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Accretive Share Repurchases and Equity Vesting

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ABSTRACT

We investigate the connection between the discontinuous probability of making accretive repurchases around the zero EPS surprise threshold and the sensitivity of upcoming CEO equity compensation value to the underlying stock price. Our study is performed using data from S&P 1,500 companies between 2006-2015. Following Almeida et al. (2016), we adjust reported EPS to its pre-repurchase equivalent, and find a discontinuous probability of making accretive repurchases when the pre-repurchase EPS is below the median analyst EPS forecast. Constructing the CEO sensitivity measure following Edmans et al. (2013), our results show that the discontinuity increases as CEO sensitivity goes up. These results suggest that accretive repurchases are a plausible explanatory mechanism for the results of Edmans et al. (2013), who found a correlation between high CEO sensitivity and beating analyst estimates. Our findings suggest that high sensitivity of a CEO's equity-based compensation to underlying share price increases the prevalence of accretive share repurchases in order to meet analyst forecasts, highlighting the need for further research into potential adverse effects of such repurchases on long-term company performance.

Keywords: Short-Termism, Managerial Myopia, Vesting, CEO Incentives, Share Repurchases, Regression Discontinuity

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Contents

Chapter 1

Introduction

Per universal economic wisdom, companies must continuously innovate and upgrade their competitive advantages to compete effectively. The most vital determinant to sustain a competitive advantage is through continuous investment in long-term assets and capabilities (Porter, 1992).

Managerial short-termism, sometimes referred to as managerial myopia or quarterly capitalism, is the concept where company executives are acting by means of boosting short-term results at the expense of long-term value. Famous examples of short-termism are earnings management, excessive dividends and buybacks, cutbacks in investments such as research and development (R&D) and capital expenditures (CAPEX) and decreases in personnel. In recent years, the concept has gained broad attention as leading politicians (Clinton, 2016; Biden, 2016), academics (Bebchuk and Jackson, 2012; Bratton and Wachter, 2010; and others), think tanks (Aspen Institute, 2009), asset managers (Fink, 2017), lawyers (Lipton, 2015), Delaware judges (Strine, 2010), central bank economists (Haldane, 2015) and company leaders (Tesseras, 2017), have been quarrelling about whether it is a critical problem for public firms, their investors and the economy as a whole.

The reputable economist Lazonick argued in his 2014 Harvard Business Review article "Profits Without Prosperity" that the increasing amount of profits spent on stock repurchases manipulate the market and leave most Americans worse off. His reasoning is that repurchases lead to cutbacks in long-term investments and innovation which hurt economic prosperity in the long run. He explains the increased repurchases by connecting executive incentives and the effect repurchases have on earnings per share (EPS) and stock prices. Stock repurchases, by their nature, lead to increased EPS (unchanged earnings, less shares) which extends to higher stock prices in the short-term. He claims executive incentives must be driving these EPS-motivated repurchases and exemplifies by pointing to the fact that 83% of the compensation of the 500 highest-paid executives in the U.S. in 2012 was through

stock options (42%) and stock awards (41%).

Although Lazonick's case is compelling, it does not explain in detail which companies engage in EPS-motivated repurchases, when they do so and why they choose to do it when they do. It also lacks a documented empirical approach. Almeida et al. (2016) gave a more detailed explanation of when EPS-motivated repurchases occur. They studied the manipulating effect repurchases have on EPS in U.S. companies and found that executives were more likely to use EPS-motivated repurchases when they were about to miss analyst EPS forecasts. They also found a tendency among companies using EPS-motivated repurchases to decrease employment, CAPEX and R&D in the four quarters that follow – classic signs of managerial myopia.

In-line with earlier research on executive compensation (Stein 1988, 1989; Jensen and Murphy, 1990; and others), Edmans et al. (2013) emphasize that the driver of short-termism in myopia models is not the magnitude of incentives, but their horizon and how they are paid. In their working paper, they are the first to take the horizon aspect of compensation into account when measuring executives' short-term concerns. They introduce a new empirical measure that is tightly linked to theory - the sensitivity of equity vesting over the upcoming year. With their model, they link the impending vesting of CEO equity to reductions in real investment. Hence, their findings support managerial myopia.

In this paper, we aim to build upon Lazonick's work and add detail to the unanswered questions in his argumentation. Mainly, we want to examine what the drivers are behind EPS-motivated repurchases. We do so by combining the work of Almeida et al. (2016) and Edmans et al. (2013), examining if the propensity of EPS-motivated repurchases is higher when executives have equity incentives with near-term payoff. We define near-term equity incentives as executive stocks and options vesting during the upcoming financial year, a measure introduced by Edmans et al. (2013). We investigate whether the propensity to manipulate earnings increases in periods when large amounts of upcoming equity based compensation vests, with the presumed goal of achieving a short-term boost (or avoiding a decline) in the share price to maximize the payoff of their equity based compensation. Our empirical scope covers U.S. firms in the S&P 1,500 between the years 2006-2015 and our research question is as follows:

Does sensitivity to vesting equity compensation increase managers' propensity to raise EPS through share repurchases?

By employing binned averages analysis and a regression discontinuity design, we are able to test whether the propensity to pursue accretive repurchases is different for firms with pre-repurchase EPS below or above analyst expectations, which we

refer to as the pre-repurchase surprise, for the quarter. To test whether this behaviour is influenced by how much value is at stake for CEOs, we split our data sample into quarters based on the sensitivity (value change) of CEO equity compensation to movements in the share price. Within each quartile, the discontinuity is calculated, after which we compare to see if the discontinuity is stronger when there is more value at stake for the CEO. Our findings identify a discontinuity in accretive repurchases around the zero pre-repurchase surprise threshold. We also find that the discontinuity is increasing when CEO equity compensation is more sensitive to share price movements.

This paper is organized as follows. Chapter 2 summarizes related previous literature and outlines our research contribution, chapter 3 describes our data collection process, chapter 4 outlines our empirical method, variable definitions and hypotheses development, chapter 5 reports descriptive statistics and presents our results, chapter 6 includes our discussion, chapter 7 highlights limitations and suggestions for future research, and chapter 8 concludes.

Chapter 2

Background

2.1 Previous Literature

2.1.1 Short-Termism (Competing Theories)

As touched upon in the introduction, short-termism and its consequences has become a popular area of discussion within academia, economics, politics and business.

Opinions about short-termism are mixed. One view is that short-term actions, fueled by the growing influence of hedge funds, impede innovation, salary development and long-term value of companies, and hence the economy (Aspen Institute, 2009; Bratton and Wachter, 2010; Coffee and Palia, 2016; Lipton, 2015; Strine, 2010). On the other hand, some academics have claimed that hedge funds play a valuable part in the market eco-system (Bebchuk and Jackson, 2012; Gilson and Gordon, 2013; Kahan and Rock, 2007) and that concerns about short-termism are overstated (Bebchuk, 2013; Roe, 2013).

Porter (1992) explained managerial short-termism as cutbacks in long-term investments, such as R&D, to meet or beat short-term performance targets. He argued many American companies invest too little in assets and capabilities critical for competitiveness (such as employee training), while other waste capital on investments with limited financial or social reward (such as unrelated acquisitions). His conclusion was that such investment priorities put American companies at a disadvantage in global competition and ultimately threaten the long-term growth of the U.S. economy.

Lazonick (2014) argues that U.S. companies distribute too much cash through repurchases and dividends instead of investing it in innovation for future growth and raising employee wages. He shows that repurchases not only lead to cutbacks in investments and innovation, but also to manipulation of earnings and share prices. Lazonick maintains that this evolution has been driven by executive incentives and will hurt economic prosperity in the long run. He supports his claims by pointing

to evidence in S&P 500 data between the years 2003-2012. Allegedly, 91% of net income were used for repurchases and dividends (payouts) during this period, leaving only a small amount to be reinvested.

In direct opposition to Lazonick (2014), Fried and Wang (2017) argue that company payouts are misleading as a measure of short-termism. First, they point out that payouts only tell half the truth of the cash flow exchange between companies and its owners. Specifically, payouts fail to account for equity and debt issuance. Fried and Wang suggest a measure that accounts for this – net shareholder payouts – with which they show that S&P 500 companies only distributed 22% of net income during the period 2005-2014. Second, they claim that looking at S&P 500 firms gives a misleading picture of the economy as a whole. S&P 500 firms are often mature and have less growth opportunities than other firms. They show that S&P 500 firms are net exporters of capital, while public firms outside of the S&P 500 are net importers of capital. Then, they move on to dissect the rest of Lazonick's claims. First, they claim that looking at payouts as a percentage of net income is highly misleading as it gives a false impression that net income reflects the total resources that are generated from operations and are available for investments. Second, they claim a company's ability to invest, innovate or increase salaries is not constrained by how much they choose to distribute through repurchases and dividends, if they can issue new equity and debt for investment purposes. Third, they maintain that even if payouts would result in less investment, innovation and lower salaries in a specific company - the shareholder receiving the payout could easily invest it elsewhere, enabling other companies to invest, innovate and increase salaries.

2.1.2 Studies on Executive Compensation

The use of executive compensation as a mechanism of aligning the interests of executives and shareholders is a hot topic to both regulators and academics (Alok et al., 2016). According to Holmström and Tirole (1993), incentives that links executive pay to stock price performance is often recommended as an optimal governance tool. In 2015, stock price performance was the single largest contributor to executive pay in S&P 500 companies[1]. However, the logic of linking executive pay and stock performance fall apart if stock prices fail to reflect firm fundamentals (Alok et al., 2016). Coval and Stafford (2007) and Khan et al. (2012) among others, have shown that stock prices sometimes deviate from fundamental values. Hence, linking pay to short-term stock performance can lead to suboptimal managerial behavior when the market systematically misvalues managerial actions (Keynes, 1936; Campello and Graham, 2013). For instance, Cohen et al. (2013) show that the market sometimes

[1]Equilar, 2016. 2016 CEO Pay Trends. An Equilar Publication.

undervalues R&D. In such cases, short-term executive incentives may lead managers to suboptimally cut R&D (Stein, 1989; Edmans et al., 2013).

Issues regarding how executive equity incentives should be structured have been at the center of corporate governance discussions ever since Stein (1988, 1989) and Jensen and Murphy (1990) argued that what matter in CEO compensation is not the amount you pay, but the weighting of it towards the short-term as opposed to the long-term and how you pay. Ever since, an intense debate regarding the optimal duration of executive compensation has raged (Gopalan et al., 2014).

Previous research has provided mixed evidence on whether equity incentives amplify managerial short-termism. Earlier research finds that CEO equity incentives reduce managerial myopia (Cheng, 2004; Dechow and Sloan, 1991), while later research is more mixed and in some cases even point to the contrary (Bebchuk and Fried, 2010 a, 2010 b; Burns and Kedia, 2006; Cheng and Warfield, 2005; Edmans et al., 2013; Efendi et al., 2007; Erickson et al., 2006).

Edmans et al. (2013) emphasize that the driver of short-termism in myopia models is not the magnitude of incentives, but their horizon. In their working paper, they use recent changes in compensation disclosure (FAS 123R) to introduce a new empirical measure that is tightly linked to theory - the dollar value sensitivity of equity vesting over the upcoming year. With their model, Edmans et al. (2013) link the impending vesting of CEO equity to reductions in real investment. A similar but more advanced model of executive compensation duration was introduced by Gopalan et al. (2014). They quantify a total pay duration for executives, and find that duration varies based on certain firm characteristics such as industry, and that pay duration has an impact on ratios related to short-termism.

2.1.3 Studies on Earnings Manipulation

Earnings, more specifically earnings per share (EPS), is the most widespread accounting-driven metric of short-termism[2]. Almeida et al. (2016) show that executives have an increased propensity to use stock repurchases to manipulate earnings ahead of earnings reports when they are about to miss analyst EPS forecasts. They also find a tendency among companies using EPS-motivated repurchases to decrease employment, CAPEX and R&D in the four quarters that follow (short-termism).

