Share Repurchases and Seasoned Equity Offerings

A Thesis Presented in Partial Fulfillment of International Bachelor in Economics and Business Economics

Sam Louise van der Giessen

Abstract

This thesis examines the differences in S&P 1500 firms that conduct either a Seasoned Equity Offering or a Share Repurchase, in the year preceding announcement. I found that when controlling for the variables; firm size, market-to-book ratio and year, firms conducting a share repurchase have less financial constraints and more investment opportunities than other S&P 1500 firms in the year preceding the announcement. Furthermore, whilst holding the same controls, firms that conduct an SEO have more financial constraints and more investment opportunities than other S&P 1500 firms, in the year preceding announcement. These findings justify the positive market reaction to a share repurchase announcement, however do not completely justify the negative market reaction to an SEO announcement.

Keywords: Seasoned equity offering (SEO); Share repurchase

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Contents

1 Introduction

The theories of Modigliani and Miller (1985) imply that changes in capital structure should not add nor reduce the value of the firm. However, in the paper of Myers (2001) is stated that "after all the values of pizza's DO depend on how they are sliced. Consumers are willing to pay more for the several slices than for the equivalent whole". There is constant innovation in the design of securities and in new financing schemes, suggesting that there is some financial incentive to do so. This incentive being the possible gains from share price fluctuations and the perception of the market. An SEO is an offering for new shares on the equity market by a publicly traded firm in order to raise capital. Such an offering reduces the stock price significantly, which is caused by the negative signal it gives to investors (Asquith & Mullins, 1986). A share repurchase occurs when a publicly traded firm buys back its own shares. Share repurchases create a positive abnormal return upon announcement and send a positive signal to the market. This positive signal is most strongly influenced by the free cash flow hypothesis (Nohel & Tarhan, 1997). The free cash flow hypothesis states that an excessive amount of funds freely available to management, can lead to agency costs arising from conflict between managers and shareholders (Jensen, 1986). Hence, when conducting a share repurchase this excessive amount freely available funds is reduced. These theories will be more elaborately explained in the following sections.

In this thesis, the differences between firms conducting SEO's and firms conducting share repurchases will be studied, and with this also the motives for these transactions. With this information can be analyzed whether the differences in 'signals' given to the market upon announcement are justified. More elaborately, do firms which conduct an SEO really perform worse, and are firms conducting a share repurchase really better?

This leads to the research question which will be studied in this thesis:

"What are the significant differences between firms conducting either a SEO or a share repurchase and firms conducting neither?"

The above question will be answered using S&P 1500 firms over the time period of 1992 to 2016. Financial distress and investment opportunity proxies will be the main variables used to determine the significant differences between firms.

The main findings in this thesis are that when having analyzed all the data using all the methods that will be described in the data and methodology section, clear distinctions can be made between SEO and Repurchase firms and other S&P 1500 firms. I find significant differences between S&P 1500 firms in the year preceding a share repurchase and the control firms. These differences reveal that firms that will conduct a share repurchase have less financial constraints than other S&P 1500 firms, however they do not have less investment opportunities. This finding was unexpected as theory would suggest that repurchase firms should have less investment opportunities in the year preceding the transaction. Reasons for this will be elaborately explained in the theoretical framework. Furthermore, I also find significant differences between control firms and firms that will conduct an SEO. These differences lead to the conclusion that firms which will conduct an SEO have more financial constraints and more investment opportunities than other S&P 1500 firms. Hence, these significant differences between firms do partly justify the opposite market reactions to the two types of announcements. This is because when a firm conducts an SEO it does indeed have more financial constraints and worse performance, however, it also has (on average) higher investment opportunities than any other firm in the S&P 1500 index. This second point implies that firms conducting SEO's do have more opportunities for growth and profits than other firms. This was also shown by the finding that SEO firms suffer from the underinvestment problem. Therefore, the negative reaction of the market is not completely justified. In contrast to this, firms conducting share repurchases do indeed have (on average) higher performance, less financial constraints, but they also have significantly higher investment opportunities. Hence the positive market reaction to a share repurchase announcement is absolutely justified.

The next sections include the Theoretical Framework, Data and Methodology, Results, and Conclusions. The Theoretical Framework will consist of a literature review and will explain the topic and the theory behind the two respective hypotheses. From here the Data and Methodology sections will elaborate on the data sample used, modifications of the data, variable creation and will explain all the statistical tests that will be used to answer the research question. Next, the Results section will describe all the output and explain its implications for the research question and hypotheses. Finally, the conclusion will tie all the threads together, summarize the thesis and its implications, suggest possible improvements and propose options for further research.

2 Theoretical Framework

In this thesis, I aim to find the significant differences between firms conducting a share repurchase and firms conducting an SEO, in the year preceding the announcement. Furthermore, do these differences justify the different 'signals' (positive for repurchases, negative for SEO's) given to the market when such a transaction occurs. The next section will discuss the theory behind this thesis and explain the hypotheses made.

2.1 Share Repurchases

In economic literature, numerous reasons are given for the positive 'signal' generated by a share repurchase, which is usually reflected by the positive bump in the share price upon announcement. Firms may have several objectives with a share repurchase such as: information signaling (Billet & Xue, 2007) and getting rid of excess cash on the balance sheet (Jensen, 1986). An excessive amount of funds freely available to management, can lead to agency costs arising from conflict between managers and shareholders according to the free cash-flow hypothesis (Jensen, 1986). This is supported by evidence showing that diversified firms destroy value by subsidizing inefficient divisions, resulting that diversified firms are worth less than the sum of their individual components (Shin and Stulz, 1998 and Rajan et al. 2000). This phenomenon is based on large, mature, low-growth firms that are prone to overinvest (Nohel & Tarhan, 1998). For firms where this is an issue, the problem can be resolved by a share repurchase. The excess cash is then redistributed to shareholders implying higher earnings and smaller risks for shareholders. Hence, firms conducting share repurchases are believed to have low investment opportunities as they are unable to invest their excess cash efficiently, and therefore redistribute it to shareholders instead in order to avoid agency costs.

Nonetheless, the disclosure of positive information is the most important reason for a positive market response to the announcement of a share repurchase (Billet & Xue, 2007). The reduction in information asymmetry between managers and investors is caused by the credible 'signal' given to the market when an announcement occurs. A share repurchase is a positive signal because management buys back own shares, therefore also carrying more of the potential risk themselves. Management has more information concerning the company than investors, hence increasing their own stake shows investors that the

firm must be doing well (low business risk). When a firms conducts a share repurchase the business risk appears to decrease permanently which is mainly the result of a lower stock beta after the announcement (Lakonishok & Vermaelen, 1990). This favorable information release induces market perception of business risk to be adjusted downwards. To clarify, if management buys back their own shares, then this must imply that they believe the company is performing well and has low financial constraints which is then confirmed by the decrease business risk after a share repurchase.

This leads to the first hypothesis to be as follows:

H1: Firms conducting a share repurchase have less financial constraints and less investment opportunities than other S&P 1500 firms, in the year preceding the buyback.

