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Master Thesis

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The short-term price impact of actual share repurchase announcements in Norway

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by
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Abstract

The master thesis examines stock performance around the announcement of open-market share repurchase transactions and the effect of intangible assets and share repurchases. The study uses data on actual share repurchase transactions conducted by firms listed on the Oslo Stock Exchange (OSE). There is evidence that share repurchases generally follows after a negative drift. The results show that the abnormal return around the announcement is 0.30% on average, with a significant t-statistics of 2.05. Intangible assets and abnormal returns also show a correlation. The overall results might suggest that managers, on average, are able to time the market.

This thesis is a part of the MSc programme at BI Norwegian Business School. The school takes no responsibility for the methods used, results found, or conclusions drawn.

Keywords: Share repurchases, price impact, undervaluation hypothesis, underreaction hypothesis, open market repurchases, information asymmetry

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1.0 Introduction

Share repurchases have become a relevant and important topic within the corporate finance area over the recent years, due to favorable changes in regulations, tax laws, and change of attitude towards shareholder value maximization (Vermaelen, 2005). The method is a common way for firms to distribute cash surplus to their shareholders or attract short-term investors' attention. Managers view it as a flexible method to influence earnings per share, adjust the capital structure, take advantage of investment opportunities, or repurchase shares when managers consider the shares to be undervalued (Brav, Graham, Harvey, & Michaely, 2005). However, the interest has brought concern that firms withhold long-term investments to pursue short-term targets such as earnings per share. The presumption is that firms underinvest and instead use share repurchases to strengthen the stock price in the short-term at the expense of long-term shareholder value (Manconi, Peyer, & Vermaelen, 2018). Still, the literature on share repurchases from the U.S. and Norway shows that it is associated with both increased stock price at the announcement and positive long-term excess return (Vermaelen, Ikenberry, and Lakonishok (2000); Skjeltorp (2004); Comment and Jarrell (1991)).

Reports from the U.S. show that firms increased their cash distribution from 26.6% in 1972 to 82% in 2000, and used the same amount on repurchases as on dividends. Share repurchases were, however, not allowed in Norway until 1999 (Skjeltorp, 2004). Since then, it has become more attractive and now takes a significant portion of firms' total cash distribution. The aggregated amount repurchased on the Oslo Stock Exchange (OSE) in 1999 was 4.5 billion NOK and has increased with 148% to 11.1 billion NOK in 2018 (OBI, 2020). However, the proportion of overall cash distribution is significantly lower in Norway compared to the U.S.

This thesis's main objective is to examine the short-term price impact following the announcement of actual share repurchase transactions in Norway. Skjeltorp (2004) studied the market impact on share repurchase programs and actual share repurchase transactions in Norway from 1999-2001. Even though the study only contained a small data set, he found a significant positive abnormal return for both share repurchase programs and actual share repurchase transactions. Our research will focus on actual share repurchase transactions and use the same method as

Skjeltorp did in his study. However, we will cover a more extended period (2010-2018), which significantly lengthens the data with 6136 share repurchase transactions on the OSE. Also, in the U.S., there has been much work on the subject, but due to regulations, it has only been possible to study the announcement effect of share repurchase programs and not actual repurchase transactions. Therefore, we find it interesting to study whether share repurchase transactions also show a significant positive abnormal return in Norway, as we study a different timeframe than what Skjeltorp did.

The paper's second objective is to examine the relationship between intangible assets and the short-time price impact. The specific cash flow related to the intangible asset can be difficult to value as the asset has no physical substance. A previous study from Barth and Kasznik (1999) showed that firms with higher intangible-to-asset ratio produce a higher abnormal return related to actual share repurchases. This paper will, therefore, study whether this expectation also is accurate for Norwegian firms.

1.1 Disposition

The first chapter gave a brief introduction to share repurchases and prior research. Chapter 2 outlines essential theories and previous literature associated with share repurchases. Chapter 3 discusses the proper methods and institutional settings. The paper's hypothesis, data, methodology, and results are presented in sections 4 through 5. In chapter 6, the results of our findings are summarized, and chapter 7 presents the conclusion of the thesis.

2.0 Theory and literature review

The second chapter is divided into two parts; the first section goes through the theoretical background regarding share repurchases, and the second section goes through related research for share repurchases.

2.1 Theoretical background

A large part of the theoretical framework on share repurchases is based on the efficient market hypothesis, Miller-Modigliani theorem, and the Principal-Agent problem.

The efficient market hypothesis states that a stock price should reflect all relevant information (Malkiel & Fama, 1970). Accordingly, stocks should trade at their fair value, making it impossible for managers to repurchase shares that are either undervalued or overvalued. Hence, market timing capability of share repurchases should not provide an abnormal return.

Miller and Modigliani (1961) argue that in a perfect and complete capital market, a firm's dividend policy, according to the irrelevance theory, should not affect its value. Thus, from an investor's perspective, dividend policy is irrelevant, as, from a value creation standpoint, a share repurchase should have the same effect on value creation as dividends. Hence, an investor will not benefit from any particular dividend policy.

The principal-agent problem is a conflict between an asset's owners and the management that control the assets (Eisenhardt, 1989). The theory assumes that the management (agents) act in their own interest and that there is asymmetric information between the management and the shareholders (principals).

The theories on share repurchases provide a wide range of reasons for why one should expect a positive announcement effect of a share repurchase (Skjeltorp, 2004). However, the focus in this thesis will be on the signaling undervaluation, the underreaction hypothesis, and intangible assets as a measure of information asymmetry.

2.1.1 Signaling undervaluation hypothesis

The signaling undervaluation hypothesis states that firms repurchase shares when they are perceived as undervalued (Vermaelen, 1981). The theory is based on the information asymmetry between management and shareholders, where managers are believed to have more knowledge about the firm's actual value due to their understanding of its position in the market and prospects. Accordingly, the management might disagree with the pricing of its shares and may want to repurchase shares when the shares are perceived as undervalued. The repurchase is seen as a positive move by the management, and shareholders generally react to the

announcement positively (Grullon & Michaely, 2004). However, earlier literature states that it could send a negative signal because it might show that the firm does not have any profitable investment opportunities (Grullon & Ikenberry, 2000). Also, expecting abnormal return following a repurchase contradicts the efficient market hypothesis, which states that the repurchase announcement should not affect the share price.

Previous research has found evidence for both negative drift (Ikenberry, Lakonishok, and Vermaelen (1995); Yook (2010)) and positive abnormal return (Vermaelen (1984); Grullon and Michaely (2002)) related to share repurchases. The negative pre-announcement drift supports the idea where management has market timing capability to repurchase shares when shares are undervalued. Likewise, the positive abnormal return confirms that the share repurchase sends a signal of undervaluation through rising share price after the repurchase announcement. Also, a survey conducted by Brav et al. (2005) presented that the management viewed undervaluation as their primary motive to repurchase shares.

