which I examine companies' abnormal returns in months surrounding share repurchases. After testing these hypotheses by using a newly collected data set of actual monthly U.S. share repurchases, this study effectively answers the research question and supplements the literature on stock repurchases with new insights. The findings of this thesis suggest that in the most recent time period of 2011-2018, managers are still timing the market when conducting share repurchases. The average firm is timing the market by attaining significantly lower prices for their repurchased stock compared to the average market price over various comparison periods. Firms that repurchase infrequently, firms in which insiders are net buyers of shares, and firms that experience an aggregate market downturn in the months before the repurchase are able to obtain significantly lower repurchase prices. Additionally, this thesis finds that the magnitude with which firms repurchase shares is presumably followed by increases in abnormal stock price returns in future months.

The body of this paper is structured in the following manner. Section 1 covers the introduction and states the research question of this thesis. Section 2 provides an overview of the relevant literature within the context of share repurchases and market timing and proposes the five different hypotheses. Section 3 details the data collection and the variables used for testing the hypotheses. The details of the methodology are laid out in Section 4. Section 5 discusses the empirical results of the analyses. Finally, Section 6 concludes this paper and discusses the limitations of the research.

2. Literature Review

The purpose of this section is to provide an overview of the current literature and knowledge regarding share repurchases and market timing. Section 2.1 discusses the literature in general concerning share repurchases and Section 2.2 details on the link to market timing, thereby opening the door to several appealing questions. Section 2.3 focuses more on the empirical evidence on variations in the market timing of share buybacks and offers improved insights regarding the different determinants that affect repurchasing characteristics. Section 2.4 covers the development of the hypotheses used to address the research question of this thesis.

2.1 Share repurchases

For several years, researchers have thoroughly studied the motivations, timing and performance of stock repurchases. Issuance of stock can help firms to profit from overvaluation, but the repurchasing of stock can be seen as the opposite and could help firms benefit from undervalued shares. In recent years, share repurchasing has become more popular for companies since it allows them to increasingly opt for the flexibility of a buyback program over a higher dividend. This option is more favorable since committing to a dividend can be difficult to reverse.

2.1.1 Differences in literature before and after 2004

A significant difference exists in the literature on share repurchases regarding studies conducted before and after 2004. Before 2004, firms in the US were not yet required to report detailed repurchasing information. As a result, studies on stock repurchases that were conducted before 2004 relied primarily on repurchasing announcements and proxies for actual repurchases. Since firms usually repurchase less or more than originally announced, linking these announcement events to managers' market timing abilities is problematic (Stephens & Weisbach, 1998). At the beginning of 2004, the Securities and Exchange Commission (SEC) adopted amendments to the Exchange Act Rule 10b-18, which regulates stock repurchasing transactions. These amendments required U.S. firms to provide detailed information regarding their repurchasing activities in their financial reports. Consequently, after the amendments were put in place, research had to be based on actual share repurchasing data rather than proxies and announcements. This development allowed the authors of relevant literature to uncover newer, more reliable insights on the share buyback activities in the US.

2.1.2 Motives for share repurchases

As mentioned in Section 2.1.1, studies that were conducted on stock repurchases before 2004 relied primarily on repurchasing announcements and proxies for actual repurchases. Dittmar (2000) utilized a proxy for actual share repurchases to examine the different motives firms had for repurchasing stock. Dittmar (2000) suggests that the possible motives firms might have for repurchasing shares could

include profiting from potential undervaluation, distributing excess capital, working towards a desired leverage ratio or protecting themselves against takeovers. Nevertheless, Dittmar (2000) observed no evidence that supported the idea that stock repurchases could be substitutes for dividends. The possible repurchase motives for firms are further elaborated below.

Profit from potential undervaluation. As Dittmar (2000) discovered, firms can choose to repurchase stock to take advantage of potential undervaluation. By repurchasing stock, managers try to signal inside information to the market. Vermaelen (1981) called this development the 'signalling hypothesis', a term which suggests that managers find their firms' stocks to be undervalued according to their insider knowledge. The firms repurchase shares to try to boost their share prices to a certain level. Several studies that belong to literature on share repurchases and undervaluation include evidence for significant positive abnormal returns after announcements of share repurchases were released (Ikenberry et al., 1995; Stephens & Weisbach, 1998; Jagannathan & Stephen, 2003; Dittmar & Field, 2015; Bargeron, Bonaime, & Thomas, 2017). The existence of these positive abnormal returns supports the 'signalling hypothesis' and indicates that firms do signal undervaluation to the market.

Distribution of excess capital. The distribution of excess capital to shareholders is a potential motive that companies might have to buy back stock. Some researchers who have conducted studies on repurchases discovered that the distribution of excess capital through stock repurchases can resolve several risks and agency costs (Jensen, 1986; Grullon & Michaely, 2004). For example, Oswald and Young (2004) uncovered evidence in the UK that stock repurchases help to reduce agency costs relative to free cash flows and overinvestment problems.

Leverage ratios. Dittmar (2000) discovered that companies also buy back stock to change their leverage ratios. Firms often try to achieve optimal leverage ratios, which is widely discussed in the academic literature on the subject. Bagwell and Shoven (1988) discovered that firms can reach their optimal capital structure by repurchasing shares. Since buying back shares will reduce the amount of firms' equity, doing so leads to higher leverage ratios. Therefore, firms with below-average leverage ratios are more likely to repurchase stock. Busch and Obernberger (2017) observed that high-leverage firms are less likely to buy back shares and discovered evidence that was consistent with older literature concerning this subject.

Price support argument. More recent literature regarding the motives for share repurchases suggests that firms participate in repurchase transactions when they try to intervene in their stock prices if they tend to significantly drop and subsequently deviate from their underlying values. Brav et al. (2005) discovered that firms name weak stock performance as the main motivator in repurchasing shares. This finding is consistent with the hypothesis that firms intervene when their stock prices drop and is accepted by other researchers (Stephen & Weisbach, 1998; Ben-Rephael et al., 2013; Busch &

Obernberger, 2017).

2.2 Market timing

A significant question that exists in the extensive literature on share repurchases concerns whether managers are timing the market. Timing the market can be defined as managers issuing shares when prices are high and repurchasing shares when prices are low. When managers are actually able to time the market when repurchasing shares, one can suggest that the average prices for repurchasing stock are lower than their average market prices.

Several researchers have uncovered evidence that attests to the existence of the market timing of share repurchases, while others disagree with the interpretation of these findings. Ikenberry et al., (1995) and Baker and Wurgler (2002) discovered evidence that is consistent with the market timing of equity, which refers to the issuance of shares when prices are high and the repurchasing of shares when prices are low. Moreover, when Graham and Harvey (2001) conducted their study on this subject, they learned that the managers who participated in anonymous surveys timed the market. Two-thirds of the participating chief financial officers (CFOs) agreed that market timing is an important consideration in issuing equity. Additionally, Brav et al., (2005) surveyed CFOs and discovered that 86.4% of all financial executives agree that firms repurchase shares when their stocks appear to be undervalued. Both surveys found that CFOs consider misvaluation as the main motive for buying back shares; these findings support the hypothesis that managers believe they can time the market. To test the managerial timing ability of stock repurchases, Brockman and Chung (2001) distinguished this timing ability from naïve investment strategies by using a bootstrapping method. They examined the timing abilities of repurchasing firms in Hong Kong that were chosen for their study sample. The authors found that managers from these firms significantly outperformed an uninformed strategy, which implies that managers use private information when buying back their stocks and thus time the market. Additionally, Cook, Krigman and Leach (2004) also uncovered evidence of managers' market timing abilities when examining repurchasing data from 64 U.S. firms.

As mentioned in Section 2.1.1, a substantial difference exists between studies that were conducted before and after 2004. Before 2004, U.S. firms were under no obligation to disclose trading information. After the SEC amended Rule 10b-18 in 2003, U.S. firms became obligated to disclose detailed repurchasing information. After 2004, several researchers (e.g. De Cesari, Espenlaub, Khursed & Simkovic, 2012; Ben-Rephael et al., 2013) examined stock repurchases while relying on actual repurchasing data and presented evidence that was consistent with the hypothesis concerning market timing. Likewise, Obernberger (2014) and Dittmar and Field (2015) researched the timing ability of stock repurchases based on actual repurchasing data. Both studies included the construction of an extensive dataset which enabled the researchers to provide more reliable insights on repurchasing activities. Dittmar and Field (2015) discovered that managers of U.S. firms were able to repurchase their stocks at a lower-than-average market price, which is consistent with the market timing hypothesis.

Furthermore, they discovered evidence that firms pay even lower prices and experience higher subsequent abnormal returns if they can be described as infrequent repurchasers. Based on these results, they suggest that the average firm can time the market when repurchasing stock.

In contrast to the previously mentioned studies, Obernberger (2014) disputes the interpretation of the evidence that suggests that firms buy back stocks at below-average market prices. Obernberger states that these results can be fully explained by the contrarian trading hypothesis instead of the market timing hypothesis. The contrarian trading hypothesis states that repurchases are driven by negative returns (Stephens & Weisbach, 1998); therefore, firms repurchase more when share prices are low. The contrarian trading hypothesis also claims that ex-post firms can repurchase at below-average market prices, while ex-ante firms have no timing ability. Since Obernberger (2014), in contrast to Dittmar and Field (2015) and Ben-Rephael et al. (2014), found no evidence for the subsequent abnormal performance of actual share repurchases, one could conclude that the contrarian trading hypothesis is more plausible to explain the empirical evidence.

2.3 Variations in timing

The literature that was discussed in Sections 2.1 and 2.2 indicates that the average U.S. firm buys back stock at significantly lower prices in comparison to the average closing stock price over the months surrounding a repurchase. Based on this evidence, one could suggest that the manager of an average firm can time the market in the context of stock repurchases. Additionally, several researchers have studied the variations in the market timing of share buybacks. This section describes the literature regarding the potential differences between firms and repurchasing characteristics and their effect on the market timing abilities of managers repurchasing shares.

2.3.1 Firm characteristics

Several researchers have examined the link between repurchasing activities and firm characteristics. Ben-Rephael et al., (2014) observed that small firms repurchase their stocks at discounts in the month when a transaction occurs, but larger firms do not. Likewise, Dittmar and Field (2015) discovered that small firms and firms with lower market-to-book values and higher cash-to-assets ratios repurchase stocks at more favorable prices. These findings indicate that firm size influences timing the market in the context of share buybacks. Regarding the interpretation of these findings, Ben-Rephael et al., (2014) conjecture that small firms strategically repurchase stock depending on the overall market to benefit from mispricing and buying back stock at a discount. In contrast, large firms repurchase on a more regular basis and focus on executing their repurchase programs rather than buying at favorable prices. Additionally, Ben-Rephael et al., (2014) suggest that the differences in firm size and repurchase characteristics are partly due to information asymmetry. Information asymmetry takes place when in a transaction one party has more or better information than the other party. Since small firms possess higher information asymmetry, they are motivated to profit more from underpricing. Large firms

experience low levels of information asymmetry in comparison to small firms; therefore, they are less able to benefit from the information.

