Erasmus University Rotterdam

Erasmus School of Economics

Bachelor Thesis Financial Economics

The effect of intangible assets on share repurchases in the United States

Author	*Sander Vos*
Student Number	*483476*
Supervisor	*Amy Li*
Second accessor	*Dr. Haikun Zhu*
Date final version	

Abstract

In this paper, the effect of intangible assets on share repurchases is examined by using companies listed on the NYSE, AMEX and NASDAQ from 2004-2019. A significant positive effect of intangible assets on the likelihood a company repurchases shares is found. Furthermore, a significant negative effect of firm size on positive share repurchase returns is found causing the signaling theory not to be rejected. The relationship between intangible assets and share repurchases diminishes during the financial crisis and is insignificant prior to the financial crisis.

Table of contents

List of Tables

1. Introduction

In 2018 share repurchases around the world totaled 806 billion dollars (CBNC, 2019). This is a 55 percent increase compared to 2017 and a 32 percent increase compared to the last record set in 2007. Share repurchases are a payout policy just like dividends (Allen & Michaely, 2003). It is a way to reward shareholders. However, this is not the only motive for a company to repurchase shares.

There has been plenty of research on these motives and a lot of other subjects regarding share repurchases. The leading theory why a company repurchases shares is that the company wants to show that it is undervalued (Ikenberry, Lakinoshok & Vermaelen, 1995). This undervaluation could be the result of information asymmetry between the company and investors. Information asymmetry can exist because of different circumstances. One of these possible circumstances is researched by Barth and Kaznik in their paper from 1999. They propose that when a company has a lot of intangible assets, this can result in information asymmetry due to the fact that intangible assets are not always visible. Take for example investments in research and development. The value of these investments is not always visible for the market.

The scientific relevance of this research entails that the paper where this research is based on is over 20 years old (Barth and Kaznik, 1999). A lot has happened in these years. Therefore, it is interesting to examine if there is still a relationship between intangible assets and share repurchases. Furthermore, this paper will show that the financial effect has an effect on intangible assets and therefore information asymmetry, that was not yet researched. Lastly, this paper will use monthly data which is an exception to the usual yearly or quarterly data. Especially for repurchase data, many companies repurchase shares more than once per year. Monthly data gives a better overview when these different share repurchases took place. Based on these prior findings, the following question is conceived:

What is the effect of intangible assets on share repurchases between *2004-2018 in the American market?*

The outcome of this research is in line with previous findings, a positive effect of intangible assets on share repurchases is found. Moreover, a positive effect of the idle cash

and the book-to-market ratio on share repurchases is found, as theory would predict. Furthermore, the signaling theory cannot be rejected because the effect of the size of a company on share price returns is significant and negative. The rest of the independent variables are insignificant. Lastly, in accordance with the hypothesis, the relationship between intangible assets and share repurchases diminishes during the financial crisis. The relationship is insignificant prior to the financial crisis.

Hereafter, the paper will begin with examining the literature regarding share repurchases, intangible assets, and the financial crisis, and it will conclude with the different hypotheses in *Chapter 2.* The data and methodology will be explained in *Chapter 3 and 4.* The empirical results will be listed and elaborated on in *Chapter 5.* A conclusion will be drawn in *Chapter 6* and at last several limitations and recommendations will be summed up in Chapter *7.*

2. Literature review

This part of the paper will research literature about share repurchases on the American market, the different ways of repurchasing shares and the relation between intangible assets and share repurchases. Eventually the hypotheses will be stated.

2.1. The American market

In this paper the focus will be on the American stock exchange. This is important because in every country there are different rules containing share repurchases. Vermaelen (2005) writes different reasons to regulate the repurchases of shares in his book.

2.1.1. Regulations on the American market

The first reason to regulate share repurchases is that a company can try to manipulate the value of its stocks by repurchasing shares. Secondly, unequal treatment of shareholders can arise from a share repurchase, if a shareholder is unaware that the company is repurchasing the shares, he will not offer his shares while he maybe would have offered his share if he would have been aware of the share repurchase. The third reason is that other stakeholders like creditors can be disadvantaged by the decline of capital following a share repurchase. Lastly regulations are necessary to prevent some sort of insider trading. Insider trading contains the trading of shares on basis of information only available from within the company, this information is not publicly accessible (Jaffe, 1974). A share repurchase often happens because managers think the shares are undervalued. Based

on this information people could trade these shares at just the right moment to make profit. If the manager spreads this information to some people who make profits of this information, then there is insider trading.

Because of these reasons, regulations conform share repurchases are necessary. The United States do have these regulations. To prevent companies from manipulating their share's value, the Securities and Exchange Commission (SEC) implemented the *safe harbor rule*, these are some price and trade restrictions (SEC, 2003). The downside is that companies can deviate from the safe harbor rule without any consequences (Kim, Schremper, & Varaiya, 2005). Furthermore, companies are required to publicly announce that they have permission from the board to repurchase share. This entails that it is clear for every shareholder that they can offer their shares to the company.

What appears is that it is easy to repurchase shares in the US. This is because the United States has few rules and companies do not even have to comply with all rules, like the safe harbor rule.

2.2. Share repurchase motives

Share repurchases can be part of a payout policy (Allen & Michaely, 2003). A payout policy is a way to reward a shareholder for investing in the company. A share repurchase is not the only payout policy, the other one is payment of dividends. So, both methods are a way of rewarding the shareholders for their invested capital. The big difference is that the shareholder does not "lose" his share, he gets a small reward for being a shareholder. But what is the difference between these payout policies and what is the reason to choose for one or the other?

2.2.1. Dividend policy

Miller and Modigliani (1961) say that in a perfect market there is no difference between the two payout policies, they are perfectly substitutable. A critique on this article is that it does not take taxes into account. It is of frequent occurrence that the two payout policies are taxed different within the same country. In the US dividends are generally taxed at a higher rate than the so-called capital gain, the tax which a shareholder has to pay if a company repurchases his shares (Poterba, 2004). If this is the case, a company could choose to reward the shareholder by repurchasing the shares because the taxation on this payout policy is favorable (Bierman & West, 1966).

Other reasons for choosing a share repurchase over dividends is that the payment of dividends creates the expectation that this payment is permanent and will be paid every year from now on (Guay & Harford, 2000). A share repurchase is commonly seen as a one-time occurrence. Lastly a stock dividend, a dividend payment not in money but in shares, can weaken the position of the board because the shareholders earn more voting rights. A share repurchase is the other way around, there are less shares and thus, fewer voting rights. This strengthens the positions of the board, a deeper dive into this subject will follow later in this paper.

