ERASMUS UNIVERSITY ROTTERDAM

Master thesis

The effects of simplification of companies on forecasting accuracy

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Abstract

The objective of this study is to find evidence whether simplification of companies leads to more accurate forecasts. In order to find this evidence, I focus on management forecasts and use spin-offs as a proxy for simplification, as companies separate unnecessary divisions during a spin-off. As such, their business becomes less complicated. This simplification should make it easier for management to issue accurate forecasts. Using several analyses, I find no evidence that forecasts become more accurate after a spin-off. Therefore, I find no evidence to confirm my research question that simplification of companies leads to more accurate forecasts. As a result, practitioners calculating enterprise value should not put more emphasis on management forecasts after a spin-off.

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1. Introduction

The objective of this study is to find an answer to the following research question:

Does simplification of companies lead to more accurate forecasts?

It is important to find an answer to this research question, as it could help increase market efficiency. Both management and analysts issue forecasts on a regular basis. In general, the purpose of their forecasts is to adjust market expectations, so that researchers and investors can use these forecasts to calculate enterprise value. In this respect, Hutton and Stocken (2009) examine whether preceding management forecasts can affect investor response to new management forecasts. They find a stronger investor response for companies that issued more accurate forecasts in the past. Similarly, if investors and researchers know that management forecasts are more accurate after simplification, then they will depend more on their forecasts when calculating enterprise value. This should give them a better estimate of the enterprise value and, ultimately, increases market efficiency.

However, as companies grow, they become more complex. This could make it more difficult to create accurate forecasts. Duru and Reeb (2002) research the effects of international diversification of companies on analyst forecasting accuracy. They find that, as companies do more business in foreign countries, the forecasting of their earnings becomes more complex. This makes it harder for analysts to issue accurate forecasts. Following the same logic, I hypothesize that forecasts become more accurate after simplification, as companies become less complicated.

To provide an answer to my research question, I will focus on management forecasts and use spin-offs as a proxy for simplification of companies. Spin-offs are a form of corporate restructuring that involves the separation of a division. In a spin-off, a public company separates a part of the company to become a subsidiary. Current shareholders receive a proportion of the subsidiary stock that is equal to their ownership in the parent company. After the spin-off, there are thus two independent companies: the parent company and the spin-off. The result is that the parent company has become less complicated.

In my research, I examine three main variables: Earnings Per Share, Sales and Capital Expenditure. I use three time frames to capture the effects of a spin-off on management forecasting accuracy. To examine whether my results hold under different assumptions, I perform three robustness tests based on analyst forecasts (instead of management forecasts), quarterly data (as opposed to annual data) and first forecast issued by management (instead of the last forecast). The aim of these analyses is to find a positive effect on management forecasting accuracy, meaning that forecasts become more accurate after a spin-off.

Using the aforementioned analyses, I find no evidence that forecasts become more accurate after a spin-off. Therefore, I find no evidence to confirm my research question that simplification of companies leads to more accurate forecasts. As such, investors and researchers should not depend more on management forecasts after a spin-off when calculating enterprise value.

This thesis contributes to existing research for several reasons: Firstly, to the best of my knowledge, this is the first study to investigate the effects of spin-offs on forecasting accuracy. Secondly, most research focuses solely on forecasts of Earnings Per Share. I will be researching two additional variables: Sales and Capital Expenditure. Thirdly, as I find no evidence that forecasts become more accurate after a spin-off, it could be that there are other confounding factors that play a role in forecasting accuracy after a spin-off. Knowing this could help future research.

The rest of this paper is organized as follows. In chapter 2 an overview will be given of the most relevant literature regarding forecasting and spin-offs. Chapter 3 will develop the hypothesis. Chapter 4 will discuss the data. Chapter 5 will explain the methodology being used. Chapter 6 will detail the empirical results. Chapter 7 will discuss various implications of the analyses. Chapter 8 will discuss any limitations of this research. Lastly, chapter 9 will finalize with a conclusion.

2. Literature review

2.1 Forecasting

In this section I will lay out some of the most substantial research related to forecasting.

Both management and analysts issue forecasts on a regular basis. Management forecasts are typically issued to align shareholders expectations to management expectations about key figures (e.g. revenue, earnings per share and profit) (Ajinkya and Gift, 1984). Analysts are typically employed by brokerage houses and regularly publish forecasts for their clients. These clients can be large private investors or institutional investors (e.g. mutual funds, hedge funds or pension funds). Like management forecasts, analyst forecasts include forecasts about key figures (e.g. revenue), but typically also include industry opinion and stock recommendations. Stock recommendations can be either buy, sell or hold (Hong, Kubik and Solomon, 2000). In general, the purpose of management and analyst forecasts is to adjust market expectations of researchers and investors and to help them calculate enterprise value (Schipper, 1991).

As both management forecasts and analyst forecasts serve the same purpose, this gives rise to the question whether managers or analysts are more accurate. Managers are insiders of the company and have access to private information. Hence, they have an information advantage over analysts and should be able to forecast more accurately (Diamond, 1985; Altschuler, Chen and Zhou, 2015). However, the primary function of analysts is to provide forecasts. Analysts have access to an enormous amount of proprietary information, which managers do not. Analysts participate in daily morning conference calls in which they get updated on the latest macroeconomics news and its implications (Hutton, Lee and Shu, 2012). Furthermore, they have access to reports of prominent economists (Jennings, 1987). These insights into macroeconomic trends give them a clear advantage over managers who do not have access to this proprietary information. Hutton, Lee and Shu (2012) investigate this issue and study whether analyst forecasts or management forecasts are more accurate. They find that in approximately 50% of the cases, analyst forecasts are more accurate and in approximately 50% of the cases, management forecasts are more accurate. They also research under which circumstances both tend to be more accurate. They find that if the forecast is more related to macroeconomic factors (over which managers do not have any control), then analyst forecasts are more accurate. However, if forecasts are more related to unpredictable actions within the company, then management forecasts are more accurate. These findings confirm earlier statements that managers have an information advantage as a result of access to private information of the company and analysts have an information advantage because of their access to proprietary information of macroeconomic news (Hutton, Lee and Shu, 2012).

Hong and Kubik (2003) write an influential study on the characteristics related to the accuracy of analyst forecasts. They focus on career concerns and find that analysts who forecast more accurately are more likely to have a better job (i.e. they work for more prestigious companies and have a higher pay). They also find that, when controlling for accuracy, analysts who issue more optimistic forecasts tend to have more favorable career outcomes. Interestingly, they also find that for forecasts of stocks that are underwritten by the analysts' own brokerage houses, accuracy matters less than issuing optimistic forecasts, indicating a potential conflict of interest.

Clement and Tse (2005) also look at the characteristics of analysts and their forecasting behavior. They classify bold forecasts as "above both the analyst's own prior forecast and the consensus forecast immediately prior to the analyst's forecast, or else below both" (Clement and Tse, 2005). Additionally, they classify herding forecasts as "all other forecasts (i.e., those that move away from the analyst's own prior forecast and toward the consensus)" (Clement and Tse, 2005). They find that bold forecasts are more likely to be issued by analysts who were accurate in the past, analysts who work for large brokerages, analysts who forecast more frequently and analysts with more general (i.e. not company-specific) experience. Moreover, Clement and Tse (2005) find that analysts who follow a large number of industries are less likely to issue bold forecasts. These results confirm earlier research from Hong, Kubik and Solomon (2000) stating that more experienced analysts are more likely to issue bold forecasts. Next, Clement and Tse (2005) find that bold forecasts are more accurate than herding forecasts and that the improvement of accuracy is larger for bold forecasts than for herding forecasts when comparing the original forecasts with the revised forecasts.

Kumar (2010) investigate the role of gender on forecasting abilities. He hypothesizes that in a male-dominated industry, like financial services, only women with above-average skills apply for a job. As such, female analysts represent a special group of women who should have above-average forecasting abilities. Indeed, his findings do show that women issue bolder forecasts than men and that these forecasts are more accurate. This reinforces findings from Clement and Tse (2005) indicating that bold forecasts are more accurate. Furthermore, Kumar (2010) find that the stock market is aware of these gender differences and responds more strongly to female forecast revisions.

Duru and Reeb (2002) research the effects of companies' international diversification on analyst forecasting accuracy. They hypothesize that as companies do more business in foreign countries, the forecasting of their earnings becomes more complex. This would make it more difficult for analysts to make accurate forecasts. Indeed, Duru and Reeb (2002) find that more international diversification results in less accurate forecasts. Moreover, these forecasts are also more optimistic, which corroborates findings from Lim (2001) that indicates that analysts' earnings forecasts are more optimistically biased if companies have less predictable earnings.

There are several studies available related to corporate events and forecasting accuracy. Haw, Jung and Ruland (1994) compare forecasting accuracy of analysts before and after a merger. They find that analyst forecasting accuracy decreases after a merger, but that this reduction is only temporary. Hartnett and Romcke (2015) study initial public offering disclosures in Australia and find that management revenue forecasting errors are smaller than profit forecasting errors, indicating that it might be easier for management to forecast revenue compared to profit.