Based on previous research this above hypothesis most commonly shows to be true. As was explained in the previous paragraphs, firms conducting a share repurchase are usually large, mature, low growth firms that are prone to overinvest. This indicates that repurchase firms have less investment opportunities. Furthermore, a share repurchase indicates that management believes that the firm is performing well, signaling that repurchase firms have low financial constraints (Billet & Xue, 2007). Hence, the hypothesis that repurchase firms will have less investment opportunities and less financial constraints than other S&P 1500 firms.

2.2 Seasoned Equity Offerings

There are numerous reasons for a firm to conduct an SEO, the three main theories in finance explaining these motivations are the Pecking Order Theory, the Free Cash Flow Theory and the Tradeoff Theory, as explained in Myers (2001). The Pecking Order Theory states that there is an order in the sources used by firms to fund capital expenditures. The most preferred source is retained earnings (internal cash flow), the second is debt, and finally equity issuance. According to this theory equity issuance is perceived as a 'last resort', and debt as an indicator for firms in need of external finance. This theory would imply that firms with high debt and financial distress risk are more prone to issue equity. The free cash flow theory states that excessive debt will increase firm value, despite default risk, when firms operating cash flow is significantly higher than the investment opportunities (Myers, 2001). Furthermore, the cash generated from the SEO increases

the amount of funds freely available to management, which may lead to agency costs according to the free cash-flow hypothesis (Jensen, 1986). However, this theory is mainly based on mature firms that tend to overinvest.

Finally, the Tradeoff Theory states that there is a tradeoff between maximizing the tax shield and minimizing financial distress costs. According to Myers (2001) the tradeoff theory predicts moderate debt levels by firms. Hence, firms which have low financial distress risk will tend to have more debt than companies with high risk. This is because, high financial distress risk increases the chance of default, and intangible assets are prone to sustain more damage when there is risk of default (Myers, 2001). Therefore, the tradeoff theory contradicts with the pecking order theory, because the tradeoff theory assumes that high debt is not affiliated with financial distress. However, this has shown to contradict with evidence in many circumstances. It has been found that the single largest determinant of debt/assets ratios is profitability (Wald, 2000). This study showed that the most profitable firms in an industry often borrowed the least. Examples of such firms are Microsoft and large pharmaceutical firms (Myers, 2001). Hence, for the second hypothesis the Pecking Order Theory will be used rather than the Tradeoff Theory.

In economic literature, many reasons are given for the negative 'signal' generated by an SEO, which is usually reflected by the negative bump in the share price upon announcement. One of these possible reasons is high leverage, as is also predicted by the Pecking Order Theory. If the cash generated by an SEO is used to pay off debt, the decline in leverage reduces the riskiness of debt, at the expense of equity holders as this reduces their return. However, leverage-related explanations play only a limited role to the negative return, as was shown in the study by Asquith & Mullins, 1986. Moreover, the main reason for the negative return is information asymmetry between management and investors (Billet & Xue, 2007). This is because a stock issue gives some inside information of management concerning the value of the firm. Especially if an SEO involves management sales (own) stock, this is a strong negative signal to the market regarding the current value of the firm. This leads to the second hypothesis:

H2: Firms conducting SEO's have greater financial constraints however also more investment opportunities than other S&P 1500 firms, in the year preceding issue.

Using the pecking order theory, one would expect that equity issuance is a final resort

for financing, after debt and retained earnings. This would imply that firms issuing equity have high leverage and low internal funds, therefore creating greater financial constraints. Furthermore, a reason to issue equity can be the need for external finance (Billet & Xue, 2004). Firms that have a higher need for external finance are presumed to have more investment opportunities. These factors explain why firms conducting SEO's will be likely to have greater financial constraints and more investment opportunities than other S&P 1500 firms.

Hence for both types of announcements, asymmetric information shows to be one of the main drivers of the positive/negative 'signal' given to the market. However, the characteristics of the individual firms might lead to the motivations for each type of transaction. For this reason, this thesis will analyze the differences between SEO firms and repurchase firms from firms that have conducted neither transaction in the year preceding announcement. This will show whether there are key variables such as financial distress and investment opportunities that influence either transaction. If these key indicators can be distinguished per firm type (either SEO or repurchase firm), then this should clarify whether it is justified that there is difference in signal given to the market when either transaction is announced.

3 Data and Methodology

3.1 Sample

The data sample is retrieved from the SDC database using the Thomson One platform, which offers global data for this purpose. From here all the share repurchases and all the SEO's in the S&P 1500 are obtained. The S&P 1500 is used rather than the S&P 500 in order to obtain a larger sample. All data was collected from 1985 until the present leading to a sample starting in 1998 until 2016, This can be seen in Table 1 of the appendix. Together with company name, the CUSIP codes, announcement date and filing date (only for SEO's) are all obtained from the SDC database per transaction. From the data set, only the first observation per firm is used. This implies that if a firm has numerous SEO's or share repurchases that only the first one is used. From the list of share repurchases all observations where the repurchase did not occur (but was initially supposed to occur) are removed. Furthermore, for all SEO's observations where the filing date is more than 60 days before offer date are removed, in order to remove shelf registration offerings. Also, observations where no filing date or offer date is given are also excluded. These same steps were also taken in the paper by Billet & Xue, 2007.

Next, financial information of all firms in the S&P 1500 index over the respective time-period is extracted from the COMPUSTAT database. This yields a list of financial information of each firm for each year. This dataset is merged in Stata with the dataset including all share repurchases and consequently with the dataset including all SEO's, creating one large dataset. The data is merged by CUSIP code and the variable 'Matchyear'. 'Matchyear' is a variable created in the COMPUSTAT dataset which equals the year of the financial data plus one. Therefore, when the data is merged, the financial data of the firm is given for the year preceding the share repurchase or SEO. This creates one dataset which includes all firms in the S&P 1500 index and their financials, where can be distinguished whether the firm has performed an SEO or a repurchase or neither (control). All data from the control group is kept (for every year), so this could be matched with SEO or repurchase firms at a later stage. For the SEO and repurchase firms, only the financial data from the year preceding the transaction is kept.

The sample description of the data is shown in tables 1-3 in the appendix. The first table shows the amount of observations per group per year. The second and third table

show the average size of the SEO or share repurchase, and the size of this transaction relative to the average size of the market value of equity of the firm. From here can be seen that the average size of a repurchase is much larger than that of an SEO. However, this table also reveals that 27% of the market value of equity is issued on average, and only 8% is repurchased on average. Hence, the average size of an SEO is relatively larger than that of a share buyback, relative to the market value of equity of the firm (of the preceding year). This contrast occurs because the average size of a repurchase firm is much larger than an SEO firm (significant at 1%), this can be seen in table 9 of the appendix.

3.2 Variables

Using the COMPUSTAT data, various variables required for the analysis are obtained, including the market value of the firm, EBIT (earnings before interest and taxes) and capital expenditures, which will from now on be referred to as CAPEX. Total assets is also obtained and serves as the main proxy for firm size, next to EBIT. Next to this, other variables are combined to create new variables to serve as proxies for financial distress, performance and investment opportunities. These will be described below. Note: all variables are created from financial data of the firm for the year preceding the share repurchase or SEO, hence yielding firm information before the actual transaction.