2.3.2 Repurchasing frequency

Section 2.3.1 indicates that firm size influences repurchase characteristics. Since small firm markets are less liquid, their repurchasing activity is limited and their repurchasing frequency is reduced. However, large firms are more liquid in comparison to small firms; therefore, they can repurchase on a more regular basis (Ben-Rephael et al., 2014). Examining the link between repurchasing frequency differences and market timing ability is worthwhile since doing so can contribute to the general understanding of the repurchasing activities of large and small firms. Dittmar and Field (2015) noted that significant differences distinguish frequent repurchasers from infrequent repurchasers. Firms that repurchase frequently are larger, have significantly higher market-to-book ratios, are more profitable and pay significantly higher dividends. The authors conjecture that these differences result in different motives for buying back stocks and unique roles in market timing for infrequent and frequent repurchasers. Moreover, Dittmar and Field (2015) present evidence that demonstrates that firms that buy back infrequently repurchase back stock at a larger discount than firms that buy back frequently. They conjecture that frequent and infrequent repurchasers could have different motives for buying back stock. While conducting their research, they found the general correlation that firms' market timing abilities are declining in the frequency of repurchase activities. This evidence suggests that frequent repurchasers do not buy back stock strategically based on over- or undervaluation or the overall market; instead, they repurchase on a systematic basis. Infrequent repurchasers time their repurchasing activities strategically and can obtain more beneficial prices for their shares and better profit from potential misvaluations.

2.3.3 Insider trading activity

Various researchers have studied the relationship between insider trading behavior and firm repurchases and have uncovered mixed evidence related to market timing. Since signalling undervaluation is often considered to be a rationale for buying back stocks, it is interesting to observe how insider trading activity relates to repurchasing. Louis, Sun and White (2010) studied insider trades that were made after repurchasing announcements. The authors find that insider selling is largely driven by informed traders who are trying to exploit investor mispricing and timing announcements to mitigate potential undervaluation. Babenko, Tserlukevich and Vedrashko (2012) also examined share repurchasing announcements and insider purchases. The authors found that announcement returns and past insider purchases are positively related, especially for firms that priced less efficiently. Based on this information, one could conjecture that insiders that purchase shares of their firms provide credibility to the undervaluation signal.

Additionally, Bonaimé and Ryngaert (2013) studied the effects of insider trading and share

repurchases on long-run abnormal returns. They provided evidence that both insider buying and insider selling are more likely to occur during the quarter of a repurchase. Their findings suggest that the act of repurchasing investing strategies as a signal of undervaluation includes concurrent insider trading transactions, which supports the validity of the signal. Furthermore, Dittmar and Field (2015) also examined insider trades conducted by repurchasing firms within the same month. They conjecture that firms repurchase stock at a discount when insiders view the firm as undervalued. Consistent with this conjecture, they found that firms that experience a relatively high level of net insider buying within a repurchase month can repurchase stock at a significantly lower price. This finding is consistent with the hypothesis that managers can time the market.

2.4 Hypotheses development

The literature review comprehensively elaborated on the relationship between actual share repurchases and the market timing abilities of managers. Based on this relationship, this thesis will develop and present several hypotheses in this section. Other researchers have clearly stated that the average U.S. firm pays a significantly lower price than the average closing stock price over monthly periods surrounding a transaction when repurchasing stock. It is particularly interesting to examine whether the same results can be found using the new dataset that was compiled for this thesis. First, this thesis formulates a general hypothesis based on the prediction that if managers can time the market, then the price for repurchasing stock will likely be lower than the average market price. Much like Dittmar and Field (2015), I operate under the idea that a relative repurchase price is constructed to measure market timing. The relative repurchase price (REP) is calculated as the difference between the average monthly price paid for repurchasing shares and the average daily closing price over various horizons surrounding the repurchase. Therefore, if the REP is significantly less than zero, one can conclude that managers are timing the market. Based on this prediction, the following hypothesis was constructed:

H1: *The relative repurchase price is, on average, significantly less than zero.*

This thesis will focus on other factors that could influence repurchasing firms' abilities to time the market. Both Dittmar and Field (2015) and Ben-Rephael et al., (2014) present evidence that firms that can be described as infrequent repurchasers repurchase stock at larger discounts than firms that repurchase frequently. As discussed in Section 2.3.2, this evidence suggests that the motives frequent and infrequent repurchasers have for buying back stock could be different. These differences were also confirmed by Ben-Rephael et al. (2014); however, this study focuses on firm size. The authors of these respective studies present evidence that smaller firms repurchase less frequently than larger firms; therefore, smaller firms can repurchase more strategically depending on misvaluation. Larger firms repurchase on a more regular basis; consequently, their repurchases are more frequent and are not necessarily meant to be made at favourable prices. Instead, they are intended to execute their repurchase

programs. As a result, small firms can obtain more favorable prices for repurchasing stock than large firms can (Ben-Rephael et al., 2014). Both the mentioned studies confirm that evidence for the market timing hypothesis exists. To further address the research question, the distinction between frequent and infrequent repurchasers should be made. Based on the relevant findings in the existing literature, the second hypothesis was constructed:

H2: *Firms that repurchase less frequently can repurchase stock at a larger discount than frequent repurchasing firms.*

This thesis will investigate whether managers can time the aggregate market. Jagannathan, Stephens, and Weisbach (2000) found that the magnitude of which firms repurchase increases following low stock returns. Dittmar and Field (2015) found the same results and linked them to managers' abilities to time stock repurchases. Given stock price fluctuations over time, managers' abilities to repurchase at discounts correlates with the aggregate market. The study of Dittmar and Field (2015) indicates that the coefficients on the pre-repurchase period market returns are significantly positive, which suggests that firms are paying higher relative repurchase prices following higher market returns and vice versa. These results demonstrate that managers time the aggregate market. The new sample period used in this thesis captures different aggregate market movements compared to the old sample period used in the aforementioned studies. This period will provide new insights regarding the ability of managers to time the aggregate market. Hence, the following hypothesis is formulated in the following manner:

H3: *Firms pay a lower relative repurchase price following low aggregate market returns.*

To further examine managerial market timing through stock repurchases, it is worthwhile to look at insider purchases. If managers are timing the market and firms repurchase stock at a discount, it is plausible to expect more insider purchases in these cases. As discussed in Section 2.3.3, some researchers predict that if insiders of undervalued firms buy back shares on a personal scale, firms will then pay a lower relative repurchase price when repurchasing stock. This prediction provides further insight into the timing abilities of managers. Dittmar and Field (2015) examined the relationship between insider purchases and relative repurchase prices. They used net insider buying as a proxy for misvaluation for their study. Following Jenter's study (2005), they constructed this proxy by utilizing the insider buying net of insider selling. Dittmar and Field (2015) found that firms repurchase at significantly lower relative repurchase prices when they experience relatively high levels of net insider trading. Keeping this evidence in mind, it is interesting to study whether these results also apply for the new data set used in this thesis. Subsequently, the fourth hypothesis is formulated in the following

manner:

H4: *Firms with relatively high net insider trading pay significantly less when repurchasing stock.*

To further test managers' abilities to time repurchase transactions and to extend the results of Dittmar and Field (2015), this thesis will examine companies' abnormal returns in months when a firm repurchased stock and in months before and after a share repurchase. De Cesari et al., (2012) predicted that if managers try to exploit misvaluations in the market when repurchasing shares, then the period before the transaction will experience negative abnormal returns and the period following the transaction will experience positive abnormal returns. They indeed found results that indicated that firms experienced negative abnormal returns in the months before repurchases were made; in the months following the repurchases, firms experienced positive abnormal returns. The study links these observations to managerial timing. This thesis will examine whether the same results can be found regarding the new sample period. Therefore, the following hypothesis was constructed:

H5: *Firms experience negative abnormal returns before a repurchase and positive abnormal returns following a repurchase.*

Examining the first hypothesis provides a general insight into the ability of managers to repurchase their stock at a lower price relative to the average market price. The answer to this hypothesis presents the first evidence for the market timing of share repurchases. Subsequently, the other hypotheses are tested to potentially add on the general evidence on managerial market timing and find out what drives this ability. After testing these hypotheses, this thesis will be able to effectively address the research question and provides literature on share repurchases with new insights.

3. Data

This chapter elaborates on the data used to answer the hypotheses. The chapter is divided into two sections. First, the data collection process is described in Section 3.1. Subsequently, Section 3.2 discusses the data modification step that was used to increase the robustness of statistical inferences.

3.1 Data collection

This thesis focuses on actual share repurchases of listed U.S. companies from 2011–2018. To examine whether a firm can time the market when repurchasing stock, monthly data of actual repurchase prices and stock prices was utilized. The monthly actual U.S. repurchase dataset that is used in this thesis was constructed using the repurchase data project of PhD Candidate Y. Li at the Erasmus School of Economics. The data comes from all 10-K and 10-Q filings that were made between 2004–2019; the data was downloaded from the SEC database EDGAR and was extracted using Python codes. Since the Python codes did not recognize all the repurchasing data from the filings, data on several companies had to be collected manually from the EDGAR database. The sample used for this thesis consisted of actual U.S. share repurchasing data from 2011–2018. The data comprises the number of repurchased shares per month, the average price paid for the repurchased shares, the number of shares firms repurchased as part of share buy-back programs and the maximum number of shares or maximum dollar amount that could potentially still be repurchased as part of these programs.