2.1.2 The underreaction hypothesis

The underreaction hypothesis state that the market does not immediately react to a share repurchase program announcement but will react over time and slowly adjust (Skjeltorp, 2004). Yook (2010) questions whether the reason behind this slow reaction is due to skepticism that the repurchase program will not be carried out. Investors know that a share repurchase program announcement is not a commitment; thus, it is possible that firms may not go through with the repurchases. The skepticism can lead the value of the announcement not to be fully absorbed in the short-term. However, the outcome will be integrated over the long-term, leading us to the fact that some of the effects of only looking at the short-term might mitigate the actual impact of repurchase transactions. Nonetheless, our study contains observations of repurchase transactions, not repurchase program announcements. We expect this to lower the short-term price impact due to the already announced repurchase program's price-impact, which generally occurs before the first actual repurchase.

2.1.3 Information asymmetry and intangible assets as a measure

Information asymmetry is included in most of the hypotheses related to share repurchases and price impact. Marosi and Massoud (2007) argue that the degree of asymmetric information could be found in the intangible to asset ratio, as intangible assets can be hard to estimate correctly. If the degree of information asymmetry would impact the potential price impact following repurchase announcements, we should expect to find a higher price impact for firms with higher intangible assets.

Barth and Kasznik (1999) studied the relationship between share repurchase and intangible assets and found evidence for higher abnormal return related to firms with more intangible assets. The findings may support the expectation that intangible assets act as a predictor towards the degree of information asymmetry. They also argue that intangible assets are generally unrecognized in the balance sheet, which may lead to biases of high intangible assets for firms using mergers and acquisitions compared to inhouse research and development.

2.2 Empirical literature

Previous research on share repurchases can be categorized into two different categories; studies on the announcement of a share repurchase program and studies on actual share repurchase transactions. Tables 1 and 2 below presents a list of studies related to share repurchases and their results. Most of the papers found a significant positive abnormal return on average in both categories. Although this paper does only focus on share repurchase transactions, it is interesting to include other studies on the topic to get a better sense of what drives the effects.

Table 1: Empirical literature and results on share repurchase programs

Country	Author(s)	Period	Obs	Event Window	CAR
US	McNally (1999)	1984-1988	702	(-1, +1)	2.5%
	Grullon and Michaely (2002)	1980-1997	4443	(-1, +1)	2.7%
	Vermaelen (1981)	1970-1978	243	(-1, +1)	3.7%
	Ikenberry et al. (1995)	1980-1990	1239	(-2, +2)	3.5%
	Stephens and Weisbach (1998)	1981-1990	591	(-1, +2)	2.7%
	Comment and Jarrell (1991)	1984-1988	1197	(-1, +1)	2.3%
	Lee, Park, and Pearson (2015)	2007-2011	2395	(-2, +2)	1.4%

UK	Rau and Vermaelen (2002)	1985-1998	126	(-2, +2)	1.1%
	Oswald and Young (2004)	1995-2000	266	(-1, +1)	1.4%
Germany	Gerke, Fleischer, and Langer (2003)	1998-2000	192	(-1, +1)	6.1%
	Seifert and Stehle (2005)	1998-2003	39	(-1, +1)	5.9%
Canada	Li and McNally (2007)	1989-1992	183	(-2, +2)	3.6%
Norway	Skjeltorp (2004)	1998-2001	318	(-2, +2)	2.5%
Australia	Ramsay and Lamba (2000)	1989-1998	103	(-1, +1)	3.3%
Japan	Zhang (2002)	1995-1999	39	(-1, +2)	6.0%
Korea	Lee and Jung (2003)	1994-1998	382	(0, +5)	2.8%
Switzerland	Chung, Isakov, and Pérignon (2007)	1999-2003	10	(-2, +2)	1.8%

Table 2: Empirical literature and results on share repurchase transactions

Country	**Author(s)**	**Period**	**Obs**	**Event Window**	**CAR**
UK	Rees (1996)	1981-1990	885	(-2, +2)	0.3%
Canada	Vermaelen et al. (2000)	1989-1997	1060	(-15 +15)	0.9%
Norway	Skjeltorp (2004)	1998-2001	100	(-1, +1)	0.9%
Sweden	Råsbrant (2013)	2000-2009	9624	(0, +1)	0.7%
Australia	Akyol and Foo (2013)	1998-2008	927	(0, +1)	0.4%
France	Ginglinger and L'her (2006)	1998-1999	363	(0, +1)	0.6%

First, table 1 shows that the majority of the studies have been on the U.S. market, where the focus was on share repurchase programs. Other markets, for example, the U.K. and Norway, have studied both share repurchase programs and transactions. Regulatory differences between the U.S. and Europe are mainly the reason behind this difference in approach; in the U.S., firms only have to disclose their transactions in the next fiscal report, while in Europe, firms need to report each repurchase within the next trading day. Accordingly, researchers can study both methods in other markets than in the U.S. Second, previous research has primarily been in the period 1980-2000. Share repurchases were allowed early in some markets such as the U.S., while in Norway, share repurchases were not allowed until 1999 (Skjeltorp, 2004). Third, all the papers found a positive abnormal return from share repurchases; however, there are differences between the regions. The average CAR in the U.S. and Germany is notably higher than in other areas, which can be related to regulatory differences. Also, European firms usually need approval at the annual general meeting, which might lower the abnormal returns because share repurchases may already be expected (Manconi et al., 2018). Fourth, abnormal

return in more recent papers such as Lee et al. (2015) and Akyol and Foo (2013) show a decline in abnormal return and find that share repurchases are more driven by short-term investors and that share repurchases are more incorporated in the share price than before. Fifth, abnormal return from share repurchase transactions is lower than share repurchase programs, which derives from the fact that the price reaction is already incorporated in the price after the announcement of a share repurchase program. Finally, all the papers find support for the signaling undervaluation theory, where firms also use share repurchases to signal undervaluation of the stock.

3.0 Methods and Institutional Settings

The third chapter is divided into four parts. The first section explains the main methods used in repurchase programs. The second section describes the Norwegian institutional setting regarding law and regulations. The last section presents the institutional differences between the settings in Norway and the U.S.

3.1 Share Repurchase Methods

There are three methods on how share repurchases are conducted (Grullon & Ikenberry, 2000); fixed-price tender offer, Dutch-auction, and Open-Market Repurchase (OMR). The fixed-price tender offer is a method where firms repurchase shares from all shareholders for a specific price at a particular time, usually at a premium. The technique is used when there is an intention to repurchase a significant portion of the outstanding shares. The Dutch-auction refers to a method when firms want to repurchase an intended volume of shares at a specific price range. The OMR is the most common method used when firms announce their intention to repurchase shares in the open market. The shares are bought openly in the market through brokers, and, therefore, there is no premium over the market price. All three methods have found a significant positive abnormal return when announced, while OMR was the one with the lowest return out of the three methods (Comment & Jarrell, 1991). The focus of the paper will be on OMR, which, according to Ikenberry et al. (1995), was used in 90% of the repurchasing value between 1985 and 1993 in the U.S. OMR allows us to study the effect of a so-called "normal" transaction where the firm goes out to the market and repurchase shares daily, or more often than the other methods. Therefore, we find it interesting to

study whether these transactions produce an abnormal return, as previously mentioned papers have found.