3.2.1 Q Ratio

The Q ratio is commonly known as a proxy for the quantity and quality of investment opportunities (Billet & Xue, 2007). It is calculated using the formula below:

$$QRatio = \frac{\text{Market value of equity} + \text{book value of debt}}{\text{total assets}} \tag{1}$$

The Q ratio, like the market to book ratio indicates investment opportunities, and can therefore also be tied to the need for financing. The market to book ratio (M/B) is defined as the market value of the firm divided by the book value. Smaller firms with more investment opportunities, but lower internal finance or debt capacities may face an underinvestment problem (Billet & Xue, 2007). If the firms suffer from an underinvestment problem, then this can be determined by the KZ index (Billet & Xue, 2007).

3.2.2 KZ Index

The KZ index indicates the need for external financing and therefore also financial constraint. This proxy was designed by Kaplan and Zingales (1997). The formula for the KZ index is shown below:

$$KZ_{it} = -1.002\frac{CF_{it}}{A_{it-1}} - 39.368\frac{DIV_{it}}{A_{it-1}} - 1.315\frac{C_{it}}{A_{it-1}} + 3.139LEV_{it} + 0.283Q_{it} \quad (2)$$

Where A_{it-1} is the previous year end total assets, CF_{it} is cash flow, DIV_{it} is dividends, LEV_{it} is leverage, C_{it} is cash and short-term investments and Q_{it} is the Q ratio. Leverage is defined book leverage which equals to debt divided by total assets.

3.2.3 Z Score

The Z Score, designed by Altman (1968), is a proxy for financial distress. The formula for this measure is shown below:

$$Z = 0.012x_1 + 0.014x_2 + 0.033x_3 + 0.006x_4 + 0.999x_5 \quad (3)$$

x_1 =working capital/total assets

x_2 =retained earnings/total assets

x_3 =earnings before interest and taxes/total assets

x_4 =market value of equity/book value of debt

x_5 =sales/total assets

The Z Score next to the KZ index is key to determine whether a firm is suffering from financial distress. The lower the value of Z the higher financial distress. In this formula x_1 measures the net liquidity of firm assets relative to working capital. Hence, this measures the liquidity and financial health of the firm. x_2 is a measure of cumulative profitability of the firm over time. Hence the age of the firm is implicitly accounted for. If a firm is younger it is estimated that its probability of default is higher. x_3 measures the productivity of firm assets. x_4 shows how much firm assets can decline in value before

its liabilities exceed its assets. Hence, this measure shows how close a firm is to possible default. x_5 represents the sales generating ability of firm assets and management's ability to endure competition.

3.2.4 Performance measure

Perform is a performance measure which was also used and defined in Billet & Xue (2007). This measure is defined as the operating income before depreciation, divided by the sum of market value of equity and book value of debt, as is shown in the formula below:

$$Perform = \frac{\text{Operating income before depreciation}}{\text{Market value of equity + Book value of debt}} \tag{4}$$

This measure shows the internally generated cash flow of a firm, and hence also proxies its financial health.

3.3 Descriptive Statistics

When all the variables have been created the first step is to become familiar with the data and create descriptive statistics. These can be seen in Table 4 of the appendix. This table shows the mean, standard deviation, minimum and maximum of the observations per variable per group. These statistics can already show differences between the variables per group and can therefore also be used to observe whether the hypotheses are correct, on a very basic level. To build on this, t-tests and median tests are performed to test for statistical differences in means per group and statistical differences in medians per group. The statistically significant differences in means will show the differences between firms per group per variable. These figures can then be compared to the differences in medians. If the differences in means do not correspond with the differences in medians (for example, only one of the two is significant), then this indicates a fat tail. In this case OLS regressions are no longer appropriate, and then a probit or logit model will give more accurate results.

3.4 Probit Regression

The next step is to perform a probit regression with SEO or Repurchase as the dependent variable, and all other variables as the independent variables. After these first two

regressions, the model will be run several times with or without certain statistically insignificant variables to find the model with the best fit. To determine fit the Baysian Information Criterion (BIC) is used, the lower the value, the better the fit. From these regressions is observable which variables significantly contribute to whether a firm will conduct an SEO or share repurchase, and the size of this contribution. Furthermore, conditional and average marginal effects will also be calculated after the probit regressions. The conditional marginal effects yield the effect sizes of the significant variables on the dependent variable. This will reveal if, when an independent variable increases with 1% how much more/less likely this will make the firm to conduct either a share repurchase or SEO. The average marginal effects will show if when an independent variable increases with 1% how much more/less likely this will make the firm, on average, to conduct either a share repurchase or SEO.

The regressions described above show the relationships between the independent variables and whether a firm has conducted a share repurchase or SEO. Hence, these regressions compare every firm in the SEO or repurchase group to any firm in the control group. Therefore, different types of firms in different years with different financials are compared making it difficult to isolate the effects of the financial constraint and investment opportunities variables.

3.5 Matching

To solve the possible problem described above, a matching procedure is used to determine the effects of the independent variables, whilst controlling for variables such as M/B, year, and firm size. This is the same method as was used in Billet and Xue (2007) and the same matching variables are applied. However, before matching on all three variables, the first match will only use firm size and year as covariates. This is a simpler match and will be used as a step towards matching on all three covariates. Furthermore, matching on two covariates first and then on three will also allow for the isolation of the effect when additionally controlling for the market-to-book ratio. These matching procedures will reveal differences in financial constraint and investment opportunity variables between repurchase or SEO firms and the control group. The above described matching procedure is conducted using nearest neighbor matching (NNM) in Stata, which will be performed separately for each variable twice (once comparing SEO and control, and the

other comparing repurchase and control firms). Hence, the command is run for each variable individually whilst controlling for each of the covariates every time. NNM allows for a reduction in bias when estimating the treatment effect, which in this case is defined as whether a firm will conduct and SEO or share repurchase. A specific command in stata (biasadj) is used which specifies that a linear function of the continuous covariates is used to correct for a large-sample bias which occurs when matching with multiple covariates. Hence this is used when all three covariates are used. This is not required when the data is only matched on year and size, as the matching on year requires an exact match. The NNM procedure matches each firm with four or more firms from the control group based on first the two covariates, and then on all three covariates. The matching by year is required to be an exact match, hence two firms can only be matched if the financial data can be used from the same year. The M/B and Size is matched to the 'nearest neighbor', hence the closest four matches will be used. To clarify further, NNM assigns the missing possible outcome for each SEO or repurchase firm by using an average of the outcomes of similar control firms that receive the other treatment level. Similarity between firms is based on a weighted function of the covariates for each observation. The average treatment effect (ATE) is then computed by taking the average of the difference between the observed and assigned potential outcomes for each firm. This NNM method, including the bias adjustment stems from Abadie et al (2004), in this paper all the exact steps for the procedure, including the mathematics leading up to calculation of the ATE is explained.