Research conducted by Graham et al. (2005) also reveal that executives are willing to go beyond accounting gimmicks to manage earnings. Surveying and interviewing more than 400 CFOs they find that a shocking 78% of respondents would decrease value-creating spending on R&D, maintenance, advertising and hiring to

[2]"Short-termism". ft.com/lexicon, Financial Times. Viewed 18 July 2017, from http://lexicon.ft.com/Term?term=short_termism

meet forecasts. They also find that more than half of executives would delay a new project even if it entailed sacrificing value.

Other studies show that CEOs are more likely to manipulate earnings early in their tenure (Strong and Meyer, 1987; Elliott and Shaw, 1988; DeAngelo, 1988; Pourciau, 1993), as well as in their last year as CEO (Dechow and Sloan, 1991; Pourciau, 1993; Murphy and Zimmerman, 1993; Cheng, 2004; Kalyta, 2009).

Chen et al. (2015) found that firms with little CEO contractual protection (employee and severance pay agreements), especially in heterogeneous industries with lower transient institutional ownership, are more likely to cut R&D investments to avoid earnings decreases and engage in real earnings management.

2.1.4 Contributions to Existing Research

Earlier research, including Lazonick (2014) and others, has shown that companies can use share repurchases to boost EPS in the short run (EPS-motivated repurchases). Almeida et al. (2016) find that companies are more likely to use EPS-motivated repurchases ahead of earnings reports when analyst EPS forecasts are about to be missed. These repurchases are sometimes financed by reductions in employment, CAPEX and/or R&D.

Since long, the horizon of executive reimbursement and how it is paid has been seen as a potential driver of short-termism in U.S. public companies (Stein 1988, 1989; Jensen and Murphy, 1990). In 2015, more than 80% and of S&P 500 companies granted performance-based equity to their CEOs. In the same year, 62.2% of total CEO compensation was equity based (47.2% in stock and 15% in options)[3]. Hence, one can conclude that stock performance is the largest contributor to CEO pay and that option compensation makes out a big part of total compensation.

Since 2006, through FAS 123R, U.S. public companies are required by law to provide detailed information on executive compensation programs. The FAS 123R filings have made it possible to analyze detailed executive equity compensation data. As equity make out a meaningful part of total CEO compensation, this data is highly relevant when trying to connect short-termism and executive incentives. Edmans et al. (2013) were the first to use FAS 123R filings to link impending vesting of CEO equity to reductions in real investment.

Our research combines the work of Almeida et al. (2016) and Edmans et al. (2013). Whereas Almeida et al. (2016) show that EPS-motivated repurchases occur to beat or meet earnings forecasts in the short-term, we use the empirical approach of Edmans et al. (2013) to explore whether equity vesting within a year can be a driver of said EPS-motivated repurchases.

[3]Equilar, 2016. 2016 CEO Pay Trends. An Equilar Publication.

Chapter 3

Data Collection

Our data sample contains U.S. firms between the years 2006-2015. This period is motivated by FAS 123R, a standard introduced by the Financial Accounting Standards Board in 2006, requiring U.S. firms to annually disclose the composition of equity-based compensation. Prior to this change, the reported vesting schedule of employee stocks and options did not contain enough detail to derive the upcoming year's vesting equity, which is a crucial variable for our paper. This information is included in the annual proxy statement, hence our sample period end is set to 2015 to include a complete set of annual reports in each year.

We start out by collecting quarterly financial statement data for U.S. firms from Compustat, excluding financial firms (SIC code 6000-6999) and regulated utility firms (SIC 4800-4829 and 4910-4049). These kinds of firms face stricter regulations with regards to repurchases (Bens et al., 2003), making them unsuitable for inclusion in our sample. The quarterly financial statement data is thereafter merged with analyst forecasts for quarterly EPS from the Institutional Brokers' Estimate System (IBES). The data is further complemented with value-weighted average prices and historical volatility manually derived from daily stock prices collected from Center for Research in Security Prices (CRSP), as well as historical U.S. treasury rates fetched from the Federal Reserve Bank of St. Louis (FRED).

This dataset can be used to explore the discontinuous probability of accretive repurchases, as defined by Almeida et al. (2016). The data for executive compensation schemes is collected from the Execucomp database, which contains annual compensation data for firms in the S&P 1500. After merging these yearly observations with the quarterly Compustat data (the annual data is repeated for each quarter), our final dataset contains 37,169 firm-quarter observations.

Chapter 4

Method

The way that our thesis relates to short-termism in companies is by exploring how two characteristics previously identified as being connected to short-termism are interacted. Edmans et al. (2013), have found a negative correlation between how sensitive the value of upcoming CEO equity compensation is to the underlying stock price and investments in R&D, advertising and CAPEX, which they argue to be signs of short-termism. They also find that the sensitivity is positively related to the likelihood of beating analyst EPS estimates. This result is interesting when compared to the findings from Almeida et al. (2016), who identify a discontinuous probability of making accretive repurchases for companies whose pre-repurchase EPS would be below the median analyst EPS estimate. This means that the fraction of companies making accretive repurchases demonstrates an abrubt increase when comparing those companies whose pre-repurchase EPS is just below the median analyst estimate to the companies whose EPS would meet the analyst target either way. The authors leverage the existence of the discontinuity to perform an instrumental variable analysis in which they find a causal relationship between accretive repurchases (to meet analyst expectations) and decreases in employment, CAPEX and R&D.

Our interpretation of these papers is that Edmans et al. (2013) have identified a characteristic that drives myopic behaviour, while Almeida et al. (2016) have found a mechanism used by companies acting on their short-termism. If we are able to prove that there is a relationship between sensitivity and making accretive repurchases, the case for these measures' connection to short-termism is made stronger by providing the full link between the underlying factor (CEO sensitivity) and the action (accretive repurchases to meet analyst estimates) that lead to myopic actions (cuts in employment, CAPEX and R&D). In this thesis, we are not concerned with proving whether the measures lead to short-termism, which is already proven by our precursors. Instead, the goal is to explore whether the measures are connected. The method we use to test for a connection is outlined in this chapter.

4.1 Variable Definitions

This section describes what our main variables capture, how they were constructed, and how they fit together in our empirical method.

4.1.1 Adjusted EPS

In this paper, we explore whether executive compensation characteristics drive the incentive to repurchase shares to change a firm's EPS to meet or beat quarterly analyst expectations. To estimate what the EPS would have been without the share buybacks, we adjust the reported EPS by adding back the estimated number of shares repurchased. We also assume that the money spent on repurchases would yield risk-free interest for three months (the quarter). The risk-free rate is defined as the 3-month Treasury Bill rate, retrieved from FRED, Federal Reserve Bank of St. Louis.

More formally, the relationship between reported EPS and our adjusted EPS can be written:

$$EPS_{adjusted} = \frac{Earnings_{adjusted}}{Shares_{adjusted}} = \frac{Earnings_{reported} + Interest}{Shares_{reported} + \Delta Shares_{repurchased}}$$

Where $\Delta Shares_{repurchased}$ is derived from the dollar amount spent on net repurchases over the value weighted average price for the quarter. $Interest$ is the after-tax interest that would be earned if the money was invested in T-bills instead of being used for repurchases.

We follow Fama and French (2001) in estimating the dollar value spent on net repurchases, i.e. as the quarterly increase in treasury stocks. If treasury stock is zero or missing in the current and previous quarter, repurchases are measured as the difference between "Purchases of common and preferred stock" and "Sales of common and preferred stock" from the cash flow statement. For observations where any of the measures are negative, the net repurchase dollar amount is set to zero. The number of shares repurchased is calculated by dividing the dollar amount by the stock's value weighted average price during the quarter.

The adjusted EPS is rounded to the nearest two decimals, which is how EPS is reported in financial statements as well as estimated by analysts. The difference between the adjusted EPS and the analyst median estimate is defined as the pre-repurchase EPS surprise. Following Almeida et al. (2016), we divide the EPS surprise by the quarter-end share price for each company quarter observation to

obtain the EPS surprise measure used in regressions.

$$Surprise_{it} = \frac{EPS_{adjusted,it} - Median\,EPS\,Estimate_{it}}{Closing\,Price_{it}}$$

The following dummy is created to distinguish firm quarters with a negative pre-repurchase EPS surprise:

$$NegativeSurprise_{it} = \begin{cases} 1, & \text{if } EPS_{adjusted,it} < Median\,EPS\,Estimate_{it} \\ 0, & \text{otherwise} \end{cases}$$

Using the adjusted EPS, we also create a dummy variable to indicate if a company did an accretive repurchase during the quarter, i.e. if pre-repurchase EPS is one cent or more below the reported EPS.

$$AccretiveRepurchase_{it} = \begin{cases} 1, & \text{if } EPS_{reported,it} - EPS_{adjusted,it} > 0 \\ 0, & \text{otherwise} \end{cases}$$

4.1.2 Vesting Equity

Our second main variable relates to the executive compensation characteristics. More precisely we calculate a sensitivity measure for equity vesting in the next year, first developed by Edmans et al. (2013). The equity part of an executive's compensation comes in the form of stocks and options. Execucomp provides data on how many stocks that were awarded to executives each year. The number of options that vest each year is not directly reported, but can be inferred from the reported composition of options, and how this composition changes over the years. To achieve this, we group each executive's options into unique sets of strike prices and expiration date. For each unique set of strike price and date, we track the number of unvested options each year through the following relationship:

$$Newly\ Vesting\ Options_{(P,D)t+1} = Unvested\ Options_{(P,D)t} +$$
$$+ Newly\ Awarded\ Options_{(P,D)t+1} - Unvested\ Options_{(P,D)t+1}$$
$$\text{Where: P = Exercise Price and D = Expiration Date}$$

To put it simply, we calculate the decrease in unvested options between one year and the next, adjusted for potential new options with the same expiration date and strike price. Once we have the number of vesting securities, we move on to calculate their delta. From an incentive standpoint, the delta represents how many shares

the security is equivalent to. For stocks the calculation is easy, the delta is always one. The delta of an option can be calculated using the Black-Scholes formula. The required inputs for calculating option delta using the Black-Scholes formula are: the risk free rate, in our case T-bill rates; stock volatility, calculated using a five year daily stock price period; and dividend yield, calculated using the security's mean dividend yield of the previous three years.

Once we have the delta for all options and stocks, we summarize the delta for each CEO per year. The summarized delta is thereafter multiplied with each quarter's ending stock price in order to form the sensitivity measure. While the pure delta gives the total value movement in the CEO's vesting equity due to a $1 change in the company's share price, multiplying it with the year-end stock price allows us to express the value change driven by percentage changes in the stock price instead of the dollar value change. This has the advantage of being more comparable across companies with different stock prices. What we end up with is a measurement that we'll refer to as the CEO sensitivity from here on out. To ensure clarity, a numerical example of the sensitivity calculation is provided in A.2.

4.2 Binned EPS Surprise Analysis

As a starting point of our attempt to identify the discontinuity, we conduct binned analysis of the relationship between the EPS surprise and the propensity to undertake accretive repurchases. The goal of this analysis is to group observations into EPS surprise bins and compare the share of firms in each bin that did accretive repurchases. For this analysis, two bin sorting methods are considered. In our first bin analysis, we sort observations into bins based on the dollar deviation of pre-buyback EPS from the median analyst estimate, i.e. how many cents that the pre-buyback EPS is from the estimate. The other bin method divides the cent deviation by the EPS estimate, creating a measure that instead expresses the deviation in percentages of the EPS estimate. The results are then plotted in histograms showing the per bin share of firms that did accretive repurchases. By doing this, we expect there to be a difference in the two bins that split the zero surprise threshold. This difference is tested for equality using a chi-squared test. Average company characteristics per bin are also collected and analyzed for differences between these two bins.

A key assumption for the validity of a discontinuity is that firms with pre-repurchase EPS surprises in the regions around the threshold are similar. In other words, it is almost as if by chance that firms end up on either side of the threshold. This means that we expect there to be only minor differences other than the propensity to make accretive repurchases between firms just below the threshold

and those that are above it. To test whether this is true, as a robustness test we create similar plots for other company characteristics around the region of zero cent pre-repurchase deviation. These figures can be found in appendix figure A.1.