Besides the data on actual repurchases, data on stock prices was used to address the hypotheses. Using data on stock prices was necessary to construct the relative repurchase price measure and to examine long-run performance. Like Dittmar and Field (2015), this thesis used data on daily closing stock prices from the Center of Research in Securities Prices (CRSP). To address the second hypothesis, data on repurchasing frequency and firm characteristics was used. This thesis compares several firm characteristics according to repurchasing frequency and the discount or premium paid in the buybacks. The firm characteristics are obtained from the Compustat database and consist of the following: the number of total assets, the market-to-book ratios, the return on assets, the leverage ratios, the cash-to-assets ratios, the repurchase size-to-market value ratios and the annual repurchase value-to-market value ratios. By comparing these firm characteristics while considering repurchasing frequency and the REP, one of the purposes of this thesis was to discover whether the timing ability of frequent and infrequent repurchasers differ significantly in several dimensions. Additionally, data was used on aggregate market returns and firms' abnormal returns to effectively address the third and fifth hypotheses. This thesis utilized data from the CRSP database on market returns over the six months before a repurchase month, as well as data on the abnormal returns of the repurchasing firms two months before and two months after a stock repurchase was made. To address the fourth hypothesis, I studied data on insider trading. Like Jenter (2005) and Dittmar and Field (2015), this thesis also utilized net insider buying as a proxy of misvaluation. By using these tools, I examined whether firms pay lower relative repurchase prices if insiders perceive the firm to be potentially undervalued. Section 4.2 will explain this measure in more

detail. Data on insider trades was acquired from Thomson Reuters' Insider Filing Data Feed, as reported in Forms 3, 4 and 5.

Finally, this thesis presents the Fama-French regression estimates for various return windows and several subsample analyses to control for market risk. To perform these regressions, the Fama-French (1993) factors had to be obtained from the data library section of Kenneth R. French. The factors consist of the market return minus the risk-free rate (MKTRF), the returns on a portfolio of small firms minus returns on a portfolio of large firms (SMB) and the returns on a portfolio of firms with high book-to-market values minus returns on a portfolio of firms with low book-to-market values (HML).

3.2 Data modification

The monthly actual U.S. repurchase data comes from a seemingly raw dataset, which explains its exposure to outliers. To account for these outliers, this study used the winsorization technique. This technique transforms statistics by limiting the extreme values to reduce the effect of potential spurious outliers (Dixon, 1960). Winsorization is accomplished by changing the value of the outliers so that they are close to other values in the set. By way of example, if one winsorizes variables at the 1% level for both tails, the outliers beyond the 1st and 99th percentile are changed in the same value as of those at the 1st and 99th percentile. Utilizing the winsorization technique, I considered which percentiles from the data in the set needed to be cut off. When focusing on the various research variables, this thesis used winsorizing cut-offs at a 1% or 5% level. Besides the repurchase data, I winsorized several company characteristics since some data obtained from Compustat appeared to be incorrect and not realistic. Hence, part of the data obtained from Compustat appeared to be raw and exposed to outliers. The following firm characteristics were winsorized at the 1st and 99th percentile: leverage, repurchase size/market value and annual repurchase/market value. Winsorizations at the 5th and 95th percentiles were also performed on the market-to-book value and the return on assets variables. The cut-off levels depended on which winsorization best reconciled upholding sufficient variance and smoothing extreme values. Additionally, Sections 4.1 and 4.2 discuss more winsorization that this thesis performed on the REP and the net insider trading measures respectively.

4. Methodology

The research objective of this thesis is to re-examine and extend the results of Dittmar and Field (2015) and hence to study whether managers can time their repurchasing activities by buying back shares at a lower price relative to their average market price in a given period. Therefore, the methodology of this thesis was structured in the following way. Section 4.1 describes the main measure used to capture the managerial market time of repurchases, as well as the REP. The interpretation and the various comparison windows are also discussed in this subsection. Subsequently, Sections 4.2, 4.3 and 4.4 describe the methodology used for examining the various subgroupings and controlling the results for market risk.

4.1 Relative repurchase price

The methodology used to examine managers' abilities to time the market by repurchasing their stock is presented. The REP is the method that was used in this thesis to capture the possible discounted prices or premiums paid by firms repurchasing stock relative to their average market prices in windows surrounding the repurchase activity. This measure is similar to the one Dittmar and Field used in their study (2015) and was applied to study the market timing abilities of managers. As mentioned in Section 2.4, the REP is calculated as the percentage difference between the monthly average price paid for repurchasing shares and the average daily closing price over various horizons surrounding the repurchase. Consequently, the measure was constructed by subtracting the average repurchase price during the month of the transaction (REP_0) by the average stock price from the CRSP database ($CP_{\pm t}$), which was measured in *t* months surrounding the repurchase:

$$(1)\ \textit{Relative Repurchase Price}_{\pm t} = (REP_0 / CP_{\pm t}) - 1$$

To connect the relative repurchase price to the possible market timing abilities of firms, the interpretation of the measure will be explained. The REP was used to examine the (in)significant difference between the average price paid for buying back stock and the average closing stock price from the surrounding months (Dittmar & Field, 2015). If this thesis observes the average repurchase price to be insignificantly different from the average stock price, one could suggest that managers are not able to time the market. On the other hand, if managers do time the market, then one can expect that firms that repurchase pay a significantly lower price than the average stock price from a certain period surrounding the repurchase activity ($REP_0 < CP_{\pm t}$). Therefore, I suggest that managers can time the market when buying back stock if the relative repurchase price is significantly less than zero.

In this thesis, the REP was estimated by comparing the average repurchase price with the closing stock price over various periods. This method was used since firms choose when to repurchase and thus look at windows when repurchase prices are low. The relative repurchase price was examined for a repurchase month ($t = 0$), as well as over several periods surrounding a repurchase month. The

comparison periods consisted of the following: one-, three- and six-month periods surrounding a transaction and one-, three- and six-month periods following a repurchase. The rationale behind the various comparison periods used was that if firms can time the market, then they should be able to buy back stock at lower prices relative to historical prices and their predictions of future prices (Dittmar & Field, 2015).

The REP is presented per company characteristic and by repurchasing frequency to provide insights on the differences of the REP between the groups. This study also performed various regressions on the REP measure. To correctly perform the regressions on the REP, I winsorised the REP over the various comparison periods at the 1st and 99th percentiles. As discussed in Section 3.2, I used the winsorisation technique to reduce the effect of potential specious outliers. After this modification step was conducted, the regressions on the REP were performed. These regressions incorporated clustered standard errors at the firm level, as well as year- and firm-fixed effects.

4.2 Net insider trading

The methodology used to examine whether firm insiders buy back shares on a personal scale is presented in this section. This methodology is used to address the fourth hypothesis, which examines whether firms with relatively high levels of net insider trading pay significantly lower relative repurchase prices than firms with moderate-to-low net insider trading. The rationale behind this hypothesis concerns undervaluation. The prediction is made that if insiders buy back shares on a personal scale, firms then pay a lower relative repurchase price since high insider buying can be perceived as a sign of undervaluation. To address this hypothesis, this thesis used net insider trading as a proxy for misvaluation (Jenter, 2005; Dittmar & Field, 2015). Net insider trading was computed as the number of insider purchases of a firm's stock during the repurchase month minus the number of insider sales of a firm's stock during the same month, which was then divided by the outstanding number of shares. The following formula represents the net insider trading measure:

$$(2)\quad \textit{Net Insider Trading}_t = (\textit{Insider purchases}_t - \textit{Insider sales}_t) / \textit{Shares outstanding}_t$$

To examine the effect of net insider trading on the relative repurchase price, I divided the firms into quartiles based on the net insider trading measure. Consequently, Quartile 1 captures firms-months with less insider buying (negative net insider trading value); Quartile 4 captures firm-months that contain more insider buying (positive net insider trading value). Therefore, the difference between the lower quartile (less insider buying) and the higher quartile (more insider buying) can be observed. Moreover, to minimize the influence of outliers in the insider trading data, I winsorised the net insider trading measure at the 1st and 99th percentiles. As discussed in Section 3.2, this cut-off percentile is based on which level offers the most appropriate consideration between maintaining ample variance and

smoothing extreme values.

4.3 Abnormal returns

In this subsection, the methodology used to address the fifth hypothesis is described. Like De Cesari et al. (2012), this thesis predicted that if managers buy back stock when it appears to be undervalued, then firms will experience negative abnormal returns in the months before the repurchase and will contrarily experience positive abnormal returns in the months following the transaction. I tested this hypothesis by performing regressions of repurchase volumes and market-adjusted abnormal returns. The regression coefficients indicate (in)significant relations between abnormal returns in the past (following) months and the extent to which firms repurchase stock in the past (following) months. To examine firms' abnormal returns, the market-adjusted abnormal return measure was constructed by subtracting the return on the market index in a given month from the return on a company's stock in the same month (MAR_t). The following formula represents the market-adjusted abnormal return measure in *t* firm-months:

$$(3)\ MAR_t = (\text{Return on a company's stock}_t - \text{Return on the market index}_t)$$

The variable MAR – 1 (MAR + 1) indicates the difference between the return on a firm's stock in the previous (following) month and the return on the market index during the same period. The equation MAR – 1 to – 2 (MAR + 1 to + 2) was constructed to examine the magnitude of repurchase activity and the market-adjusted abnormal returns during a longer comparison period. The MAR – 1 to – 2 and MAR + 1 to + 2 allowed for a wider examination of windows of abnormal stock performance. The MAR_t variable was regressed according to the repurchase volume. For each firm-month, the repurchase volume variable was calculated by dividing the number of shares repurchased by the number of shares outstanding at the beginning of the month. Since the repurchase variable is censored at zero, the Tobit-model estimates were used for the regressions.

4.4 Control for market risk

In this subsection, the methodology used to control for market risk is presented. The control for market risk was utilized by examining post-repurchase returns and controlling them for the three Fama-French factors (Fama & French, 1993). Like Dittmar and Field (2015), I performed the regressions for different calendar-time portfolios. The monthly excess returns were computed by subtracting the risk-free rate from the CRSP monthly returns. The portfolios were examined over three, six, twelve, twenty-four and thirty-six months following a repurchase and were constructed by adding firms in the month that they repurchased, which allowed them to retain the return on the stock for the different windows. The portfolios were rebalanced each month; afterward, an equal-weighted portfolio excess return was computed. These portfolio excess returns were then regressed using the three Fama-French factors, as

detailed in Section 3.1. The following formula represents the regression of the excess returns on the three Fama-French factors:

$$(4)\ R_{it} - R_{ft} = a_{it} + \beta_1 (R_{Mt} - R_{ft}) + \beta_2 SMB + \beta_3 HML + \epsilon_{it}$$

The regression estimates were observed for the full sample, as well as for several subsamples, to examine whether differences in performance arose between the various groups. By examining the signs and significances of the alphas, this analysis controls the prior findings on the timing ability of stock repurchases for market risk. Additionally, the alphas shed insight into whether long-run performances exist after repurchasing transactions.