In addition to this type of NNM, propensity score matching (PSM) will also be used in order to compare probabilities. Using this method was inspired by the paper of Abadie & Imbens (2016), which explains why when using the PSM method bias correction is not required as it estimates on one single covariate (the estimated treatment probabilities). This will also be done individually per variable as described above, first using the covariates size and year, and second using all three covariates (including M/B). Using all three covariates solves the multidimensional matching problem which occurs when matching on single covariates dimension by dimension (Li & Zhao, 2006). The study by Li and Zhao applied three covariates: firm size, market-to-book and past returns, and explained that these variables have the largest effect regarding equity issuance. This thesis will not use past returns as a covariate, but will control for time (year) like Billet & Xue (2007).

PSM might give more accurate results as the dependent variables (SEO or repurchase) are binary variables, hence a non-linear model is more appropriate. The PSM procedure applies a Probit model, whilst the NNM described above uses a linear model (due to the bias correction). PSM implements nearest-neighbor matching on an estimated propensity score, which is a conditional probability of treatment. When the matching has occurred, the ATE is calculated in the same way as for the NNM procedure described in the previous paragraph. Where treatment is defined as whether a firm conducts an SEO or share repurchase.

4 Results

4.1 Descriptive statistics

The descriptive statistics are shown for each variable per group (SEO, Repurchase and Control) in table 4 of the appendix. At first glance, when looking at the mean performance measure for the three groups, it appears that repurchase firms are best performing (0,102), control firms second best (0,074) and SEO firms appear to be worst performing (0,018). The Pecking Order Theory would suggest that SEO firms suffer from more financial constraints and have more leverage than repurchase firms or the control group. It would also be expected that the repurchase firms generally have less financial constraints and less leverage than the control group and SEO group. At first glance these statements appear to be true when turning to the means of the Z score and Leverage in Table 4 of the appendix, and partly true when looking at the KZ index. This is because Z-Score has the highest mean (least financial distress) for repurchase firms (6,533) and the lowest mean for SEO firms (5,224). However, when looking at the means of the KZ index repurchase firms also have the lowest need for external financing (-0,349), though control firms have the largest mean (-0,152), where the SEO mean lies in between (-0,190). Nevertheless, the difference between the SEO mean and the control mean is much smaller, and might therefore not be a significant difference.

Furthermore, as was explained in the theoretical framework, SEO firms are expected to have the highest investment opportunities, and repurchase firms the lowest. Part of this statement was also shown to be correct when looking at the difference in means of the Q-ratio for the three respective groups. As the Q-ratio is a proxy for the quantity and quality of investment opportunities. The SEO group has the largest mean of (2,985), the repurchase group the second largest (2,052) and the control group had the smallest (1,861). The large gap between the SEO group and the other groups was expected, however it was not expected that the Q Ratio for the repurchase group would be higher than that of the control group. This appears to also be the case when looking at the differences in means for the M/B, which is also a proxy for investment opportunities. The difference between Repurchase and Control group means is smaller however, and might for that reason not be significant. Whether these above differences are significant will be analyzed using the t-tests in the following paragraphs.

4.2 T-tests and Median Tests

The first t-test (table 5) shows the difference in means between the SEO group and the control group. Here is tested whether the difference in means, and hence the observations made above are significant. From this table can be observed that the only significant (5%) mean differences are those for firm size, Q ratio, leverage, EBIT and CAPEX. This implies that the differences in mean investment opportunities were indeed significant, which is also shown by the differences in medians test (table 6). Moreover, as was expected by the Pecking Order Theory, the mean and median difference in leverage between the SEO and control group is also significant (5%). In addition to this, both differences in mean and medians are significant for EBIT, CAPEX and SIZE. For these three variables, the control group has higher values implying that the control group firms are, on average, larger and have more investment activity than SEO firms. CAPEX shows investment activity (Billet & Xue, 2004). Furthermore, this table implies that there are no significant differences in mean financial distress (Z score) or mean need for external financing (KZ index) proxies for the SEO group and the control group. These differences in means were expected to be significant according to the Pecking Order Theory. However, the differences in medians of these variables is significant. The fact that the difference in means is not significant, but the difference in medians is, implies that there is a fat tail. This is not only the case for the Z score and KZ index, but also for M/B and performance. This implies that linear models (such as OLS) are no longer appropriate, and that nonlinear models will give more accurate results. This will be done later on.

The second t-test (table 7) shows whether the difference in means for the respective variables are significant between the Repurchase group and the control group. From here can be observed that the difference in means for firm size, leverage, KZ index, EBIT, CAPEX and Z-score are significant differences. For all these significant differences in means, the differences in medians are also significant (table 8). This implies that the mean measures of financial distress (Z score) and need for external financing (KZ index) are indeed better for repurchase firms than for the control group (as was expected). Likewise, repurchase firms also have less leverage, are larger (size and EBIT) and have more investment activity (CAPEX). These findings coincide with the earlier statement that repurchase firms are large, mature, low-growth firms that are prone to overinvest (Nohel & Tarhan, 1998). Moreover, the lower leverage is also explained by the Pecking Order

Theory. Furthermore, the difference in means and medians for performance are both insignificant, implying that control firms and repurchase firms have equal performance. The mean level of investment opportunities is not significantly different, which would be expected, nevertheless the difference medians is significant. This is shown by the insignificance of t-test both the M/B and the Q ratio, and the significance of these variables when testing for the difference in medians. As was explained before, this contrast implies a fat tail.

The third t-test (table 9) shows whether the difference in means of the variables is significant for the repurchase and SEO group. This yielded that only the difference in means for KZ index, M/B and Z-score are insignificant differences between repurchase firms and SEO firms. This implies no difference in mean financial distress (Z score) and need for external financing (KZ index) between the two groups. The differences in medians for these values is significant (table 10), implying a fat tail which will be analyzed at a later stage. There is a significant (1%) difference in the mean proxy for investment opportunities (Q ratio), this is also the case for the difference in medians which is significant at 6%. This implies that SEO firms indeed have higher investment opportunities than repurchase firms according to the Q ratio. When looking at the M/B neither the difference in means or medians is significant. The contrast between these two measures for investment opportunity implies that there is some uncertainty whether this is a valid difference. However, the Q ratio is assumed to be a more accurate measure, as the M/B ratio can significantly underestimate investment opportunities for financially constrained firms (Adam & Goyal, 2008). SEO firms have a better Q-ratio, higher leverage and lower performance according to both the t-test and the difference in medians test. This combination indicates an underinvestment problem; smaller firms with more promising investment opportunities, but lower returns on capital and limited excess debt capacity (Billet & Xue, 2007). If this is the case, then this should also be apparent when consulting the KZ index, which confirms the underinvestment problem when looking at the medians test, but not when looking at the t-test. Finally, SEO firms are smaller (Size and EBIT) and have a lower investment activity (CAPEX) than repurchase firms. These differences were already apparent when contrasting the two groups with the control group and therefore do not yield any additional information.

To briefly conclude what is written in the previous paragraphs, for all tests, firm size (Size & EBIT) and investment activity (CAPEX) is highest for repurchase firms and lowest for SEO firms. Furthermore, investment opportunities as reflected by the Q ratio are highest for SEO firms (significant at 5%) and lowest for control firms (significant at 10%). The M/B ratio gives no clear conclusions. The performance of Repurchase firms and control firms is equal, however for SEO firms it is significantly lower (significant at 5%). Leverage is highest for SEO firms and lowest for repurchase firms, as is expected by the pecking order theory. Both the KZ index and the Z-score yield that repurchase firms have less financial constraints and less need for external financing than control firms. When comparing SEO and control, the medians test reflects that SEO firms are more financially constrained and have higher need for external finance (t-test is insignificant). Most findings coincide with the hypotheses when looking at the t-tests, and all findings coincide with the hypotheses when looking at the median tests.