3.2 Norwegian Institutional Settings

Share repurchases by firms listed on the Oslo Stock Exchange (OSE) are regulated by the Public Limited Liability Companies Act (PLLCA) of June 1997 (Allmennaksjeloven) and the Securities Trading Act (STA) of June 2007 (Verdipapirhandelloven). In Norway, share repurchases were prohibited until January 1, 1999, when regulations from the PLLCA made it possible for Norwegian firms to repurchase their own shares.

The E.U. commission regulation (E.C.) No 2273/2003 of December 22, 2003, which is part of Norwegian law, describes how to conduct share repurchase programs without violating laws surrounding market manipulation and insider trading from the Securities Trading Act. The regulations are interesting for our paper because the regulations prohibit firms from repurchasing shares without announcing the transactions to the market within the next trading day, allowing us to study the effect of actual share repurchase transactions. First, the purpose of the repurchase program must be to reduce the share capital, either in value, number of shares, debt conversion to shares, or employee stock ownership plans (ESOP). Second, the management must specify the repurchase program on the general meeting, considering how to acquire shares, the maximum volume of shares, total value, price range, and the program's length. Both the voting rights and all shareholders, including non-voting stock, must have at least two-thirds of the votes in favor of the program to get the plan approved (Oslo Børs, 2019). The PLLCA prohibits firms from owning more than 10% of their total outstanding shares, and the repurchase must be made out of retained earnings. The program length is also limited to a maximum of two years. Third, firms cannot repurchase their own shares if the total share capital less total value of treasury shares is lower than the minimum share capital required, which is 1 MNOK for public limited companies. Finally, firms are not allowed to repurchase more than 25% of the average daily traded volume. The highest price is limited to the highest unregulated intraday transaction, and information regarding the repurchase each day needs to be disclosed before the next exchange opening.

3.3 Difference between Norwegian and U.S. institutional settings

Jaemin, Schremper, and Varaiya (2004) conducted a survey that examined the world's ten largest stock markets. The result was that share repurchases are strictly regulated in most countries; however, in the U.S., regulations were quite different. In the U.S., companies only have to disclose the intent to repurchase shares, but not reveal anything related to the execution of these intended share repurchases. Therefore, previous research from the U.S. only studies the announcement effect on share repurchase programs. However, in Norway, we can study the actual share repurchase due to the requirement to disclose share repurchases before the next trading day. At the same time, firms in the U.S. only have to reveal the total amount of treasury shares in their quarterly fiscal report. The difference in the requirement of disclosure allows us to study whether there is a significant impact of the share repurchase transactions and not only the announcement of a share repurchase program, which is the only way in the U.S. With this in mind, we can expect to see a different result in our paper as some of the effects of the announcement of the share repurchase program is already incorporated in the share price before the actual share repurchase transaction.

4.0 Hypothesis

The fourth chapter is divided into two parts. The first section examines the short-term abnormal return of share repurchase transactions on the announcement day in Norway. The second section discusses the relationship between the short-term abnormal return and intangible assets in Norway.

4.1 Hypothesis related to share repurchase at announcement day

Previous research on share repurchases has studied several aspects which have been presented earlier in this paper. The most common way has been on both the short- and long-term horizon of either a share repurchase program or the actual share repurchase. Since firms traded at OSE need to inform the market about its share repurchase within the next trading day, we find it interesting to study the short-term price impact of actual share repurchase transactions. The hypothesis is based on an event study methodology. Following previous writings on the subject, the hypothesis on the short-term price impact of actual share repurchases is presented as follows:

$\boldsymbol{H_0}$: *There is no abnormal return of actual share repurchase announcements*

$\boldsymbol{H_1}$: *There is an abnormal return of actual share repurchase announcements*

4.2 Hypothesis related to the relationship between intangible assets and abnormal return

One of the fundamentals of the signaling undervaluation hypothesis is information asymmetry between the insiders and the outsiders of the firm. The idea is that insiders have more information about the firm's position in the market and its prospects (Marosi & Massoud, 2007). It is assumed that firms with a higher amount of intangible assets suffer from a higher degree of information asymmetry and, therefore, greater uncertainty about the firm's true value (Barth & Kasznik, 1999). As a result, this paper will study whether this is accurate for firms that repurchase shares and whether the degree of intangible assets affects abnormal return. Following earlier papers' structure, the hypothesis on intangible assets and share repurchases is presented as follows:

$\boldsymbol{H_{0,1}}$: *There is no relationgship between intangible asset ratio and* abnormal return of actual share repurchase announcements

$\boldsymbol{H_{1,1}}$: *There is a relationgship between intangible asset ratio and* abnormal return of actual share repurchase announcements

When studying the relationship between abnormal return and intangible asset ratio, there is not necessarily a significant linear relationship that can explain the relationship between the two. Most of the firms listed on the OSE are following the International Financial Reporting Standards (IFRS) for their financial reporting. In IFRS, there are specific requirements on how to capitalize intangible assets. If these requirements are not satisfied, the items are expensed instead, even if the firm believes it increases the firm's value. Examples of these items may be research, employee training, further developments of trademarks, copyrights, prototypes, and license (KPMG, 2017). The different methods to expense intangible assets may lead to mixed results, leading to an inaccurate intangible to asset ratio. As a result, it

may be challenging to find a linear relationship between the intangible asset ratio and abnormal return. In addition to looking at the firm-specific intangible to asset ratio, this paper will study whether there is a relationship between sectors with a higher degree of intangible assets than sectors with a lower degree. It is expected that the study will show a higher abnormal return towards the sectors with a high intangible assets ratio compared to the sectors with a low intangible asset ratio. The hypothesis is presented as follows:

$$\boldsymbol{H_{0,2}}: \textit{High intangible asset ratio sectors outperform low intangible asset ratio sectors}$$

$$\boldsymbol{H_{1,2}}: \textit{High intangible asset ratio sectors does not outperform low intangible asset ratio sectors}$$

5.0 Data and Methodology

The fifth chapter is divided into two parts. The first section reviews how the data have been gathered and cleaned. The second section explains how the analysis is conducted.

5.1 Data description

The initial sample includes all open market share repurchase transactions authorized between January 2010 to December 2018 and consists of 6136 observations. The first repurchase in the sample was January 2, 2010, and the last repurchase was December 28, 2018.