The difference between the two payout methods and why a company would prefer one over the other is now clear. These are not the only reasons why a company would choose to repurchase its shares. The are many other reasons for a share repurchase. The three most important theories in the current economic climate will be explained hereafter.

2.2.2. Signaling theory

The first and leading theory is the signaling theory (Ikenberry, Lakinoshok & Vermaelen, 1995). This theory entails that a company wants to show the market that its share is undervalued. In other words, the company is not valued right by the market since the value of the stock does not reflect the value of the company. This happens because of information asymmetry, the managers of the company have a much better overview of the state of the company (Barth & Kaznik, 1999). The market does not have this overview and because of this it could happen that the market does not value the company and its share price right. So, the company repurchases its own shares to signal the market that the company is undervalued and, in that way, “solves” the information asymmetry. Ikenberry, Lakinoshok and Vermaelen acknowledged that the initial average increase of the value of the shares was 3,5% after the company announced it was going to repurchase shares. This increase was applicable to every company, it did not matter if the company was undervalued, overvalued or valued just right. At the long-term the value of the undervalued companies would keep increasing, while the value of the overvalued companies would decrease back to the old level or even under the old level. This tells us that the information that the company wants to show the market by repurchasing the shares, namely that the company is undervalued, will only be incorporated in the purchasing strategies in the market at the long-term.

The question arises if the signaling theory is not just an easy way for insider trading. Insider trading has been explained prior in this paper. D'mello and Schrof (2000) researched if the signal theory, or signaling, is not just a way for managers to get profits on the short-term via insider trading. This article stated that managers were completely aware of the undervaluation of the company at each share repurchase announcement. Yet as stated in the last paragraph of this paper, the initial increase of the value of the company is the same for every company. The extra increase of the value of the undervalued company will be in the long-term. This research reveals that insider trading by managers of an undervalued company is not that easy because profits will arise in the long-term.

There are other reasons why insider trading via the signal theory is not easy. For a reaction on the market the signal needs to be credible. Vermaelen (2005) made various conditions for a signal to be credible. First the signal needs to be costly. If the signal costs the company a lot of money the market will trust the credibility of the signal (Vermaelen, 1984). Therefore, managers often pay a premium over the value of the company's share. This means they incur additional costs just to show that the company is undervalued. Secondly the company must be able to benefit from the signal. It is not credible if a company announces a share repurchase if it cannot benefit from it. The market will not believe that the company will repurchase the shares. The last condition is the believe that an overvalued company would not give a signal because what the signaling theory showed us is that the value of an overvalued company will go back to the old level or even decrease at the long-term.

However, not everyone agrees that an undervalued company should give a signal via for example a share repurchase. Allen and Michaely (2003) wrote that giving off a costly signal is a waste of money. They argued that in the long-term the market will find out that the company and thus the share price is undervalued. Consequently, repurchasing shares is just a waste of time and money. Vermaelen (1984) already made this assumption but he still argued that despite this it is still valuable to give a signal by repurchasing shares. Increasing the value of the shares is not the only purpose of the share repurchase, the value of the company will also increase. This will come in handy if the company is being bought. So, because of the signal the company prevents it will be bought for a lower price than its actual value.

In general, there is a consensus that the signaling theory is the main reason for managers to announce a share repurchase. However, research has been done to find alternate motives for companies to repurchase shares. These other motives will be explained in the following paragraphs.

2.2.3. Leverage theory

The first alternative theory is the leverage theory (Vermaelen, 1981). This theory entails that a company buys back the shares, owner's capital, to change the ratio between debt and owner's equity. So, for a more volatile change of this ratio the company can even repurchase the shares by taking out a new loan and thus creating more debt.

The reason for a company to attract debt is that interest costs are deducted from the profit and therefore the corporate tax will be lower. So, if the profit is lower because the debt and therefore the interest costs are higher, then the corporate tax will be lower. Having more owner's capital does not give a right to a deduction of taxes. Because of this it can be alluring for a company to take on more liabilities. This structure of attracting more debt to gain more taxation benefits is also called the tax shield (Kemsley & Nissim, 2002).

Nevertheless, this theory is not the leading theory in economic science. There is still a lot of dissension about the validity of the leverage theory. Dittmar (2000) has tested if increasing the leverage, the ratio between debt and owner's equity, is a reason for companies to repurchase shares. She noticed that when the leverage is not ideal to optimally utilize taxation benefits, this could be a significant indication to predict share repurchases. However, there are many economists who have not been able to proof the leverage theory (Vermaelen, 1981).

2.2.4. Free cash flow hypothesis

The second alternative is also heavily debated between economists. This theory is the free cash flow hypothesis (Jensen, 1986). He describes a situation where a company has a lot of cash but no profitable investing options. Even though the company would like to invest the cash it is not doable because of a lack of options. Shareholders are not pleased with this situation because the like to see their company using all means to maximize profit and thus increasing the value of their shares. So, shareholders are growing dissatisfied with the managers and this could create a situation where managers have to increase costs just to show the shareholders that they are working in their best interest. It often happens that

companies choose to invest the surplus in cash in projects with a negative net present value just to persuade the shareholders that the board is trying to increase the value of their shares by investing money in projects (Vermaelen, 2005). This situation where shareholders are afraid that the goals of the board differ from their goals and thus the board must make costs to convince them otherwise is called the agency cost problem (Jensen, 2005)

The free cash flow hypothesis from Jensen originally does not focus on the repurchase of shares. However other economists have argued that a company can somewhat solve the agency costs problem by repurchasing shares with the surplus in cash (Allen, Bernardo & Welch, 2000). The purpose of the repurchase of the shares is that the surplus in cash is now gone and the board must make more efficient choices with the cash that is left. In other words, the company has less cash and therefore they have to be more careful which project to invest in. Allen, Bernardo and Welch think that the company will make better decisions because of this. So, by repurchasing the shares management shows to shareholders that they are willing to govern the company better and more efficient.

This theory is somewhat similar to the signaling theory, but now the company only sends a signal to its shareholders and not to the market. Different economists have looked at the free cash flow hypothesis as an argument to repurchase shares. Grullon and Michaely (2004) have described in their paper that the value of a company increases more if a company has high agency costs. Dittmar (2004) found a positive correlation between a surplus in cash and share repurchases. Besides, she found a negative correlation between share repurchases and the growth rate of a company. So, if a company has a lot of opportunities to grow, investing options, then it will be hesitant to repurchase shares. Nevertheless, the variables used by Dittmar do not seem right to prove that shares are being repurchased to decrease the agency costs.