4.3 Regression Discontinuity Design

The latter parts of our analysis revolves around the regression discontinuity design (RD). The main idea of RD is that treatment- and control groups are split by a threshold value of some running variable, in our case the pre-buyback EPS surprise. Companies that are below the threshold (would have reported EPS below the analyst median expectation without repurchases, i.e. whose non-observed adjusted EPS is below the analyst target) are considered as the treatment group, while those that have a zero pre-buyback EPS surprise or higher are the control group. What this means is that we are using a company's reported EPS and reported repurchases to recreate the EPS that would have prevailed for that company had it not undertaken the repurchases. The adjusted EPS as we call it is never actually observed. What analysts take in to account is the reported EPS, which could have been increased by repurchases during the quarter that do not affect the earnings, but decrease the number of outstanding shares, thus potentially increasing EPS.

Our method uses the Fuzzy RD design, which exploits discontinuities in the probability of treatment conditional on the value of the pre-buyback EPS surprise (Angrist & Pischke, 2009). In our setting, being assigned to the treatment group is defined as having a negative pre-repurchase EPS surprise, which means that we will use the Fuzzy RD design to evaluate whether the probability of doing an accretive share repurchase, as defined at the end of section 4.1.1, is discontinuous around the zero surprise threshold. Our main regression can be expressed in the following way:

$$
\begin{aligned}
&AccretiveRepurchase_{it} = \alpha + \beta_1 * NegativeSurprise_{it} + \beta_2 * Surprise_{it} + \\
&\beta_3 * Surprise_{it}^2 + \beta_4 * Surprise_{it}^3 + \beta_5 * Surprise_{it} * NegativeSurprise_{it} + \\
&\beta_6 * Surprise_{it}^2 * NegativeSurprise_{it} + \beta_7 * Surprise_{it}^3 * NegativeSurprise_{it} + \\
&\beta_8 * X_{it} + \eta_i + \theta_t + \epsilon_i t
\end{aligned}
$$

where the treatment variable $NegativeSurprise_{it}$ is interacted with polynomials of the $Surprise_{it}$ variable. This allows for treatment effects that change as a function of the size of $Surprise_{it}$, which is advantageous since an accretive repurchase to reach a zero surprise level is more feasible for firms whose pre-repurchase EPS is close to the median analyst estimate. X_{it} is a vector of control variables, containing a dividend payer dummy, return on assets (ROA), previous quarter's stock performance, cash-

to-assets and size of the actual EPS. η_i and θ_t denote firm- and year fixed effects.

Our model specification is similar to that of Almeida et al. (2016), with the exception that we include the size of EPS as a potential control variable. The reason we include the new control variable is because accretive repurchases become relatively easier for firms with higher EPS estimates and actuals, the percentage increase of raising EPS by one cent is smaller for a company with a \$10 EPS compared to one with a \$0.10 EPS. A discussion on this matter is provided in the appendix.

4.4 CEO sensitivity and accretive repurchases

The intention of this paper is to test for a connection between CEO sensitivity and an increase of the discontinuous probability to undertake accretive repurchases around the zero surprise threshold. Our way of analyzing this potential relationship is to split the observations in our sample in to four quartiles based on CEO sensitivity. In this way, we want to test whether the discontinuity increases per quartile as we move up in CEO sensitivity. By comparing the size and confidence interval of the discontinuity in each quartile, we wish to see whether the effects is statistically differentiated in each quartile, or at least between the quartile with largest sensitivity compared to the quartile with the lowest sensitivity.

4.5 Hypothesis

The goal of our thesis is to explore the relationship between the discontinuity in accretive repurchases around the zero pre-repurchase EPS surprise threshold, and the sensitivity of short-term CEO equity compensation to the company share price. In order to evaluate a potential relationship, we must first establish the existence of a discontinuity in accretive repurchases around the zero surprise threshold. For this reason, the first step building up towards our research question is as follows:

Step 1. *The fraction of firms doing accretive repurchases follows a discontinuous pattern around the zero EPS surprise threshold.*

After testing for the existence of a discontinuous pattern, we move forward to see if the potential discontinuity is strengthened when CEOs have larger values at stake in terms of upcoming equity compensation. Our measure of choice for the value at stake is the sensitivity measure, defined as the change in value of the equity compensation driven by changes in the company share price. The motivation to meet analyst forecasts should be higher for CEOs with more sensitivity, given that declines in share price have a negative effect on the value of equity compensation in

the next 12 months, and the discontinuity should be increasing with the sensitivity measure. This gives rise to our main hypothesis:

Hypothesis. *The discontinuity of the fraction of firms making accretive repurchases around the zero surprise threshold is stronger for companies where the CEO's sensitivity to the stock price is high.*

In the results section of this paper, we construct our analysis by way of initially finding out whether the prerequisite in Step 1 is fulfilled, after which we move on to test the paper's hypothesis by sorting the data sample into quartiles based on CEO sensitivity.

Chapter 5

Results

This chapter contains the main results from our analysis. Starting off with the descriptive statistics for our dataset, we then move on to our analyses. In the second section, we analyze whether there is a discontinuous propensity to do accretive repurchases around the zero EPS surprise treshold, employing binned average accretive repurchases as well as regression discontinuity techniques. In the third section, the data sample is split up into quartiles based on sensitivity to vesting equity, and the regression discontinuity analysis is run on each quartile.

5.1 Descriptive statistics

This section reports descriptive statistics for our data sample in Table 5.1. Details about the data sample are provided in chapter 3, and the self-created variables are described in chapter 4. Panel A contains statistics for company repurchasing behaviour. Panel B relates to the EPS surprise of reported and adjusted EPS. Panel C displays descriptive statistics for the CEO sensitivity measurement. Panel D contains a select number of control variables and company characteristics variables, for which detailed definitions are provided in the table caption.

Table 5.1: Descriptive statistics for variables of interest and control variables. All observations are quarterly, except for Panel C, where the observations are yearly (but repeated over the year to get quarterly data) Panel A relates to share repurchases, which are measured in the same way as Fama and French (2001). This method is described in section 4.1.1. Panel B reports descriptive statistics for the variables related to EPS surprises. Both variables report the dollar difference in reported (or adjusted to pre-buyback) EPS to the median analyst estimate. The pre-buyback EPS is described in section 4.1.1. In Panel C, descriptive statistics for the variable showing next-year equity compensation's sensitivity to stock prices, measured in millions of U.S. dollars. For example, the mean sensitivity states that in our sample, if the stock price changes by 1%, the value of equity (options and stocks) vesting next year changes by $5.9 million. Panel D reports descriptive statistics for a number of company characteristics, some of which are used as control variables in regressions. Parenthesized codes show which Compustat item was used when applicable. Market capitalization is defined as common shares outstanding (cshprq) times the quarter-end share price (prccq). Assets is the average assets (atq) reported in the previous and current quarter. Cash-to-assets is similarly defined as the mean of current and previous cash and equivalents (cheq) divided by average assets. Return on assets is the current quarter's net income (niq) divided by average assets. Dividend payer is a dummy variable that is equal to 1 if the company has paid dividends (dvy) in any of the previous four quarters. Stock performance is calculated as the share price at book closing date (prccq) of the quarter compared to that of the previous quarter.

Panel A: *Repurchase descriptive statistics*	Mean	Median	SD	1%	5%	25%	50%	75%	95%	99%	N
Positive Net Pepurchase (Indicator)	0.30	0.00	0.46	0	0	0	0	1	1	1	121 214
If repurchases above 0:											
Repurchased amount ($M)	116	10	472	0	0	1	10	59	500	1 826	121 214
Repurchased shares percentage	1.2%	0.6%	1.9%	0.0%	0.0%	0.1%	0.6%	1.5%	4.2%	8.6%	108 818
Accretive repurchase (Indicator)	0.28	0	0.45	0	0	0	0	1	1	1	120 610

Panel B: *EPS Surprise descriptive statistics*	Mean	Median	SD	1%	5%	25%	50%	75%	95%	99%	N
EPS surprise ($)	0.01	0.01	0.44	-0.66	-0.2	-0.02	0.01	0.05	0.2	0.51	121 051
Pre-buyback EPS surprise ($)	0.00	0.01	0.43	-0.66	-0.2	-0.02	0.01	0.05	0.19	0.5	116 963

Panel C: *Compensation sensitivity descriptive statistics*	Mean	Median	SD	1%	5%	25%	50%	75%	95%	99%	N
Sensitivity to stock price ($M)	5.9	2.1	12.4	0	0	0.6	2.1	5.9	23.8	56.0	37 172

Panel D: *Company characteristics descriptive statistics*	Mean	Median	SD	1%	5%	25%	50%	75%	95%	99%	N
Market capitalization ($M)	5 948	836	22 852	23	61	267	836	2 925	23 855	107 650	120 998
Assets ($M)	5 495	744	25 487	17	47	220	744	2742	21 298	90 191	120 952
Cash-to-assets	22%	14%	24%	0%	1%	5%	14%	33%	76%	95%	104 440
Return on assets	-0.1%	1.1%	8.1%	-25.6%	-11.3%	-0.4%	1.1%	2.3%	5.3%	10.6%	104 354
Dividend payer	0.44	0	0.5	0	0	0	0	1	1	1	109 985
Quarterly stock performance	4%	0%	77%	-58%	-36%	-10%	0%	12%	42%	95%	121 037

The descriptive statistics for repurchases report positive net repurchases happening in 30% of the firm quarter observations in our sample. Amongst firms that make repurchases, the mean amount repurchased is $116 million, while the median is only $10 million. This fact reveals that some of the firms in the sample make very large repurchases. The largest repurchase recorded in our sample was made by GE in the last quarter of 2015, where they spent $22.3 billion on repurchases. However, that particular transaction was driven by a $20.4 billion stock swap, which nonetheless has a similar effect as a regular share repurchase. The repurchased share percentage is on average 1.2% of shares outstanding. In the sample of quarters with net repurchases, 28% of the repurchases did have an accretive repurchase effect, i.e. increasing EPS by one cent or more.

When looking at analyst forecasts and EPS surprises, we see a slight tendency for companies to beat the median analyst EPS estimate by one cent. Adjusting for repurchases and instead looking at pre-buyback EPS, we find that the mean surprise is zero. This is an indication of accretive repurchases having an effect on the tendency to meet or beat analyst forecasts. However, analysts do of course take into consideration that companies are doing repurchases, so this discrepancy should be expected.

The CEO sensitivity to the company stock price, defined as the change in value of equity compensation coming in the next 12 months driven by stock price changes, has an average value of $5.9 million. This means that for a 1% decline in stock price,

equity compensation in the next 12 months is worth $5.9 less.

As for company characteristics, the mean market capitalization is $5.9 billion, while the median is just $836 million, showing once again that our sample includes some large outliers in the left side of the spectrum. The same is true for assets, where the mean is $5.5 billion, and the median is $744 million. The cash-to-assets ratio in our sample is on average 22%, and ROA is slightly negative on average at -0.1%. However, the median ROA is 1.1%, exposing that we have some quarter observations with large losses. 44% of the sample companies are dividend payers, as defined by having paid a dividend in one or more of the previous four quarters. On average, company stocks have appreciated 4% over the quarter, but this is countered by a median stock movement of 0% in our sample.

5.2 Identification of the Discontinuity Effect

Our first analysis consists of determining whether the discontinuity in accretive buybacks discovered by Almeida et al. (2016) is also present in our data sample as a whole. In other words, this section deals with testing whether hypothesis 1 holds.

5.2.1 Bin Analysis

As a first step, we arrange the observations in bins depending on how many cents away pre-buyback EPS is from the median analyst estimate. In each bin we calculate the percentage of companies that did an accretive repurchase. The results are presented in Figure 5.1. The highlighted bar shows the bin of companies whose pre-buyback EPS is one cent below analyst estimates. Of these observations, 11.2% did accretive repurchases (which by definition means that they met or beat the median analyst expectation). For companies that would exactly meet the analyst forecast without repurchases (Bin 0.00), the fraction of accretive repurchasers is 7.9%. This difference in frequency is statistically significant when tested for equality using a chi-square test. In table 5.2, we report average company characteristics of the quarter for the observations in bins close to the zero pre-repurchase EPS surprise. The table does not indicate any major difference in quarterly company characteristics between the binned observations that just miss, just hit or are just above their EPS target. This supports the idea of there being a discontinuity in accretive repurchases that is driven by being below target and does not seem to be correlated with other company characteristics. Appendix table A.8 reports average company characteristics for a longer range of bins from 20 cents below to 20 cents above target.