The data of share repurchases conducted on OSE was collected from OBI Financial Data from B.I. Norwegian Business School managed by Bernt A. Ødegaard (OBI, 2020). The data includes information about the repurchasing firm, repurchase date, the total number of share repurchased, and closing price. The Thomson Reuters Datastream database was used to obtain accounting data for each firm. Table 3 provides a summary of all share repurchase transactions included in the sample.

Table 3: Descriptive statistics of all repurchases 2010-2018

Number of firms	164
Number of repurchase events	6136
Aggregate value of shares repurchased (in billion NOK)	50.2
Number of firms with 1 repurchase event	32
Number of firms with 2 - 10 repurchase event	56
Number of firms with 11 - 50 repurchase event	38
Number of firms with 51 - 100 repurchase event	16
Number of firms with over 100 repurchase event	22

Table 3 presents descriptive statistics of the repurchase transactions. The total number of actual share repurchases was 6136, executed by 164 firms. The aggregated value of share repurchases over the period was on 50.2 billion NOK. Most firms have approximately two to ten repurchase event during the period, while 22 firms repurchased over 100 times.

Figure 1: Cumulated Share Repurchase at OSEAX by year (mNOK)

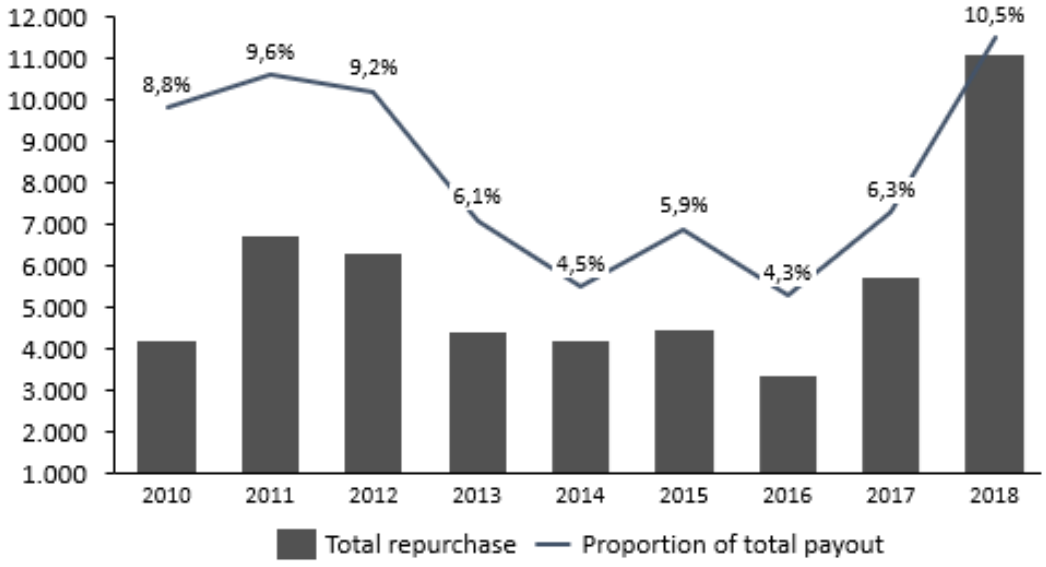


Figure 1 illustrates the cumulated share repurchases conducted on the Oslo Stock Exchange All-share Index (OSEAX) from 2010 to 2018. The proportion of share repurchased to the total payout varies between 4.3% to 10.5%. Also, it does not seem to be any clear trend in the sample. However, there is a rapid increase in the aggregated value of share repurchases in 2018. Comparing the results with data from the S&P 500 Index in the U.S., the increase in 2018 appears to be the same.

The results are consistent with Dittmar and Dittmar (2008), where they found evidence of firms repurchasing more shares in strong markets when the stock market had risen. In Norway, OSEAX increased substantially from the middle of 2017 until the middle of 2018, with approximately 26% growth. The price later fell 17.2% from the top, making it attractive for firms to repurchase more shares, as firms for the last quarter of 2018 amounted to approximately 30% of the total shares repurchased in 2018.

Further, the data collected on share repurchases include a variety of different types of share repurchases. First and foremost, it contains actual share repurchases, but also employee stock ownership plans (ESOP), equity certificates, tender offers, and repurchases associated with partners. Thus, we find it necessary to clean the data only to include actual share repurchases.

Newsweb, a website made by OSE, provides information about every share repurchase and information on what has been agreed on in the general meetings (Newsweb, 2020). For this reason, it was possible to go through each share repurchase and categorize whether it was an actual share repurchase or not. Nonetheless, it must be stated that there could be some human errors in this process; thus, there might be some transactions involving ESOP and other transactions in the dataset containing actual share repurchases. Following the structure of previous papers, ESOP's exclusion is based on the fact that ESOP is a form of compensation to employees and is executed independently of the share price performance. Therefore, we expect ESOP repurchases to have a lower signaling power than actual share repurchases.

For the same reason as with ESOP, we exclude repurchases related to partnerships. Moreover, share repurchases connected to tender offers are excluded because they are non-open market transactions, and the management sets the price. Likewise, it is necessary to rule out share repurchases made by firms categorized as equity certificates, as these firms are not ordinary traded shares. Additionally, transactions with insufficient accounting data from the Thomas Reuters Datastream has been excluded in the study.

Table 4: Descriptive statistics of share repurchase after cleaning 2010-2018

Number of firms	88
Number of repurchase events	4435
Average repurchase events	7.53
Aggregated value of shares repurchased (in billion NOK)	44.8
Number of firms with 1 repurchase event	14
Number of firms with 2-10 repurchase events	26
Number of firms with 11-50 repurchase event	21
Number of firms with 51-100 repurchase event	9
Number of firms with over 100 repurchase event	18

Table 4 provides a summary of all share repurchase transactions after cleaning the data. The number of repurchasing firms is almost reduced by fifty percent to 88 firms, and a total of 1701 repurchasing events is excluded. Nevertheless, the cleaning barely reduces the total aggregated value of share repurchases from 50.2 billion NOK to 44.8 billion NOK. The results show that even if half of the firms are excluded from the sample, large firms usually repurchase shares often and for a significant amount. The average number of shares repurchase events per firm equals to 50.4, and 18 firms have more than 100 repurchase events.

Telenor and Photocure are the firms with the highest repurchase transaction volume, with 414 and 385 transactions, consists of more than 18% of the total transaction volume. The high percentage of firms with significantly more share repurchase transactions can lead to a bias toward large firms. There is also a bias towards the clustering of transactions, where firms repurchase shares for a consecutive number of days. To deal with the clustering bias, a 30-day filter is implemented. The filter includestakes the first repurchase transactions and has a 30-day window before includingtaking the next transaction. For instance, Telenor and Photocure transactions go down from 414 and 385 transactions to 26 transactions each. Before the filter, these two firms amounted to 18% of the total volume, while after the filter, they shrunk down to 7.7%. Also, to handle illiquid stocks, there is a minimum requirement of 125 trading days before the estimation window. Accordingly, the total number of transactions gets reduced from 4435 to 655.