On the other hand, How, He and Kao (1992) have not found empirical evidence for a correlation between the increase of the value of a share after a share repurchase announcement and the free cash flow hypothesis. This theory has also created a dispute between economists.

It seems that the signaling theory is the leading theory. However, that does not prevent economists from finding other theories why a company would repurchase its shares.

2.3. Share repurchases and intangible assets

This paper will investigate the relationship between intangible assets and share repurchases. To better understand this relationship, it is important to know the theories why a company repurchases shares as mentioned above. Barth and Kaznik wrote a paper about the relationship between share repurchases and intangible assets in 1999. They researched the signaling theory and the free cash flow hypothesis.

2.3.1. Findings of Barth and Kaznik

In their research Barth and Kaznik (1999) assumed that having a lot of intangible assets creates more information asymmetry. This is because intangible assets are not always mentioned on the financial statement of a company. Think of investments in research and development or advertising. Thus, the company is investing in projects to increase its value, but the market is not noticing these investments. This creates information asymmetry and therefore, could be a reason for the company to repurchase shares. The paper investigated two relationships: the relation between the variables and the likelihood to repurchase shares and the cross-sectional relationship between the variables and market returns. For intangible assets both relationships were significantly positive. Variables used were research and development expenses, advertising expenses, idle cash, growth, book-to-market ratio, general information asymmetry, dividends and stock option plans. The expenses/investments in research and development and advertising were seen as intangible assets.

Besides using intangible assets as a proxy for information asymmetry, the paper also uses a variable for general information asymmetry independent from the intangible assets. The prediction is that there will be a positive correlation between general information asymmetry and repurchase likelihood. In contrast to this prediction there is a significant negative correlation between these two variables. That does seem odd because one would expect a company to be more likely to repurchase shares when information asymmetry is high. The reason for this odd relationship could be that the general information asymmetry variable is not complete and thus cannot give the right relationship. Because of this, this paper will not contain a general information variable, it is simply too difficult to create a right estimate that takes all aspects of information asymmetry into account.

However, when looking at cross sectional data and market returns it shows that the market return will be higher when there is more information asymmetry. So, it seems like the proxy is not completely wrong. The market return is also higher when a company has more intangible assets due to investments in research and development. So, the predictions for information asymmetry because of intangible assets correspond with the results. This paper will also investigate this relationship. In this paper information asymmetry will be researched through the relationship between share repurchases and intangible assets.

2.3.2. Share repurchase method

Furthermore, research is done to examine if the free cash flow hypothesis is a motivation for a company to repurchase shares (Barth and Kaznik, 1999). They looked at idle cash and growth. Their prediction, conform with the free cash flow hypothesis, was that a company with a more idle cash and low growth is more likely to repurchase shares. This prediction was deemed right. However, it was only significant for idle cash. The results were in line with the hypothesis when using the signaling theory, because a company was more likely to repurchase shares when the company was undervalued. So, they looked into market returns. The free cash flow hypothesis states that market return will be positive for companies with more idle cash. The paper got the opposite results, which means that they cannot prove that the free cash flow hypothesis is the motivation for the company to buy shares.

It looks like the signaling theory is a better explanation because intangible assets and thus information asymmetry has a significantly positive relationship with both repurchase likelihood and market returns. So, it seems that when a company is undervalued it gives a signal by repurchasing shares at which the market will react positively. This is also endorsed by the relationship between the book to market ratio and the market returns. This relationship is significantly positive which means that the market return will be higher if a company is seen as undervalued.

2.4. Financial crisis and share repurchases

Finally, this paper will investigate the way share repurchases are influenced by an economic shock and in particular the financial crisis of 2007-2009. The effect of the financial crisis on payout policies and specifically share repurchases has been researched in different papers. Chen Harper and Iyer (2018) looked at the effect of a general economic shock on

share repurchases. They used the financial crisis of 2007-2009 as a benchmark for an economic shock. This paper does not research how many share repurchases are done in total but what happens to the total amount of shares that is bought in a single share repurchase. This amount seems to increase during economic distress. In a second paper by Bliss, Cheng and Denis (2015), it was examined whether the total share repurchases have increased or decreased during the financial crisis. During the crisis, the total amount of corporate payouts, dividends and share repurchases, decreased. This reduction in share corporate payout were more likely for companies with a high growth rate, no excess in cash and a high leverage. This was the case because those firms would want to invest the cash they have because in times of economic distress it is important to keep growing or maintaining the current status of the company. Secondly, these companies are more vulnerable for such a credit supply shock, they simply do not have the cash for a corporate payout.

2.5. Hypotheses

In this section of the paper the hypotheses will be stated. It will elaborate on how these hypotheses came to be.

2.5.1. Hypothesis 1

In the paper of Barth and Kaznik intangible assets are seen as a source of information asymmetry. Intangible assets are not always stated on the balance and therefore it is not clear that these intangible assets, for example research and development, are a part of the company. This means that when the book value of the company is higher than the market value, the company is undervalued. When a company has a lot of intangible assets it is more plausible that the company is undervalued. If a company is undervalued, it would be more likely to repurchase shares to show the market that it is undervalued. Therefore, the following hypothesis is conceived.

Hypothesis 1: There is a positive correlation between intangible assets and share repurchases.

2.5.2. Hypothesis 2

There are different theories about share repurchase motives. The leading theory is the signaling theory. This theory entails that companies repurchase shares to send a signal to the market that the company is undervalued. A company can be undervalued because of

different reasons. As discussed, information asymmetry can be one of the reasons. Because of the information asymmetry a company gives a signal that it is undervalued by repurchasing shares. The signaling theory states that the market will react positively to the share repurchase announcement of an undervalued company. To research this theory the following hypothesis is conceived.

Hypothesis 2: The signaling theory is the reason for positive returns of the share price after the share repurchase announcement.

2.5.2. Hypothesis 3

As discussed, the financial crisis of 2007-2009 had an effect on the share repurchases. The main effect was that companies with no idle cash and investment opportunities were less likely to repurchase shares. (Bliss, Cheng and Denis, 2015). Companies with more investments and thus, more intangible assets, are less likely or not able to repurchase shares. Due to the financial crisis and mainly the credit supply shock, these companies do not have the cash to repurchase shares. The expectation in the first hypothesis is that intangible assets are positively correlated with the likelihood that a company repurchases shares. As explained, during the financial crisis some companies do not have enough cash to repurchase shares. Consequently, a company could have a lot of intangible assets but will not repurchase shares because of a lack of cash. However, if there was not a financial crisis and thus, the company would have more cash, it could have repurchased shares. The following hypothesis will be examined.