The deviation of EPS to analyst expectations, measured in cents, is how market participants communicate about the earnings announcement. For our second bin

Figure 5.1: Frequency of accretive repurchases per dollar away from EPS target

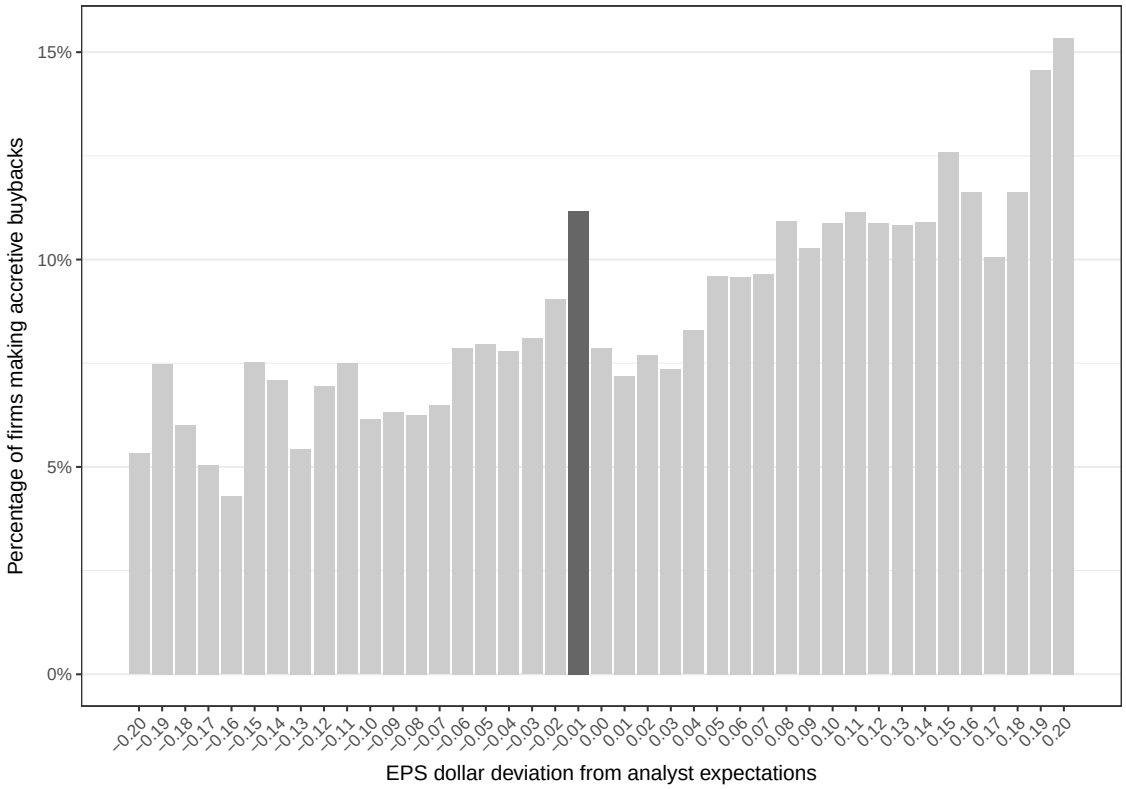


Table 5.2: Table showing quarterly company characteristics for companies in pre-repurchase EPS surprise bins, defined as cents from median EPS target by analysts. The table includes companies whose pre-repurchase EPS is from one cent below to one cent above their median EPS target. A longer table reporting twenty cents above/below is available in appendix table A.8

Cents from target	Accretive Repurchase Frequency	Observations	Assets	ROA	Cash	Cash-to-assets	Dividend payer frequency	Quarterly stock performance	Repurchases (non-accretive included)
-0.010	0.112	7288	4346	-0.009	479.631	0.243	0.412	0.8%	0.321
0.000	0.079	11396	4931	-0.002	539.010	0.237	0.402	1.7%	0.324
0.010	0.072	11653	5038	0.001	666.567	0.246	0.396	2.9%	0.333

analysis, we augment this deviation by dividing the dollar difference by the EPS target[1], thereby expressing the deviation in percentage terms instead. The results from this bin analysis are displayed in Figure 5.2. In the bin of companies that were 1% or less below their target EPS, 60.3% made accretive repurchases, compared to 9.4% for the group of companies that was precisely at or less than 1% above the target. However, when we examine the characteristics of bins close to the zero surprise divider in table 5.3, there are large differences between the groups close to the zero surprise divider. The group whose pre-repurchase EPS is just below the target EPS seems to consist of vastly larger companies than the group that is on track to just meet their target. This effect might be due to larger companies having larger EPS, in order to be 1% below the target EPS you would need to have an EPS target of at least \$1. As previously discussed, having a larger EPS makes it

[1]For cases where the EPS target is zero, we add one to the target and pre-buyback EPS to avoid dividing by zero

comparatively easier to complete an accretive share repurchase. A longer range of bin characteristics is provided in appendix table A.9.

To conclude our bin analysis, the average number of companies doing accretive repurchases does make a discontinuous jump from the bin just below the zero surprise threshold. This holds for both the cent and the percentage definition of the surprise, supporting the claim that companies undertake accretive repurchases in cases where they would otherwise miss the median analyst EPS estimate. A concerning fact about the second part of the bin analysis is the large discrepancies in characteristics between bins. This highlights the need for a more sophisticated analysis, allowing us to control for such discrepancies. One option is the regression discontinuity framework introduced in section 4.3 , which we will turn to next.

Figure 5.2: Frequency of accretive repurchases per dollar away from EPS target, scaled by size of EPS

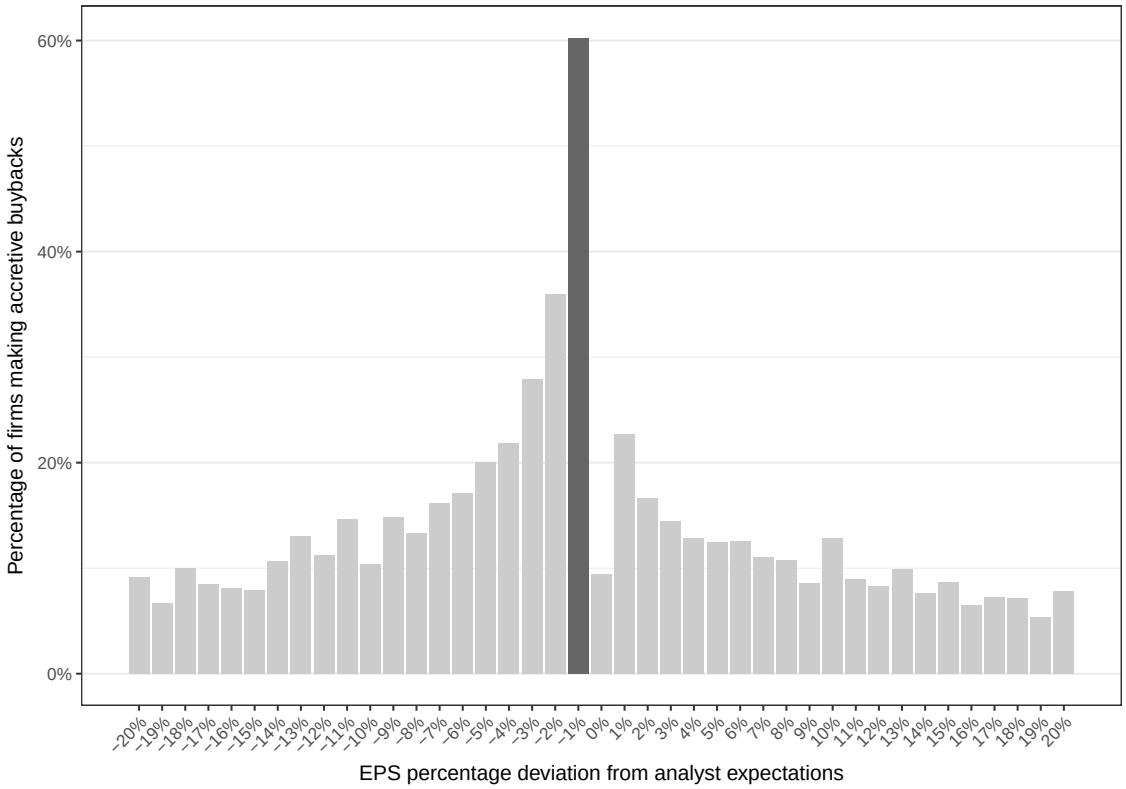


Table 5.3: Table showing quarterly company characteristics for companies in pre-repurchase EPS surprise bins, defined as cents from median EPS target by analysts and scaled by the EPS target, giving the deviance as a percentage of EPS target. The table includes bins for companies that are from 1% below to 1% above their analyst median EPS target for the quarter.

Percent from target	Accretive Repurchase Frequency	Observations	Assets	ROA	Cash	Cash-to-assets	Dividend payer frequency	Quarterly stock performance	Repurchases (non-accretive included)
-1%	0.603	370	23623	0.029	2355.185	0.115	0.697	1.7%	0.716
0%	0.094	11943	5705	-0.001	611.550	0.232	0.418	1.7%	0.338
1%	0.227	2639	12355	0.015	1436.400	0.166	0.643	4.0%	0.518

5.2.2 Regression Discontinuity Analysis

For a more sophisticated analysis of the discontinuity effect, we turn to the regression discontinuity design (RD), described earlier in chapter 4. This method allows us to use covariates such as size (approximately measured through assets), to overcome the issue of bin heterogeneity highlighted in the analysis above. Furthermore, we want our analysis to be comparable to that of Almeida et al. (2016), who also use RD to identify discontinuity. To ensure comparability, we follow our predecessors by defining the EPS surprise as the dollar deviation scaled by end-of-quarter share price instead of the more simple dollar deviation used in the first bin analysis. We also follow Almeida et al. in how the model specifications are constructed, i.e. using various polynomials of the pre-repurchase EPS surprise, firm- and year-quarter fixed effects as well as control variables. To make sure that the analysis carries over to our second part where we need CEO sensitivity data, from here on out we constrict our data set to only include observations where we have information about executive compensation in addition to the quarterly information on the company's financial performance and analyst expectations. As mentioned in the Data collection section, this set contains 37,169 observations. Table 5.4 reports result from the RD analysis. The evidence suggests that a negative pre-repurchase EPS surprise is a significant predictor of accretive share repurchases. The coefficient suggests that the probability of an accretive share repurchase increases by 12.7-19.7% for companies that have a pre-repurchase EPS just below the median analyst prediction compared to companies with a zero pre-repurchase EPS surprise. The results are robust to variations of the model specification. The regressions show that the discontinuity in the probability of making accretive repurchases when you would otherwise miss analyst targets (having a negative pre-repurchase EPS surprise) first documented by Hribar et al. (2006) and subsequently by Almeida et al. (2016) is present in our dataset which considers data in later periods than our predecessors. Furthermore, comparing our results to those of Almeida et al. (2016), we find a larger discontinuity. This is expected, as the repurchases in our data set, which uses a more recent time period (2006-2015, compared to (1988-2010), are generally higher than the repurchases in the dataset used by Almeida et al. Since the use of share repurchases has gone up, it is reasonable to expect that more companies have the ability to use repurchases in order to increase their EPS to meet analyst targets, thus making the discontinuity stronger.

To summarize the results from our initial RD analysis, the regressions show that the discontinuity in the frequency of accretive repurchases when you would otherwise miss analyst targets (having a negative pre-repurchase EPS surprise), first documented by Hribar et al. (2006) and subsequently by Almeida et al. (2016).