5. Results

The following section elaborates on the empirical results of this research which support the conclusion of the research question proposed in Section 1. First, Section 5.1 sets out the summary statistics of the sample and gives insight regarding the research variables. Subsequently, Section 5.2 presents the statistical results on the relative repurchase price to provide a conclusion regarding managers' abilities to time the market. Next, Section 5.3 details the Tobit regression estimates on market-adjusted abnormal returns and monthly repurchase volumes by providing more support for the conclusion to the research question. Finally, after observing various effects of the research variables on the potential of firms to repurchase at a discount and ahead of price increases, this thesis facilitates control for market risk by examining post-repurchase returns by employing Fama-French (1993) regressions in Section 5.4.

5.1 Summary statistics

The main sample of this study involved actual share repurchases of listed U.S. companies that occurred between 2011–2018. This research employed the monthly repurchase dataset from all 10-K and 10-Q filings during the sample period and matched closing stock prices from the CRSP database. By performing the research in this way, this thesis excluded actual repurchases of firms that did not have available data on their monthly closing prices. After merging the closing stock price dataset with the monthly actual repurchase dataset, I identified 2,323 companies that have repurchased shares as part of an open market repurchase program at least once during the sample period. The full sample of actual U.S. share repurchases contained 2,323 firms and 8,645 repurchasing firm-years.

Table 1 presents the descriptive statistics of firms conducting repurchases for the sample, which were reviewed by firm-year. This table illustrates the variations in repurchasing activity during each year of the sample period. Additionally, the table illustrates the differences in repurchasing frequency by categorizing firms according to their repurchasing frequency during a firm-year. Firms were categorized as infrequent repurchasers if they had conducted 1–4 repurchase transactions in a year. Firms that conducted 5–8 repurchase transactions in a year were categorized as moderate repurchasers, and firms that repurchased at least 9 times in a year were categorized as frequent repurchasers. As can be seen in Table 1, most firms in the sample were categorized as infrequent repurchasers (44.9% of the repurchases during 2011–2018). However, by observing the percentage of the aggregate dollar value of the repurchases between the repurchasing frequency categories, this thesis uncovered some intriguing results, which are also illustrated in the table. Although the majority of repurchasing firms could be described as infrequent repurchasers, the majority of the aggregate dollar value of the repurchases could be attributed to the frequent repurchasers (57.6% of the repurchases during 2011–2018). Furthermore, the table illustrates that the largest number of firms conducting repurchases occurred in 2015, while the aggregate dollar value of repurchases peaked in 2014.

Table 2 presents summary statistics of company characteristics for firms conducting repurchases during the sample period. The table demonstrates that there are clear differences between firms that

repurchase infrequently and firms that repurchase frequently. Most of the repurchasers in the sample were categorized as infrequent repurchasers, while the frequent repurchasers represented the minority in the sample. The difference in firm size between frequent and infrequent repurchasing firms is another interesting feature to note. Firms that are frequent repurchasers are significantly bigger than firms that are infrequent repurchasers; they have higher total assets, higher market-to-book values, higher return on assets, higher leverage, higher cash-to-assets and higher dividend pay-outs. Looking at the repurchase size and annual repurchase value per the market value of equity, one can observe similar statistics as those observed by Dittmar and Field (2015).

Table 2 illustrates remarkable differences between infrequent and frequent repurchasing firms through the repurchase statistics per the market value of equity. The median frequent repurchaser buys back stock for 0.39% of its market value, while the median infrequent repurchaser purchases stock for 0.45% of its market value. The median frequent repurchaser annually buys back stock for 4.17% of its market value, but the median infrequent repurchaser buys back stock for 2.26% of its market value. These observations mark the differences between frequent and infrequent repurchasers in terms of potential motives for buying back stock and the possible interference of market timing.

Overall, the summary statistics are quite similar to those by Dittmar and Field (2015), which allows their study to be re-examined and extended properly. As such, the findings of this thesis can accurately be compared to the results of the study of Dittmar and Field (2015), which uncovers the conclusion if managers are still able to time the market when conducting share repurchases.

Table 1
Summary statistics for firms that buy back stock summarized by firm-year.

Year	Aggr. repurchases *(billions of dollars)*	Number of firms repurchasing	Repurchasing frequency *(as a percentage of repurchases)*		
			Infrequent	*Moderate*	*Frequent*
2011	$564	1,096	49.1	29.5	21.4
2012	$536	1,085	45.9	31.2	22.9
2013	$528	1,035	44.7	30.0	25.3
2014	$613	1,109	43.4	29.1	27.5
2015	$540	1,206	43.0	28.2	28.8
2016	$439	1,095	43.8	29.9	26.3
2017	$398	932	46.9	26.8	26.3
2018	$552	1,087	43.0	29.9	27.1
Repurchasing firm-years		8,645	44.9	29.3	25.7
Percent of the aggregate dollar value of repurchases			11.8	30.6	57.6

The sample represents 8,645 firm-years; firms were considered if they conducted one or more repurchase transactions in any given year from 2011 to 2018. Firms are classified based on their repurchasing frequency. Firms that bought back stock 1–4 times during a particular year are described as infrequent repurchasers, while firms that bought back stock 5–8 times are described as moderate repurchasers. Firms that bought back stock 9–12 times during a particular year are categorized as frequent repurchasers.

Table 2

Summary statistics of company characteristics for firms that buy back stock.

Firm characteristic	Full sample	Repurchasing frequency			Diff. frequent–infrequent
		Infrequent	*Moderate*	*Frequent*	
Total assets	13.275	7.957	11.805	24.229	16.272***
(millions)	(2.023)	(1.512)	(1.988)	(3.767)	(2.255***)
Market-to-book	3.044	2.705	2.994	3.711	1.005***
	(2.162)	(1.888)	(2.163)	(2.770)	(0.883***)
Return on assets	5.01%	3.63%	5.10%	7.34%	3.71%***
	(4.68%)	(3.55%)	(4.78%)	(6.63%)	(3.07%***)
Leverage	21.40%	21.35%	20.52%	22.51%	1.17%**
	(17.40%)	(16.96%)	(16.79%)	(18.69%)	(1.73%***)
Cash-to-assets	15.65%	15.41%	15.62%	16.13%	0.72%*
	(9.68%)	(9.24%)	(9.30%)	(10.51%)	(1.27%***)
Dividend pay-out	1.78%	1.78%	1.68%	1.87%	0.08%
	(0.40%)	(0.24%)	(0.26%)	(0.64%)	(0.40%***)
Repurchase size/MV	1.08%	1.22%	1.10%	0.82%	-0.40%***
	(0.05%)	(0.45%)	(0.50%)	(0.39%)	(-0.06%***)
Annual repurchase/MV	5.14%	2.94%	6.60%	7.38%	4.44%***
	(2.26%)	(1.00%)	(3.23%)	(4.17%)	(3.17%***)
Number of observations	8,645	3,883	2,537	2,225	

The sample represents 8,645 firm-years; firms were considered if they conducted one or more repurchase transactions in any given year from 2011 to 2018. Firms are classified based on their repurchasing frequency. Firms that bought back stock 1–4 times during a particular year are described as infrequent repurchasers, while firms that bought back stock 5–8 times during a given year are described as moderate repurchasers. Firms that bought back stock 9–12 times during a particular year are categorized as frequent repurchasers. Accounting variables (firm and repurchasing characteristics) are measured at the fiscal year-end before the repurchase month and are summarized at firm-year. The variable definitions are discussed in the Appendix. The significant differences between the groups are tested using *t*-tests for means and the Wilcoxon non-parametric test for medians. The significances at the 1%, 5%, and 10% levels are respectively indicated by '***', '**' and '*'.

5.2 Findings on the relative repurchase price

For this thesis, market timing is measured as the percentage differences between the average repurchase price and the average CRSP stock price during various monthly windows surrounding the repurchase. This variable is referred to as the REP. If managers are indeed able to time the market when repurchasing stock, the relative repurchase price should be significant. The following subsections will present the findings on the REP.

5.2.1 Relative repurchase price over various comparison periods

This subsection provides the first statistics on the REP. Table 3 presents the average (median) relative repurchase price summarized by year for the full sample of actual monthly share repurchases. As illustrated in the table, I found significantly negative average (median) relative repurchase prices for all comparison windows. This finding indicates that the average firm can repurchase stock at a discount. The price for which an average firm repurchases stock is 1.4% lower in comparison to its average market price within the month, which implies that managers time their repurchase transactions in periods when the stock price seems to be undervalued. Looking at the full sample, one can conclude that the significantly negative relative repurchase prices for all comparison windows indicate that firms also time their repurchases when the prices are low relative to longer horizons. Furthermore, when observing the relative repurchase price per year, one can note that Table 3 illustrates that the average firm buys back stock at a lower price relative to their average market price for all calendar years except 2015 and 2018. The median firm paid the lowest relative repurchase price in 2016 at -4.61% for six months before and after the comparison period, while the highest price on average is paid in 2015 at -0.61%. By observing the forward-looking comparison periods, one can observe that 2015 appears to be the worst period for the repurchasers: firms bought back stock at an average premium of 0.08%, 0.89% and 2.07% in the month of the repurchases and one, three, and six months after the repurchases were made, respectively. However, in 2015, the average repurchase price premium of 0.08% for the one-month looking-forward window was not significantly different from the average stock price of the given period; therefore, nothing can be determined based on this result. The same can be said for the positive relative repurchase price percentages in 2018 for the month of the repurchase and the one-month looking-forward period.

In addition to the results in Table 3, this thesis examined how the relative repurchase price varied over time. Figure 1 details how the relative repurchase price behaved concerning the aggregate annual repurchase values of firms. The figure illustrates that firms pay lower relative repurchase prices in years when the aggregate annual repurchase values were lower (2016 and 2017), except for the year 2011, when the repurchase price was low whilst the aggregate repurchase value was relatively high. These results suggest that if firms pay higher relative prices when buying back stock, then the aggregate annual repurchase value will be relatively high.