4.3 Probit Regression

When using a binary variable as the dependent variable, a Probit model is more appropriate as it measures probabilities and therefore has a distribution between 0 and 1. The first Probit model examined has Repurchase as the dependent variable. The regression output can be seen in table 11. Individually rerunning the Probit regression with different combinations of variables and analyzing the BIC and AIC yields that a model with only CAPEX, EBIT, and leverage as variables has the best fit (table 12). However, the fit remains to be relatively poor as the R squared states that only 3,3% of the variation from the mean is predicted by the model. From this model, it can only be concluded that EBIT and leverage have a significant relationship with whether a firm conducts a share repurchase. EBIT has a positive coefficient, as would be expected because it is a proxy for performance. Hence, if a firm performs better, it is more likely to conduct a share repurchase. Furthermore, the coefficient of Leverage is negative, implying that firms with lower leverage are more likely to conduct a share repurchase. For this Probit model the average and conditional marginal effects were also calculated (table 12). This table also includes the average marginal effects estimated after the probit regression for share repurchases (only the significant variables have been included). The average marginal effect estimates that firms increasing their leverage with one percent, will on

average be 1,5% less likely to conduct a share repurchase. From these results, it follows that capital structure has a small impact on whether a firm will conduct a share repurchase. The average marginal effect of firm size (EBIT) is even smaller, and can therefore not be meaningfully interpreted. Table 12 also shows the conditional marginal effects estimated after the probit regression for share repurchases. EBIT has a very small effect size, however, leverage for the total sample of 21%, the marginal effect at the mean is estimated to be -1,5%. This number implies that firms that increase their leverage with one percent will be 1,5% less likely to conduct a repurchase at the mean. Hence the conditional and average marginal effects yield the same outcome.

Another probit model was also created with SEO as the independent variable (table 13). Individually rerunning the Probit regression with different combinations of variables and analyzing the BIC and AIC yields that a model with CAPEX, EBIT, Q-ratio, leverage and Z-score as variables has the best fit (table 14). From this model it can be concluded that EBIT, Q-ratio and Z-score have significant effect on whether a firm conducts an SEO, with a significance level of 5%. CAPEX and leverage have significance at 10% and 11%. This model still has relatively low fit as the R squared states that only 3% of the variation from the mean is predicted by the model. Again, average and conditional marginal effects were calculated for this model (table 14). Unfortunately, for CAPEX and EBIT the effect sizes are too small the be interpreted meaningfully. However, for the Q ratio the average marginal effect estimates that firms increasing their Q ratio with one percent, will on average be 0,3% more likely to conduct a share repurchase. From these results, it follows that firms with more investment opportunities are more likely to conduct a share repurchase, as was expected. Furthermore, for the Z score the average marginal effect estimates that firms increasing their Z score with one percent, will on average be 0,04% less likely to conduct a share repurchase. This implies that firms with more financial constraints are less likely to conduct a share repurchase, this too corresponds with economic theory. The conditional marginal effects yield the same results as the average marginal effects (Table 14).

4.4 Matching

4.4.1 Nearest Neighbor Matching

As explained in the data and methodology section, the NNM procedure will be used to determine the effects of the independent variables, whilst controlling for M/B, year, and firm size. The average treatment effect (ATE) of the variables on whether a firm will conduct a share repurchase will be analyzed, which is given as the output of the NNM procedure. Firstly the test is run individually for each independent variable with Repurchase as the dependent variable, and using size and year as the covariates. Secondly the same procedure is done with SEO as the dependent variable. Finally these two steps are repeated whilst adding one more covariate (market-to-book). The output of the several NNM procedures for Share Repurchases can be viewed in tables 15 and 16.

Table 15 shows that the NNM procedure for repurchase firms yields a significant result for EBIT, CAPEX, Z-score, leverage and performance. This output shows that firms with higher performance and more investment opportunities are more likely to conduct a share repurchase, as is shown by the positive coefficients for EBIT, Perform and CAPEX. This outcome corresponds with the earlier statement that repurchase firms are large, mature, low-growth firms that are prone to over-invest (Nohel & Tarhan, 1998). Furthermore, the negative coefficient for leverage implies that firms with lower leverage are more likely to conduct a share repurchase. This finding indicates that capital structure is indeed relevant when contemplating if a firm will conduct a share repurchase or not. Finally, a positive coefficient for Z-score and negative coefficient for leverage imply significantly less financial distress for repurchase firms than for control firms. This also coincides with the Pecking Order Theory, as repurchase firms usually use their internal capital (retained earnings) to finance the buyback. Unfortunately, the sizes of the coefficients cannot be interpreted, as this is a linear model. The insignificant coefficients for KZ index and Q ratio, imply that there is no significant difference between the investment opportunities and need for external financing between the repurchase and control group. For repurchases the NNM result is the same when using either two or all three covariates, only the sizes of the coefficients change slightly and the coefficient for the Q-ratio becomes significant. Furthermore, when only using the covariates size and year, the coefficient of market-to-book is significant with a positive coefficient. This positive coefficient is unlikely

to represent more investment opportunities because when low-growth firms have higher debt, their M/B ratio is higher than would be implied solely by investment opportunities (Adam & Goyal, 2008). However, together with the Q ratio becoming significant, it does appear to be the case that repurchase firms have higher investment opportunities than control firms. Hence, these findings only partly support hypothesis 1. Firms conducting a share repurchase do indeed have less financial constraints however they do not have less investment opportunities than other S&P 1500 firms, in the year preceding the buyback when controlling for M/B, firm size and time.

The next NNM procedure, shown in table 16, has SEO as the dependent variable. When only using firm size and year as covariates, the NNM gives a significant result for EBIT, CAPEX, Z-Score, Leverage and Q ratio. This result is different when using all three covariates, as then CAPEX and Q ratio become insignificant. When using all three covariates, this NNM yields a significant result for EBIT, Z score, KZ index and leverage. This output shows that lower performing firms which have higher financial distress and need for external financing are more likely to conduct an SEO. This is shown by the negative coefficients for EBIT and Z score and the positive coefficients for KZ index and leverage. Furthermore, the result that higher leverage makes a firm more likely to conduct an SEO is consistent with the Pecking Order Theory and implies that capital structure is indeed relevant. The size of these coefficients cannot be interpreted as this is a linear model. Nevertheless, the insignificant coefficients of the Q ratio and CAPEX imply no significant differences between the SEO and control group when looking at current investment activity and investment opportunities. This does not correspond with hypothesis two. Hence, firms conducting SEO's do indeed have greater financial constraints however they do not have more investment opportunities than other S&P 1500 firms, in the year preceding issue when controlling for M/B, size and time. However, when not controlling for M/B, the NNM reveals that SEO firms have less investment activity and more investment opportunities, which is consistent with hypothesis two.