Hutton and Stocken (2009) examine whether previous management forecasts can affect investor response to new management forecasts. They find a stronger investor response for both announcements of good and bad news for companies that issued more accurate forecasts in the past. This implies that managers can build a certain reputation based on their forecasting accuracy and that a good reputation is beneficial so that investors will respond more strongly to management forecasting announcements.

Ajinkya, Bhojraj, and Sengupta (2005) investigate whether governance controls (i.e. outside directors and institutional ownership) have an effect on management earnings forecasts. Theory suggests that governance controls help protect shareholder interests (Shleifer and Vishny, 1997; Bushman and Smith, 2001). Ajinkya, Bhojraj, and Sengupta (2005) find that companies with more outside directors and institutional ownership issue forecasts more often and that these forecasts are more accurate and less optimistically biased, resulting in greater transparency for shareholders.

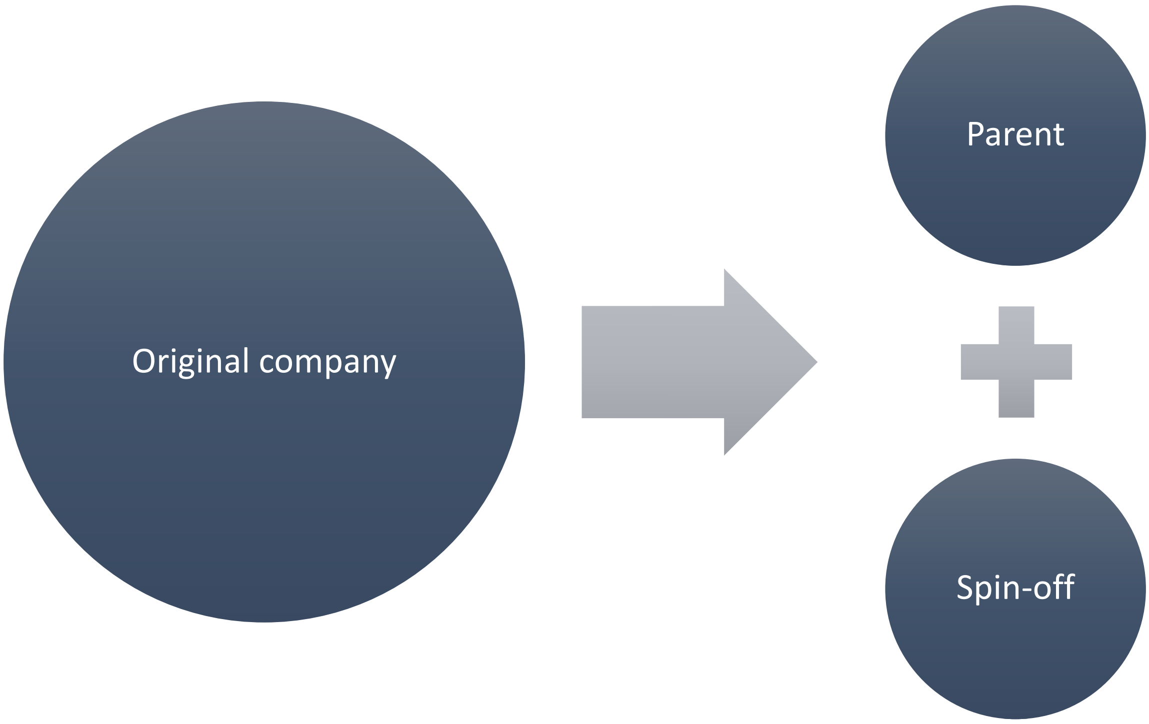
2.2 Spin-offs

In this section I will delve deeper into the literature that is available about spin-offs.

Corporate restructuring is the reorganization of a company's debt, operations or structure in order to make it more profitable and improve its business. Companies can decide to restructure their businesses for many reasons. They may be preparing for a sale, buyout, merger or a change in overall goals. It could be that their products or services are failing or that they are not bringing in enough revenue to pay their monthly obligations. Consequently, companies can decide to sell their assets, reduce their debt or restructure other arrangements (Eckbo and Thorburn, 2013).

One type of corporate restructuring is a spin-off. In a spin-off, a public company separates a part of the company to become a subsidiary. Current shareholders receive a proportion of the subsidiary stock that is equal to their ownership in the parent company. After the spin-off, there are two independent companies: the parent company and the spin-off (see figure 1). Both are publicly traded companies with a unique ticker, different management and board of directors. Shareholders hold an equal proportion of shares in the parent company as they hold in the spin-off. Hence, if after the spin-off the total value of the parent company and the spin-off does not change, then the total value of the shares for each shareholder does not change (Eckbo and Thorburn, 2013).

Figure 1: The spin-off process

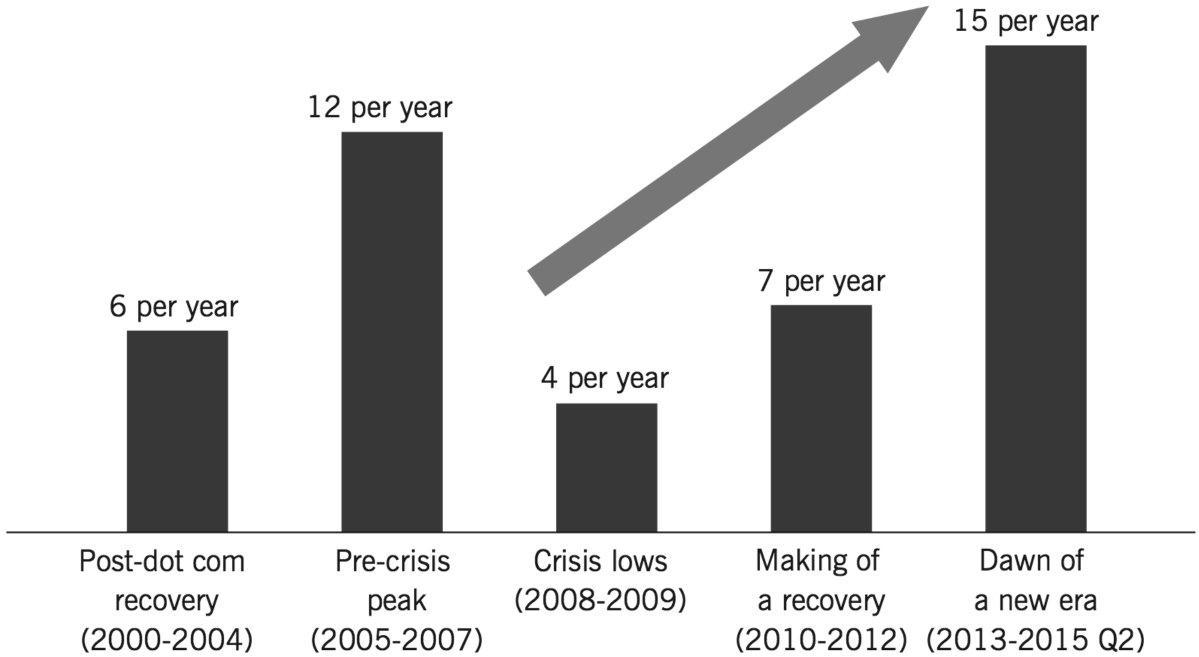


However, in practice, the total value of the parent company and the spin-off does change after the announcement of a spin-off. Eckbo and Thorburn (2013) review 24 studies with a total of 2,957 spin-offs announced between 1962 and 2007. They find a cumulative abnormal return (CAR) ranging from 1.7% to 5.6% and an average (i.e. weighted-average) CAR of 3.3%. These findings indicate that spin-offs do create value and that shareholders are better off after a spin-off has taken place (Eckbo and Thorburn, 2013).

Spin-offs could create value as a result of simplification of a company's structure. As companies separate unnecessary divisions during a spin-off, this allows them to focus better on their core competencies. Studies find stronger positive announcement returns for spin-offs that increase corporate focus (Daley, Mehrotra and Sivakumar, 1997; Desai and Jain, 1999). Another source of value creation related to simplification could be due to the elimination of negative synergies. Allen, Lummer, McConnell and Reed (1995) find evidence that spin-offs offer a way to undo unsuccessful prior acquisitions and may be re-creating value destroyed during a prior acquisition. A spin-off could also increase the probability for a takeover, because the parent company is now a smaller and more focused company. This threat pushes management to work harder in order not to lose control over their company. If the company were to be acquired by another company, shareholders would still be better off compared to before the spin-off as this would lead to an increase in the total value of the two companies combined (Chemmanur and Yan, 2004).