Table 3

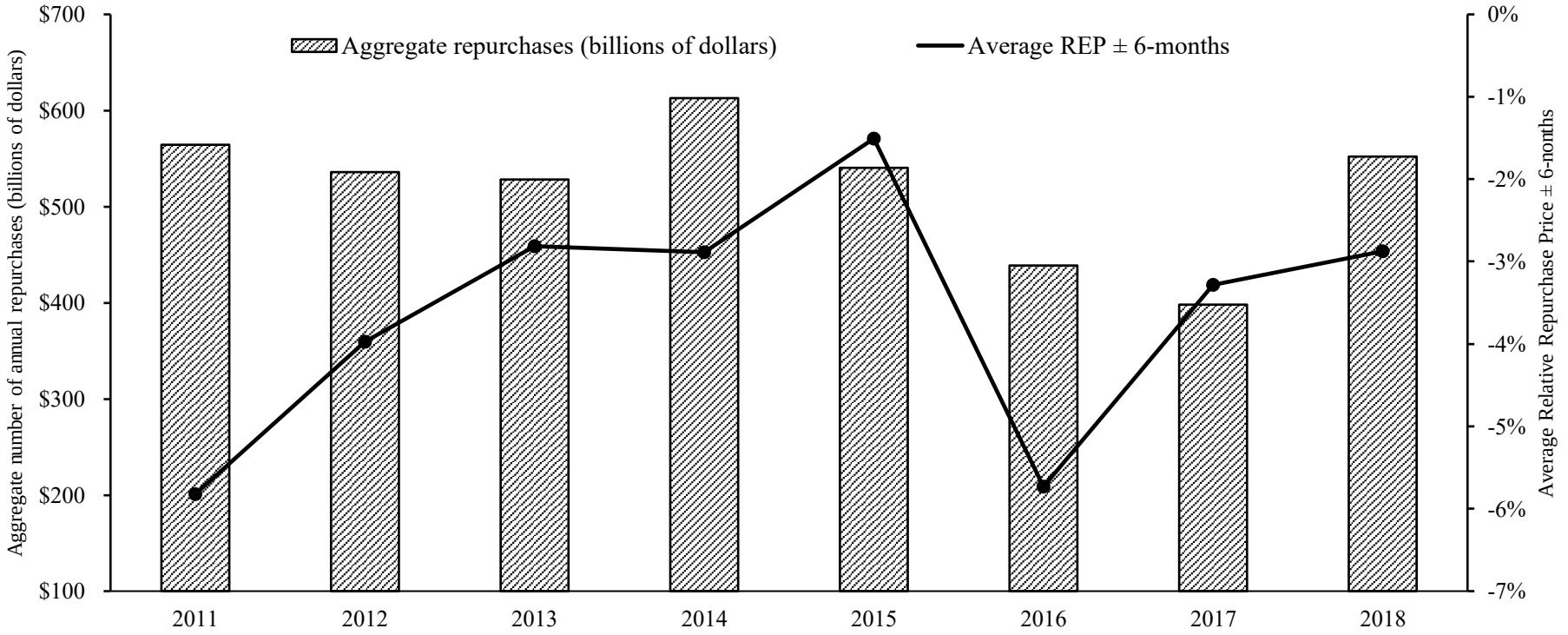
Average (median) relative repurchase price summarized by year.

Year	Number of monthly repurchases	Actual repurchase month	Comparison period			Comparison period		
			± 1 month	*± 3 months*	*± 6 months*	*+ 1 month*	*+ 3 months*	*+ 6 months*
2011	5,868	-1.85%***	-2.77%***	-4.45%***	-5.82%***	-2.03%***	-2.74%***	-2.87%***
		(-1.60%***)	(-2.09%***)	(-3.19%***)	(-4.57%***)	(-1.86%***)	(-2.71%***)	(-3.37%***)
2012	5,924	-1.58%***	-2.11%***	-3.03%***	-3.97%***	-2.24%***	-3.25%***	-5.09%***
		(-1.22%***)	(-1.54%***)	(-2.11%***)	(-2.81%***)	(-2.07%***)	(-3.18%***)	(-5.27%***)
2013	5,897	-2.28%***	-2.39%***	-2.69%***	-2.81%***	-3.22%***	-5.04%***	-7.02%***
		(-1.51%***)	(-1.54%***)	(-1.64%***)	(-1.62%***)	(-2.55%***)	(-4.26%***)	(-6.54%***)
2014	6,510	-1.47%***	-1.65%***	-2.37%***	-2.89%***	-1.55%***	-1.91%***	-2.26%***
		(-1.01%***)	(-1.00%***)	(-1.35%***)	(-1.78%***)	(-1.26%***)	(-2.06%***)	(-3.15%***)
2015	7,126	-0.35%***	-0.64%***	-0.94%***	-1.51%***	0.08%	0.89%***	2.07%***
		(-0.12%)	(-0.28%***)	(-0.43%***)	(-0.61%***)	(0.00%)	(0.38%***)	(0.57%***)
2016	6,338	-2.43%***	-3.11%***	-4.49%***	-5.73%***	-3.43%***	-5.23%***	-7.20%***
		(-1.76%***)	(-2.31%***)	(-3.48%***)	(-4.61%***)	(-2.85%***)	(-5.01%***)	(-7.64%***)
2017	5,299	-1.58%***	-2.20%***	-2.70%***	-3.28%***	-2.36%***	-3.34%***	-4.54%***
		(-1.22%***)	(-1.66%***)	(-1.89%***)	(-2.16%***)	(-2.31%***)	(-3.46%***)	(-5.01%***)
2018	6,383	0.16%	-0.88%***	-2.31%***	-2.88%***	0.08%	-0.36%**	-0.21%***
		(0.23%*)	(-0.33%***)	(-1.05%***)	(-1.40%***)	(0.26%**)	(-0.11%*)	(-0.50%**)
All	49,345	-1.40%***	-1.94%***	-2.85%***	-3.60%***	-1.79%***	-2.55%***	-3.27%***
		(-1.02%***)	(-1.34%***)	(-1.84%***)	(-2.39%***)	(-1.59%***)	(-2.64%***)	(-3.89%***)

The sample represents 49,345 months; 2,241 firms conducted repurchases from 2011 through 2018. The table illustrates the relative repurchase price as a percentage difference between the monthly average price paid for repurchasing and the average stock price during the month of the transaction, as well as windows around the repurchases. The measure was constructed in the following manner: Relative repurchase price = (Average price paid for repurchasing stock during the transaction month / Average closing stock price reported on CRSP) – 1. The measure was computed over six comparison windows: one, three, and six months surrounding the transactions and one, three, and six months after the transactions were made. The significant differences between the groups were tested using *t*-tests for means and the Wilcoxon non-parametric test for medians. The significances at the 1%, 5% and 10% levels are thereafter respectively indicated by '***', '**' and '*'.

Figure 1

Aggregate repurchases (left scale) versus the average REP for six months surrounding the repurchase (right scale).



The figure presents the annual aggregate repurchases versus the REP from the six months surrounding the repurchase. The measure is constructed as follows: Relative repurchase price = (Average price paid for repurchasing stock during the transaction month / Average closing stock price reported on CRSP) – 1.

5.2.2 The effect of repurchasing frequency on the relative repurchase price

This subsection provides the results regarding the effect of repurchasing frequency on managers' abilities to time the market. Table 4 illustrates the relation between the repurchasing frequency of firms and the average (median) relative repurchase price. As illustrated in the table, the relative repurchase price was declining in the frequency of repurchases for all windows; this implies that the more frequently a firm repurchased stock in a year, the lower the relative repurchase price became. This finding corresponds with the conjecture that the frequency with which a firm repurchases shares may affect managers' abilities to time the market. The motivation behind this conjecture is that firms that repurchase less frequently in a year experience more flexibility in timing their repurchases in comparison to firms that repurchase monthly. Concerning the findings presented in Table 4, the difference in the average (median) relative repurchase price between infrequent and frequent repurchasers increased as the comparison period increased. When looking at the six months before and after the comparison period, I found that the average (median) difference between infrequent and frequent repurchasers was -3.89% (-3.64%) compared to -0.80% (-0.77%) for the month of the repurchase comparison period. This can again be seen as a sign of managers timing the market since the gap between infrequent and frequent repurchasers becomes larger when the period to time the repurchase becomes larger.

As indicated previously, the evidence suggests that the ability to time the market is especially strong for infrequent repurchasers. Nevertheless, these findings are the result of univariate tests that were conducted solely on repurchasing frequency, while the summary statistics presented in Table 2 indicate significant differences in characteristics between firms that repurchase infrequently and frequently. To control for firm characteristics, this thesis examined the relative repurchase price in multivariate analyses. As illustrated in Table 5, the relative repurchase price is regressed on several firms and their repurchasing characteristics. The dependent variable is measured over the following six comparison windows: one, three and six months before and after the repurchases and one, three and six months after the repurchases. The relative repurchase price variable was regressed according to the firm characteristics described in Section 3.1, namely the repurchasing frequency and the prior six-month market return. The repurchasing frequency was measured using two dependent variables: infrequent and frequent repurchasers. Infrequent and frequent repurchaser variables are dummy variables that are equal to one for firms that buy back stock 1–4 times and 9–12 times during a year, respectively. As illustrated in Table 5, the regression coefficient for infrequent repurchasers was significantly negative for all comparison periods, while the coefficient for frequent repurchasers was significantly positive for all comparison periods. Using the six months before and after the comparison period, I found that the regression coefficient was a significant -0.019 for infrequent repurchasers in comparison to a significant 0.008 coefficient for frequent repurchasers.

By focusing on the firm characteristics, I found that for some comparison periods, especially the forward-looking periods, larger firms paid a significantly higher relative repurchase price. Moreover, the results indicate that low market-to-book value firms paid significantly lower relative repurchase prices for all comparison periods. Furthermore, firms with higher returns on assets and lower leverage ratios obtained significantly lower prices for their repurchased stock, particularly for the forward-looking comparison windows. The findings on the relative repurchase price in a multivariate setting thus demonstrate that smaller firms with lower market-to-book values were able to obtain lower relative repurchase prices, which suggests that it is more likely that these firms were able to time the market.

5.2.3 Aggregate market returns and relative repurchase prices

This subsection presents the results regarding the effect of aggregate market returns on the relative repurchase price. By focusing on the prior six-month market return variable in the multivariate setting of Table 5, I found the coefficient to be significantly positive for all comparison periods. Using the six months before and after the period, I also found the coefficient to be 0.245, which indicates that if the market return increased during the prior six months, then firms paid a higher relative repurchase price for their shares. However, if the market return declined in the prior period, then the relative repurchase price firms paid for their shares was lower. This finding addresses the third hypothesis, which suggests that firms pay relatively less to repurchase shares following low aggregate market returns. Therefore, the provided evidence indicates that managers were timing the aggregate market by buying back stock at a discount when the prior aggregate market experienced a downturn.

Altogether, both the multivariate and univariate settings indicate that the average firm times the market by attaining a significantly lower price for their repurchased stock. As discussed in Section 2.3.3, since the results indicate managers' market timing abilities, one can suggest that managers also purchase stock on their own accounts. In the next subsection, the results on insider trades and the relative repurchase prices are discussed.

Table 4

Average (median) relative repurchase price summarized by repurchasing frequency.