Hypothesis 3: The correlation between intangible assets and the likelihood a company repurchases shares is lower during the financial crisis in comparison to prior and after the financial crisis.

3. Data

Hereafter follows a description of the database and program used to obtain the data for the research. It will explain which datasets are used, the characteristics of these datasets and which data was obtained from the databases.

3.1. Database

The database that was used contains all companies listed on the NYSE, AMEX and NASDAQ downloaded from the SEC EDGAR database. from 2004-2019. This database consists of monthly data about share repurchases, the price paid per share, etc. The

database contains companies which repurchased shares but also companies which did not repurchase shares. For the eventual research having both kind of companies is important because a repurchasing sample and a non repurchasing sample is needed. Another dataset that is used is a dataset with the exact share repurchase announcement days. Both datasets were provided by PhD candidate Y.Li.

3.2. Compustat

The aforementioned database does not contain accounting information, such as total assets, about the companies. After the samples were made, accounting information about the companies was obtained via Compustat. Furthermore, the hypotheses consist of different independent variables which are acquired from Compustat. Table 1 gives an overview of these different variables and their predicted sign.

4. Methodology

This section will explain how the data that is obtained will be converted to actual empirical results. The different variables that are used and the expectation of the sign of the coefficient will be explained. Furthermore, the different regressions will be shown.

4.1. Intangible assets and share repurchases

Firstly, the summary of the independent variables is given in Table 1.

Table 1: Summary of independent variables

The table summarizes all the independent variables which will be used in the researched including the hypotheses that will use the variable and the expected sign of the variable.

Independent Variable	***Hypothesis***	***Sign***
Book-to-market ratio	1,2,3	+
Intangible assets	1,2,3	+
Idle Cash	1,3	+
Size	2	-
Number of shares	2	+

It is the expectation that a company with more intangible assets and thus, more information asymmetry, will be more likely to repurchase shares. This is exactly what is being researched with hypothesis 1.

For researching this hypothesis, a sample from 2012-2018 will be used. This period is chosen because when looking at the economic recovery from the financial crisis in the United states, this really started at 2012. This can be deduced by for example, looking at the growth in total jobs (Bivens, Fieldhouse & Shierholz, 2013).

Moreover, a distinction between repurchasing firms and non repurchasing firms will be made. Because of this, it is possible to look if having intangible assets is a significant reason for a company to repurchase shares. Because a company can repurchase shares in several years of this window, it could be the case that a company is listed twice or more as a repurchaser. However, this is not a problem because the company will not be listed twice in the same year. It is only possible that a company will be listed several times over different years. Therefore, the accounting information of the company will change, and thereby the variables. The observations of the non repurchasing companies are companies which do not repurchase shares in the entirety of the window.

The dependent variable of this research will be the likelihood that a company will repurchase shares. To obtain different results for this likelihood, a sample of 5,991 observations of non repurchasers and 9,761 observations of repurchasers is used. The likelihood will be 1 for repurchasers and 0 observations for non repurchasers.

Furthermore, control variables are used which can influence the likelihood a company repurchases shares. The first one will be intangible assets scaled by total assets. A positive relation is expected as explained.

Secondly, idle cash will be used as an independent variable. It is expected that a company with more idle cash will be more willing to repurchase shares. This variable is calculated by adding net cash flow from investing and operating activities and subtracting net cash flow from financing activities. The net cash flow from financing activities is subtracted, because when this cash flow is negative it usually means that a company is paying off its debt. Debt is often paid off when a firm has excess cash. In short, when the net cash flow from financing activities is negative, this entails that the company has more idle

cash. Therefore, the net cash flow from financing activities should be subtracted to calculate idle cash. In prior research, different proxy variables are examined to calculate the idle cash (Barth and Kaznik, 1999). Following the paper, this calculation is the best way to represent the idle cash flow. Because the sample consists of companies in many industries, there are some companies with no sales or almost no sales. This results in very high or very low idle cash ratios. To better the model, these big outliers are discarded by removing all observations higher than 5 or lower than -5.

As a third variable, the book-to-market ratio is used. Companies with a high book-to-market ratio are undervalued and will be more likely to repurchase shares. On the other hand, companies with a low book-to-market ratio are overvalued and will be less likely to repurchase shares. The book to market ratio is calculated by dividing the book value of the stock by the market value of the stock. To prevent big outlier, every observation with a ratio higher than 3 or smaller than -3 will be discarded. This is in line with prior research (Barth and Kaznik, 1999).

With the help of these independent variables, a regression on the likelihood a company repurchases shares is made. This regression will be tested for heteroskedasticity. This paper will also examine the correlation between the variables. Eventually this regression will be tested:

$$SRL_i = \alpha + \beta_1 INT_i + \beta_2 IDC_i + \beta_3 BMT_i + +\varepsilon$$

SRLi = The likelihood a firm will repurchase shares. 1 for repurchasing firms and 0 for non repurchasing firms

INTi = Intangible assets scaled by total assets

IDCi = net cash flow from operating activities plus investing activities minus financing activities, scaled by total sales

BMTi = The book-to-market ratio of a company is calculated by dividing the book value of the stock by the market value of the stock

4.2. Signaling theory

In the literature review it became clear that around a share repurchase announcement the returns of a stock will be positive. The leading explanation for this positive return is the signaling theory. The market reacts positively on the announcement

because the company gives a signal that its share is undervalued. When a share is undervalued it means that the market does not have the information to value the share in the right way. Thus, there is information asymmetry. The signaling theory states that a company repurchases shares to signal the market that there is information asymmetry and thus, the share is undervalued. The theory states that the positive returns are a result of the signal the company gives by announcing the share repurchase. The theory will be researched with the second hypothesis.

Information asymmetry is not the only variable that is an indication for the validity of the signaling theory. Other variables are firm size, the book-to-market ratio and the size of the share repurchase. The relationship between the firm size and the abnormal returns is expected to be negative. Larger companies are better proctored by the market. There is a smaller chance that a share repurchase announcement by a large company will give new information to the market. For a small firm it is possible that the market has not paid enough attention to it, a share repurchase announcement by a smaller firm can result in higher positive returns.