4.4.2 Propensity Score Matching

As described in the data and methodology section the PSM procedure is the same as the NNM procedure above, except for that it uses a Probit model instead of a linear model, allowing for a more accurate interpretation of the coefficients. The interpretation of the

coefficients is possible because the model yields an average treatment effect, rather than a Probit regression output. The first model, which is shown in table 17, shows Repurchase as the dependent variable (the treatment variable) for each of the individual PSM tests. This procedure will predict the effect of each variable on the probability of conducting a share repurchase. Table 17 shows that the PSM procedure for Repurchase firms yields a significant result for all variables except for CAPEX, for both sets of covariates. Hence, the results are the same when using only size and year as covariates, and when also using M/B. Furthermore, the coefficients barely change and the coefficient of M/B is insignificant in the model with only two covariates. In the following section the coefficients of the model using all three covariates will be interpreted as this method was also applied by Billet & Xue (2007) and Li & Zhao (2006). The Q-ratio has a positive coefficient of 0,2, implying that firms that conduct a repurchase have higher investment opportunities in the year preceding the repurchase than control firms. The coefficient indicates that the Q ratio is 0,2 higher for firm that will conduct a share repurchase in the following year. This was not an expected result and contradicts with hypothesis 1. The KZ index and the Z-score indicate that lower measures for financial distress increase the chance of a firm conducting a share repurchase. The KZ index is on average 0,15 lower and the Z score is on average 2 higher for repurchase firms in the year preceding the repurchase. This is also supported by the positive coefficients for performance (0,028) and EBIT (201). The large coefficient for EBIT implies that EBIT is on average 201 million higher for firms conducting a share repurchase, than for control firms (in the year before the repurchase). Furthermore, the negative coefficient for leverage (-0,06) also implies that firms with 0,06 lower leverage are more likely to conduct a share repurchase, therefore indicating the importance of capital structure. These last three points therefore support hypothesis 1, and correspond with the pecking order theory. This PSM model therefore gives the same result as the NNM, showing that firms conducting a share repurchase do indeed have less financial constraints however they do not have less investment opportunities. The insignificance of the CAPEX variable indicates that there is no significant difference in investment activity between firms conducting a repurchase and control firms in the year preceding the transaction.

The same PSM models is also run with SEO as the dependent variable (treatment variable). The output for these models can be seen in table 18. These models yield

significant outcomes for all variables when using all three covariates. When only using firm size and year as covariates performance becomes insignificant and the KZ index becomes significant at 6% rather than 1%. In addition to this, the coefficients of the independent variables remain fairly similar. The coefficients of the model with three covariates will be interpreted, as was done in the previous paragraph. When using all three covariates every coefficient supports hypothesis 2, implying that firms conducting SEO firms do indeed have greater financial constraints and have more investment opportunities than other S&P 1500 firms, in the year preceding issue when controlling for M/B, size and time. This is shown by the positive coefficients for the KZ index (0,3) implying an increased need for external financing of 0,3 on average in the year preceding the SEO in comparison with control firms. Furthermore, the negative coefficients for Z score (-1,7), Perform (-0,03) and EBIT (-332) imply that when a firm has more financial constraints and lower performance it is more likely to conduct an SEO. The coefficient for Perform is not significant (only at 12%) when M/B is not used as a covariate, however the coefficient for EBIT implies that the same conclusion can still be made concerning lower performance. EBIT is on average 332 million lower and the Z score is 1,7 lower for firms in the year preceding an SEO than control firms. The negative coefficient for CAPEX (-42) and the positive coefficient for Q ratio (0,15) indicate that a firm with less investment activity but more investment opportunity is more likely to conduct an SEO. CAPEX is on average 42 million lower, and Q ratio is on average 0,15 higher for firms in the year preceding an SEO than for control firms. Finally, the positive coefficient for leverage (0,08) indicates that firms on average have 0,08 more leverage when they conduct and SEO in the following year. To conclude, SEO firms have a better Q-ratio, higher leverage and lower perform measures (EBIT). This combination indicates an underinvestment problem: smaller firms with more promising investment opportunities, but lower returns on capital and limited excess debt capacity (Billet & Xue, 2007). This observation is further supported by the KZ-index, which was not yet the case in earlier tests. These results support hypothesis two, indicating that SEO firms have higher financial constraints and more investment opportunities than other S&P 1500 firms, in the year preceding issue when controlling for M/B, size and time (and also when only controlling for size and time).

5 Conclusion

5.1 Summary

The goal of this thesis was to find the significant differences between firms conducing a share repurchase and firms conducting an SEO. The reason for this was to discover if it is justified that the market has opposite reactions to the announcement of these transactions. This led to the two hypotheses being that firms conducting an SEO/Repurchase have more/less financial constraints and more/less investment opportunities than other S&P 1500 firms, in the year preceding the SEO/buyback. From the results section can be concluded that when not controlling for M/B, firm size and time (not matching), the second hypothesis (for SEO's) holds true, but the first hypothesis (for repurchases) does not. This is concluded from the most accurate model in the results section, before the matching procedures, the Probit regressions. This implies that SEO firms are indeed more financially restricted and have more investment opportunities than other S&P 1500 firms in the year preceding the transaction. However, for repurchases the only significant finding in this section is that repurchase firms have higher EBIT (proxy for performance and size) and lower leverage, in the year preceding the buyback. This finding implies that capital structure is indeed relevant when determining the likelihood of a firm conducting a share repurchase. The second part of the results section, including the NNM and the PSM models yielded more extensive results. All variables were significant for both models except for CAPEX in the repurchase model. These models implied that when controlling for firm size, M/B and time, both hypotheses are correct except for the second part of hypothesis one. This means that a significant difference was found between the investment opportunities of firms conducting a share repurchase and other firms in the S&P 1500 index. However this difference was that firms conducting a repurchase have *more* investment opportunities than control firms, which was not expected.

5.2 Interpretations and Implications

The findings summarized above yield that the estimation of whether a firm will conduct a share repurchase or SEO is more accurate when controlling for firm size, M/B and time. Furthermore, the significant differences between firms do partly justify the opposite market reactions to the two types of announcements. This is because when a firm

conducts an SEO it does indeed have more financial constraints and worse performance, however, it also has (on average) higher investment opportunities than any other firm in the S&P 1500 index. This second point implies that firms conducting SEO's do have more opportunities for growth than other firms. This was also shown by the finding that SEO firms suffer from the underinvestment problem. Therefore, the negative reaction of the market is not completely justified. In contrast to this, firms conducting share repurchases do indeed have (on average) higher performance, less financial constraints, but they also have significantly higher investment opportunities (when looking at the PSM). Hence the positive market reaction to a share repurchase announcement is absolutely justified. Nevertheless, all these criteria can also already be observed before an SEO or share repurchase, when controlling for the relevant variables. Hence, the question, why does the announcement cause the positive/negative signal? A reason for this can be that when such a transaction is announced, the firm has gained the attention of the market and is revalued by the market upon announcement.