Repurchasing frequency	Actual repurchase month	Comparison period			Comparison period		
		± 1 month	*± 3 months*	*± 6 months*	*+ 1 month*	*+ 3 months*	*+ 6 months*
Infrequent repurchaser	-1.79%***	-2.63%***	-4.16%***	-5.44%***	-2.31%***	-3.35%***	-4.15%***
	(-1.29%***)	(-1.97%***)	(-3.30%***)	(-4.73%***)	(-2.13%***)	(-3.79%***)	(-5.13%***)
Moderate repurchaser	-1.16%***	-1.51%***	-2.09%***	-2.56%***	-1.45%***	-2.02%***	-2.72%***
	(-1.08%***)	(-1.32%***)	(-1.76%***)	(-2.07%***)	(-1.55%***)	(-2.45%***)	(-3.46%***)
Frequent repurchaser	-0.99%***	-1.23%***	-1.44%***	-1.56%***	-1.27%***	-1.74%***	-2.37%***
	(-0.77%***)	(-0.92%***)	(-1.03%***)	(-1.08%***)	(-1.19%***)	(-1.91%***)	(-2.85%***)
Difference infrequent – frequent	-0.80%***	-1.40%***	-2.72%***	-3.89%***	-1.04%***	-1.62%***	-1.78%***
	(-0.52%***)	(-1.05%***)	(-2.26%***)	(-3.64%***)	(-0.94%***)	(-1.87%***)	(-2.28%***)

The sample represents 49,345 months; 2,241 firms conducted repurchases from 2011 through 2018. The table illustrates the REP as a percentage difference between the monthly average price paid for repurchasing and the average stock price during the month of the transaction, as well as windows around the repurchases. The measure was constructed as follows: Relative repurchase price = (Average price paid for repurchasing stock during the transaction month / Average closing stock price reported on CRSP) – 1. The measure was computed over six comparison windows: one, three and six months surrounding the transactions and one, three and six months after the transactions. Firms are classified based on repurchasing frequency. Firms that bought back stock 1–4 times during a year are described as infrequent repurchasers, while firms that bought back stock 5–8 times during a year are described as moderate repurchasers. Firms that bought back stock 9–12 times in a year are categorized as frequent repurchasers. The significant differences between the groups were tested by using *t*-tests for means and the Wilcoxon non-parametric test for medians. The significances at the 1%, 5% and 10% levels are respectively indicated by '***', '**' and '*'.

Table 5

Regressions of the REP on firms and repurchasing characteristics.

	Comparison period			**Comparison period**		
	± 1 month	*± 3 months*	*± 6 months*	*+ 1 month*	*+ 3 months*	*+ 6 months*
Infrequent repurchaser	-0.007***	-0.014***	-0.019***	-0.006***	-0.012***	-0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Frequent repurchaser	0.003***	0.006***	0.008***	0.003**	0.007***	0.010***
	(0.001)	(0.000)	(0.000)	(0.007)	(0.001)	(0.001)
Ln (Total assets)	0.006***	0.007***	0.012***	0.009***	0.015***	0.026***
	(0.004)	(0.006)	(0.001)	(0.001)	(0.000)	(0.000)
Market-to-book	0.001***	0.001***	0.001**	0.002***	0.004***	0.006***
	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
Return on assets	-0.041***	-0.037***	-0.024	-0.069***	-0.123***	-0.190***
	(0.000)	(0.001)	(0.143)	(0.000)	(0.000)	(0.000)
Leverage	0.016***	0.017**	0.011	0.024***	0.037***	0.052**
	(0.004)	(0.023)	(0.246)	(0.002)	(0.004)	(0.011)
Cash-to-assets	-0.016**	-0.0129	-0.013	-0.022**	-0.030**	-0.051**
	(0.028)	(0.176)	(0.351)	(0.020)	(0.039)	(0.023)
Prior 6-month market return	0.091***	0.155***	0.240***	0.176***	0.217***	0.230***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	-0.061***	-0.084***	-0.131***	-0.074***	-0.122***	-0.196***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	46,101	46,101	46,101	46,101	46,101	46,101
Number of firms	2,201	2,201	2,201	2,201	2,201	2,201
Adjusted R^2	0.041	0.047	0.051	0.055	0.075	0.093

The table illustrates the regressions of the REP. The measure was constructed in the following manner: Relative repurchase price = (Average price paid for repurchasing stock during the transaction month / Average closing stock price reported on CRSP) – 1. The measure was computed over six comparison windows: one, three and six months surrounding the transactions and one, three and six months after the transactions. Accounting variables (firm and repurchase characteristics) were measured at the fiscal year-end before the repurchase month. The variable definitions are discussed in the Appendix. The year and firm fixed effects were included in the regression and the standard errors were clustered at the firm level. The *p*-values can be found within the parentheses. The significances at the 1%, 5% and 10% levels are respectively indicated by '***', '**' and '*

5.2.4 The effect of insider trading activity on the relative repurchase price

This subsection provides the results on the potential effect of insider trading activity on the REP. As mentioned in Subsection 5.2.3, it is particularly interesting to examine whether managers also purchase stock on their own accounts as they evidently can time the market. Like Dittmar and Field (2015), this thesis examined insider trading activity for firms during the months when they repurchased stock. As discussed in Section 4.2, the net insider trading measure is used to capture insider trades and acts as an indicator of the potential misvaluation of a firm. The results provided in Table 6 address the conjecture that when the magnitude of insiders purchasing stock is high, firms pay significantly less to repurchase stock. The motivation behind this conjecture is that high net insider trading indicates that a firm is being misvalued; insiders try to exploit this misvaluation by purchasing stock.

As shown in Table 6, for all comparison periods and insider trading quartiles, firms were repurchasing shares at relatively lower prices than their average market prices. However, I found mixed results when looking at the differences between the fourth quartile (more insider buying than selling) and the first quartile (more insider selling than buying). For the comparison periods surrounding the repurchase, except for the insignificant one-month window, the difference between the fourth quartile and the first quartile was significantly negative at -0.59% and -1.08% for the three and six months before and after the repurchases, respectively. However, in contrast to this thesis' conjecture, the firms with low levels of insider trades (Quartile 1) obtained, on average, a lower relative repurchase price than firms with high levels of insider trades (Quartile 4) for the forward-looking comparison periods. Like Dittmar and Field (2015), I posit that these findings could be the result of the correlation between insider trades and firm characteristics.

Table 7 presents the regression estimates for firm characteristics, repurchasing frequency, prior six-month market returns, and the net insider buying variable on the relative repurchase price. These regressions were performed using the same analysis used in Table 5; however, this analysis included a dummy variable for net insider buying. This variable is equal to one for firms where the net insider trading variable is positive (more insider buying than selling). As illustrated in Table 7, I found the net insider buying variable to be significantly negative for all comparison periods. Consistent with the expectations, the significant negative coefficients imply that firms repurchase with larger discounts when insider trading is characterized as 'net buying' and demonstrate that the insiders likely viewed the firms' stock to be undervalued. This result fully confirms the hypothesis that firms pay lower prices when repurchasing stock at the same time when insiders purchase more stock.

Table 6

Average (median) relative repurchase price summarized by the level of insider trading.

Insiders trading shares	**Actual repurchase month**	**Comparison period**			**Comparison period**		
		± 1 month	*± 3 months*	*± 6 months*	*+ 1 month*	*+ 3 months*	*+ 6 months*
Quartile 1 *(less insider buying)*	-1.71%*** (-1.26%***)	-1.71%*** (-1.36%***)	-1.76%*** (-1.43%***)	-1.81%*** (-1.59%***)	-2.04%*** (-1.85%***)	-2.76%*** (-3.07%***)	-3.51%*** (-4.50%***)
Quartile 2	-1.55%*** (-1.06%***)	-1.69%*** (-1.15%***)	-1.88%*** (-1.43%***)	-2.07%*** (-1.49%***)	-1.82%*** (-1.64%***)	-2.43%*** (-2.68%***)	-3.27%*** (-4.06%***)
Quartile 3	-0.91%*** (-0.84%***)	-1.40%*** (-1.24%***)	-1.98%*** (-1.75%***)	-2.42%*** (-2.04%***)	-1.31%*** (-1.51%***)	-2.00%*** (-2.55%***)	-2.86%*** (-3.77%***)
Quartile 4 *(more insider buying)*	-1.15%*** (-1.00%***)	-1.58%*** (-1.32%***)	-2.34%*** (-1.99%***)	-2.88%*** (-2.59%***)	-1.57%*** (-1.65%***)	-2.19%*** (-2.55%***)	-2.88%*** (-3.93%***)
Difference between Q4–Q1	0.56%*** (0.26%***)	0.13% (0.04%)	-0.59%*** (-0.56%***)	-1.08%*** (-0.99%***)	0.47%*** (0.20%***)	0.57%*** (0.52%***)	0.63%*** (-0.56%**)

This table represents 27,314 months from 2011 to 2018 during which firms conducted repurchases while insiders traded on their accounts. The level of insider trading was captured using the net insider trading measure and was computed using the following equation: Net insider trading = (insider purchases during the transaction month – insider sales during the transaction month) / the number of shares outstanding. Firms are divided into quartiles based upon net insider trading measure; Quartile 1 captures firm-months with less insider buying (negative net insider trading value) and Quartile 4 captures firm-months with more insider buying (positive net insider trading value). The REP price was constructed using the following equation: Relative repurchase price = (Average price paid for repurchasing stock during the transaction month / Average closing stock price reported on CRSP) – 1. The measure was computed over six comparison windows: one, three and six months surrounding the transactions and one, three and six months after the transactions. The significant differences between the groups were tested using *t*-tests for means and the Wilcoxon non-parametric test for medians. The significances at the 1%, 5% and 10% levels are respectively indicated by '***', '**' and '*'.

Table 7

Regressions of the REP, including net insider trading.