These reasons make spin-offs an attractive option for companies seeking to separate a division. In fact, spin-offs have been more popular lately. A recent article from Zenner, Junek and Chivukula (2015) studies the trends in corporate spin-offs and finds that companies are announcing more spin-offs now than in any year since the turn of this century. The number of spin-offs took a dive during the last financial crisis in 2008 and has been climbing steadily since (see figure 2). They also find that spin-offs are now more likely to be smaller, lower-rated companies, which often include innovative structures in order to maximize shareholder value. Also, they find that the decision to initiate a spin-off is often driven by shareholder activists. Zenner, Junek and Chivukula (2015) find that these trends are led by low interest rates, caused by the quantitative easing programs of the FED and the ECB. Reasons for this is that with low interest rates, companies have easy access to debt. They do not necessarily need to do a spin-off in order to raise cash and reduce debt. Also with low interest rates, investors are looking for more yield, which they tend to find in yield-driven equity (e.g. high dividend stocks) and growth stocks.

Figure 2: Number of separation announcements by S&P 500 companies



Source: Zenner, Junek and Chivukula, 2015

3. Hypothesis development

As companies grow, they become more complex. This could make it more difficult for both managers and analysts to create accurate forecasts. As stated in section 2.1, Duru and Reeb (2002) find that as companies do more business in foreign countries, it becomes more difficult for analysts to issue accurate forecasts.

Following the same logic, I hypothesize that forecasts become more accurate after a spin-off. During a spin-off, companies separate unnecessary divisions, allowing them to focus better on their core competencies. This simplification of the company should make it easier to issue accurate forecasts. As stated in chapter 1, the goal of this thesis is to find an answer to the following research question:

Does simplification of companies lead to more accurate forecasts?

To provide an answer to this question, I will test the following hypothesis:

Hypothesis 1:
H0: Simplification of companies has no effect on management forecasting accuracy.
H1: Simplification of companies has a positive effect on management forecasting accuracy.

As spin-offs make companies less complicated, they seem an appropriate proxy for simplification. I hypothesize that such simplification has a positive effect on management forecasting accuracy, meaning that forecasts become more accurate after a spin-off.

4. Data

To conduct my research, I collect data from various sources. I use a private database that contains the spin-off data, which I received from Shuo Xia. To acquire the forecasts and actuals data, I use the IBES database. I retrieve several control variables from Compustat.

4.1 Spin-off data

The spin-off database is a private database and was received from Shuo Xia. The initial database consists of 299 spin-offs announced during a period from 1994 until 2014 (see table 1).

As I am researching whether spin-offs affect forecasting accuracy, I only focus on the parent companies as these are the ones that change and become less complicated. Most of the parent companies in my database originate from the United States, with only one company from Canada and one company from the United Kingdom. The database provides me with CUSIP, GVKEY and SIC identification codes, announcement dates of the spin-offs and some additional information.

To obtain the forecasts and actuals data, I merge the spin-off database with the IBES database. In order to do that, I have to convert the CUSIP identification codes to IBES identification codes, which give me several complications.

Firstly, some CUSIP identification codes match with multiple IBES identification codes. I solve this by tagging those CUSIP identification codes where this is the case. I find one issue, which I manually look up in the IBES database and find only one correct IBES identification code.

Secondly, there are three date variables (resulting in three different files) in the IBES Guidance – Identifiers database to match the CUSIP identification codes: *Last modification date*, *IBES ticker end date* and *IBES ticker start date*. I use the date variable *Last modification date* and double check with the *IBES ticker end date* and *IBES ticker start date* variables, but find no additional CUSIP – IBES matches.

Thirdly, I manually match some CUSIP identification codes with IBES identification codes. To prevent myself from matching the wrong companies I use the following criteria: either the CUSIP identification codes in both spin-off and IBES database are similar (i.e. they have one or more digits in either one of the databases) or the names have to be identical. I find an additional 21 CUSIP – IBES matches as a result of similar CUSIP identification codes and an additional 3 CUSIP – IBES matches because of identical names.

After converting the CUSIP identification codes to IBES identification codes, I end up with 243 spin-offs out of the original 299 spin-offs. Of those, 212 companies are matched automatically, 28 companies are matched manually as a result of similar CUSIP identification codes and 3 companies are matched manually as a result of identical company names. An overview of the spin-off database after converting the identification codes can be found in table 1.

Table 1: Spin-off database

Year	Frequency		
	Initial database	After conversion identification codes	Final sample
1994	6	3	2
1995	15	10	7
1996	20	11	6
1997	21	11	7
1998	20	14	7
1999	13	10	7
2000	15	14	9
2001	8	8	7
2002	6	6	6
2003	12	11	9
2004	10	9	5
2005	11	9	5
2006	10	8	5
2007	19	17	13
2008	13	10	8
2009	9	8	5
2010	7	7	5
2011	17	17	9
2012	15	15	10
2013	25	21	14
2014	27	24	21
Total	299	243	167

Other complications lead to the removal of additional data. Spin-offs that occur on the same day are assumed to be the same. I also remove data that could interfere with the analysis. In my analysis, I assume that there is a maximum of three years in which the effect of a spin-off is noticeable. Therefore, I try to remove all spin-offs of the same parent company that are within a time frame of 3 years from each other. However, doing this makes it impossible to merge the spin-off database with the IBES database due to duplicate IBES identification codes. I solve this problem by removing all parent companies that have multiple spin-offs. The result is the removal of 10 observations on the same day and the removal of an additional 66 observations because of potential interference. The final spin-off sample is outlined in the last column of table 1.

Note that my sample of spin-offs is quite evenly distributed over the years 1994 until 2014, albeit with a slight overrepresentation of the final years (2013, 2014). Additionally, the final sample includes only companies from the United States.

4.2 Forecasts and actuals data

The IBES (Institutional Brokers Estimates System) database can be found via WRDS (Wharton Research Data Services). It provides me with forecasts and actuals data that are essential for my research (see table 2 for an overview of the IBES database measures).

Table 2: IBES Database Measures

Measure	Abbreviation
Capital Expenditure	CPX
Dividends per Share	DPS
EBITDA per Share	EBS
EBITDA	EBT
Earnings Per Share	EPS
Funds from Operations Per Share	FFO
Fully Reported Earnings Per Share	GPS
Gross Margin	GRM
Net Income	NET
Operating Profit	OPR
Pre-tax Income	PRE
Return on Assets (%)	ROA
Return on Equity (%)	ROE
Sales	SAL

For doing my research, it is critical to know that the IBES database provides me with IBES identification codes only, which is why I have to convert the CUSIP identification codes to IBES identification codes. Furthermore, it provides me with annual, semi-annual and quarterly data and announcement dates of forecasts and actuals, each separated by year.

4.3 Control variables

I retrieve several control variables from Compustat. Since Compustat uses CUSIP9 identification codes, I match the CUSIP9 identification codes from my spin-off database to the Compustat database. This allows me to retrieve several control variables on an annual basis, which I will further elaborate in chapter 5: Methodology.

5. Methodology

5.1 Main analysis

As mentioned earlier, the goal of this research is to find evidence whether simplification of companies leads to more accurate forecasts. In this section I will lay out the specifics of the methodology I use.

Before diving into the formulas being tested, I define forecasting accuracy as the inverse of forecasting error: as forecasting accuracy becomes smaller, forecasting error becomes bigger. Based on several leading studies from Ajinkya, Bhojraj, and Sengupta (2005), Duru and Reeb (2002) and Hong and Kubik (2003), I decide to use the following definition for *Forecasting error*:

$$Forecasting\ error = \frac{|Forecast - Actual|}{|Actual|} \tag{1}$$

In this definition, *Forecast* is the first forecast issued by management for the corresponding year after the publication of the last annual report, but before the end of the year. *Forecast* is either a point or a range forecast. It excludes all other one-sided directional and qualitative forecasts. If the forecast is a point, then the actual value of the forecast is used. If the forecast is a range, then the midpoint of the range is used. The same method is also used in a leading study of Hutton, Lee and Shu (2012). *Actual* refers to the last actual figure issued by management. The reasoning for this is that occasionally figures may still change even after the publication of a company's annual report. By taking the last actual number issued by management, I increase the reliability of my research. Furthermore, by using the absolute difference between *Forecast* and *Actual*, I correct for errors that can arise when the difference between *Forecast* and *Actual* is negative. Finally, by dividing by the absolute number of *Actual*, I make *Forecasting error* a relative measure which is necessary to adjust for extremely big or small *Forecast* or *Actual* numbers.

The proxy I am using for the simplification of companies is a spin-off event. As stated in chapter 3, companies separate unnecessary divisions during a spin-off. This allows them to focus better on their core competencies and could make it easier to issue more accurate forecasts.

As the effect of spin-offs on forecasting accuracy is not previously studied during the time of my research, I have to decide on a time frame when the effect of a spin-off would be noticeable. Clearly there is a tradeoff to be made: time frames too short will result in a sample size too small, time frames too long will result in too much noise in the data.