Table 5: Sector specific aggregated repurchases and intangible to asset ratios

Sector	Aggregated repurchases	Avg. Intangible to asset ratio	Repurchase ratio
Communications	12,061,772,822	27.6%	27%
Consumer Discretionary	2,326,803,690	5.4%	5%
Consumer Staple	3,291,626,865	17.0%	7%
Energy	15,286,344,605	29.4%	34%
Financials	4,969,145,516	1.6%	11%
Health Care	55,978,734	0.6%	0%
Industrials	2,666,591,664	9.1%	6%
Materials	3,010,833,115	4.3%	7%
Technology	1,083,435,744	60.6%	2%
Utilities	20,755,969	0.2%	0%
Average	4,477,328,872	15.6%	10.0%

Table 5 summarizes all share repurchase transactions in sectors and the average intangible to asset ratio. The Communication and Energy sectors stand out on the high end, with over 60% of the total aggregated shares repurchased. The result is as expected based on the sector's total market value of the OSEAX, where the Energy sector is the biggest with over 40% and Communication with 9.2% (Oslo Børs, 2018). On the low end, the Health Care and Utilities sectors only repurchased 1.7% of the total aggregated shares repurchased. The low repurchase activity from the Health Care sector was as expected as the sector is only equivalent to 0.3% of the total market value of the OSEAX. However, we expected the utility sector to have a higher repurchase activity, based on their 7.9% market value of the OSEAX (Oslo Børs, 2018). Technology is the sector with the highest intangible to asset ratio, with 60.6%; however, repurchases were low and only represented 2.4% of the total aggregated shares repurchased. That being said, in 2018, the Technology sector only had a market cap of 2.3% on the OSEAX, which means the sector repurchased approximately as much as their proportion on the OSEAX.

5.2 Methodology

In this part, we present methodologies used to test the hypothesis introduced in chapter 4. The analysis is organized in two steps. First, we present an event study methodology for testing the price impact of share repurchase transactions. Finally,

we describe what regressions we have used to study what price effect intangible assets have.

5.2.1 Univariate analysis

The standard event study methodology, as presented in Mackinlay (1997), is used in our research to estimate the effect of actual share repurchase transactions. Brown and Warner (1985) state that advanced models such as the Fama and French three-factor model (1993) and Carhart's (1997) four-factor model for measuring abnormal return have little impact on short-term abnormal return, and the use of the market model is more than sufficient. Hence, we use the market model to estimate the expected return.

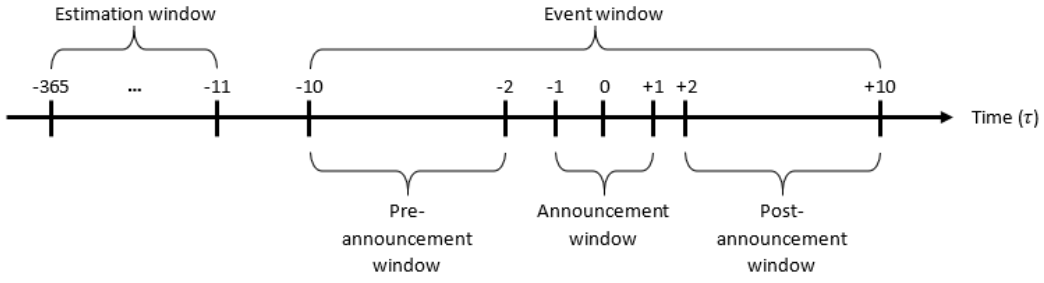
The expected return of each stock are obtained using the market model:

$$E(R_{i,\tau}) = \widehat{\alpha}_i + \widehat{\beta}_i R_{m,\tau}$$

Where $E(R_{i,\tau})$ is the expected return for security *i* at day t, $R_{m,\tau}$ is the return on the value-weighted OSEAX in at day τ, while α_i and β_i are the market model parameters.

The parameters in the market model are estimated using the ordinary least squares (OLS) regression over 365 days prior to the event window, from day [-365] until day [-10]. The announcement day is defined as day [0]. Furthermore, the short-term event window will take place ten days before and ten days after the announcement day [-10, +10]. The announcement window will occur one day before and one day after the announcement day [-1, +1]. Figure 2 below illustrates the timing of the event study.

Figure 2: Estimation and event window illustration



Due to non-synchronous traded stocks on the OSE, the estimated beta using the market model might be asymptotically downward biased for stocks traded very frequently or infrequently on average. The beta adjuster suggested by Scholes and Williams (1977) are implemented to control non-synchronous trading. The beta adjuster produces comparable results to the OLS estimator made by the market model and is calculated as follows:

$$\beta_{SW} = \frac{\hat{\beta}_i^- + \hat{\beta}_i + \hat{\beta}_i^+}{1 + 2\hat{\rho}_M}$$

Where $\hat{\beta}_i^- + \hat{\beta}_i + \hat{\beta}_i^+$ are the lagged, matching, and leading beta estimates for security *i*, and $\hat{\rho}_M$ is the first-order autocorrelation coefficient of the OSEAX.

The abnormal return is calculated as the actual return subtracted by the expected return given by:

$$AR_{i,\tau} = R_{i,\tau} - E(R_{i,\tau}) = R_{i,\tau} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,\tau}) \qquad \tau = T_1 + 1, \dots, T_2$$

Where $AR_{i,\tau}$ is the abnormal return of security *i* at day τ, $R_{i,\tau}$ is the actual return on security *i* at day τ, $R_{m,\tau}$ is the return on the OSEAX, and $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the estimated market model parameters.

The aggregated abnormal return for all securities for period τ is then averaged to obtain the daily average abnormal return, and is calculated as follows:

$$\overline{AR}_\tau = \frac{1}{N}\sum_{i=1}^{N} AR_{i,\tau}$$

Where $\overline{AR}_\tau$ is the average abnormal return for all securities at day τ and *N* is the total number of securities.

The cumulative abnormal return (CAR) is calculated by cumulating abnormal return in the event period from τ_1 to τ_2:

$$CAR_{i,(\tau_1,\tau_2)} = \sum_{i=\tau_1}^{\tau_2} AR_{i,\tau}$$

Where $CAR_{i,(\tau_1,\tau_2)}$ is the sum of each individual securities abnormal return in period τ_1 to τ_2.

The CAR is then used to calculate the estimated average CAR for all firms:

$$\overline{CAR}_{(\tau_1,\tau_2)} = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,(\tau_1,\tau_2)}$$

Where $\overline{CAR}_{(\tau_1,\tau_2)}$ is the average of all cumulative abnormal returns, and N is the total number of events.