The relationship for book-to-market ratio is positive. A high book-to-market value means the company is undervalued. Thus, with a high book-to-market ratio it is expected that the returns of a share repurchase announcement will be higher than the announcement of a firm with a low book-to-market ratio.

The relationship with the number of shares that is being repurchased is positive. When a company repurchases a lot of shares it gives the signal that the company is being heavily undervalued. Also, if a company spends a lot of money to give off a signal to the market, the market will be less reluctant to regard this signal as trustworthy. Therefore, it is likely that when the number of repurchased shares is high, returns will increase.

The dependent variable is the returns of the firm's stock. The short-term effect of the share repurchase announcement will be examined. Therefore, a window of five days will be used. Two days prior the announcement, the announcement date itself and two days after the announcement. To calculate the returns, the stock price at two days before the announcement and two days after the announcement are obtained. Hereafter, the

percentual difference between these two prices is calculated. The return of the stock is the percentual increase or decrease of the share price inside the window.

Eventually, an OLS regression with these variables is made with the stock returns as the dependent variable.

$$RET_i = \alpha + \beta_1 INT_i + \beta_2 SIZE_i + \beta_3 BMT_i + \beta_4 AoS_i + \varepsilon$$

RETi = The increase or decrease of the share price in where a window of -2;2 days is used with at day 0 the share repurchase announcement.

INTi = Intangible assets scaled by total assets

SIZEi = The size of the firm announcing the share repurchase

BMTi = The book-to-market ratio of a company equals

AoSi = Number of shares repurchased as a percentage of total shares

4.3. Financial crisis

This section will look at the relationship between intangible assets and share repurchases prior, during and after the financial crisis of 2007-2008 by researching hypothesis 3.

The expectation is that this relationship will reduce because the so-called growth firms with a high book-to-market ratio and many investment opportunities will be more reluctant to repurchase shares during the financial crisis due to the credit supply shock. These are the firms with high intangible assets.

For this section, the regression of the first hypothesis is used.

$$SRL_i = \alpha + \beta_1 INT_i + \beta_2 IDC_i + \beta_3 BMT_i + \varepsilon$$

SRLi = The likelihood a firm will repurchase shares. 1 for repurchasing firms and 0 for non repurchasing firms

INTi = Intangible assets scaled by total assets

IDCi = net cash flow from operating activities plus investing activities minus financing activities, scaled by total sales

BMTi = The book-to-market ratio of a company is calculated by dividing the book value of the stock by the market value of the stock

However, more periods will be considered to test this hypothesis. For the period before the financial crisis, repurchasers and non repurchasers in 2004 -2006 will be used. This is the period up to the financial crisis and 2004 is the earliest year for which data is available. The sample of firms during the financial crisis consists of repurchasers and non repurchasers from 2007-2008 (Kirkpatrick, 2009). This period is chosen because the financial crisis was at its height during these two years. Hereafter, the recession was less heavy. This does not mean that the recession was over after 2008 but this paper is only interested in the years where the crisis was at its top. The last sample will be the same sample and results obtained from the first hypothesis form 2012-2018.

5. Results

In this chapter, the results of the various regressions will be presented. The results will be presented in the order of the hypotheses. Firstly, the descriptive statistics of the first and second hypothesis are listed in Table 2.

Table 2: Descriptive statistics of the variables

In this table, the descriptive statistics of the different variables used are listed. Panel A contains the independent variables used for the first hypothesis. These are the intangible assets, idle cash and the book-to-market ratio. The panel distinguishes repurchasers and non repurchasers Panel B lists the descriptive statistics of the second hypothesis. These are the dependent variable, the returns, and the independent variables. These are the intangible assets, size, book-to-market ratio and number of shares repurchased.

Panel A

		Repurchasers		***Non-Rep***		
Var	***Obs***	***Mean***	**Stdv**	***Obs***	**Mean**	***Stdv***
INT	9.761	0.2	0.21	5.991	0.15	0.21
IDC	9.761	- 0.09	0.84	5.991	- 0.83	2.00
BMT	9.761	1.01	0.09	5.991	1.00	0.14

Panel B

Variable	*Obs*	*Mean*	*Stdv*
INT	246	0.21	0.20
SIZE	246	7.97	1.79
BMT	246	1.60	4.86
AOS	246	0.007	0.009
RET	246	1.87	6.17

5.1. The effect of intangible assets on share repurchases

The empirical results for the first hypothesis are listed in Table 3.

Table 3: Regressing the likelihood a company repurchases shares in 2012-2018.

The table shows the outcomes of a regression of the likelihood a company repurchases shares, where the likelihood equals 1 for repurchasers and 0 for non repurchasers. It lists the coefficients, p-values and the robust standard errors of the independent variables. These variables are the intangible assets, idle cash and the book-to-market ratio. Furthermore, the intercept, R squared and the probability that all the coefficients are zero, denoted by Prob > F, are given. Lastly, sample size and significance level is given, where * denotes significant at 1%, ** means significant at 5% and *** is significant at 10%.

Variable	*Coef*	*P > t*	*RSE*	
INT	0.176	0.000*	0.018	
IDC	0.083	0.000*	0.004	
BMT	0.107	0.005*	0.038	
Inter	0.467	0.000*	0.077	
R^2				0.034
Prob > F				0.000*
Sample				15,380

Robust standard errors are used because the white test made clear that heteroskedasticity is a problem with this sample. Furthermore, all coefficients are significant at a 1% level. This means that for each coefficient individually, the null hypothesis that the coefficient is zero can be rejected.

When comparing these empirical results to prior outcomes, the most important similarity is that the coefficient of the intangible assets is the same (Barth and Kaznik, 1999). It is positive and significant. This means that having more intangible assets could be a reason that a company repurchases shares.

The idle cash flow coefficient is also positive and significant. It shows that having idle cash, so cash that is not used, could be a reason for companies to repurchase shares. This is also concurrent with prior research.

The only difference in comparison to preceding outcomes is the book to market ratio (Barth and Kaznik, 1999). This paper, as well as their research has an expected positive coefficient. The difference is that this coefficient is significant and the coefficient from their paper is insignificant. It is not clear how they calculated their book-to-market ratio and they do not give an explanation why the coefficient could be insignificant.

Furthermore, this research will look at the correlation between the variables listed in Table 4.

Table 4: Correlation between the independent variables.

The table shows the correlation between the independent variables. These variables are the intangible assets, book-to-market ratio and the idle cash flow.