	Comparison period			Comparison period		
	± 1 month	*± 3 months*	*± 6 months*	*+ 1 month*	*+ 3 months*	*+ 6 months*
Infrequent repurchaser	-0.007***	-0.014***	-0.019***	-0.006***	-0.012***	-0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Frequent repurchaser	0.003***	0.005***	0.008***	0.003**	0.007***	0.010***
	(0.002)	(0.000)	(0.000)	(0.018)	(0.001)	(0.001)
Net insider buying	-0.002***	-0.004***	-0.005***	-0.002**	-0.003***	-0.005***
	(0.001)	(0.000)	(0.000)	(0.022)	(0.002)	(0.000)
Ln (Total assets)	0.006***	0.008***	0.013***	0.009***	0.015***	0.026***
	(0.004)	(0.005)	(0.001)	(0.001)	(0.000)	(0.000)
Market-to-book	0.001***	0.001***	0.001***	0.002***	0.004***	0.006***
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)
Return on assets	-0.041***	-0.037***	-0.024	-0.069***	-0.123***	-0.190***
	(0.000)	(0.001)	(0.135)	(0.000)	(0.000)	(0.000)
Leverage	0.016***	0.017**	0.012	0.024***	0.037***	0.052**
	(0.005)	(0.022)	(0.234)	(0.002)	(0.004)	(0.011)
Cash-to-assets	-0.016**	-0.013	-0.013	-0.022**	-0.030**	-0.051**
	(0.030)	(0.179)	(0.349)	(0.021)	(0.040)	(0.023)
Prior 6-month market return	0.091***	0.156***	0.241***	0.177***	0.218***	0.231***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	-0.061***	-0.084***	-0.131***	-0.075***	-0.122***	-0.196***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	46,101	46,101	46,101	46,101	46,101	46,101
Adjusted R^2	0.041	0.047	0.052	0.055	0.075	0.093

This table presents regression coefficients of the REP that were based on firm and repurchasing characteristics, including net insider trading. The net insider buying measure is a dummy variable which is equal to one for firms where the net insider trading is positive (more buying than selling). The REP was constructed using the following equation: Relative repurchase price = (Average price paid for repurchasing stock during the transaction month / Average closing stock price reported on CRSP) – 1. The measure was computed over six comparison windows: one, three and six months surrounding the transactions and one, three and six months after the transactions. Accounting variables (firm and repurchasing characteristics) were measured using the fiscal year-end before the repurchase month. The variable definitions are discussed in the Appendix. Year and firm fixed effects were included in the regression and the standard errors are clustered at the firm level. The *p*-values can be found within the parentheses. The significances at the 1%, 5% and 10% level are respectively indicated by '***', '**' and '*'.

5.3 Relation between abnormal returns and repurchase volumes

This subsection provides the findings regarding the relationship between abnormal stock returns in the past (following) months and the magnitude with which firms repurchased shares in the present month. As discussed in Section 4.3, the variable to capture abnormal stock return is the market-adjusted return (MAR). Table 8 presents the Tobit regression estimates for market-adjusted returns on repurchase volumes of firms. The dependent variable is the repurchase volume, which was computed by dividing the number of shares a company repurchased in a given month by the company's number of shares outstanding. Like De Cesari et al. (2012), I conjectured that if managers repurchase stock when it appears to be undervalued, then the period before the repurchase experiences negative abnormal returns and the period following the transaction experiences positive abnormal returns. One could consider this to be another sign of the market timing aspect of firms repurchasing stock.

As illustrated in Table 8, I found the MAR_0 coefficient to be significantly negative at a 1% level, which indicates a negative relationship existed between firms' abnormal returns in the month of a transaction and the repurchase activity in the given month. Based on this result, one could suggest that companies time their repurchases in months that experience abnormal return declines. Moreover, I found the coefficient of the market-adjusted return in the previous month (MAR – 1) to be significantly negative (-0.0482) at the 1% level, which was consistent with my expectations; this indicates that firms perform more repurchasing transactions in the present month when the abnormal returns in the prior month have declined. On the other hand, in contrast to my expectations, I found the coefficient of the market-adjusted return in the following month (MAR + 1) to also be significantly negative (-0.0666). Since this was similar to the MAR – 1 coefficient, one can infer that a negative relationship existed between the firms' abnormal returns in the following month and the magnitude with which firms repurchased shares in the present month. When looking at the two-month periods for the abnormal returns, I discovered that the coefficient of the market-adjusted returns in the previous months (MAR – 1 to – 2) was statistically insignificant. Therefore, no conclusions can be drawn based on this finding.

By way of contrast, this thesis found the coefficient of the market-adjusted return in the following months (MAR + 1 to + 2) to be significantly positive (0.0269) at a 10% level. This indicates a positive relationship between the firms' abnormal returns during the following two months and the magnitude with which firms repurchased shares in the present month; this finding is consistent with this thesis' expectations. Overall, the findings in Table 8 indicate that repurchasing firms can time the market by using stock repurchases. Firms seem to repurchase more stock when abnormal returns are declining. Furthermore, while the following one-month abnormal return period (MAR + 1) was significantly negative, the wider window of future abnormal stock performance (MAR + 1 to + 2) was significantly positive. This evidence demonstrates that the repurchase activity of firms is presumably followed by increases in stock price abnormal returns during future months (more than one month following a repurchase transaction).

Table 8
Regressions of repurchase volumes and market-adjusted abnormal returns.

Independent variables	**Dependent variable**
	Repurchase volume
MAR 0	-0.0299**
	(0.042)
MAR – 1	-0.0482**
	(0.016)
MAR + 1	-0.0666***
	(0.001)
MAR – 1 to – 2	-0.0136
	(0.351)
MAR + 1 to + 2	0.0269*
	(0.076)
Constant	0.0128***
	(0.000)
Observations	46,872
Number of firms	2,224
Log likelihood (full model)	131747.23

The sample represents 45,119 firm-months; firms were considered if they conducted one or more repurchase transactions in any given year from 2011 to 2018. The table presents the Tobit regression estimates for firms' market-adjusted returns on their repurchase volumes. The dependent variable is the repurchase volume, which was computed by dividing the number of shares a company repurchased in a month by the company's number of shares outstanding at the beginning of the month. The variable MAR was constructed by subtracting the return on the market index in each month from the return on a company's stock in the particular month. As such, MAR – 1 (MAR + 1) indicates the difference between the return on a firm's stock in the previous (following) month and the return on the market index during the same period. Likewise, MAR – 1 to – 2 (MAR + 1 to + 2) was constructed to examine the magnitude of repurchasing activity and the market-adjusted abnormal returns during the two previous (following) months. Year and firm fixed effects were included in the regression. The significances at the 1%, 5% and 10% levels are respectively indicated by '***', '**' and '*'.

5.4 Controlling for market risk

This section examines post-repurchase returns to control the analysis for market risk. As discussed in Section 4.4, I regressed the monthly stock returns on the three Fama-French (1993) factors over several periods. Like Dittmar and Field (2015), this thesis conjectured positive long-term returns (e.g. positive and significant alphas) would follow repurchases if managers could time the market. Table 9 presents the Fama-French analyses of the total sample in conjunction with several subsamples. As illustrated in Panel A of Table 9, I found positive alphas for all the six different return periods for the full sample. This evidence is consistent with the mentioned conjecture and confirms the prior findings that revealed that firms are timing the market when repurchasing stock. Subsequently, this thesis discusses the alphas of various subsample analyses.

Subsample analysis by repurchasing frequency. Panel B of Table 9 presents the subsample analysis of market-adjusted returns according to repurchasing frequency. To gain insight regarding the differences between long-term returns and infrequent repurchasers (firms repurchasing 1–4 times a year) and frequent repurchasers (firms repurchasing 9–12 times per year), this thesis examined the alphas of the constructed portfolios according to repurchasing frequency over the various return horizons. I discovered that the alphas of both portfolios were significantly positive on all horizons, much like the findings on the full sample. However, the portfolios of infrequent repurchasers tended to significantly outperform the frequent repurchasers in terms of long-term returns, especially for the longer return horizons. This evidence is consistent with the prior findings that indicate that infrequently repurchasing firms tend to be more adept at timing the market when repurchasing stock in comparison to firms that repurchase frequently.

Subsample analysis by the number of net insider purchases. Panel C of Table 9 presents the market-adjusted returns according to the number of net insider purchases over the various horizons. To compare the long-run returns of firms with low net insider buys and high net insider buys, I constructed two different portfolios according to the number of net insider purchases in a similar manner to the one illustrated in Panel B. Again, I found that the alphas that were significantly positive for the portfolios on all horizons. When comparing the alphas of the two portfolios, I found almost no significant differences between the long-run return alphas of firms with low net insider buys and firms with high net insider buys. Only for the one-year return horizon did I observe the high net insider buys portfolio's alpha (0.007) to be significantly higher than the alpha of the low net insider portfolio (0.006). The findings regarding the one-year return horizon are consistent with the conjecture that firms pay significantly less when repurchasing stock when the magnitude of insiders purchasing stock is high since this can be an indication of the firm being misvalued. However, the four other return horizons provided no significant differences between the two portfolios on net insider purchases. This evidence implies that firms that allow more insider trades to take place can only time the market over short horizons.

Subsample analysis by prior six-month returns. Panel D of Table 9 presents the market-adjusted returns of portfolios divided according to the prior six-month returns. The portfolios were constructed by dividing repurchasing transactions that experienced negative prior six-month returns or transactions following positive six-month returns. As illustrated in Panel D of the table, this thesis found the alphas to be significantly positive for all portfolios and return horizons, except for the one-year return horizon where the prior six-month returns were negative. Moreover, the alphas for the two groups were significantly different for all horizons. When comparing the alphas of the groups, I found that the long-term returns of repurchase transactions following negative six-month returns significantly outperformed the repurchases following positive six-month returns, except for the one-year return horizon.

Altogether, the results in this section indicate that managers, on average, do time the market when repurchasing stock. This market timing ability particularly differs based upon the frequency with which firms repurchase shares within a year. Additionally, this evidence suggests that the long-term performance of repurchasing firms can persevere for horizons of up to three years.

Table 9
Fama-French regressions.