Then, to determine the statistical significance, we use t-statistics for both $AR_\tau$and $CAR(\tau_1, \tau_2)$. The t-statistic for AR_τ is calculated as follows:

$$t\left(AR_{i,\tau}\right) = \frac{\overline{AR}_\tau}{\sigma(AR_{i,\tau})/\sqrt{N}}$$

Where $\overline{AR}_\tau$ is the average abnormal return, and $\sigma(AR_{i,t})$ is the standard deviation of the abnormal return of stock *i* at day τ.

The t-statistics for $CAR(\tau_1, \tau_2)$ is calculated as follows:

$$t(CAR_{i,(\tau_1,\tau_2)}) = \frac{\overline{CAR}_\tau}{\sigma(CAR_{i,(\tau_1,\tau_2)})/\sqrt{N}}$$

Where $\overline{CAR}_\tau$is the average cumulative abnormal return and $\sigma(CAR_{i,(\tau_1,\tau_2)})$ is the standard deviation of the cumulative abnormal return.

5.2.2 Cross-sectional analysis

We examine the price impact of intangible assets by using linear regression analysis. The dependent variable (CAR) studies the event window of one trading day before the event up until one trading day after the event. Thus, the dependent variable will be CAR [-1, +1]. Firms in Norway can report to the market on the actual trading day or the next day before the market opens; therefore, day [-1] might capture some of the effects if firms report before the market has closed on the actual trading day.

The auxiliary hypotheses discussed in chapter 4 leads us to the following equation:

$$CAR_{i,(\tau_1,\tau_2)} = \alpha + \beta_1 INTANG_{i,\tau}$$

Where $CAR_{i,(\tau_1,\tau_2)}$ is the cumulative abnormal return over trading day [-1] up to trading day [+1] for security i, α is the intercept, and $INTANG_{i,t}$ is the intangible-to-asset ratio of firm i.

6.0 Empirical Results

The empirical results are separated into two parts. The first section studies the short-term price impact on actual share repurchase announcements. The second section evaluates the relationship between intangible assets and share repurchases.

6.1 Short-term price impact on actual share repurchase announcements

This part examines the short-term price impact of actual share repurchase announcements. The theory is that repurchasing firms have market timing capability to repurchase shares when the stock is undervalued. Investors will, therefore, find it profitable to buy shares in firms that repurchase shares.

Figure 3: CAR for [-10,10] related to the announcement day

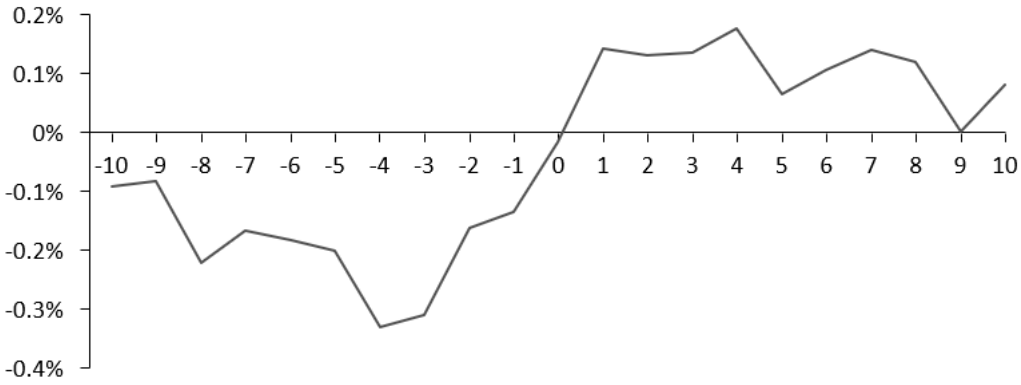


Figure 3 illustrates the average cumulative abnormal stock return (CAR) for the 21-day event window. The CAR begins ten days before the announcement day and continues ten days after the announcement in 87 different firms. The sample includes 655 share repurchase transactions from January 2010 to December 2018, and the market model parameters are calculated from 365 days to 10 days before the announcement day. The figure shows that share repurchase transactions are

preceded by a negative drift before the announcement day. On the announcement day, there is a significant price impact of the share repurchase transactions, which may indicate that managers, on average, time repurchases after a negative drift. However, the price impact following the announcement day tends to fade soon after. These findings are consistent with the signaling undervaluation hypothesis, and with prior studies such as Vermaelen (1981), Ikenberry et al. (1995), and Comment and Jarrell (1991).

Table 6: CAR and test-statistics for different event windows

Event window	CAR %	t-stat	Obs
(-10,-2)	-0.1620%	-0.64146	655
(0,1)	0.2754%	2.25731	655
(-1,1)	0.3042%	2.05229	655
(2,10)	-0.0604%	-0.27960	655

In table 6, the average CAR and t-statistics are calculated for different event windows. Looking at the pre-event CAR from day [-10] to day [-2], the CAR is not significantly different from zero with a t-statistic of -0.64. The low test-statistics indicates a high degree of variation in the sample, even if the average shows a negative CAR. Nevertheless, the results show a noticeable negative drift before the announcement day, resulting in a pre-event CAR of -0.16%. Thus, the results indicate that some managers repurchase shares after a negative drift. The average CAR over the next days [-1, +1] around the event day, results in a significantly positive CAR of 0.30% and statistically significant at 5% (t-statistic of 2.05). The positive CAR is consistent with the signaling undervaluation hypothesis in which the first repurchase sends a positive signal that the shares are undervalued. However, the average CAR after the announcement day [+2, +10], is not significantly different from zero with a CAR of -0.06% and t-statistics of -0.28. The positive impact following the event day gives some confirmation about the overreaction hypothesis, where the market overreacts to the announcement, and the stock consequently falls to its actual value.

Table 7: Change in CAR and t-statistics for different samples

	CAR (-1, +1)	t-stat	obs
Main sample	0.3042%	2.05229	655
ESOP	0.0035%	0.01497	242
Main sample incl. ESOP	0.2192%	1.74562	897

In part 5.1, it was settled that share repurchases related to employee stock ownership plans (ESOPs) should be removed. The argument was based on the credibility that these repurchases is a part of employee compensation and is generally done regardless of the share price. Table 7 presents the changes occurring when only looking at ESOP transactions and what happens to the main sample if we include ESOPs. The CAR goes from 0.30% to 0.0035% with a non-significant t-statistics of 0.015 when looking at only ESOPs. Also, if ESOPs are included in the primary sample, the CAR falls from 0.30% to 0.22% with a non-significant t-statistics of 1.75. These findings are consistent with the expectations that ESOPs sends a low signal to the market than an actual share repurchase.