I decide to test three time frames in my research: Time frame 1 is the longest time frame and includes data from 3 years before the spin-off until 3 years after the spin-off. Time frame 2 contains data from 2 years before the spin-off until 2 years after the spin-off. Time frame 3 is the shortest time frame and includes data from 1 year before the spin-off and 1 year after the spin-off. Note that in all time frames tested, the actual year of the spin-off (year 0) is excluded.

To assess my hypothesis, I will test the following formula first:

$$Forecasting\ error_{i,t} = \beta_0 + \beta_1.Spin\text{-}off_{i,t} + \varepsilon_{i,t} \quad (2)$$

In this formula, *Spin-off* is a dummy variable and becomes 1 when the data is published after the spin-off and equals 0 otherwise. This allows me to compare the data from before the spin-off to after the spin-off. In accordance with my hypothesis, I am expecting *Forecasting error* to decrease after the spin-off. Therefore, I expect the dummy variable *Spin-off* to have a negative coefficient. As mentioned above, I will study three time frames, which should give me reliable insights of the effects on forecasting accuracy before and after the spin-off has taken place.

Next, I will test the following formula:

$$Forecasting\ error_{i,t} = \beta_0 + \beta_1.Spin\text{-}off_{i,t} + \beta_2.Size_{i,t} + \beta_3.MB_{i,t} + \beta_4.Leverage_{i,t} + \beta_5.Loss_{i,t} + \beta_6.Horizon_{i,t} + \beta_7.Analyst\ count_{i,t} + \beta_8.Analyst\ dispersion_{i,t} + \beta_9.Herfindahl\ index_{i,t} + \beta_{10}.Point\ forecast_{i,t} + \beta_{11}.Good\ news_{i,t} + \varepsilon_{i,t} \quad (3)$$

This formula includes control variables similar to studies from Ajinkya, Bhojraj, and Sengupta (2005) and Hutton, Lee and Shu (2012). All control variables are retrieved from Compustat (see section 4.3) and are annual figures matching the corresponding year. *Size* is calculated as the natural logarithm of total assets. Larger companies tend to be more complex, but have generally better information environments, which in turn may affect management's forecasting abilities. *MB* is market to book, which is calculated as market value of equity divided by book value of equity. Companies with high market to book ratios are often regarded as having more growth opportunities than companies with low market to book ratios, which could also affect management's forecasting abilities. *Leverage* is calculated as total assets divided by the book value of equity. Companies with more leverage are usually strictly monitored by their debt holders, which should improve the company's information environment. *Loss* is a dummy variable and equals one if net income is negative and zero otherwise.

It might be more difficult to issue forecasts for companies that have negative earnings (Ajinkya, Bhojraj, and Sengupta, 2005). *Horizon* is the number of days between the day of the forecast and the end of the respective year. As the number of days before the end of the year becomes less, forecasting should become easier; more information is available later during the year and the risks for external shocks becomes lower. *Analyst count* is the natural logarithm of the number of analyst estimates. Following the same method as in formula (1), analyst estimates are counted starting after the publication of the last annual report and ending at the end of the respective year. As *Analyst count* becomes larger, management is under bigger scrutiny and this should improve the company's information environment. *Analyst dispersion* is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Again, the only analyst forecasts used in *Analyst dispersion* are those starting after the publication of the last annual report and ending at the end of the respective year. *Analyst dispersion* reflects how difficult it is for analysts to forecast a company's figures, which could also affect management's forecasting abilities. *Herfindahl index* is a proxy for industry concentration and is calculated as the sum of the market shares squared. Finally, I add control variables to reflect the type of forecasts. *Point forecast* is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. *Good news* is a dummy variable and equals one if the management forecast is greater than the mean of the analyst forecasts.

Five regression models are tested. Regression model 1 tests formula (2) and is a pooled regression with only one independent variable, being the dummy variable *Spin-off*. Regression model 2 tests formula (3) and is a pooled regression similar to model 1, but includes control variables. Regression models 3, 4 and 5 test formula (3) and include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression models 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. If the management error is positive, then management was too optimistic compared to the actual number. If the management error is negative, then management was too pessimistic compared to the actual number. If management makes an error, I expect management to make a larger error if management is optimistic compared to pessimistic. The reasoning for this is as follows: if management is pessimistic, management might not show their true value due to repercussions on the stock market. Additionally, there are increased risks of being fired. This expectation shows me that if management is pessimistic, it will not publish its true value but will mitigate its forecasting value. When management is optimistic, they will show its true forecasting value. Alternatively, management may actually be overconfident and overestimate its forecast, leading to bigger forecasting error (Malmendier and Tate, 2005).

The IBES database provides me with a wide variety of measures (see table 2) and I try to study as many forecasting variables as possible in my research. However, due to a lack in observations, I have to limit my research to the variables Capital Expenditure, Earnings Per Share and Sales.

For my main analysis, I will focus on forecasts of Earnings Per Share and use time frame 2 as my main time frame. I will then use forecasts of Earnings Per Share for different time frames (i.e. time frames 1 and 3) and use forecasts of Sales and Capital Expenditure on my main time frame (time frame 2). Doing so, I can investigate whether my results are similar over different time frames and over different forecasting variables.

Additionally, I performed several robustness tests. As it was not possible to change the independent variable *Spin-off*, I changed the dependent variable *Forecasting error*.

5.2 Robustness tests

My first robustness test studies the effects of spin-offs on analyst forecasting error. Instead of using management forecasts, I use the mean of all analyst forecasts. Similar to the mean of analyst forecasts in the *Analyst dispersion* control variable, I use only forecasts after the publication of the last annual report, but before the end of the respective year. A similar method is also used in a study from Duru and Reeb (2002), in which they use the Analyst Estimate Consensus from the IBES database.

My second robustness test studies different periodicities. Due to a lack of data, I could only extend my research to quarterly data (as opposed to annual data). Note that I only change the dependent variable *Forecasting error* and that my control variables remain annually. Quarterly data is used in a robustness test from Kumar (2010).

My third and last robustness test changes the first forecast issued by management to the last forecast issued by management. Again, I only use forecasts starting after the publication of the last annual report, but before the end of the year. Using the last forecast is similarly done in a study from Clement and Tse (2005).

6. Empirical results

As discussed in section 5.1, my main analysis focuses on forecasts of Earnings Per Share during time frame 2. Before diving into the regression results, I will first look into the descriptive statistics.

6.1 Descriptive statistics

Table 3 provides descriptive statistics of management forecasts for Earnings Per Share (EPS) during time frame 2. The total number of observations (N) is 198. The mean and the median *Forecasting error* is 0.20 and 0.07. This implies that the distribution of the forecasting error is right skewed and that there are some outliers with large forecasting errors (which increases the mean). With a mean of 0.51, the dummy variable *Spin-off* reflects that the sample consists of almost an identical number of observations before and after the spin-off has taken place. Further investigation shows that 97 observations are before the spin-off and 101 observations are after the spin-off has taken place (see Appendix 1). *Size* is calculated as the natural logarithm of total assets and *Analyst count* is the natural logarithm of the number of analyst estimates. Both *Size* and *Analyst count* have means and medians quite close to each other, indicating an approximate normal distribution and implying effectiveness of the usage of logarithms. The mean and median for *Size* are 8.85 and 8.82 and the mean and median for *Analyst count* are 3.92 and 4.03 respectively. The mean and median for *MB (Market to Book)* are 4.54 and 2.41. The mean and median for *Leverage* are 4.40 and 2.61. *Loss* is a dummy variable with a mean of 0.08. Further investigation shows that the sample includes 145 observations where net income is positive and only 12 observations where companies reported a net loss (see Appendix 1). *Horizon* is the number of days between the day of the forecast and the end of the respective financial year. With a mean of 283.39 days and a median of 313.00 days, *Horizon* is fairly long. This is expected, as I am using the first forecast issued by management for the corresponding year after the publication of the last annual report. The mean and the median for *Analyst dispersion* are 0.09 and 0.05 respectively. The mean and the median for *Herfindahl index* are 4217.23 and 4333.80 respectively. Companies with a *Herfindahl index* above 2500 are considered to be operating in highly concentrated markets (Federal Trade Commission, 2010). As such, my sample predominantly includes companies in highly concentrated markets. *Point forecast* is a dummy variable with a mean of 0.20. The sample includes mostly range forecasts (159 observations) and only 39 point forecasts (see Appendix 1). Lastly, the dummy variable *Good news* has a mean of 0.48. The sample consists of 103 observations where the management forecast is greater than the average of the analyst forecasts and 95 observations where the management forecast is smaller than the average of the analyst forecasts (see Appendix 1).

Table 3: Descriptive statistics of management forecasts for EPS:
2 years before until 2 years after spin-off

This table shows descriptive statistics for time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. Forecasting error is the management error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The dummy variable Spin-off is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective financial year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts.