Table 5.4: Negative pre-repurchase EPS and accretive share repurchase probability
This table reports the regression discontinuity effect of having a negative pre-repurchase EPS surprise on the probability of making accretive repurchases. The pre-repurchase EPS surprise is defined as $(PreRepurchaseEPS - MedianAnalystEstimate)/SharePrice$. The relationship between the EPS surprise, accretive repurchases and associated variables are defined in section 4.1.1. From left to right, each column adds regression control elements. We use both linear and third-order polynomials of the pre-repurchase EPS surprise, and introduce company- and year fixed effects as controls. The last two columns include a vector of control variables (ROA, cash-to-assets, dividend payer indication and stock performance), as well as size of EPS in the last column. The control variables are defined in Table 5.1. The first value in each column is the estimated coefficient, its associated standard deviation is displayed in parentheses below.

	1	2	3	4	5	6
Coefficient	0.1970***	0.1969***	0.1825***	0.1635***	0.1472***	0.1266***
Standard Error	0.0108	0.0108	0.0105	0.0095	0.0092	0.0088
Z-value	18.3045	18.2954	17.3757	17.2946	16.0466	14.4314
P> |z|	0	0	0	0	0	0
CI Lower	0.1759	0.1758	0.1619	0.1449	0.1292	0.1094
CI Upper	0.2181	0.2180	0.2030	0.1820	0.1652	0.1438
Polynomial order	1	1	1	3	3	3
Firm Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Year-quarter Fixed Effects	No	No	Yes	Yes	Yes	Yes
Control variables	No	No	No	No	Yes	Yes
EPS control variable	No	No	No	No	No	Yes

Note: *p<0.1; **p<0.05; ***p<0.01

Furthermore, comparing our results to those of Almeida et al. (2016), we identify a larger discontinuity in our sample compared to their regressions using the same model specification. We argue that this is expected since overall repurchases in our data set which considers a more recent time period, 2006-2015 compared to 1988-2010, are generally higher than they were in earlier periods. Since the use of share repurchases has gone up, it is reasonable to expect that more companies have the ability to use repurchases in order to increase their EPS to meet analyst targets, thus making the discontinuity stronger. The next step of our analysis is to explore whether the discontinuity can be explained by how much the value of the CEO's upcoming equity fluctuates with the company share price.

5.3 The Relationship Between Equity Value Sensitivity and Accretive Repurchases

Having identified the existence of a discontinuous probability of accretive repurchases in the previous section, our next focus area is to test Hypothesis 2. This means that we want to identify whether CEO equity value sensitivity to vesting equity is a driver of this discontinuity. The idea of this analysis is that while we believe the discontinuity that we identified in the previous section is present regardless of the level of CEO equity value sensitivity, we want to explore whether the discontinuity is stronger in companies where the CEO has a lot of equity value at stake. Missing analyst expectations most likely results in a lowered share price, so relative to CEOs

with less value at stake, high-sensitivity CEOs should be more inclined to commit to accretive repurchases in order to push their EPS high enough to meet analyst expectations. The reason for their increased motivation to do this is that missing analyst expectations often leads to lowered share price due to a loss of investor confidence in the company, something a CEO with high equity-based compensation in the near future should be concerned about due to the implications for his private wealth.

To analyze whether our beliefs about CEO sensitivity being a driver of accretive repurchases is correct, we split the data sample into four groups based on the sample quartiles of CEO sensitivity. The variable used to define CEO sensitivity is the approximated change in value of their equity that will vest within one year if their company's share price drops by 1%, for which a detailed definition can be found in section 4.1.2. Table 5.5 displays condensed descriptive statistics for these sub-samples.

Table 5.5: Descriptive statistics for sub-samples of quartile-grouped data based on CEO vesting equity sensitivity. All variables are as defined previously in section 4.1.2 for the sensitivity measure and table 5.1 for the company characteristics.

CEO vesting equity sensitivity ($M)	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Median	.166	1.357	3.831	12.770
Max	.697	2.373	6.386	241.550
Company characteristics (Mean values)	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Market capitalization ($M)	3 585	3 317	7 935	20 243
Assets ($M)	4 337	4 217	7 003	17 058
Cash-to-assets	0.17	0.18	0.18	0.15
Return on assets	0.6%	1.2%	1.6%	2.0%
Dividend payer	0.49	0.45	0.50	0.60
Quarterly stock performance	1.3%	3.9%	5.4%	5.4%

Looking at the data divided into quartiles, it is evident that company characteristics vary per sub-sample. Most variables relating to company characteristics increase with CEO equity sensitivity. The underlying reasons for these variations would be very interesting to explore. However, that is outside of the scope for this thesis, but highlights the need for a regression model which incorporates controls for these covariates.

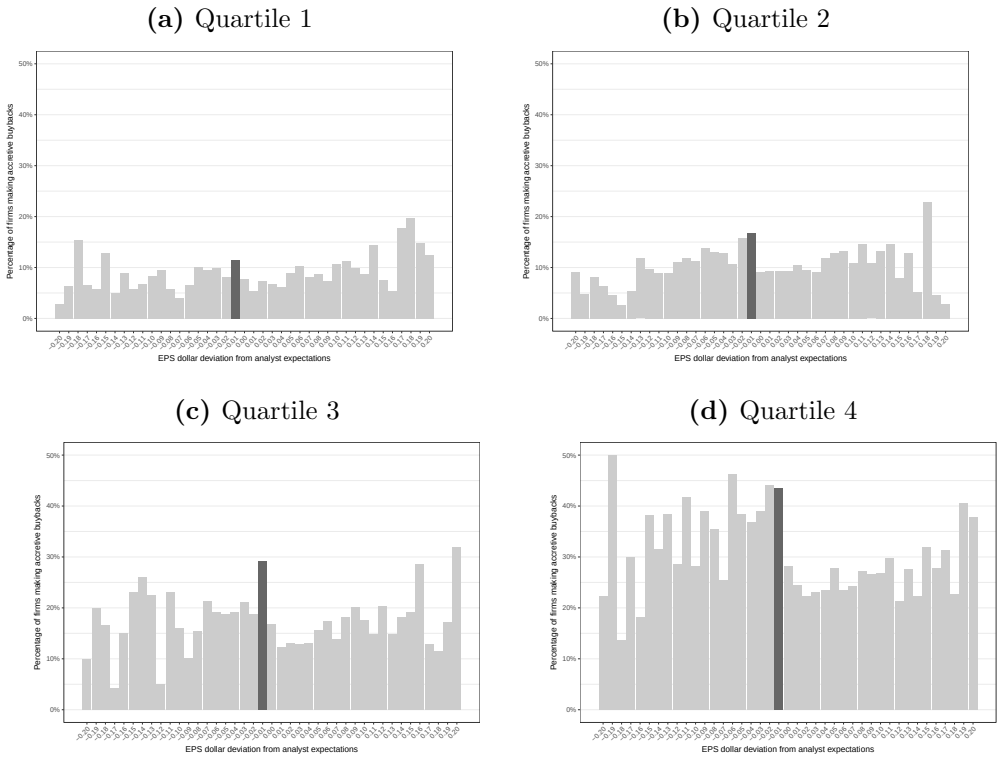
5.3.1 Bin analysis of quartiles

To visually analyze the discontinuity in each sub-sample, we repeat the bin analysis previously conducted on the full sample. The method is identical except for the fact that we now have four sub-samples to look at. The first binning method sorts observations into bins based on the pre-buyback EPS cent deviation from the median

analyst estimate. The results are presented in figure 5.3. The highlighted bar shows the bin of observations with pre-repurchase EPS one cent below the analyst estimate.

Comparing the quartiles, we see a common theme in the sharp drop of accretive repurchases between the -1 cent bin to the 0 cent bin, which is the phenomenon that we are mainly concerned with in this thesis. Furthermore, the analysis highlights that the overall share of companies doing accretive repuchases increases per quartile, i.e. companies with high CEO sensitivity are more frequently doing accretive repurchases regardless of the relation between their pre-repurchase EPS and analyst estimates. This result points to the fact that there are many other motivations for conducting repurchases. The most basic explanation for share repurchases is that the company tries to increase demand and price of the stock, both mechanically but also by signaling to market participants that the share is currently underpriced. Therefore, this result is non-controversial since attempts to increase the price of the company's stock is expected when the CEO's compensation is more sensitive to the underlying share price. Whether or not the share actually is underpriced in relation to these share repurchases is a very interesting topic of research which is not part of this paper's scope.

Figure 5.3: Per quartile frequency of accretive repurchases per dollar away from EPS target



Our second method of sorting observations into bins is based on the percentage deviation of pre-repurchase EPS to the median analyst estimate. Figure 5.4 displays the accretive repurchase frequency per bin for each quartile.

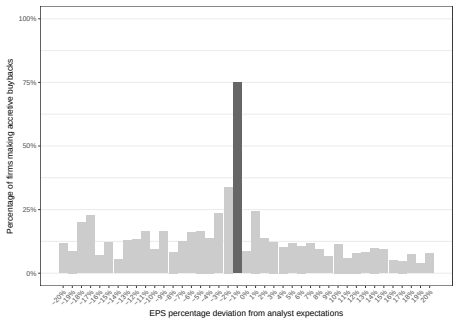
The patterns are similar to the previous bin analysis, a sharp drop in the share of accretive repurchases in the bin of observations where pre-repurchase EPS is just hitting the median analyst target compared to the bin that is just below the target. The phenomenon is present in all quartiles.

Interestingly, comparing the bin of observations where pre-repurchase EPS is less than one percent below the target across quartiles, the highest share of accretive repurchases are found in Quartile 1, which consists of the lowest sensitivity CEO observations. However, the pattern for bins more than one percent below the target reflect what is intuitively expected. The share of companies doing accretive repurchases increases per quartile as CEO sensitivity is increased.

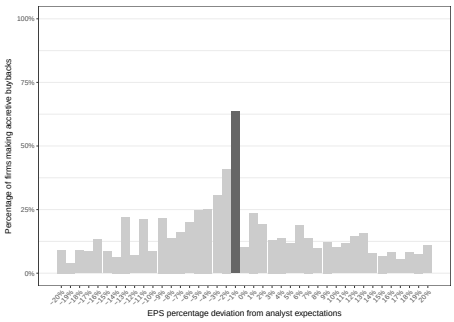
As we did state in the preceding bin analysis of the full sample, this method is rather unsophisticated. As was the case for the full sample, company characteristics are considerably different in the bin that is just below vs. the bin that is just on the target. More importantly, there is no good way to compare the bin analysis across quartiles in order to draw conclusions about whether accretive repurchasing behaviour increases with CEO sensitivity. For these reasons, we will once again turn to using the regression discontinuity method for further analysis.

Figure 5.4: Frequency of accretive repurchases per dollar away from EPS target, scaled by size of EPS

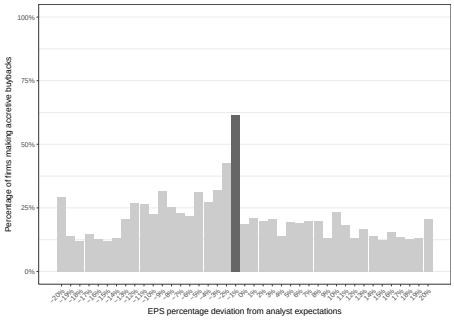
(a) Quartile 1



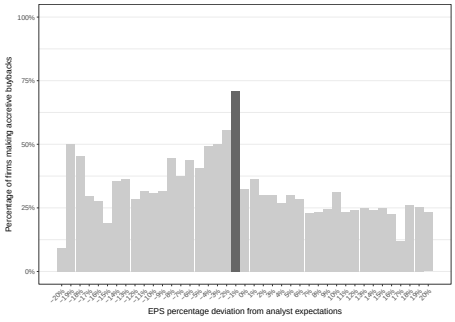
(b) Quartile 2



(c) Quartile 3



(d) Quartile 4



5.3.2 RD analysis of quartiles

The next step of our analysis yet again turns to the regression discontinuity analysis, repeated for each sub-sample. We wish to uncover whether companies around the zero pre-repurchase EPS surprise threshold act differently based on their CEOs 1-year equity value sensitivity to stock price movements. The focus is on whether the coefficient for the discontinuity of the frequency of companies making accretive repurchases around the zero pre-repurchase EPS surprise increases with the CEO sensitivity. Since the equity sensitivity measure does not vary from quarter to quarter, we cluster standard errors based on company-year clusters. The results from these regressions are displayed in table 5.6.