Table 8: Change in average CAR and t-statistics with changed assumptions

	Avg CAR (-1, +1)	t-statistics	Observations
Min days (15)	0.3122%	2.74336	931
Min days (30)	0.3042%	2.05229	655
Min days (60)	0.4037%	2.30854	462

Further, in part 5.1, a 30-day filter was implemented to control for clustering bias, so that the data would not be affected by consecutive repurchases that would mitigate the effect from a share repurchase. Likewise, it is expected that the short-term signaling effect should decrease after the first repurchase transaction. Table 8 presents the changes made to the CAR when altering the filter. The reduction to a 15-day filter increases the CAR from 0.30% to 0.31%, with an increase in the t-statistics up to 2.74. However, an increase to a 60-day filter also increases the CAR from 0.30% to 0.40%, with an increase in the t-statistics up to 2.31. The increase in the CAR may support the expectation of the signaling undervaluation hypothesis as a cluster of repurchases weakens the effect of a share repurchase. The results demonstrate that there might be a lower abnormal return for firms with a higher degree of share repurchases. Nonetheless, there is no clear pattern of whether a 15-

day filter is better than a 60-day filter. This supports the findings from Grullon and Michaely (2002), where firms who regularly repurchase shares uses the share repurchases more as a substitute to dividends and as a result should lead to weaker signal and lower abnormal return.

Table 9: Change in average CAR and t-statistics when dividing into two groups by number of transactions

	Low	High
Transactions	Max 5	Min 6
Average CAR	1.0604%	0.1631%
t-statistics	1.76709	1.20644
Transactions	Max 15	Min 16
Average CAR	0.5398%	0.1358%
t-statistics	1.97157	0.83841

Table 9 presents CAR for different groups with a different number of transactions. Sorting firms into two groups based on the number of share repurchasing events provides information about firms who repurchase shares several times versus those who only repurchase a few times. There is a strong relationship between the short-term abnormal return and the firms who tend to repurchase shares less often. The group with a maximum of five share repurchases had a robust abnormal return with an average CAR of 1.06% and t-statistics of 1.77. The average CAR is roughly 250% above the average CAR for the primary sample. There is the same pattern in the other group when the regression should only include a maximum of 15 transactions. However, the average CAR and t-statistics go down for both groups containing minimum requirements for transactions. When setting a minimum limit of six days, the average CAR goes down to 0.16% and t-statistics of 1.20. The results show a tendency towards firms that do not repurchase shares regularly have a higher abnormal return than firms that repurchase shares more often. An explanation behind this could be that firms with few share repurchases only repurchase shares when the price is low and better at timing the market.

6.2 Relationship between intangible assets and share repurchases

This part examines the relationship between abnormal return and intangible assets related to share repurchase announcements. Barth and Kasznik (1999) state that

firms with more intangible assets are more likely to repurchase shares and generally produce a higher abnormal return. Their findings are based on the belief that intangible asset is a way to measure the degree of asymmetry information between management and shareholders since intangible assets can be hard to value. When the information asymmetry increases, as intangible assets increase, management may value the firm more correctly than the market. This asymmetry can result in a stronger signal of undervaluation for firms with higher intangible assets, causing a higher abnormal return.

Figure 4: Intangible to total assets ratio based on accounting numbers on OSE

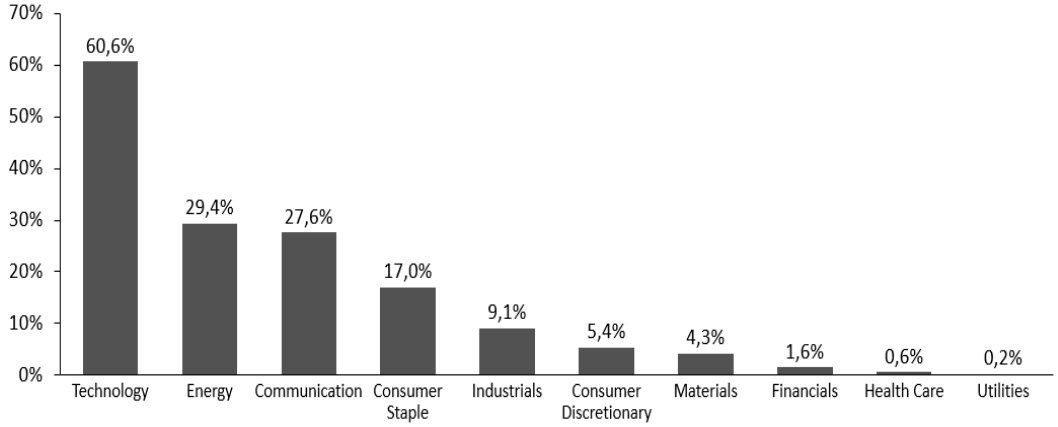


Figure 4 illustrates the intangible-to-assets ratio for all firms in the sample. The intangible-to-assets ratio starts as high as 60.6% in the Technology sector, more than two times higher than the second-highest, namely the Energy sector, at 29.4%. On the other side, we have Utilities, Health Care, and Financials with an intangible-to-asset ratio close to zero. Based on the findings presented by Barth and Kasznik (1999), we should expect to find a higher abnormal return from the sectors in our sample with the highest amount of intangible assets.

Table 10: Linear relationship between abnormal return and intangible asset ratio based on OLS-regression

		Predicted sign	Coefficient	p-value
Intercept		+	0.0027	0.162
Intangible asset ratio		+	0.003	0.746
Adj r^2	-0.001			
n	655			

Table 10 presents the linear relationship between abnormal return and intangible assets. The slope has a coefficient of 0.30%, with a p-value of 0.75. The results show no significant linear relationship between intangible assets and abnormal returns in the sample. Some firms make many acquisitions; thus, it is assumed that it is easier to recognize the value of the intangibles for those firms. However, it could be hard to value firms that do R & D even within the same sector.

For that reason, it can be hard to find any linear relationship between intangible assets ratio and abnormal return. The sample is divided into two groups to analyze further the relationship between intangible assets ratio and abnormal return. The high sector group includes the sectors with the highest average intangible-to-asset ratios and consists of Technology, Energy, and Communication. The low sector group contains the sectors with the lowest average of intangible-to-asset ratio and includes Utilities, Health Care, and Financials.

Table 11: High-intangible assets ratio sectors compared to low-intangible assets ratio sectors

	Avg CAR (-1, +1)	t-statistics
High ratio sector group	0.2076%	0.099247
Low ratio sector group	-0.0302%	-0.109318

Table 11 presents the results of the high- and low group of intangible assets ratio. The results demonstrate a tendency towards higher abnormal returns for the high group and are coherent with the findings from Barth and Kasznik (1999). However, the results are not significant, with a t-statistics of 0.1. It appears to be a considerable variation within the groups, and there seems to be no support of the expectation that higher amounts of intangible assets yield a higher abnormal return.