	INT	BMT	IDC
INT	1.000		
BMT	0.007	1.000	
IDC	0.114	0.029	1.000

Most of these correlations are in line with prior research. In contrast to earlier outcomes, the book-to-market ratio is positively correlated to the intangible assets. (Barth and Kaznik, 1999). This means that when intangible assets increase, the book-to-market also increases. This is as expected, because this entails that the market undervalues the company due to the fact that it cannot value the increase in intangible assets.

5.2. Empirical results signaling theory

This section will look at the results of the regression to test if the signaling theory is a reason for companies to repurchase shares. These results are listed in Table 5.

Table 5: Regression to test the signaling hypothesis.

The regression consists of the dependent variable, the returns. These returns consist of the changes in the share price of a company which are measured over a -2;2 days window where day 0 is the day of the announcement. The table lists the coefficients, p-values and the robust standard errors of the independent variables. These variables are the intangible assets, the size, the book-to-market ratio and the number of shares repurchased. Furthermore, the intercept, R squared and the probability that all the coefficients are zero, denoted by Prob > F, are given. Lastly, sample size and significance level is given, where * denotes significant at 1%, ** means significant at 5% and *** is significant at 10%.

Variable	***Coef***	***P > t***	***RSE***	
INT	0.001	0.964	0.018	
SIZE	-0.002	0.343	0.003	
BMT	-0.00002	0.978	0.001	
AOS	0.070	0.867	0.440	
Inter	0.037	0.089	0.021	
R^2				0.005
Prob > F				0.841
Sample				246

Table 5 shows that this model is not significant. All coefficients are insignificant, except for the intercept which is significant at a 10% level. The Prob > F is 0.841 which means that we cannot exclude the possibility that all coefficients are zero. The reason for the model being insignificant could be that 80 of the 232 returns calculated around the share repurchase announcement were negative. The signaling theory expects a positive increase in the share price around the announcement. It could be that the explanatory power of the model will be higher if only the positive returns are considered. Barth and Kaznik did not do this in their paper. They did a cross sectional research when looking at the stock returns. In contrasts to this paper, they were not especially looking to find proof for the signaling hypotheses, they

were only examining the relationship between intangible assets and share repurchases. Table 6 shows what happens if only the positive returns are used.

Table 6: Signaling hypothesis with only positive returns.

The regression consists of the dependent variable, the returns. These returns consist of the changes in the share price of a company which are measured over a -2;2 days window where day 0 is the day of the announcement. Only the announcements with positive returns are used. The table lists the coefficients, p-values and the robust standard errors of the independent variables. These variables are the intangible assets, the size, the book-to-market ratio and the number of shares repurchased. Furthermore, the intercept, R squared and the probability that all the coefficients are zero, denoted by Prob > F, are given. Lastly, sample size and significance level is given, where * denotes significant at 1%, ** means significant at 5% and *** is significant at 10%.

Variable	***Coef***	***P > t***	***RSE***	
INT	0.003	0.873	0.020	
SIZE	-0.007	0.004*	0.002	
BMT	0.002	0.187	0.001	
AOS	0.498	0.360	0.542	
Inter	0.090	0.000*	0.021	
R^2				0.051
Prob > F				0.038**
Sample				152

Now that only the positive returns have been used, the results have completely changed when compared to the results of Table 5. The size of the company and the intercept are significant at a 1 % level. The size of the company has negative effect on the return of the share price and the rest of the coefficients have a positive but insignificant effect.

Moreover, the R squared increased a lot and the F > is now 0.038 which means that we can exclude the possibility that all coefficients will be 0. The coefficients have all increased, especially that of the number of shares purchased. This is also an indication that this model has more explanatory power than that of Table 5. As mentioned before, the variable of the size is significant, and its coefficient is negative which is in line with the signaling theory (Vermaelen, 2005). Although, based on these results, the signaling

hypotheses cannot be confirmed, it cannot be rejected because the coefficient of the size is negative and significant.

5.3. The effect of the financial crisis.

The goal of the last hypothesis is to examine whether the financial crisis had any effect on the relationship between share repurchases and intangible assets. This will be done by looking at the period before, during and after the financial crisis. The period after the financial crisis, the years 2012-2018 are listed in Table 3. For the period before the crisis, the years 2004-2006 are chosen. The years 2007-2008 are chosen for the period during the financial crisis. The relationship between the likelihood a company buys shares and among others, intangible assets, is shown in Table 7

Table 7: Regressing the likelihood a company repurchases shares in 2004-2006 and 2007-2008.

The table shows the outcomes of a regression of the likelihood a company repurchases shares, where the likelihood equals 1 for repurchasers and 0 for non repurchasers. It lists the coefficients, p-values and the robust standard errors of the independent variables. These variables are the intangible assets, idle cash and the book-to-market ratio. Furthermore, the intercept, R squared and the probability that all the coefficients are zero, denoted by Prob > F, are given. Panel A shows the outcomes of the regression for 2007-2008 and Panel B for 2004-2006. Lastly, sample size and significance level is given, where * denotes significant at 1%, ** means significant at 5% and *** is significant at 10%.

Panel A

Variable	***Coef***	***P > t***	***RSE***	
INT	0.115	0.009*	0.044	
IDC	0.069	0.000*	0.007	
BMT	0.173	0.000*	0.040	
Inter	0.22	0.000*	0.040	
R^2				0.031
Prob > F				0.000*
Sample				3,147

Panel B

Variable	***Coef***	***P > t***	***RSE***	
INT	0.037	0.244	0.031	
IDC	0.071	0.000*	0.006	
BMT	- 0.040	0.309	0.040	
Inter	0.554	0.000*	0.041	
R^2				0.022**
Prob > F				0.000*
Sample				7,006

When examining Panel A of Table 7, all variables are significant at a 1% level. The sign of the coefficients has not changed. Nevertheless, the coefficients have changed. The coefficient of the intangible assets is lower in comparison to 2012-2018, in accordance with the hypothesis. The lower value could be due to the fact that companies simply did not have the cash to repurchase shares during the financial crisis (Bliss, Cheng and Denis, 2015). Consequently, a company could have a lot of intangible assets and therefore, information asymmetry, but because of a lack of cash it will not repurchase shares. The mean of the idle cash in 2007-2008 is also lower than the mean of the idle cash in 2012-2018. It becomes clear that during the financial crisis, the relationship between the likelihood a company repurchases shares and intangible assets somewhat diminishes in comparison to 2012-2018.