Variable	N	Mean	Standard Deviation	25%	Median	75%
Forecasting error	198	0.20	0.40	0.02	0.07	0.22
Spin-off (0/1)	198	0.51	0.50	0.00	1.00	1.00
Size (log)	157	8.85	1.55	7.71	8.82	10.12
MB	147	4.54	9.36	1.68	2.41	4.12
Leverage	157	4.40	11.06	2.10	2.61	3.85
Loss (0/1)	157	0.08	0.27	0.00	0.00	0.00
Horizon	198	283.39	76.28	250.00	313.00	334.00
Analyst count (log)	198	3.92	0.74	3.58	4.03	4.44
Analyst dispersion	198	0.09	0.12	0.03	0.05	0.10
Herfindahl index	193	4217.23	2404.25	2456.62	4333.80	5530.67
Point forecast (0/1)	198	0.20	0.40	0.00	0.00	0.00
Good news (0/1)	198	0.48	0.50	0.00	0.00	1.00

6.2 Regression results

Table 4a presents regression results of forecasts for Earnings Per Share (EPS) during time frame 2. The dependent variable is the management *Forecasting error* of Earnings Per Share. Initially, regression model (1) shows strong significant results (at a 1% level) for the variable *Spin-off*. However, when adding control variables (model (2)) and firm fixed effects and year fixed effects (model (3)), *Spin-off* becomes insignificant. The same happens to the *Constant*, which is significant at a 1% level in model (1), but becomes insignificant in models (2) and (3). In model (2), *Analyst dispersion* is positive and significant at a 1% level and stays positive and significant at a 1% level in model (3). In model (3), a one unit increase of *Analyst dispersion* would lead to 2.737 increase in *Forecasting error*. The dummy variable *Loss* is positive and significant at a 10% level in both models (2) and (3). In model (3), when companies report a net loss, this would lead to 0.583 larger *Forecasting error* compared to when net income is positive. *Point forecast* is positive and significant at a 10% level in model (2), but becomes insignificant in model (3). In model (3), *MB (Market to Book)* is negative and significant at a 5% level. This implies that if *MB* increases by one unit, then *Forecasting error* decreases by 0.064. *Leverage* is positive and significant at a 5% level. This would mean that a *Leverage* increase of one unit would also increase *Forecasting error* by 0.310. *Herfindahl index* is -0.000 (rounded) and positive at a 1% level, meaning that according to model (3), a larger *Herfindahl index* has almost no effect on *Forecasting error*.

Models (4) and (5) split the sample in order to find evidence if *Forecasting error* is different for the sample when management was optimistic (model (4)) compared to when management was pessimistic (model (5)). Interestingly, model (4) shows no significant results and model (5) shows many significant results. In model (5), the *Constant* is negative and strongly significant at a 1% level. *Spin-off* is positive and significant at a 5% level. This would imply that management forecasts after the spin-off have a 0.077 larger *Forecasting error* than before the spin-off if management is pessimistic. *Size* and *MB* are positive and significant at a 1% level. Surprisingly, *MB* is also significant in model (3) but is negative (instead of positive in model (5)). *Leverage* is negative and significant at a 1% level. In model (3), *Leverage* is also significant, but is positive (instead of negative in model (5)). *Analyst count* is negative and strongly significant at a 1% level. *Analyst dispersion* is positive and significant at a 1% level (same as in models (2) and (3)). *Herfindahl index* is the same as in model (3) and is -0.000 and significant at a 1% level. *Point forecast* and *Good news* are positive and strongly significant at a 1% level.

All results are based on clustered standard errors to correct for heteroscedasticity and serial correlation. There could be some problems with multicollinearity (especially in models (4) and (5)). I have tested variables that are highly correlated (>30%) and found no variables that are individually insignificant, but jointly significant. The corresponding correlation table can be found in Appendix 2. Furthermore, there may be some concerns about having too few degrees of freedom in models (4) and (5) arising from the small sample size and too many parameters being estimated. I find that the year dummies are jointly significant, confirming correct usage of year fixed effects. Therefore, model (3) should give me the most reliable results, which will be my main focus in further analyses.

Table 4a: Regression results of management forecasts for EPS: 2 years before until 2 years after spin-off

This table shows regression results for time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. The dependent variable is the management error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The independent variables consist of the dummy variable Spin-off, which is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.115***	-0.323	0.887	1.018	-0.904***
	(6.89)	(-1.33)	(0.79)	(0.25)	(-3.72)
Spin-off (0/1)	0.171***	0.083	-0.092	-0.386	0.077**
	(3.16)	(1.65)	(-0.50)	(-0.68)	(2.34)
Size (log)		0.010	0.040	-0.132	0.174***
		(0.37)	(0.28)	(-0.37)	(9.24)
MB		0.002	-0.064**	-0.155	0.117***
		(0.95)	(-2.37)	(-0.88)	(7.56)
Leverage		-0.000	0.310**	0.071	-0.032***
		(-0.25)	(2.45)	(0.83)	(-4.01)
Loss (0/1)		0.645*	0.583*	0.354	-0.042
		(1.88)	(1.95)	(0.56)	(-1.61)
Horizon		0.000	0.000	0.002	-0.000
		(1.31)	(0.39)	(1.13)	(-0.28)
Analyst count (log)		0.011	-0.128	0.430	-0.355***
		(0.38)	(-0.88)	(0.91)	(-6.25)
Analyst dispersion		2.439***	2.737***	0.861	0.619***
		(3.27)	(3.15)	(0.58)	(2.80)
Herfindahl index		-0.000	-0.000***	-0.000	-0.000***
		(-0.85)	(-3.42)	(-1.46)	(-4.48)
Point forecast (0/1)		0.069*	0.103	0.384	0.630***
		(1.79)	(1.57)	(1.06)	(8.39)
Good news (0/1)		0.027	0.005	0.138	0.058***
		(0.65)	(0.08)	(0.37)	(3.05)
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0463	0.6019	0.1512	0.0144	0.0687
Number of firms	80	59	59	38	45
Number of observations	198	143	143	67	76

In order to analyze my data further, I will investigate whether the regression results of forecasts for Earnings Per Share are similar during time frames 1 and 3. The descriptive statistics for these additional analyses can be found in Appendix 3(a,b). In general, the descriptive statistics for the additional analyses are approximately the same as for the main analysis.

Table 4b presents regression results of forecasts for Earnings Per Share (EPS) during time frame 1. As stated in section 5.1, time frame 1 is the longest time frame and consists of data starting from three years before the spin-off until three years after the spin-off. Not surprisingly, some variable results seem quite similar compared to time frame 2. The *Constant* in model (1) is positive and significant at a 1% level. *Analyst dispersion* is positive and significant at a 5% level in models (2) and (3) and significant at a 10% level in models (4) and (5). *Herfindahl index* has the same (rounded) coefficient as in time frame 2, but is only significant in model (4). *Loss* is positive and significant at a 10% level in model (3), but is, unlike in time frame 2, insignificant in model (2). The rest of the explanatory variables that are significant in models (1), (2) and (3) of time frame 2 are now insignificant, including the dummy variable *Spin-off* (which is insignificant in all models).

Models (4) and (5) seem quite different compared to time frame 2. In model (4), the *Constant* is positive and significant at a 10% level. *Analyst count* is negative and strongly significant at a 1% level. In model (5), *Loss* is negative and significant at a 5% level. *Good news* is negative and significant at a 5% level.

Overall, the models (1), (2) and (3) show quite similar results compared to time frame 2. Models (4) and (5) show quite different results raising further suspicions of potential problems.

Table 4b: Regression results of management forecasts for EPS: 3 years before until 3 years after spin-off

This table shows regression results for time frame 1, which consists of data starting from three years before the spin-off until three years after the spin-off and excludes the year of the spin-off itself. The dependent variable is the management error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The independent variables consist of the dummy variable Spin-off, which is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.172***	0.124	-0.521	4.684*	-0.051
	(2.91)	(0.41)	(-0.41)	(1.90)	(-0.15)
Spin-off (0/1)	0.356	-0.038	0.381	0.132	0.050
	(1.15)	(-0.45)	(1.65)	(0.74)	(1.03)
Size (log)		0.023	0.206	-0.183	0.007
		(0.48)	(1.17)	(-0.67)	(0.19)
MB		0.002	0.007	0.008	0.002
		(0.94)	(1.14)	(1.02)	(0.47)
Leverage		0.003	-0.003	-0.000	-0.011
		(0.81)	(-0.85)	(-0.06)	(-1.39)
Loss (0/1)		0.547	0.870*	0.193	-0.089**
		(1.44)	(1.81)	(1.30)	(-2.15)
Horizon		0.001	-0.000	0.001	0.000
		(1.41)	(-0.66)	(0.66)	(1.23)
Analyst count (log)		-0.122	-0.166	-0.398***	0.015
		(-1.13)	(-1.17)	(-3.16)	(0.80)
Analyst dispersion		2.506**	2.948**	1.816*	0.671*
		(2.09)	(2.23)	(2.02)	(1.84)
Herfindahl index		-0.000	-0.000	-0.000**	0.000
		(-1.03)	(-1.15)	(-2.56)	(0.89)
Point forecast (0/1)		0.080	0.232	-0.004	0.020
		(1.26)	(1.64)	(-0.02)	(0.92)
Good news (0/1)		0.010	0.041	0.026	-0.050**
		(0.17)	(0.57)	(0.17)	(-2.43)
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0044	0.3635	0.1261	0.1531	0.0005
Number of firms	91	66	66	46	53
Number of observations	290	209	209	91	118