5.3 Improvements and Suggestions for Future Research

Possible improvements for this thesis are as follows. Firstly, additional control variables can be implemented at the beginning of the research. An example of this could be controlling for firms which have done multiple SEO's or multiple share repurchases. These firms will likely have more severe differences with the control group than firms that have only done one repurchase or SEO. Furthermore, one could also control for the size of the repurchase or the SEO in comparison to market value of equity. Firms conducting larger transactions are also likely to have larger differences in financials with the control group. Controlling for these differences might therefore allow a more accurate and elaborate explanation of firm differences. A second improvement of this thesis would be to specify the deviation which is allowed between potential nearest neighbors in the NNM and PSM procedures. This would imply that two observations can only be matched if they are in within a certain range for the variables size and market-to-book. This specification will then also allow the possibility to test with smaller samples and, then can also be tested which distance yields the same results as in this thesis.

A possibility for future research would be to run the same tests as in this thesis but then also for the year after the share repurchase or SEO. Then these findings could be

contrasted with the financial data before the announcement and can be observed if there are significant differences. This will explain whether the 'signals' generated by these transactions occur because a firm changes after such a transaction is conducted, or not. This will give an extra dimension when explaining the negative/positive market reaction to such an announcement. The final suggestion for improvement would be to also analyze a subset of firms which has conducted both types of transactions, an SEO and a share repurchase. This would be much like the paper by Billet and Xue (2007) however more focus would be placed on differences in firm characteristics. Moreover, not only firms that have conducted a repurchase and then an SEO will be analyzed, but also firms who did this the other way around.

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7 Appendix

Table 1: Sample description

Year	Control	REP	SEO
1998	239	2	2
1999	1462	43	83
2000	1473	9	77
2001	1455	13	59
2002	1442	19	43
2003	1435	27	40
2004	1454	31	15
2005	1435	21	25
2006	1367	32	31
2007	1347	24	23
2008	1334	11	24
2009	1299	25	22
2010	1289	27	15
2011	1254	28	15
2012	1213	44	27
2013	1187	40	17
2014	1173	31	22
2015	1152	8	28
2016	1041	0	10
Total	24051	435	578

Table 2: SEO sample description

Average size of the SEO is defined as the average size of the transaction. The Size/Market value of equity measure shows the mean of the average size of each SEO transaction divided by the market value of equity of the firm.

Average Size SEO	Size/Market value of equity
237,144.100	0.2688252

Table 3: Repurchase sample description

Average size REP is defined as the average size of the repurchase transaction. The Size/Market value of equity measure shows the mean of the average size of each transaction divided by the market value of equity of the firm.

Average Size REP	Size/Market value of equity
1,529,287.000	0.0801793

Table 4: Sample description

SIZE is defined as total assets. The QRATIO is defined in equation (1). Perform is defined in equation (4). LEV is defined as book leverage which equals to debt divided by total assets. The KZ_INDEX is defined in equation (2). EBIT is defined as earnings before interest and taxes. M_B is defined as the market value of the firm divided by the book value. Z_SCORE is defined in equation (3). CAPEX is defined as capital expenditures.

Group	Variable	Observations	Mean	Standard Deviation	Min	Max	Median
Control	SIZE	24.051	5521.990	17334.840	0.017	403821.000	436.480
	QRATIO	24.051	1.861	2.275	0.001	100.756	1.660
	PERFORM	24.051	0.074	1.557	-220.000	26.063	0.065
	LEV	24.051	0.205	0.247	0.000	16.549	0.214
	KZ_INDEX	24.051	-0.152	2.260	-132.063	49.105	0.275
	M_B	24.051	3.683	48.366	-1351.687	5603.074	2.975
	Z_SCORE	24.051	5.264	12.264	-160.462	938.858	2.962
	EBIT	24.051	546.361	1916.170	-19095.000	38299.000	27.097
	CAPEX	24.051	286.079	1229.231	0.000	37985.000	18.430
Repurchase	SIZE	435	18234.660	48441.380	28.880	346808.000	2,244.600
	QRATIO	435	2.052	1.635	0.025	11.477	1.549
	PERFORM	435	0.102	0.058	-0.065	0.503	0.096
	LEV	435	0.169	0.197	0.000	2.461	0.129
	KZ_INDEX	435	-0.349	1.334	-11.044	3.802	-0.171
	M_B	435	7.892	65.494	-53.613	1300.630	2.712
	Z_SCORE	435	6.533	8.815	-5.459	124.043	4.272
	EBIT	435	2584.405	8039.637	-134.013	66290.000	237.219
	CAPEX	435	1110.671	3961.820	0.069	34271.000	79.587
SEO	SIZE	578	2185.610	8458.414	1.698	149422.000	436.480
	QRATIO	578	2.985	4.329	0.090	40.025	1.660
	PERFORM	578	0.018	0.294	-4.575	0.714	0.065
	LEV	578	0.244	0.252	0.000	1.974	0.214
	KZ_INDEX	578	-0.190	4.108	-77.994	5.819	0.275
	M_B	578	4.591	13.855	-132.504	77.017	2.975
	Z_SCORE	578	5.224	14.870	-70.077	215.679	2.962
	EBIT	578	102.077	760.147	-10537.000	7837.000	27.097
	CAPEX	578	128.909	485.877	-6.998	9118.000	18.430

Table 5: t - test: difference in means: SEO vs Control

Variable	SEO mean	NO mean	Difference	P-value
SIZE	2,185.610	5,521.990	-3,336.380	0.000
QRATIO	2.985	1.861	1.124	0.000
PERFORM	0.018	0.074	-0.056	0.386
LEV	0.244	0.205	0.038	0.000
KZ_INDEX	-0.190	-0.152	-0.038	0.697
M_B	4.591	3.683	0.908	0.652
EBIT	102.077	546.361	-444.285	0.000
CAPEX	128.909	286.079	-157.170	0.002
Z_Score	5.224	5.264	-0.041	0.937

Table 6: Difference in medians: SEO vs Control

Variable	SEO median	NO median	Difference	P-value
SIZE	436.480	1,022.223	-585.743	0.000
QRATIO	1.660	1.354	0.306	0.000
PERFORM	0.065	0.093	-0.028	0.000
LEV	0.214	0.174	0.040	0.012
KZ_INDEX	0.275	-0.025	0.299	0.000
M_B	2.975	2.282	0.692	0.000
EBIT	27.097	87.409	-60.312	0.000
CAPEX	18.430	49.222	-30.792	0.000
Z_Score	2.962	3.601	-0.639	0.000

Table 7: t - test: difference in means: Repurchase vs Control

Variable	REP mean	NO mean	Difference	P-value
SIZE	18,234.660	5,521.990	12,712.670	0.000
QRATIO	2.052	1.861	0.191	0.081
PERFORM	0.102	0.074	0.028	0.709
LEV	0.169	0.205	-0.037	0.002
KZ_INDEX	-0.349	-0.152	-0.198	0.069
M_B	7.892	3.683	4.209	0.074
EBIT	2,584.405	546.361	2,038.044	0.000
CAPEX	1,110.671	286.079	824.592	0.000
Z_Score	6.533	5.264	1.269	0.032