Table 5.6: Regression discontinuity results for the four sub-samples based on CEO sensitivity quartiles. The model specifications used for the regressions are those from Table 5.4's column 1 for Panel A and column 5 for Panel B. The Discontinuity Coefficient represents the discontinuity in the probability of making an accretive repurchase. Clustered standard errors are in parentheses below the coefficient.

Panel A	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Discontinuity coefficient	0.0731***	0.1516***	0.1677***	0.2573***
	(0.0141)	(0.0200)	(0.0236)	(0.0273)
Z-value	5.1800	7.5944	7.1178	9.4290
P> |z|	0.0000	0.0000	0.0000	0.0000
CI Lower	0.0454	0.1125	0.1215	0.2038
CI Upper	0.1007	0.1908	0.2139	0.3108
Panel B	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Discontinuity coefficient	0.0695***	0.1480***	0.1447***	0.2319***
	(0.0143)	(0.0211)	(0.0239)	(0.0250)
Z-value	4.86	6.79	6.65	9.19
P> |z|	0.0000	0.0000	0.0000	0.0000
CI Lower	0.0415	0.1067	0.0979	0.1829
CI Upper	0.0975	0.1893	0.1915	0.2810

Note: *p<0.1; **p<0.05; ***p<0.01

The results table shows that the coefficient is larger for quartiles with higher CEO sensitivity, which is in line with our hypothesis. This relationship holds true in both model specifications. Panel A's model specification is comparatively simpler, as it does not incorporate any covariates and a linear interaction of the running variable. In Panel B, the regression incorporates both control variables, fixed effects as well as a third-order interaction term. We feel that these two vastly different model specifications indicate that our results are not dependent on the model specification. Compared to the regression for the full sample, standard errors are larger now which has its explanation in the smaller number of observations used for each regression. The larger standard errors make the confidence intervals wider. Table 5.6 displays confidence intervals for the 95% level of statistical significance. At this level, Quartile 4 and Quartile 3 are not statistically significantly different, as their

confidence intervals overlap, while Quartile 2 is statistically significantly different from Quartile 1 and Quartile 4. In this sense, we have a mixed bag of results. For a more complete analysis, we report confidence intervals at significance levels of 90% and 99% in table 5.7.

Table 5.7: Range of confidence intervals for the discontinuity coefficient estimated in regressions from table 5.6. For each quartile of data, the 90, 95 and 99% confidence intervals using clustered standard errors are reported.

Panel A				
Sig. level	Quartile 1	Quartile 2	Quartile 3	Quartile 4
90%	0.0499 - 0.0963	0.1188 - 0.1845	0.1289 - 0.2064	0.2124 - 0.3022
95%	0.0454 - 0.1007	0.1125 - 0.1908	0.1215 - 0.2139	0.2038 - 0.3108
99%	0.0367 - 0.1094	0.1002 - 0.2031	0.1070 - 0.2284	0.1870 - 0.3276
Panel B				
Sig. level	Quartile 1	Quartile 2	Quartile 3	Quartile 4
90%	0.0460 - 0.0930	0.1133 - 0.1826	0.1055 - 0.1840	0.1908 - 0.2731
95%	0.0415 - 0.0975	0.1067 - 0.1893	0.0979 - 0.1915	0.1829 - 0.2810
99%	0.0327 - 0.1063	0.0937 - 0.2023	0.0832 - 0.2062	0.1675 - 0.2964

Comparing Panel A and Panel B, we find virtually the same pattern in each panel. For that reason, we will continue the analysis focusing on Panel B.

These results show that the discontinuity is significantly different when comparing quartile 1 to it's neighboring quartile 2 at the 95% confidence level. This indicates that while the discontinuity effect is still present for companies where the CEO's compensation has a low sensitivity to the underlying stock price, the effect is weaker when compared to that of companies in which the CEO's vesting equity has a higher sensitivity to underlying stock price movements.

Our results fail to identify any difference in the discontinuity effect between quartile 2 and 3, and even the estimated coefficient is very close in these cases. In fact, quartile 2's discontinuity coefficient is slightly stronger than quartile 3's. Nonetheless, their confidence intervals overlap at all significance levels. This suggests that companies within the middle quartiles do not seem to vary in their propensity to make accretive repurchases when they are trailing behind the analyst median estimate. Do note that the probability of them doing accretive repurchases still goes up by about 14.5% when they do seem like they are missing the target, but that the average effect is the same whether the CEO has a next year vesting sensitivity between \$0.7-6.4 million (the range of vesting equity sensitivity in quartiles 2 to 3).

The sample of companies with CEO's in the top quartile, where the sensitivity is between \$6.4-242 millions, has the strongest discontinuity coefficient. At a 10% significance level, this effect is also statistically significantly different from that of quartile 3 and the rest of the data sample. This result suggests that there is a correlation between companies with CEOs having a large value at stake within the upcoming year through equity and option vesting, and the discontinuous probability

of making accretive repurchases when there is a risk of missing the analyst EPS estimate otherwise. An important factor in our analysis is the expected correlation between share repurchases and the measure we use for CEO equity compensation sensitivity. We should expect companies that have large equity based payments, a key driver of the CEO sensitivity measure, coming in the next 12 months to also make more repurchases of shares than other companies in order to fulfill these obligations. However, this does not provide an explanation to the discontinuous jump in frequency of accretive repurchases around the zero repurchase threshold, which is what we are concerned with in our analysis. The way this mechanic would have to work in order to explain the discontinuity is if there were a correlation between having a negative pre-repurchase EPS surprise and simultaneously having to make large repurchases in order to compensate the CEO with different forms of equity. As all companies in quartile 4 have large upcoming equity payments to make, there seems to be nothing that suggests that this correlation would exist. In order to test this, we have conducted an additional RD analysis, where we look for a discontinuity in the CEO sensitivity around the zero pre-repurchase EPS surprise for quartile 4. The results are reported in table 5.8. We find no significant discontinuity, indicating that there does not seem to be an issue with spurious correlation between CEO sensitivity and the pre-repurchase EPS surprise.

Table 5.8: Complementary regression discontinuity results for the quartile with highest CEO sensitivity. The model specification is similar to the one in column 5 of table 5.4 with the exception that we switch out accretive repurchases and instead look for a discontinuity in the CEO sensitivity measure, which is what the Discontinuity Coefficient reports. Clustered standard errors are in parentheses below the coefficient.

	Quartile 4
Discontinuity Coefficient	2032
	(1405)
Z-value	1.4455
P> |z|	0.1483
CI Lower	-723
CI Upper	4786
Note: *p<0.1; **p<0.05; ***p<0.01	

To conclude our analysis of the connection between CEO sensitivity quartiles and the discontinuity effect, the results indicate that there is a correlation between these phenomenons. We were able to confirm that the discontinuous effect exists in all quartiles of CEO sensitivity sub samples, meaning that regardless of the CEO's sensitivity, companies are more likely to make accretive repurchases when their EPS would otherwise miss the median analyst estimate. We also find evidence that the discontinuity is the least apparent in the quartile of companies where the CEO's equity compensation has a low sensitivity to the underlying stock price, and that companies in the quartile of CEOs with the highest sensitivity has the strongest

discontinuity effect. In essence, what this means is that there is a correlation between the willingness of companies to mechanically raise their EPS and the sensitivity of the CEO's short-term equity compensation. Connecting these findings to the claims made by Almeida et al. (2016), that there is a causal relationship between EPS-driven repurchases and cutbacks of investments in R&D, CAPEX and employment, indicates that CEOs with a high stock price sensitivity to their short-term equity compensation are more likely to make such cutbacks in cases where the company EPS otherwise risks missing the median analyst estimate.

Chapter 6

Discussion

Our results suggest that we are able to once again identify the discontinuous frequency of firms making accretive share repurchases around the zero surprise threshold. Firms whose quarterly EPS would otherwise fall below the median analyst EPS estimate make more accretive repurchases than their peers whose EPS is able to meet analyst estimates without making repurchases. In itself, this finding is nothing new, both Hribar et al. (2006) and Almeida et al. (2016) have come to the same conclusions before us. Our paper's contribution is twofold. First, we use a more recent dataset and find that the discontinuity is still present in the more modern setting. Secondly, using data from 2006 and onward, after implementation of FAS 123R, allows us to test whether the discontinuity is correlated with CEO equity compensation value sensitivity.

By itself, the discontinuity is an interesting phenomenon. The findings by Almeida et al. (2016), who use the discontinuity to identify a causal effect of accretive repurchases on decreases in R&D, CAPEX and employment; three factors generally considered crucial for long-term success. Their results suggest an adverse effect on long-term performance that is driven by accretive repurchases fueled by the incentive for companies to meet their EPS targets. Our results suggest that the discontinuity has become even stronger in the more recent period used in our study. This is a cause for concern given the aforementioned adverse effects on investments, employment and R&D. Take note that while we have not tested whether the increased discontinuity has translated into increased cuts in such investments, it does suggest that the behaviour has become more common. In essence, what the increased discontinuity says is that the effect per company might still be the same, but the effect on the economy as a whole is more detrimental since the behaviour has become more widespread.

Regarding our second contribution to the existing research, we stated an hypothesis that the behaviour of conducting accretive repurchases in the region just below

the zero EPS surprise threshold is influenced by the sensitivity of CEOs' equity compensation vesting in the upcoming 12 months. Our results indicate that there is a correlation between high CEO sensitivity and the level of the discontinuity. While the relationship is not strictly increasing per quartile, we find significantly different discontinuity coefficients for the bottom and upper quartile, i.e. the quartile with the least and the most CEO sensitivity. In the quartile with the lowest CEO sensitivity, the discontinuity coefficient is still present. This is not surprising since we never claimed nor believe that the discontinuity is fully driven by CEO sensitivity, it should always be in any CEO's interest to meet analyst expectations regardless of the impact on their personal financial situation. Still this result supports our hypothesis, as the discontinuity in the least sensitive quartile is significantly smaller than it is for the other quartiles. This means that mechanically increasing EPS through repurchases when you are close to the zero repurchase threshold is less widespread in the least sensitive quartile.

In the middle quartiles our results fail to identify any difference in how the probability of accretive repurchases jumps at the zero surprise threshold, these two groups act in a similar fashion. This is the reason why we are unable to state that our results indicate that the discontinuity increases linearly with CEO sensitivity. Our results suggest that the discontinuity stays the same in the middle region and then it increases once again for companies in the most sensitive quartile. We find a significantly (10%-level) different and larger discontinuity coefficient for the quartile with the most sensitive CEOs. As we argued in our hypthesis formulation, these CEOs will have the highest incentive from a personal financial point of view to meet/beat the median analyst estimate. This, we argue, is a reason why companies in this quartile express the largest jump in probability of making accretive repurchases when their pre-repurchase EPS is just below the median analyst EPS estimate. Interestingly, Edmans et al. (2013) who originated the sensitivity measure, find that the measure is positively related to the likelihood of beating analysts' estimates. Our results suggest that their finding might have a partial explanation in the connection between high sensitivity and making accretive repurchases. Edmans et al. also find that rising CEO sensitivity is negatively related to R&D and cutting investments. We argue that this relationship can be partially explained by the fact that accretive repurchases are more common for high-sensitivity firms. To finance such repurchases some companies cut down on investments, as shown by Almeida et al. (2016). In that sense, our thesis provides a partial reason for the the myopic effects driven by sensitivity, which was found by Edmans et al. (2013). The accretive repurchase discontinuity, which is increasing with said sensitivity, also is related to cuts in R&D and CAPEX investments. Therefore, there is a reason to believe that one of the ways that CEO sensitivity negatively affects such investments is that

high sensitivity companies more frequently perform accretive repurchases in order to meet their EPS target and therefore have to cut investments.

Chapter 7

Limitations and Suggestions for Future Research

To our knowledge, this is the first study to test if U.S. executives' sensitivity to vesting equity compensation increase their propensity to act short-term by boosting EPS through share repurchases. The study fulfills its purpose and finds that executives with high sensitivity (Quartile 4) engage in EPS-motivated repurchases to a greater extent than executives with low sensitivity (Quartile 1). However, there are limitations to our study and consequent results.