Table 4c presents regression results of forecasts for Earnings Per Share (EPS) during time frame 3. This time frame is the shortest time frame and consists of data starting from one year before the spin-off until one year after the spin-off. Similar to time frame 2, the *Constant* and the dummy variable *Spin-off* are positive and strongly significant at a 1% level in model (1). The *Constant* is also significant at a 10% level in model (3) and the dummy variable *Spin-off* is significant at a 5% level in model (2). Equally similar to time frame 2 is the *Herfindahl index*, which has a coefficient of 0.000 (rounded) and is significant at a 5% level in model (3). *Analyst dispersion* and *Loss* are positive and significant at a 5% level in model (2), but are insignificant in model (3). Other variables are quite different compared to time frame 2. *Size* is negative and strongly significant at a 1% level in model (3) (where it is insignificant in time frame 2). *Leverage* is positive and significant at a 10% level in model (2). *Horizon* and *Analyst count* are positive and strongly significant at a 1% level in model (3).

Results of models (4) and (5) are disregarded as the large T-statistics and omitted explanatory variables indicate problems with multicollinearity due to a small sample size and having too few degrees of freedom.

Overall, these results of Earnings Per Share in time frame 3 are fairly dissimilar compared to time frame 2. This is potentially caused by a lower sample size due to a shorter time frame.

Table 4c: Regression results of management forecasts for EPS: 1 year before until 1 year after spin-off

This table shows regression results for time frame 3, which consists of data starting from one year before the spin-off until one year after the spin-off and excludes the year of the spin-off itself. The dependent variable is the management error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The independent variables consist of the dummy variable Spin-off, which is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.103***	-0.388	4.195*	-7.613***	1.398***
	(7.39)	(-1.25)	(1.94)	(-2.4e+14)	(1.3e+14)
Spin-off (0/1)	0.161***	0.134**	-0.089	0.098***	-0.067***
	(3.12)	(2.48)	(-0.46)	(2.3e+14)	(-1.0e+14)
Size (log)		-0.019	-0.783***	0.909***	0.255***
		(-0.63)	(-3.43)	(2.6e+14)	(2.9e+14)
MB		0.009	0.034	0.072***	-0.078***
		(1.68)	(0.46)	(1.6e+14)	(-1.4e+14)
Leverage		0.018*	-0.021	0.074***	-0.133***
		(1.71)	(-0.16)	(9.2e+13)	(-6.5e+14)
Loss (0/1)		0.308**	-0.048	-0.103***	-0.284***
		(2.55)	(-0.26)	(-1.6e+14)	(-1.9e+14)
Horizon		0.000	0.002***	-0.004***	-0.002***
		(0.96)	(3.59)	(-3.0e+14)	(-3.0e+14)
Analyst count (log)		0.074	0.505***	-0.050***	-0.431***
		(1.65)	(3.72)	(-7.4e+13)	(-8.3e+14)
Analyst dispersion		1.534**	-0.110	4.949***	-4.079***
		(2.59)	(-0.18)	(7.7e+14)	(-9.3e+14)
Herfindahl index		0.000	0.000**	0.000***	-0.000***
		(0.12)	(2.20)	(6.0e+13)	(-2.9e+14)
Point forecast (0/1)		0.055	0.006		
		(0.99)	(0.02)		
Good news (0/1)		0.055	0.081		
		(1.12)	(0.58)		
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0848	0.6274	0.0333	0.1368	0.2712
Number of firms	68	48	48	29	27
Number of observations	106	74	74	38	36

To find more support for my results of management forecasts for Earnings Per Share during time frame 2, I expand my analysis with two more variables: Sales and Capital Expenditure. The descriptive statistics for these additional analyses can be found in Appendix 3(c,d). In general, the descriptive statistics for the additional analyses are approximately the same as for the main analysis.

Table 5 shows regression results of management forecasts for Sales during time frame 2. Similar to the results of Earnings Per Share, the *Constant* and the dummy variable *Spin-off* are positive and strongly significant at a 1% level in model (1). Models (2) and (3) differ to some extent, but there are still some notable similarities. *Analyst dispersion* is positive and strongly significant at a 1% level. *MB (Market to Book)* is negative and significant at a 1% level in model (3) and significant at a 5% level in model (2). *Herfindahl index* has the same coefficient (0.000) as in the results of Earnings Per Share, but is significant at a 5% level in model (2) and insignificant in model (3). The rest of the results in models (2) and (3) differ from those of Earnings Per Share. *Size* is negative and significant at a 5% level in models (2) and (3). *Leverage* and *Analyst count* are positive and significant at a 5% level but only in model (2).

Results of models (4) and (5) are disregarded as the large T-statistics and omitted explanatory variables indicate problems with multicollinearity due to a small sample size and having too few degrees of freedom.

Overall, these results show some similarities compared to the results of Earnings Per Share during time frame 2.

Table 5: Regression results of management forecasts for Sales: 2 years before until 2 years after spin-off

This table shows regression results for time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. The dependent variable is the management error of sales, which is calculated by |forecast - actual| / |actual|. The independent variables consist of the dummy variable Spin-off, which is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.052***	-0.136	1.646*	3.191***	9.055
	(5.66)	(-0.86)	(1.92)	(1.8e+04)	
Spin-off (0/1)	0.154***	0.019	0.014	-0.149***	0.571
	(3.72)	(0.58)	(0.29)	(-1.8e+04)	
Size (log)		-0.066**	-0.205**	-0.469***	-0.871
		(-2.13)	(-2.22)	(-2.5e+04)	
MB		-0.055**	-0.109***	-0.013***	-0.424
		(-2.60)	(-4.71)	(-2455.80)	
Leverage		0.032**	0.064	-0.084***	0.592
		(2.28)	(1.31)	(-2.7e+04)	
Loss (0/1)		0.019	-0.001	0.363***	
		(0.30)	(-0.02)	(7745.64)	
Horizon		-0.000	-0.000	0.001***	0.002
		(-1.58)	(-0.73)	(1.3e+04)	
Analyst count (log)		0.150**	0.021	-0.058***	-0.527
		(2.64)	(0.18)	(-1751.23)	
Analyst dispersion		2.464***	2.912***	3.036***	
		(5.88)	(10.78)	(5.1e+04)	
Herfindahl index		0.000**	0.000	0.000***	
		(2.74)	(1.23)	(3.0e+04)	
Point forecast (0/1)		-0.024	-0.041	-0.240***	
		(-0.51)	(-0.89)	(-1.4e+04)	
Good news (0/1)		0.019	-0.027	0.253***	
		(0.68)	(-1.21)	(6942.65)	
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0881	0.7401	0.1786	0.0260	0.0072
Number of firms	55	23	23	19	15
Number of observations	133	59	59	38	21

Table 6 shows regression results of management forecasts for Capital Expenditure (CAPEX) during time frame 2. Similar to the results of Earnings Per Share, the *Constant* and the dummy variable *Spin-off* are positive and significant in model (1). Models (2) and (3) show some results that are similar to the results of Earnings Per Share. *MB (Market to Book)* and *Leverage* are negative and significant at a 5% level *(MB)* and at a 1% level *(Leverage)* in model (3). I do notice that in this table *Leverage* is negative, but is positive in the results of Earnings Per Share model (3). *Loss* is positive and significant at a 1% level in model (3) and significant at a 10% level in model (2). The *Herfindahl index* is again the same coefficient (-0.000) as in the results of Earnings Per Share and is strongly significant at a 1% level in model (3). The rest of the results differ from those of Earnings Per Share. *Horizon* is negative and significant at a 10% level in model (3). *Analyst count* is negative and strongly significant at a 1% level in model (3). *Point forecast* is positive and strongly significant at a 1% level. *Good news* is positive and significant at a 5% level in model (3).

Again, results of models (4) and (5) are disregarded as the large T-statistics and omitted explanatory variables indicate problems with multicollinearity due to a small sample size and having too few degrees of freedom.

Overall, these results show some similarities compared to the results of Earnings Per Share during time frame 2.

There are some similarities when comparing the regression results of Earnings Per Share during time frame 2 to the other time frames and variables. Firstly, the *Constant* and the dummy variable *Spin-off* are positive and significant in model (1) regarding most of the results. When adding control variables, firm fixed effects and year fixed effects, their significance typically disappears. Secondly, some of the control variables in models (2) and (3) show similarities across the different time frames and variables. *Analyst dispersion* is often positive and significant. The coefficient of the *Herfindahl index* is always 0.000 (rounded) and is either significant or insignificant. Other control variables show some weaker similarities. *MB (Market to Book)* is negative and significant in model (3) in results of all variables but only for time frame 2. *Loss* is often positive and significant, but occasionally only at a 10% level. Furthermore, it is difficult to draw any inferences from models (4) and (5) as these models often had problems due to a low sample size and insufficient degrees of freedom.