	Intercept	RMRF	SMB	HML	Adj R^2
Panel A: Fama-French regressions full sample					
Three months	0.003***	1.002***	0.156***	0.051***	0.986
Six months	0.005***	1.011***	0.146***	0.049***	0.986
One year	0.006***	1.036***	0.147***	0.051***	0.992
Two years	0.010***	1.047***	0.230***	0.015***	0.993
Three years	0.023***	1.029***	0.295***	-0.010***	0.987
Panel B: Subsample analysis organized by repurchases					
Three-month returns					
Infrequent (1–4 times/year)	0.003***	1.004***	0.159***	0.039***	0.984
Frequent (9–12 times/year)	0.002***	1.003***	0.155***	0.052***	0.986
Frequent–Infrequent	-0.001***				
Six-month returns					
Infrequent (1–4 times/year)	0.005***	1.003***	0.144***	0.034***	0.982
Frequent (9–12 times/year)	0.004***	1.014***	0.146***	0.049***	0.986
Frequent–Infrequent	-0.001***				
One-year returns					
Infrequent (1–4 times/year)	0.007***	1.021***	0.160***	0.064***	0.993
Frequent (9–12 times/year)	0.005***	1.040***	0.144***	0.048***	0.992
Frequent–Infrequent	-0.002***				
Two-year returns					
Infrequent (1–4 times/year)	0.013***	1.039***	0.234***	0.014***	0.992
Frequent (9–12 times/year)	0.010***	1.048***	0.232***	0.015***	0.993
Frequent–Infrequent	-0.003***				
Three-year returns					
Infrequent (1–4 times/year)	0.034***	1.008***	0.351***	0.025***	0.989
Frequent (9–12 times/year)	0.021***	1.033***	0.287***	-0.015**	0.987
Frequent–Infrequent	-0.013***				
Panel C: Subsample analysis organized by the number of net insider purchases					
Three-month returns					
Low net insider buys	0.002***	1.015***	0.153***	0.041***	0.986
High net insider buys	0.002***	1.024***	0.156***	0.043***	0.984
High–Low	0.000				
Six-month returns					
Low net insider buys	0.003***	1.018***	0.155***	0.050***	0.987
High net insider buys	0.004***	1.018***	0.160***	0.060***	0.987
High–Low	0.001				
One-year returns					
Low net insider buys	0.006***	1.033***	0.171***	0.057***	0.994
High net insider buys	0.007***	1.028***	0.204***	0.057***	0.994
High–Low	0.001***				

Table 9 *(continued)*

	Intercept	RMRF	SMB	HML	Adj R^2
Two-year returns					
Low net insider buys	0.013***	1.037***	0.240***	0.012***	0.992
High net insider buys	0.013***	1.043***	0.257***	0.017***	0.992
High–Low	0.000				
Three-year returns					
Low net insider buys	0.027***	1.017***	0.294***	-0.002	0.986
High net insider buys	0.027***	1.028***	0.372***	-0.001	0.986
High–Low	0.000				
Panel D: Subsample analysis organized by prior six-month returns					
Three-month returns					
Prior six-month return (negative)	0.0031***	0.981***	0.328***	0.258***	0.992
Prior six-month return (positive)	0.0028***	0.999***	0.141***	0.046***	0.982
Positive–Negative	-0.0003***				
Six-month returns					
Prior six-month return (negative)	0.011***	0.916***	0.367***	0.113***	0.993
Prior six-month return (positive)	0.004***	1.025***	0.121***	0.046***	0.983
Positive–Negative	-0.007***				
One-year returns					
Prior six-month return (negative)	-0.006***	1.070***	0.216***	0.142***	0.992
Prior six-month return (positive)	0.004***	1.043***	0.130***	0.029***	0.993
Positive–Negative	0.008***				
Two-years returns					
Prior six-month return (negative)	0.019***	1.136***	-0.023***	-0.435***	0.994
Prior six-month return (positive)	0.009***	1.047***	0.221***	0.016***	0.993
Positive–Negative	-0.010***				
Three-years returns					
Prior six-month return (negative)	0.056***	0.974***	0.360***	0.025***	0.995
Prior six-month return (positive)	0.014***	1.047***	0.245***	-0.008***	0.981
Positive–Negative	-0.042***				

This table presents the Fama-French regression estimates for several return windows succeeding 52,101 months, during which firms conducted repurchases from 2011 through 2018. The estimates are presented in different portfolios. For each month, portfolios were constructed that were comprised of firms that bought back stock within the prior 3, 6, 12, 24 or 36 months. Firms were added to the portfolios according to the month in which they conducted a repurchase transaction; the (excess) return on this stock was retained in the portfolio for the different comparison periods. For example, the three-month portfolio contained three-month returns. Each month, the portfolios were rebalanced, after which an equal-weighted portfolio excess return was computed by subtracting the risk-free rate from the stock returns. The calculated excess returns in the portfolios were then regressed using the three Fama-French (1993) factors as detailed in Section 3.1. The estimated intercepts from the regressions were utilized to measure abnormal performance. Furthermore, different subsample analyses were used to provide better insight into the abnormal performance of different kinds of firms. The significant difference between the estimated intercept from the regressions between the groups was tested, as well as the significance of the coefficients themselves. The significances of the coefficients at the 1%, 5% and 10% levels are respectively indicated by '***', '**' and '*'.

6. Conclusion and limitations

This concluding section presents a summary of the results of this thesis. In Section 6.1, the main findings and conclusions of this research are provided. In Section 6.2, the limitations of this thesis are presented.

6.1 Conclusion

Managers' ability to time the market using share repurchasing have been widely discussed in academic literature. By examining a newly collected data set that consists of actual monthly U.S. stock repurchases on the open market from 2011–2018 and re-examining the results of Dittmar and Field's study (2015), this thesis contributes to the extensive literature on stock repurchases. The empirical results demonstrate that numerous firms are timing the market with repurchases and which factors can have an effect on this ability. These empirical results fully address the research question of this thesis.

Hypothesis 1. By reviewing the first part of Section 5, one can conclude that, on average, managers repurchase stock at a discount when the repurchase prices are compared to the average market price. For all comparison windows, the average (median) relative repurchase price was significantly negative, which implies that firms buy back stock at a discount of 1.4% compared to unsophisticated investors, on average. After reviewing these results, one can safely accept the first hypothesis.

Hypothesis 2. The conclusion to the second hypothesis captures the potential differences in the market timing of repurchases and repurchasing frequency. This thesis found the REP to be declining in relation to the frequency with which firms repurchase shares, which suggests that infrequent repurchasers can better time the market than frequent repurchasers can. By examining the longer comparison period surrounding the repurchase transaction, I concluded that the average infrequent repurchaser can buy back stock at a lower relative repurchase price (3.89%) than the average frequent repurchaser can. The reasoning behind this finding is that firms that repurchase less frequently during a year experience more flexibility in timing their stock repurchases in comparison to firms that repurchase monthly. After observing this evidence, one can also accept the second hypothesis.

Hypothesis 3. The third hypothesis suggests that managers are timing the aggregate market by buying back stock at a discount when the prior aggregate market experiences a downturn. This thesis indeed found that firms pay lower relative prices when repurchasing stock following market return declines in a multivariate setting. This result indicates that managers are timing the aggregate market when repurchasing shares.

Hypothesis 4. The fourth hypothesis addresses the market timing abilities of managers by examining insiders who repurchase stock in the same month of a repurchase transaction. The reasoning behind this hypothesis is that high net insider trading is an indication of the firm being misvalued since insiders try to exploit this misvaluation by purchasing stock. This thesis uncovered compelling results regarding superior returns when insiders repurchased shares on their accounts. As expected, this thesis found that the firm-months with high insider purchases exhibited a lower relative repurchase price than

firms-months with low insider purchases for all comparison periods. Therefore, one can fully accept the conjecture that superior returns are attained when insiders repurchase shares on their accounts.

Hypothesis 5. To further test the managerial ability to time repurchases, the fifth hypothesis addresses the relationship between abnormal stock returns and the magnitude of repurchase activity. This hypothesis suggests that if managers repurchase stock when it appears to be undervalued, then the period before the repurchase will experience negative abnormal returns and the period following the transaction will experience positive abnormal returns. I discovered that the magnitude with which firms repurchase shares is presumably followed by increases in abnormal stock price returns during future months. This can be a sign of managers timing the market with repurchases.

To conclude, the results of this thesis indicate that the average firm is timing the market by attaining significantly lower prices for their repurchased stock. Additionally, this thesis demonstrates that by controlling for market risk using Fama-French factors, the long-term performances of firms that conduct repurchases can persevere for horizons of up to three years. Besides, this study concludes that the infrequent repurchasers significantly outperform the abnormal returns of frequent repurchasers on all return horizons. By using a newly collected data set of actual U.S. share repurchases from a sample period that has not been previously studied (2011–2018), I uncovered results that are similar to Dittmar and Field's (2015). In the introduction, I indicated the relevance of the studied sample period and mentioned that this period can be categorized as a decade of low interest rates. These persistently low rates made borrowing less expensive and therefore increased the possibility for firms to take on debt to fund buybacks. Taking this into account, one can suggest that firms are increasingly focusing on the timing of share repurchases and hence buy back shares for relatively lower prices. The conclusions of this thesis implicate that, when firms have access to more liquid assets, managers are still timing the market when conducting share repurchases.

6.2 Limitations and further research

The empirical research performed in this thesis is subjected to certain limitations. First of all, as mentioned in Section 3.2, the monthly actual U.S. repurchase data comes from a raw dataset. This dataset is constructed by extracting the "repurchase table" of 10-K and 10-Q filings from the SEC EDGAR database using an automated program in Python. Since some filings could not be identified by the Python codes because they did not adhere to standard formats, the dataset needed manual inspection. Nevertheless, the actual repurchase dataset used in this study is still exposed to spurious outliers. For the sake of time, I utilized the winsorization technique to reduce the effects of these fictitious outliers. Another limitation is the low explanatory power of the regressions. The R-squared ranges from 4.1% to 9.3% in the regression models. Due to the low R-squared values, the results must be interpreted with caution and more research should be conducted to explain the behaviour of the relative repurchase price.

As for suggestions for further research, it can be particularly interesting to examine whether investors potentially anticipate the timing of firms regarding share repurchases. To test this, one can observe abnormal returns around repurchase announcements and find out whether investors indeed anticipate the timing ability of firms. Since this thesis finds that most managers are timing share repurchases, findings on the anticipation of investors on this matter would be a valuable addition to the extensive literature on the timing of actual share repurchases. Besides the potential anticipation of investors, it could also be interesting to further investigate how available information influences the market timing ability of managers by examining the effect of firms' information asymmetry on the repurchase price. Overall, the most-recent dataset of actual share repurchases this thesis has used provides the extensive repurchase literature with interesting opportunities for further research on firms' market timing ability.

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Appendix

Table A1
Variable definitions

Variables	Database	Definitions
Firm and repurchase characteristics:		
Total assets	Compustat	The total assets of a firm, which are measured in millions.
Market-to-book ratio	Compustat	The market value divided by the total assets of a particular firm.
Return on assets	Compustat	The income before extraordinary items for the year before the repurchase transaction scaled by the total assets.
Leverage	Compustat	The total amount of debt divided by the total assets.
Cash-to-assets	Compustat	Cash and cash equivalents measured over total assets.
Dividend payout	Compustat	Cash dividends measured over total assets.
Annual repurchase/MV	EDGAR	The annual amount spent on repurchases scaled by the market value of equity from the prior period.
Repurchase size/MV	EDGAR	The number of repurchased shares times the average repurchase price (from the 10-K and 10-Q filings), scaled by the market value of equity from the prior period.
Repurchasing frequency:		
Infrequent repurchaser	EDGAR	Firms that repurchase during 1–4 months in a particular year.
Moderate repurchaser	EDGAR	Firms that repurchase during 5–8 months in a particular year.
Frequent repurchaser	EDGAR	Firms that repurchase during 9–12 months in a particular year.