Another relationship that somewhat diminishes is that of the idle cash. One explanation could be that a company wishes to maintain idle cash during a financial crisis to absorb eventual losses. Where during normal times a company would sooner repurchase shares when having idle cash to, for example, reduce the agency problem (Jensen, 2005). Having cash in times where there is a credit supply shock is not an unnecessary luxury for companies.

However, the coefficient of the book-to-market ratio is higher during the financial crisis. The book-to-market ratio has a bigger effect on the likelihood a company repurchases shares during the financial crisis. An explanation for this increase could be that during the financial crisis a company will be more careful with repurchasing shares. This is costly and

should only be done for good reasons, for instance, when a company is undervalued. A company is undervalued when the book to market ratio is above 1. In other words, a company could lay more emphasis on the fact that it is only willing to repurchase shares when it is undervalued. Therefore, the coefficient of the book-to-market ratio increases.

At last, the R squared is lower during the financial crisis. This is an indication that this model does not explain the reasons for repurchasing shares as well as the model in 2012-2018. This seems somewhat odd as both models are exactly the same. However, it could be that share repurchasing companies had different reasons to repurchase shares in 2007-2008 than in 2012-2018.

One of those reasons could be that a company repurchased shares because the share price was very low due to the financial crisis. During the financial crisis, the American stock prices generally declined with 50% (Dwyer, 2009). The index of the Nasdaq, which is used in this sample, declined with approximately 54,9%. Consequently, the companies which were not in heavy waters and could afford to repurchase shares, now had an opportunity. The company could repurchase shares when the prices where low to sell them again when prices increase. Because a company could have other reasons to repurchase shares in 2007-2008, the R squared could be lower.

When examining Panel B of Table 7, it immediately shows that the coefficient of the intangible assets is insignificant, but it is positive. This could be due to the fact that the mean intangible assets are almost similar for repurchasers and non repurchasers in this sample. Therefore, in this sample, intangible assets do not seem to influence whether a company will repurchase shares. Consequently, it cannot be compared to 2007-2008 or 2012-2018.

Moreover, the book-to-market ratio is also insignificant. The coefficient of this ratio is also negative. This seems odd because for the other two samples the coefficient was positive. The negative coefficient seems to flow from the fact that the mean book-to-market ratio in this sample is higher for non-repurchasers than for repurchasers.

Nevertheless, the idle cash and the intercept are significant at a 1% level. The idle cash coefficient is fairly the same as the sample of 2007-2008. One would expect the coefficient to be more similar to that of the sample of 2012-2018. This could also be due to

the fact that the mean idle cash does not differ much between the repurchasers and non repurchasers in this sample.

6. Conclusion

Now that all empirical results are listed, this section can elaborate on the implications of these results. Hereafter, conclusions will be drawn by yet again, looking at the hypotheses and answering them with the help of the results.

This research looked at companies listed on the NYSE, AMEX and NASDAQ to find the difference between companies which did repurchase shares and the ones that did not. Furthermore, the characteristics of the repurchasers was examined to find out why these companies repurchase shares. Hereby, the following research question was answered:

What is the effect of intangible assets on share repurchases between *2004-2018 in the American market?*

To answer this question, several hypotheses have been devised. The first hypothesis examines the effect of the intangible assets on the likelihood a company repurchases shares:

Hypothesis 1: There is a positive correlation between intangible assets and share repurchases.

To examine this hypothesis, a sample of repurchasers and non repurchasers over the years 2012-2018 was made. Apart from intangible assets, the book-to-market ratio and idle cash were used in a regression on the likelihood a company repurchases shares. The regression shows that the intangible assets, idle cash and book-to-market ratio have a significantly positive effect on the likelihood a company repurchases shares. This is consistent with prior research Barth and Kaznik, 1999). Therefore, the hypothesis is confirmed. A positive correlation between intangible assets and the likelihood a company repurchases shares is found.

Secondly, having a lot of intangible assets could be an indicator for information asymmetry between a company and the market (Barth and Kaznik, 1999). The leading theory why a company repurchases shares is that the company does this to send a signal that it is undervalued (Ikenberry, Lakinoshok & Vermaelen, 1995). This undervaluation is the result of

information asymmetry. The theory is called the signaling theory. Based on this theory, the following hypothesis is conceived:

Hypothesis 2: The signaling theory is the reason for positive returns of the share price after the share repurchase announcement.

To test this hypothesis, the intangible assets were used as a proxy for information asymmetry. Furthermore, size, book-to-market ratio and the number of shares purchased were used as independent variables. The dependent variable was the share price returns. The first regression was insignificant. To improve the regression, only positive returns were used. This was done because the signaling theory states that a good signal will provide for a positive return. The effect of the second regression was a more significant model. Intangible assets stayed insignificant, but the size became significant and in line with the hypothesis, negative. Based on these results, the signaling theory could not be rejected as a reason for the positive results of the share price.

Lastly, the regression of the first hypothesis was performed on the years 2007-2008 and 2004-2006 to look at the effect of the financial crisis on the relationship between intangible assets and the likelihood a company repurchases shares. This resulted in the following hypothesis:

Hypothesis 3: The correlation between intangible assets and the likelihood a company repurchases shares is lower during the financial crisis in comparison to prior and after the financial crisis.

Yet again, a sample containing both repurchasers and non repurchasers was used. Except for the intangible assets, the book-to-market ratio and the idle cash were used as independent variables. During the financial crisis, the effect of the intangible assets on share repurchases was weaker. The explanatory power of the model also weakens, an explanation for this weakening could be that during the financial crisis other reasons could come up for repurchasing shares. The model for the period prior to the financial crisis gave an insignificant effect of the intangible assets. The R squared of this model was very low, so no real conclusions from this model can be drawn. When comparing the years 2012-2018 to the years 2007-2008, the hypothesis can be confirmed. The correlation was indeed lower during the financial crisis.

7. Limitations and recommendations

The last section will look at the limitations of this research and will give recommendations for further research.

7.1. Limitations

This paper has some limitations. The first one being that the models used in the regression could contain some more independent variables. An example of such a variable could be the information asymmetry apart from intangible assets. This was tried in earlier research but it did not represent total information asymmetry (Barth and Kaznik, 1999). Other variables could be proxy variables for the idle cash and intangible assets or a variable for the growth rate of a company. These variables could improve the explanatory power of the research.