Table 6: Regression results of management forecasts for CAPEX: 2 years before until 2 years after spin-off

This table shows regression results for time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. The dependent variable is the management error of capital expenditure (CAPEX), which is calculated by |forecast - actual| / |actual|. The independent variables consist of the dummy variable Spin-off, which is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.187***	0.792	0.470	-31.676	2.249***
	(5.11)	(1.69)	(0.15)		(2.5e+14)
Spin-off (0/1)	0.116**	0.131	0.483	1.820	0.204***
	(2.04)	(1.49)	(1.06)		(4.7e+14)
Size (log)		-0.045	0.587	4.535	-0.246***
		(-1.03)	(1.54)		(-2.7e+14)
MB		-0.015	-0.252**	-1.265	-0.040***
		(-0.74)	(-2.25)		(-1.6e+14)
Leverage		0.020	-0.337***	-0.368	
		(0.54)	(-6.24)		
Loss (0/1)		0.253*	0.670***	0.170	
		(1.80)	(7.00)		
Horizon		-0.002	-0.001*	-0.000	
		(-1.24)	(-1.78)		
Analyst count (log)		0.057	-0.813***	-0.119	
		(0.82)	(-3.27)		
Analyst dispersion		0.183	-0.217	-10.329	
		(0.73)	(-0.26)		
Herfindahl index		-0.000	-0.000***	-0.000	
		(-0.78)	(-3.84)		
Point forecast (0/1)		0.113	0.904***	-1.206	
		(1.26)	(5.54)		
Good news (0/1)		-0.015	0.437**		
		(-0.13)	(2.74)		
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0323	0.2570	0.0001	0.0011	0.2090
Number of firms	53	26	26	21	13
Number of observations	126	47	47	31	16

6.3 Robustness tests

To study whether my results hold under different assumptions, I perform several robustness tests. Firstly, I will study the effects of spin-offs on analyst forecasting error. Instead of using management forecasts, I will use the mean of all analyst forecasts. Secondly, I will study different periodicities. Due to a lack of data I will focus mainly on quarterly data (as opposed to annual data in the main analysis). Thirdly, I will use the first forecast issued by management instead of the last forecast in the main analysis.

Table 7 presents the regression results of the first robustness test, which replaces management forecasts with the mean of all analyst forecasts. It appears that the results are very consistent with the main results of Earnings Per Share during time frame 2. Both the *Constant* and the dummy variable *Spin-off* are positive and strongly significant at a 1% level in model (1) and become insignificant in models (2) and (3). *Loss*, *Analyst dispersion*, and *Point forecast* are positive and significant in model (2). In model (3), *Leverage*, *Loss* and *Analyst dispersion* are positive and significant and *MB* and *Herfindahl index* are negative and significant. Model (4) shows some significant results where the results in the main analysis did not show any significant results. *Horizon* and *Analyst count* are positive and significant and *Herfindahl index* is negative and significant. Model (5) shows exactly the same signs and significant results as in the main analysis. However, there are again some concerns about having too few degrees of freedom in models (4) and (5) arising from the small sample size and too many parameters being estimated.

Overall, the results of the first robustness test are consistent with the results of the main analysis.

Table 7: Regression results of robustness test 1 for EPS: 2 years before until 2 years after spin-off

This table shows regression results for robustness test 1 during time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. The dependent variable differs from the main analysis and is the analyst error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The independent variables are the same as in the main analysis and consist of the variables Spin-off, Size, MB (market to book), Leverage, Loss, Horizon, Analyst count, Analyst dispersion, Herfindahl index, Point forecast and Good news. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Analyst error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.067***	-0.007	0.453	0.801	-0.764***
	(6.20)	(-0.05)	(0.77)	(0.51)	(-4.74)
Spin-off (0/1)	0.096***	0.039	-0.069	-0.228	0.095***
	(3.27)	(1.64)	(-0.69)	(-1.09)	(4.38)
Size (log)		-0.012	0.048	-0.099	0.123***
		(-0.69)	(0.67)	(-0.71)	(12.37)
MB		0.002	-0.034*	-0.105	0.043***
		(1.29)	(-1.89)	(-1.58)	(6.01)
Leverage		-0.000	0.017**	0.049	-0.017***
		(-0.15)	(2.01)	(1.51)	(-5.15)
Loss (0/1)		0.395**	0.298*	-0.063	-0.018
		(2.12)	(1.88)	(-0.26)	(-1.21)
Horizon		0.000	0.000	0.001*	-0.000
		(0.15)	(-0.01)	(1.77)	(-0.94)
Analyst count (log)		0.022	-0.098	0.310*	-0.195***
		(0.89)	(-1.26)	(1.79)	(-5.97)
Analyst dispersion		1.100***	1.254***	0.009	0.836***
		(2.94)	(3.54)	(0.02)	(7.96)
Herfindahl index		0.000	-0.000***	-0.000**	-0.000**
		(-0.36)	(-4.43)	(-2.65)	(-2.44)
Point forecast (0/1)		0.067*	0.060	0.207	0.395***
		(1.74)	(1.49)	(1.52)	(10.04)
Good news (0/1)		-0.007	-0.016	0.154	0.126***
		(-0.30)	(-0.48)	(1.12)	(10.39)
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0506	0.5456	0.0740	0.0032	0.0245
Number of firms	80	59	59	38	45
Number of observations	198	143	143	67	76

Table 8 shows regression results of the second robustness test, which is based on quarterly data instead of annual data. The results of this robustness test differ significantly from those in the main analysis. Model (3), the most important model, shows only insignificant results. The *Constant* is positive and strongly significant in model (1) and becomes insignificant in models (2) and (3). Inconsistent with results from the main analysis, in model (2) *Point forecast* is negative (where it is positive in the main analysis) and significant. Moreover, *MB* is also negative in model (2) and significant (where it is insignificant in the main analysis). Models (4) and (5) show some very large coefficients and many significant variables, raising concerns about having too few degrees of freedom in models (4) and (5) arising from the small sample size and too many parameters being estimated.

Overall, the results of the second robustness test are inconsistent with the results of the main analysis.

Table 8: Regression results of robustness test 2 for EPS: 2 years before until 2 years after spin-off

This table shows regression results for robustness test 2 during time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. The dependent variable differs from the main analysis and is the management error of earnings per share (EPS) based on quarterly figures and is calculated by |forecast - actual| / |actual|. The independent variables are the same as in the main analysis and consist of the variables Spin-off, Size, MB (market to book), Leverage, Loss, Horizon, Analyst count, Analyst dispersion, Herfindahl index, Point forecast and Good news. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.127***	0.380	4.547	356.957***	1.074
	(5.66)	(1.42)	(1.05)	(11.32)	(1.37)
Spin-off (0/1)	0.042	0.024	-0.109	-29.322***	0.169***
	(0.96)	(0.47)	(-0.44)	(-11.82)	(4.13)
Size (log)		-0.041	-0.683	-17.747***	-0.204**
		(-1.15)	(-1.25)	(-12.61)	(-2.15)
MB		-0.003*	-0.055	10.746***	0.003
		(-1.83)	(-0.88)	(13.97)	(0.19)
Leverage		0.001	0.031	-4.801***	-0.004
		(1.28)	(0.90)	(-14.18)	(-0.57)
Loss (0/1)		0.117	-0.022	-3.755***	0.184***
		(1.41)	(-0.14)	(-3.41)	(2.82)
Horizon		-0.000	0.002	0.016***	0.002**
		(-0.25)	(0.54)	(12.90)	(2.18)
Analyst count (log)		0.043	0.057	-48.325***	-0.029
		(0.78)	(0.40)	(-10.80)	(-0.77)
Analyst dispersion		-0.005	0.129	25.523***	-0.200***
		(-0.07)	(1.17)	(9.95)	(-2.72)
Herfindahl index		-0.000	0.000	-0.006***	0.000***
		(-0.63)	(1.52)	(-10.37)	(5.23)
Point forecast (0/1)		-0.161**	-0.638	-2.451***	-0.026***
		(-2.05)	(-0.95)	(-61.99)	(-5.03)
Good news (0/1)		0.261	0.124	64.070***	0.136***
		(1.21)	(0.44)	(9.77)	(12.66)
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0048	0.1248	0.0539	0.0187	0.0509
Number of firms	63	49	49	30	42
Number of observations	279	182	182	54	128

Table 9 shows regression results of the third robustness test, which is based on the first forecast issued by management instead of the last forecast in the main analysis. The results show some similarities compared to the results of the main analysis. The *Constant* and the dummy variable *Spin-off* are positive and significant in model (1) and become insignificant in models (2) and (3). Furthermore, *MB (Market to Book)* has a negative coefficient and *Leverage* has a positive coefficient. Both variables are significant at a 1% level. *Loss* is positive and significant at a 10% level in model (2), but is insignificant in model (3). All other variables that are significant in the main analysis are insignificant in this robustness test. Also inconsistent with the main result is *Horizon*, which has a coefficient of 0.000 and is significant at 5% level. Models (4) and (5) show some very large T-statistics and many significant variables, raising concerns about having too few degrees of freedom in models (4) and (5) arising from the small sample size and too many parameters being estimated.