First, the scope of our study is limited to executives in U.S. firms in the S&P 1,500 index between the years 2006-2015. The findings might have been different for other regions, indices and/or time periods. For example, companies in the S&P 1,500 may not be representative for the general company in the U.S., as many of these firms are mature and operate in mature industries where resources spent on investments give little return. Hence, it would not be irrational for such a company to distribute its excess cash to shareholders through dividends or buybacks to a greater extent.

Second, companies with high CEO sensitivity are often required to do repurchases in order to have shares that can be rewarded to the CEO's option exercises and share grants. Therefore, one could argue that our research question is a self-fulfilling prophecy. However, the fact that there is an increasing discontinuity with increasing sensitivity around the zero pre-repurchase surprise threshold suggests that our research still is relevant. A fruitful extension to this analysis would be to analyze whether the source of funds needed to perform the repurchases differs between the quartiles. The impact on long-term performance will probably differ if the funds were generated by decreasing R%D or CAPEX in contrast to if the repurchases were done using retained earnings.

Third, while the measure of CEO sensitivity does have an impact on the annual

salary of a CEO, we are not using any measure that captures the total wealth and/or tenure of the executive. We see a possibility of there being a wealth dynamic which impacts the CEO's incentive to hit the EPS target, such as new CEOs being under larger scrutiny to deliver results, or CEOs with higher personal wealth being less interested in boosting their annual salary by making sure that the EPS target is met. These kinds of dynamics might be important explanatory factors that add to our knowledge about the discontinuity in accretive repurchases around the zero surprise EPS, which we leave as a topic for future research.

Lastly, our research holds true in the short-term. What we have not studied, but what would be an interesting research topic in the future, is what the consequences of EPS-enhancing repurchases are in the long-term. Almeida et al. (2016) also studied stock price reactions after companies had beat consensus EPS expectations and found that reactions were less positive in companies where there had been EPS-enhancing repurchases. It would be interesting to build on this research and apply our quartile setup to see if stock price reactions differ for stock repurchasing companies with different CEO sensitivity. However, we leave this subject to future researchers.

Chapter 8

Conclusion

We set out with the purpose to test whether there is a connection between a company mechanically increasing its EPS to not miss earnings estimates by repurchasing shares and the sensitivity of the CEO's upcoming compensation towards the underlying share price. The study's data sample consists of companies in the S&P 1,500 between the years 2006-2015.

The first step of our analysis was to identify whether there is a discontinuity in accretive repurchases around the zero surprise threshold. In line with earlier papers by Hribar et al. (2006) and Almeida et al. (2016), we are able to identify the discontinuity using a simple binned average analysis but also more importantly by employing a fuzzy regression discontinuity model. These results mean that companies whose quarterly EPS would otherwise fall below the median analyst EPS estimate make more accretive repurchases than their peers whose EPS is able to meet analyst estimates without making repurchases. Using the most recent sample period, we not only find the discontinuity to still be present, but also that it seems to have increased. The increased discontinuity implies that the behaviour of trying to meet analyst estimates through repurchases that raise EPS has become more widespread.

The second part of our analysis focused on the potential connection between CEO sensitivity, a measure constructed by Edmans et al. (2013), and the aforementioned discontinuous probability of conducting accretive repurchases to meet analyst estimates. Our results suggest that there is a connection between CEO sensitivity and the discontinuity. We find a significantly different discontinuity for the quartiles with the highest and lowest CEO sensitivity measure, suggesting that the propensity to undertake accretive repurchases in order to meet analyst expectations does increase with how much value is at stake for the CEO depending on the company's stock price. In other words, the results support this paper's main hypothesis.

Chapter 9

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Appendix A

Appendix

A.1 Size of EPS and Accretive Repurchases

The way accretive repurchases are defined, as increases of EPS by at least one cent, we can draw some conclusions about which companies that make accretive repurchases. As an example, consider a simple setup of two publicly traded companies with the same amount of shares, the same P/E ratio but with vastly different earnings and market capitalization. Both companies are trailing behind the median EPS estimate by one cent. The following numerical example shows how both companies, ceteris paribus, must spend the same amount of money to perform an accretive buyback, given that their P/E ratio is unchanged before and after the repurchase. This fact means that we must be cautious about the model specification, to incorporate the fact that it is easier to make an accretive repurchase for companies with high earnings per share.

Table A.1: Numerical example showing the relationship between size of EPS and the capital needed to achieve an accretive repurchase of shares. The main assumption of the example is that the P/E ratio remains the same before and after the repurchase.

Pre-repurchase earnings and EPS

	Shares	Earnings	P/E ratio	Market cap	EPS ($)	Price per share
Big company	1000000	10000000	15	150000000	10	150
Small company	1000000	2000000	15	30000000	2	30

Actual earnings and EPS, after repurchases

	Earnings	P/E ratio	Market cap	EPS	Shares needed to achieve accretive EPS	Repurchased shares	Cash used	% of market capitalization
Big company	10000000	15	150000000	10.01	999001	999	149850	0.100%
Small company	2000000	15	30000000	2.01	995025	4975	149254	0.498%

A.2 A Numerical Example of the CEO Sensitivity Measure

This section of the appendix provides a detailed numerical example of the calculation steps used to derive the CEO sensitivity measure, which was first created by Edmans et al. (2013). In their paper, Edmans et al. also provide a numerical example of the calculation method, we have expanded upon this example by being more explicit about each step of the calculation, making replication of the sensitivity measure easier. Starting out with the raw information from Execucomp, we go step-by-step towards the completed measure of CEO sensitivity used in the thesis. For our numerical example we use the CEO of CVS Health Corporation, Larry Merlo, and calculate the sensitivity of his newly vesting equity compensation for the financial year ending 2011-12-31 (FY11). To start off, the structure of Larry Merlo's option program is obtained from Execucomp, which in turn fetches the data from the annual proxy statement. We need to get data for both FY11 and FY12 to be able to calculate the number of vesting options. The option grants are reported in table A.2. Furthermore, new options granted in 2012 are presented in table A.3.

Table A.2: Option program structure for Larry Merlo, CEO of CVS Health Corporation, as reported in the proxy statements for FY11 and FY12. Data fetched from Execucomp.

Option program structure as reported in Execucomp

As of 2011-12-31	Option type	# of options	Exercise price	Expiration date
1	Unexercisable	61,858	28.10	2016-04-01
2	Unexercisable	241,150	34.96	2018-04-01
3	Unexercisable	101,992	36.23	2017-04-01
4	Exercisable	123,714	28.10	2016-04-01
5	Exercisable	161,359	30.04	2013-04-03
6	Exercisable	136,089	34.42	2014-04-02
7	Exercisable	50,996	36.23	2017-04-01
8	Exercisable	144,144	41.17	2015-04-01
As of 2012-12-31	Option type	# of options	Exercise price	Expiration date
9	Unexercisable	0	28.10	2016-04-01
10	Unexercisable	180,863	34.96	2018-04-01
11	Unexercisable	50,996	36.23	2017-04-01
12	Unexercisable	332,736	45.07	2019-04-02
13	Exercisable	185,572	28.10	2016-04-01
14	Exercisable	136,089	34.42	2014-04-02
15	Exercisable	60,287	34.96	2018-04-01
16	Exercisable	101,992	36.23	2017-04-01
17	Exercisable	144,144	41.17	2015-04-01

Table A.3: New options granted to Larry Merlo, CEO of CVS Health Corporation, in FY12. Data fetched from Execucomp

New options as reported in Execucomp

	Option type	Grant Date	# of options	Exercise price	Expiration date
18		2012-04-02	332,736	45.07	2019-04-02

To calculate the number of options that become exercisable in in 2012, for every type of option we pair up a unique set of exercise price and expiration date. These pairs are compared between the financial years, allowing us to infer the number of newly-vesting options, as presented in table A.4. Explicitly, the number of vesting options can be inferred from the following relationship:

$$Newly\ Vesting\ Options_{(P,D)t+1} = Unvested\ Options_{(P,D)t} +$$
$$+ Newly\ Awarded\ Options_{(P,D)t+1} - Unvested\ Options_{(P,D)t+1}$$

Where: P = Exercise Price and D = Expiration Date

Table A.4: Inferred number of options that vested in FY12. Column "Compared options" reports which options are used to infer the number of options that vested, and corresponds to the number before each option in table A.3. *Years to expiry is calculated from the end of FY11.

Inferred number of newly vesting options and their delta

As of 2012-12-31 Compared options	Option type	# of options	Exercise price	Expiration date	Years to expiry*
9 - 1	Newly-vesting	61,858	28.10	2016-04-01	4.254795
10 - 2	Newly-vesting	60,287	34.96	2018-04-01	6.254795
11 - 3	Newly-vesting	50,996	36.23	2017-04-01	5.254795

Once all newly-vesting options have been identified, their delta is calculated using the well-known Black-Scholes formula. The formula for call option deltas is defined as follows:

$$Call\ Delta = e^{qt} * N(d1)$$

$$d1 = \frac{ln(\frac{S_0}{X} + t(r - q + \frac{\sigma^2}{2})}{\sigma\sqrt{t}}$$

Where: q = Dividend yield, t = Time to expiry, S_0 = Underlying stock price, X = Exercise Price, σ = Stock volatility, r = Risk free interest rate.

The inputs used for the various components of the Black-Scholes formula are as follows. Volatility is calculated using up to five years of stock price data (depending on data availability). Dividend yield is calculated using up to three years of historical dividend yield ratios. Risk free rate is defined as the rate of the treasury note or bill with the closest maturity to the option's time to expiry at the time of the delta calculation, for this example, treasury notes with a maturity between 4-6 years quoted as of December 2011. Table A.5 reports delta calculations for the newly-vesting option pairs defined previously in table A.4.

The calculated delta in table A.5 is multiplied by the number of options that are vesting in each grant, creating a measure that describes the change in value of each

Table A.5: This table shows all required inputs for the delta calculation along with the per option delta reported in the last column. The options whose delta is calculated are the newly-vesting options in table A.4

Option delta calculation

Option pairs	Exercise price	Expiration date	Years to expiry	Risk free rate	Volatility	Dividend yield	Delta
9 - 4	28.10	2016-04-01	4.254795	0.60%	31.00%	0.93%	0.778993
10 - 2	34.96	2018-04-01	6.254795	1.09%	31.00%	0.93%	0.684371
11 - 3	36.23	2017-04-01	5.254795	0.83%	31.00%	0.93%	0.663219

newly vesting option grant. To create the sensitivity measure used in the thesis, these measures are multiplied by the closing stock price at the end of FY11. This multiplication transforms the delta expression into a measure that approximates the value change of newly vesting options due to a 1% change in stock price, instead of being measured as value change per dollar increase/decrease in stock price. Expressing the sensitivity in this manner gives the added benefit of increased comparability between firms with varying share prices. The resulting option sensitivity measure is reported in table A.6. As a cautionary note, we highlight that the measure in the appendix uses dollars as unit, while the measure used in the results of the thesis uses thousands of dollars as measure.

Table A.6: Creation of the sensitivity measure used in the thesis results. The delta for each option pair comes from A.5. The share price is the closing price in FY11.

Option sensitivity calculation

Option pairs	Number of options	Delta	Share price	Sensitivity
9 - 4	61,858	0.7789933	40.78	1,965,065
10 - 2	60,287	0.6843713	40.78	1,682,529
11 - 3	50,996	0.6632186	40.78	1,379,241
Sum	173141			5,026,835

Once the option deltas are calculated, we also need to take into consideration the regular stocks awarded to Larry Merlo in FY12, since that is also part of his equity sensitivity measure. Fortunately for us, the number of shares that have been awarded each year is directly reported in the proxy statement. For the financial year 2012, Larry Merlo was awarded 55,894 shares. Since we are concerned with how this affects the sensitivity before 2012, we have to consider the delta of these share rewards at the onset of FY12. This part is also considerably easier when dealing with shares rather than options since the delta is always one for shares. Table A.7 outlines the total sensitivity for Larry Merlo before FY12. We combine the sensitivity data with corporate actions in 2011, specifically the prevalence of accretive repurchases around the zero pre-repurchase EPS surprise.

Table A.7: This table shows how the sensitivity measure is composed of sensitivity from both shares and options. All calculations needed have been detailed above. The sensitivity from shares is the number of shares times the ending share price, since the delta of shares is always 1, which is not the case for newly vesting options.