To be sure that our result is not biased of the accounting rules, the sector classification has to control the difference between average intangible asset intensity. Based on the average intangible asset intensity of market value on the S&P 500 by sector (Appendix 3), there are some changes to the high and low intangible asset groups. The Health Care sector has gone from the second-lowest degree of intangible assets to the highest one, and the Energy sector has gone from the second-highest ratio to the second-lowest.

Table 12: High intangible assets intensity sectors compared to low intangible assets intensity sectors

	Avg CAR (-1, +1)	t-statistics
High-intensity sectors	0.5959%	1.53163
Low-intensity sectors	0.1167%	0.51591

Table 12 shows that the average CAR for high-intensity sectors doubles from 0.30% to 0.60%, while the low-intensity sectors decrease over 60% to 0.12%. Also, both groups' significance falls as the t-statistic in the primary sample to the high-intensity sectors goes from 2.05 to 1.53. Even though there appears to be a higher variation in the high-intensity group than in the primary sample, the results provide some documentation that firms with a higher amount of intangible assets send a stronger signal to the market than firms with smaller amounts of intangible assets. This may also be an effect of the characteristics of the underlying companies in these sectors, where companies in the Energy sector have repurchased more aggregated value and have a higher degree of repurchases on average than the health care sector.

7.0 Conclusion

The purpose of this paper was to study the short-term price impact of actual share repurchases in Norway. The study used a data set of 655 open market share repurchase transactions from January 2010 to December 2018 by firms listed on OSE. The results show that firms generally repurchase shares after a negative drift in the share price. The average CAR of the announcement window (-1, +1) is 0.30%, with a significant t-statistics of 2.05. The findings are consistent with the signaling undervaluation hypothesis and results from (Skjeltorp (2004); Ikenberry et al. (1995); Grullon and Michaely (2002)). It is also interesting to see that share repurchases associated with employee stock option plans (ESOP) have an abnormal return of almost zero and non-significant t-statistics. The results indicate that managers do not use ESOPs as a means to signal undervaluation.

Further, there is no significant linear relationship between intangible assets and abnormal returns in the sample. That being said, the results indicate some relationship between intangible assets and higher abnormal return, as suggested by Barth and Kasznik (1999), but the results are not significant at a 5% significance level. To conclude, we have found that actual share repurchase transactions have a positive abnormal return of 0.30% in the short-term. We want to suggest readers of this paper to pursue and study the same topic and examine whether share repurchase programs in Norway also give the same answer and results.

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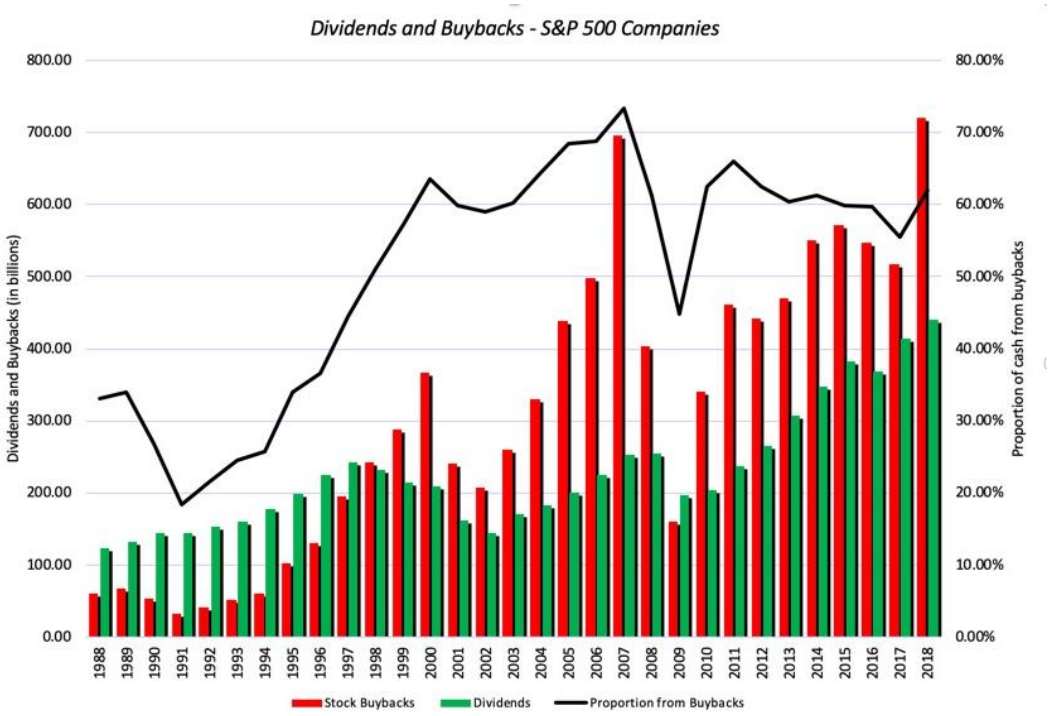
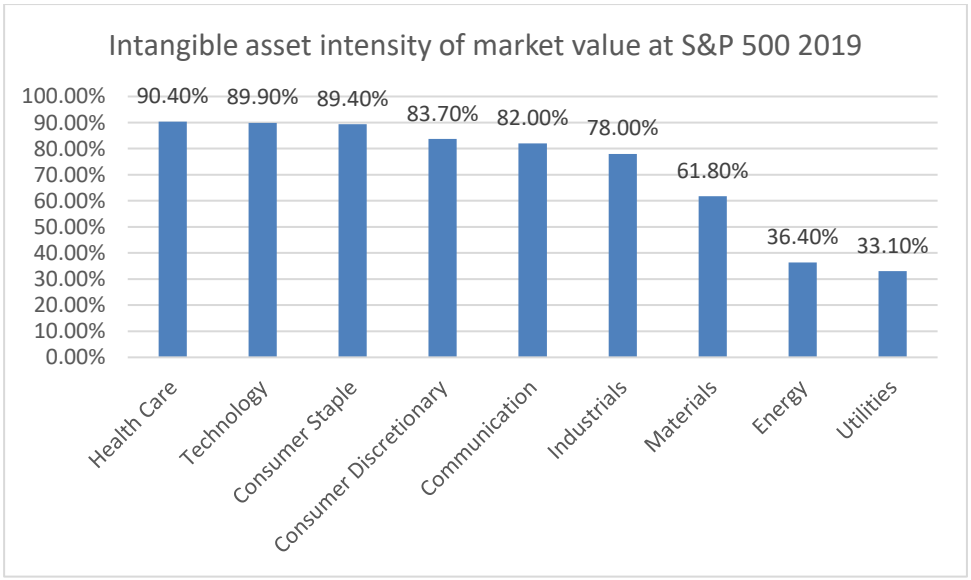
Appendix



Appendix 1: Dividends and buybacks on S&P 500 – 2019



Appendix 2: Intangible asset intensity of market value at S&P 500 in 2019