Table 8: Difference in medians: Repurchase vs Control

Variable	REP median	NO median	Difference	P-value
SIZE	2,244.600	1,022.223	1,222.377	0.000
QRATIO	1.549	1.354	0.195	0.000
PERFORM	0.096	0.093	0.003	0.358
LEV	0.129	0.174	-0.045	0.002
KZ_INDEX	-0.171	-0.025	-0.146	0.000
M_B	2.712	2.282	0.430	0.000
EBIT	237.219	87.409	149.810	0.000
CAPEX	79.587	49.222	30.365	0.000
Z_Score	4.272	3.601	0.671	0.000

Table 9: t - test: difference in means: SEO vs Repurchase

Variable	SEO mean	REP mean	Difference	P-value
SIZE	5,498.995	18,234.660	-12,735.665	0.000
QRATIO	2.874	2.052	0.822	0.000
PERFORM	0.023	0.102	-0.079	0.000
LEV	0.245	0.169	0.076	0.000
KZ_INDEX	-0.169	-0.349	0.180	0.435
M_B	4.383	7.892	-3.509	0.239
EBIT	102.077	2,584.405	-2,482.328	0.000
CAPEX	128.909	1,110.671	-981.762	0.000
Z_Score	5.224	6.533	-1.309	0.103

Table 10: Difference in medians: SEO vs Repurchase

Variable	SEO median	REP median	Difference	P-value
SIZE	436.480	2,244.600	-1,808.120	0.000
QRATIO	1.660	1.549	0.111	0.059
PERFORM	0.065	0.096	-0.031	0.000
LEV	0.214	0.129	0.085	0.000
KZ_INDEX	0.275	-0.171	0.446	0.000
M_B	2.975	2.712	0.263	0.238
EBIT	27.097	237.219	-210.122	0.000
CAPEX	18.430	79.587	-61.157	0.000
Z_Score	2.962	4.272	-1.311	0.000

Table 11: Probit regression - Repurchases

Variable	Coefficient	p-value
CAPEX	-2.18E-05	0.226
EBIT	6.72E-05	0.000
SIZE	1.07E-07	0.954
QRATIO	2.51E-03	0.799
PERFORM	4.33E-02	0.354
LEV	-3.61E-01	0.002
KZ_INDEX	-3.61E-01	0.803
M_B	3.25E-04	0.120
Z_SCORE	1.28E-03	0.413
Constant	-2.117	0.000

Observations:	24,983
Pseudo R squared:	0.0304
Bayesian Information Criterion:	4338.391

Table 12: Probit regression (with best fit) - Repurchases

AME stands for Average Marginal Effects and CME stands for Conditional Marginal Effects. (*) implies significant at 1%. The AME and CME for insignificant variables in the probit regression are left out

Variable	Coefficient	p-value	AME: dy/dx	CME: dy/dx	Mean
CAPEX	-0.00002	0.156	-	-	-
EBIT	0.00007	0.000	2.82E-06*	2.73E-06*	572.804
Leverage	-0.36841	0.001	-0.01535*	-0.01483*	0.206
Constant	-2.09831	0.000	-	-	-

Observations:	24,983
Pseudo R squared:	0.0331
Bayesian Information Criterion:	4281.911

Table 13: Probit regression - SEO

Variable	Coefficient	p-value
CAPEX	-1.52E-05	0.798
EBIT	-1.46E-04	0.000
SIZE	-4.72E-06	0.287
QRATIO	4.83E-02	0.000
PERFORM	-3.75E-03	0.612
LEV	8.87E-02	0.088
KZ_INDEX	-3.34E-03	0.562
M_B	8.35E-05	0.783
Z_SCORE	-6.44E-03	0.000
Constant	-2.027	0.000

Observations:	24,983
R squared:	0.0304
Bayesian Information Criterion:	5401.663

Table 14: Probit Regression (with best fit) - SEO

AME stands for Average Marginal Effects and CME stands for Conditional Marginal Effects. (*) implies significant at 1%. The AME and CME for insignificant variables in the probit regression are left out

Variable	Coefficient	p-value	AME dy/dx	CME dy/dx	Mean
CAPEX	-0.00007	0.099	-3.37E-06	-3.04E-06	296.825
EBIT	-0.00016	0.000	-8.29E-06*	7.46E-06*	572.804
QRATIO	0.04883	0.000	2.68E-03*	2.41E-03*	1.890
Leverage	0.08057	0.112	-	-	-
Z Score	-0.00643	0.000	-3.94E-04*	-3.54E-04*	5.282
Constant	-2.02889	0.000	-	-	-

Observations:	24983
R squared:	0.0301
Bayesian Information Criterion:	5362.939

Table 15: NNM - Repurchases

(a): Covariates: M/B, Size and Year (b): Covariates: Size and Year

Variables:	Coefficient (a):	P-value (a):	Coefficient (b):	P-value (b):
EBIT	126.802	0.000	114.053	0.000
CAPEX	-33.612	0.029	-46.479	0.003
Z-Score	1.894	0.000	2.578	0.000
KZ-Index	-0.053	0.273	-0.094	0.113
Leverage	-0.059	0.000	-0.045	0.001
Perform	0.027	0.009	0.024	0.020
Q-Ratio	0.053	0.280	0.347	0.000
M/B	-	-	4.902	0.041

Table 16: NNM - SEO

(a): Covariates: M/B, Size and Year (b): Covariates: Size and Year

Variables:	Coefficient (a):	P-value (a):	Coefficient (b):	P-value (b):
EBIT	-325.372	0.000	-405.024	0.000
CAPEX	-2.200	0.902	-92.662	0.000
Z-Score	-1.631	0.000	-1.133	0.000
KZ-Index	0.305	0.000	0.117	0.371
Leverage	0.045	0.000	0.078	0.000
Perform	-0.020	0.133	-0.011	0.344
Q-Ratio	-0.068	0.254	0.219	0.025
M/B	-	-	0.545	0.556

Table 17: PSM - Repurchases

(a): Covariates: M/B, Size and Year (b): Covariates: Size and Year

Variables:	Coefficient (a):	P-value (a):	Coefficient (b):	P-value (b):
CAPEX	-16.184	0.184	-16.889	0.163
Q-Ratio	0.227	0.010	0.301	0.001
EBIT	200.884	0.000	206.945	0.000
Z-Score	2.142	0.000	2.357	0.000
KZ-Index	-0.157	0.007	-0.171	0.014
Leverage	-0.055	0.000	-0.049	0.000
Perform	0.028	0.007	0.027	0.008
M/B	-	-	3.5364	0.307

Table 18: PSM - SEO

(a): Covariates: M/B, Size and Year (b): Covariates: Size and Year

Variables:	Coefficient (a):	P-value (a):	Coefficient (b):	P-value (b):
CAPEX	-41.694	0.002	-43.240	0.001
Q-Ratio	0.150	0.032	0.254	0.004
EBIT	-332.818	0.000	-325.806	0.000
Z-Score	-1.746	0.000	-1.487	0.000
KZ-Index	0.311	0.000	0.182	0.062
Leverage	0.077	0.000	0.074	0.000
Perform	-0.030	0.021	-0.018	0.119
M/B	-	-	0.344	0.620