Components of the sensitivity measure for Larry Merlo in FY11

Number of shares	Share price	Sensitivity from shares	Number of newly vesting options	Sensitivity from options	Total sensitivity
55,894	40.78	2,279,357	173,141	5,026,835	7,306,192

A.3 Characteristics per Earnings Surprise Bin

This appendix section reports average company characteristics per earnings surprise bin in longer ranges than what is presented in the results section of the paper. All company characteristics are as they were defined in table 5.1.

Table A.8: Table showing characteristics for companies in pre-repurchase EPS surprise bins, defined as cents from median EPS target by analysts. The table includes bins for companies that are from 20 cent below to 20 cent above their analyst median EPS target for the quarter.

Cents from target	Accretive Repurchase Frequency	Observations	Assets	ROA	Cash	Cash-to-assets	Dividend payer frequency	Quarterly stock performance	Frequency of all repurchases
-0.200	0.053	357	6236	-0.022	451.418	0.193	0.521	0.001	0.252
-0.190	0.075	361	7732	-0.023	706.437	0.177	0.550	0.054	0.247
-0.180	0.060	399	6231	-0.021	712.769	0.189	0.485	0.046	0.253
-0.170	0.050	436	5152	-0.017	489.213	0.196	0.474	0.011	0.261
-0.160	0.043	536	4544	-0.020	626.769	0.186	0.432	0.062	0.231
-0.150	0.075	518	6562	-0.019	697.790	0.185	0.506	0.022	0.261
-0.140	0.071	692	4371	-0.027	448.080	0.207	0.471	-0.010	0.273
-0.130	0.054	718	5208	-0.020	449.300	0.205	0.484	0.026	0.255
-0.120	0.070	848	5265	-0.020	419.632	0.198	0.460	0.021	0.252
-0.110	0.075	908	5198	-0.017	583.255	0.199	0.469	0.026	0.274
-0.100	0.061	1041	4665	-0.022	473.144	0.204	0.443	0.013	0.249
-0.090	0.063	1232	4782	-0.024	510.002	0.216	0.453	-0.031	0.239
-0.080	0.063	1422	4479	-0.021	488.762	0.213	0.460	0.011	0.256
-0.070	0.065	1683	5077	-0.021	404.236	0.216	0.457	0.024	0.268
-0.060	0.079	2060	3878	-0.020	352.190	0.228	0.437	0.040	0.271
-0.050	0.080	2524	5069	-0.016	522.627	0.212	0.458	0.014	0.277
-0.040	0.078	3093	4035	-0.015	404.567	0.230	0.424	0.067	0.272
-0.030	0.081	3803	3400	-0.015	336.922	0.228	0.413	0.025	0.280
-0.020	0.091	5047	4337	-0.013	496.748	0.237	0.418	0.003	0.296
-0.010	0.112	7288	4346	-0.009	479.631	0.243	0.412	0.008	0.321
0.000	0.079	11396	4931	-0.002	539.010	0.237	0.402	0.017	0.324
0.010	0.072	11653	5038	0.001	666.567	0.246	0.396	0.029	0.333
0.020	0.077	9314	5208	0.005	653.327	0.242	0.402	0.031	0.338
0.030	0.074	7289	5007	0.003	670.161	0.244	0.412	0.045	0.330
0.040	0.083	5732	5081	0.005	651.393	0.238	0.433	0.058	0.325
0.050	0.096	4625	5457	0.006	692.771	0.234	0.427	0.050	0.330
0.060	0.096	3705	5045	0.007	670.147	0.241	0.424	0.056	0.323
0.070	0.097	2962	5136	0.006	608.490	0.227	0.448	0.055	0.318
0.080	0.109	2436	5397	0.008	623.389	0.227	0.452	0.044	0.323
0.090	0.103	1994	5783	0.008	614.064	0.221	0.462	0.053	0.302
0.100	0.109	1728	6908	0.006	838.252	0.228	0.483	0.075	0.328
0.110	0.111	1454	6635	0.008	771.703	0.207	0.490	0.063	0.318
0.120	0.109	1187	5737	0.011	584.983	0.218	0.511	0.092	0.343
0.130	0.108	1052	6947	0.010	767.521	0.214	0.487	0.068	0.324
0.140	0.109	945	8006	0.011	849.564	0.209	0.520	0.078	0.305
0.150	0.126	786	6667	0.009	853.021	0.209	0.510	0.073	0.302
0.160	0.116	662	7702	0.011	860.629	0.207	0.514	0.087	0.285
0.170	0.101	557	6963	0.010	649.106	0.204	0.499	0.062	0.268
0.180	0.116	576	4811	0.012	576.223	0.198	0.488	0.051	0.299
0.190	0.146	515	9046	0.013	920.721	0.223	0.486	0.087	0.301
0.200	0.153	430	8485	0.015	857.592	0.214	0.526	0.249	0.316

Table A.9: Table showing previous quarter characteristics for companies in pre-repurchase EPS surprise bins, defined as cents from median EPS target by analysts and scaled by the EPS target, giving the deviance as a percentage of EPS target. The table includes bins for companies that are from 20% below to 20% above their analyst median EPS target for the quarter.

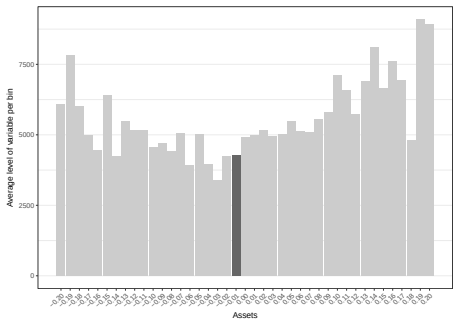
Percent from target	Accretive Repurchase Frequency	Observations	Assets	ROA	Cash	Cash-to-assets	Dividend payer frequency	Quarterly stock performance	Frequency of all repurchases
-20%	0.091	350	6629	0.014	537.759	0.137	0.514	0.018	0.317
-19%	0.066	422	4878	0.015	397.075	0.154	0.549	0.005	0.299
-18%	0.100	350	5697	0.011	442.757	0.135	0.583	-0.008	0.331
-17%	0.085	567	4081	0.013	424.703	0.162	0.512	0.001	0.325
-16%	0.081	381	4402	0.017	400.862	0.133	0.556	0.005	0.299
-15%	0.080	679	4769	0.014	481.294	0.167	0.542	0.015	0.311
-14%	0.107	487	11406	0.014	778.760	0.133	0.623	-0.013	0.339
-13%	0.130	539	5749	0.017	546.994	0.164	0.520	0.002	0.358
-12%	0.112	706	6405	0.015	717.345	0.155	0.586	0.014	0.341
-11%	0.146	704	7063	0.016	699.901	0.152	0.532	-0.007	0.358
-10%	0.104	751	6853	0.018	568.314	0.138	0.565	0.013	0.356
-9%	0.148	675	7685	0.017	960.531	0.157	0.575	0.025	0.388
-8%	0.133	934	6494	0.017	745.170	0.147	0.581	0.007	0.353
-7%	0.162	922	8100	0.018	816.178	0.143	0.596	0.007	0.424
-6%	0.171	1164	8321	0.019	852.611	0.159	0.571	0.158	0.430
-5%	0.201	1195	7798	0.019	719.930	0.146	0.601	0.009	0.448
-4%	0.218	1234	8259	0.018	943.029	0.140	0.616	0.009	0.474
-3%	0.279	1529	10276	0.020	1131.918	0.130	0.627	0.005	0.514
-2%	0.360	1418	14350	0.022	1371.672	0.132	0.661	0.011	0.564
-1%	0.603	370	23623	0.029	2355.185	0.115	0.697	0.017	0.716
0%	0.094	11943	5705	-0.001	611.550	0.232	0.418	0.017	0.338
1%	0.227	2639	12355	0.015	1436.400	0.166	0.643	0.040	0.518
2%	0.166	3239	10340	0.010	1214.499	0.187	0.558	0.020	0.450
3%	0.145	2919	9411	0.006	1204.689	0.209	0.529	0.029	0.396
4%	0.128	3231	7263	0.005	853.597	0.203	0.525	0.030	0.398
5%	0.125	2641	7001	0.002	932.033	0.221	0.496	0.021	0.395
6%	0.126	2594	7136	0.004	926.333	0.232	0.482	0.026	0.385
7%	0.110	2474	6889	-0.003	856.060	0.243	0.462	0.062	0.354
8%	0.108	2294	6448	0.001	897.681	0.221	0.483	0.053	0.366
9%	0.085	2379	5498	-0.004	664.821	0.255	0.433	0.020	0.316
10%	0.128	1695	7034	-0.003	899.843	0.260	0.454	0.035	0.350
11%	0.090	2015	6688	-0.012	831.668	0.276	0.417	0.038	0.310
12%	0.083	1786	5143	-0.006	625.763	0.263	0.411	0.046	0.298
13%	0.099	1477	4886	-0.002	662.903	0.258	0.416	0.043	0.326
14%	0.076	1841	5181	-0.012	722.496	0.288	0.380	0.043	0.292
15%	0.086	1458	4668	-0.006	523.133	0.266	0.421	0.038	0.298
16%	0.065	1583	3607	-0.015	384.396	0.292	0.348	0.045	0.277
17%	0.072	1053	5835	-0.005	851.197	0.252	0.431	0.045	0.309
18%	0.071	1119	4782	-0.012	616.178	0.279	0.371	0.048	0.282
19%	0.053	1332	4425	-0.010	512.255	0.271	0.389	0.051	0.252
20%	0.078	960	4422	-0.016	545.179	0.301	0.368	0.032	0.290

A.4 Additional Plots of Characteristics Around the Zero-Cent EPS Surprise

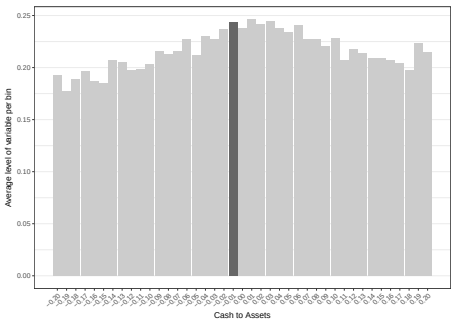
Plots showing average levels of other company characteristics than the propensity for accretive repurchases. This is a complement to the plot analysis, where we explore if other variables also jump at the zero pre-buyback EPS cent surprise threshold of zero cents deviation to the analyst median estimate. The graphs do not indicate that any other variable than the repurchased amount jumps, which is expected to jump since large repurchases are needed in order to make them accretive. Furthermore, the EPS variable seems to be increasing with the surprise bin, which is also expected since you need to have a high EPS in order to beat the median analyst forecasts.

Figure A.1: Average levels of various company characteristics per bin based on pre-repurchase EPS dollars away from EPS target. The X-axis is expressed in dollar amounts, and the dark bar indicates the $-0.01 surprise bin, i.e. being one cent away in pre-buyback EPS from analyst estimates

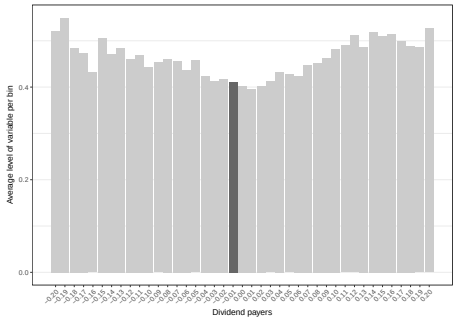
(a) Total assets



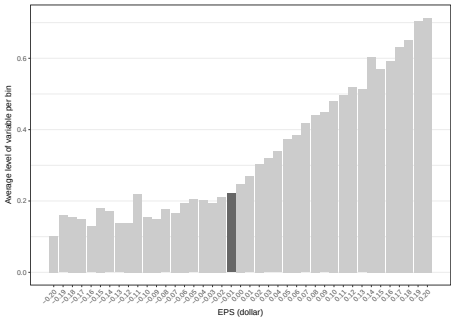
(b) Cash-to-assets



(c) Dividend payers



(d) Earnings per share



(e) Repurchased amount