Another limitation of this research is that the different industries the companies operate in is not taken into account. Differences between sectors could be that some sectors in general have less intangible assets and that other sectors, for example the technical sector, have more intangible assets. This research looked at companies listed at some specific stock markets but not at the industry it operates in. there are several ways to solve this. One being only looking at a certain industry. Another solution is making categorical variables for different industries.

Lastly, more observations could be used for the second hypothesis. For the regression with only positive returns, 152 observations are used. All the other regressions in the paper have a lot more observations than this. To obtain better coefficients, a larger sample often helps.

7.2. Recommendations

Except for one paper, no research has been done to the relationship between intangible assets and share repurchases (Barth and Kaznik, 1999). This is a field where further research can be helpful to better understand information asymmetry between companies and investors.

In prior research, it has been tried to calculate a variable containing general information asymmetry (Barth and Kaznik, 1999). This researched failed to create a good estimate. The first recommendation is to try an make a good variable entailing the general information asymmetry.

Another recommendation is to focus on the relationship between the intangible assets and the signaling theory. When a good variable entailing information asymmetry is created, the first thing to do is examining if intangible assets have an effect on positive returns or that it becomes insignificant due to the new information asymmetry variable.

At last, it is interesting not only to research if intangible assets create information asymmetry, but also if this information asymmetry can be solved in other less costly ways than repurchasing shares.

Sources

Allen, F., Bernardo, A. E., & Welch, I. (2000). A theory of dividends based on tax clienteles. *The Journal of Finance*, *55*(6), 2499-2536.

Allen, F., & Michaely, R. (2003). Payout policy. In *Handbook of the Economics of Finance* (Vol. 1, pp. 337-429). Elsevier.

Barth, M. E., & Kasznik, R. (1999). Share repurchases and intangible assets. *Journal of Accounting and Economics*, *28*(2), 211-241.

Bhargava, A. (2010). An econometric analysis of dividends and share repurchases by US firms. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *173*(3), 631-656.

Bierman, H., & West, R. (1966). The acquisition of common stock by the corporate issuer. *The Journal of Finance*, *21*(4), 687-696.

Bivens, J., Fieldhouse, A., & Shierholz, H. (2013). From free-fall to stagnation: Five years after the start of the Great Recession, extraordinary policy measures are still needed, but are not forthcoming. *Washington, DC: Economic Policy Institute*.

Bliss, B. A., Cheng, Y., & Denis, D. J. (2015). Corporate payout, cash retention, and the supply of credit: Evidence from the 2008–2009 credit crisis. *Journal of Financial Economics*, *115*(3), 521-540.

Chen, H. C., Harper, J. T., & Iyer, S. R. (2018). Economic shock and share repurchases. *The North American Journal of Economics and Finance*, *44*, 254-264.

CNBC (2019). *Share buybacks soar to record $806 billion — bigger than a Facebook or Exxon Mobil.* Consulted via https://www.cnbc.com/2019/03/25/share-buybacks-soar-to-a-record-topping-800-billion-bigger-than-a-facebook-or-exxon-mobil.html#:~:text=The%20total%20value%20of%20share,high%20watermark%20hit%20in%202007.'

Dittmar, A. K. (2000). Why do firms repurchase stock. *The Journal of Business*, *73*(3), 331-355.

D'mello, R., & Shroff, P. K. (2000). Equity undervaluation and decisions related to repurchase tender offers: An empirical investigation. *The Journal of Finance*, *55*(5), 2399-2424.

Dwyer, G.P. (2009). *Stock Prices in the Financial Crisis*. Consulted via https://www.frbatlanta.org/cenfis/publications/notesfromthevault/0909#:~:text=Stock%20prices%20fell%20roughly%2050,recessions%20since%20World%20War%20II.

Gelb, D. S., & Siegel, P. (2000). Intangible assets and corporate signaling. *Review of Quantitative Finance and Accounting*, *15*(4), 307-323.

Elliott, B., & Elliott, J. (2007). *Financial accounting and reporting*. Pearson Education.

Grullon, G., & Michaely, R. (2004). The information content of share repurchase programs. *The Journal of Finance*, *59*(2), 651-680

Guay, W., & Harford, J. (2000). The cash-flow permanence and information content of dividend increases versus repurchases. *Journal of Financial economics*, *57*(3), 385-415.

Ikenberry, D., Lakonishok, J., & Vermaelen, T. (1995). Market underreaction to open market share repurchases. *Journal of financial economics*, *39*(2-3), 181-208.

Jaffe, J. F. (1974). Special information and insider trading. *The Journal of Business*, *47*(3), 410-428

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review*, *76*(2), 323-329.

Jensen, M. C. (2005). Agency costs of overvalued equity. *Financial management*, *34*(1), 5-19.

Kemsley, D., & Nissim, D. (2002). Valuation of the debt tax shield. *The Journal of finance*, *57*(5), 2045-2073.

Kim, J., Schremper, R., & Varaiya, N. P. (2005). Open market repurchase regulations: A cross-country examination. *Corporate Finance Review*, *9*, 29-38.

Kirkpatrick, G. (2009). The corporate governance lessons from the financial crisis. *OECD Journal: Financial market trends*, *2009*(1), 61-87.

Miller, M. H., & Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. *the Journal of Business*, *34*(4), 411-433.

Poterba, J. (2004). Taxation and corporate payout policy. *American Economic Review*, *94*(2), 171-175.

Reddy, K. S., Nangia, V. K., & Agrawal, R. (2013). Share repurchases, signaling effect and implications for corporate governance: Evidence from India. *Asia-Pacific Journal of Management Research and Innovation*, *9*(1), 107-124.

Rueschhoff, N. G. (1978). The Evolution of Accounting for Corporate Treasury Stock in the United States. *Accounting Historians Journal*, *5*(1), 1-7.

SEC, *Purchases of Certain Equity Securities by the Issuer and Others.* Consulted via https://www.sec.gov/rules/final/33-8335.htm#:~:text=Rule%2010b%2D18%20provides%20a,common%20stock%20in%20the%20market.

Strehle, E.P. (2014) *Germany Treasury Shares Guide.* Consulted via file:///C:/Users/sande/Downloads/Germany%20Treasury%20Shares%20Guide%202014%20Update.PDF

Vermaelen, T. (1981). Common stock repurchases and market signaling: An empirical study. *Journal of financial economics*, *9*(2), 139-183.

Vermaelen, T. (1984). Repurchase tender offers, signaling, and managerial incentives. *Journal of Financial and Quantitative Analysis*, *19*(2), 163-181.

Vermaelen, T. (2005). *Share repurchases*. Now Publishers Inc.