Overall, the results of the third robustness test are fairly consistent with the results of the main analysis.

Table 9: Regression results of robustness test 3 for EPS: 2 years before until 2 years after spin-off

This table shows regression results for robustness test 3 during time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. The dependent variable differs from the main analysis and is the management error of earnings per share (EPS) based on the last forecast during the respective fiscal year and is calculated by |forecast - actual| / |actual|. The independent variables are the same as in the main analysis and consist of the variables Spin-off, Size, MB (market to book), Leverage, Loss, Horizon, Analyst count, Analyst dispersion, Herfindahl index, Point forecast and Good news. Five regression models are tested. Regression model 1 is a pooled regression with only one independent variable, the dummy variable Spin-off. Regression model 2 is a pooled regression similar to model 1 but includes control variables. Regression model 3, 4 and 5 include firm fixed effects and year fixed effects. Regression model 3 uses the whole sample, whereas regression model 4 and 5 split the sample: model 4 uses data if the management error is positive and model 5 uses data if the management error is negative. The *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels. T-statistics are shown in parentheses below the estimated coefficients and are based on clustered standard errors.

	Management error				
Independent variable	(1)	(2)	(3)	(4)	(5)
Constant	0.058***	0.058	0.005	-1.145***	0.260
	(3.83)	(0.53)	(0.01)	(-5789.73)	(1.13)
Spin-off (0/1)	0.055*	0.018	0.108	0.145***	0.020
	(1.86)	(0.85)	(1.60)	(1.2e+04)	(0.49)
Size (log)		-0.019	0.036	0.108***	-0.002
		(-1.64)	(0.48)	(3475.44)	(-0.08)
MB		0.002	-0.039***	-0.125***	-0.022***
		(1.14)	(-3.33)	(-1.6e+04)	(-3.95)
Leverage		-0.001	0.018***	0.055***	-0.012
		(-1.10)	(3.22)	(1.5e+04)	(-1.60)
Loss (0/1)		0.135*	0.010	0.210***	-0.039
		(1.82)	(0.26)	(1.3e+04)	(-1.40)
Horizon		0.000**	0.000	0.002***	-0.000**
		(2.38)	(0.10)	(1.5e+04)	(-2.20)
Analyst count (log)		0.022	0.024	0.204***	0.025
		(0.96)	(0.99)	(1.7e+04)	(0.79)
Analyst dispersion		0.004	0.243	0.676***	-0.117
		(0.03)	(1.58)	(9267.25)	(-1.09)
Herfindahl index		0.000	-0.000	-0.000***	0.000
		(0.98)	(-0.35)	(-5156.41)	(-0.53)
Point forecast (0/1)		0.041	0.069	0.272***	0.004
		(1.10)	(1.36)	(7116.55)	(0.17)
Good news (0/1)		0.029	0.018	0.045***	-0.058***
		(1.24)	(0.96)	(1.0e+04)	(-2.77)
Firm fixed effects	No	No	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes	Yes
R2	0.0209	0.2041	0.0143	0.0155	0.0080
Number of firms	80	59	59	34	47
Number of observations	198	143	143	49	94

7. Implications

Overall, most of the results show that the dummy variable *Spin-off* is positive and significant in model (1). However, when adding control variables, firm fixed effects and year fixed effects, its significance typically disappears. Therefore, contrary to my expectations, I find no evidence that forecasts become more accurate after a spin-off and I cannot reject the null hypothesis:

H0: Simplification of companies has no effect on management forecasting accuracy.

Therefore, I find no evidence to confirm my research question that simplification of companies leads to more accurate forecasts.

However, I do find some consistencies in the control variables. *Analyst dispersion* is often positive and significant. As stated in section 5.1, *Analyst dispersion* is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. This implies that, as it becomes more difficult for analysts to issue more accurate forecasts (i.e. their forecasts become more dispersed), it also becomes more difficult for management to issue more accurate forecasts. Also, the coefficient of the *Herfindahl index* was always 0.000 (rounded) and either significant or insignificant. As the *Herfindahl index* is a proxy for industry concentration, this implies that industry concentration has no (or a minimum) effect on forecasting accuracy. Other control variables show some weaker similarities. *MB (Market to Book)* is negative and significant in some of the results, implying that managers of companies with more growth opportunities also have better forecasting accuracy. *Loss* is often positive and significant, but occasionally only at a 10% level. This implies that managers of companies with a negative net income have more difficulties in issuing accurate forecasts.

Furthermore, it is not possible to draw any inferences from models (4) and (5) as these models often have problems due to a low sample size and insufficient degrees of freedom. For that reason, I find insufficient evidence that management forecasting accuracy differs depending on whether management was either optimistic or pessimistic.

8. Limitations

In this section I will discuss some of the limitations of my research and potential improvements.

First and foremost, there are some concerns about the small sample size. This leads to problems in models (4) and (5) specifically. A bigger sample size would have been preferred, consisting of a larger sample of spin-offs. As stated in section 4.1, I remove all parent companies that have multiple spin-offs, which results in the removal of 66 observations due to potential interference. If there were a better solution to this problem, this would have resulted in a significantly larger sample size. Furthermore, with more observations, I could expand my research to many more variables and not limit myself to only Earnings Per Share, Sales and Capital Expenditure. As stated in section 4.1, the IBES database provides me with 11 additional measures (see table 2).

Secondly, there are two variables that show some weakness in my research. In the main sample, the variable *Loss* consists of 145 observations where net income is positive and only 12 observations where companies report a net loss (see Appendix 1). This raises questions whether the results with respect to the variable *Loss* are sufficiently reliable. Furthermore, the mean and the median for *Herfindahl index* are 4217.23 and 4333.80 respectively. As stated in section 6.1, companies with a *Herfindahl index* above 2500 are considered to be operating in highly concentrated markets (Federal Trade Commission, 2010). Therefore, my sample could be biased as it mainly consists of parent companies in highly concentrated markets.

Thirdly, my sample only consists of companies from the United States. In future research, the analyses could be extended to other countries. There might be a case that management forecasting accuracy does improve after a spin-off for companies operating in emerging markets. In emerging markets the general information environment within companies could be not as well developed as in the United States. Therefore, there could be an improvement of the information environment leading to better forecasting accuracy after a spin-off has taken place.

Lastly, it could be that the models that I use are not correctly specified. Even though I used as many control variables as possible and follow the intuition of leading prior studies, there is still a possibility that the models are not correctly specified and that there is omitted variable bias. There is no way for me to truly test for endogenous variables, although I perform a Hausman test, which recommends me to use a fixed effects estimator (as I did in models (3), (4) and (5)).

9. Conclusion

In this thesis, I analyze whether forecasts become more accurate after simplification of companies. I use spin-offs as a proxy for simplification due to the fact that companies separate unnecessary divisions during a spin-off, making their business less complicated. This simplification should make it easier to issue accurate forecasts.

The goal of this thesis is to find an answer to the following research question:

Does simplification of companies lead to more accurate forecasts?

Using several analyses, I test the following hypothesis:

Hypothesis 1:
H0: Simplification of companies has no effect on management forecasting accuracy.
H1: Simplification of companies has a positive effect on management forecasting accuracy.

Unfortunately, I find no evidence that forecasts become more accurate after a spin-off and thus I cannot reject the null hypothesis. Furthermore, I find no evidence to confirm my research question that simplification of companies leads to more accurate forecasts. This implies that investors and researchers should not depend more on management forecasts after a spin-off when calculating enterprise value.

There are some alternative explanations that could be consistent with the findings of my research. There could be other confounding factors that play a critical role in forecasting accuracy after a spin-off. For example, it could be that management is often replaced after a spin-off, making comparisons before and after a spin-off impossible. It could also be that companies separating one division are often creating another division shortly after, effectively not simplifying the company. To further investigate these alternative explanations, additional research is necessary.

There are also some limitations to my research. Firstly, there are some concerns about using a too small sample size. This led to problems in models (4) and (5) specifically. Secondly, there are two variables that show some weakness in my research: *Loss* and *Herfindahl index*. Thirdly, my sample only consists of companies from the United States. Lastly, it could be that the models that I used were not correctly specified.

This thesis contributes to existing research for several reasons. To the best of my knowledge, this is the first study to investigate the effects of spin-offs on forecasting accuracy. Also, I research multiple variables (Earnings Per Share, Sales and Capital Expenditure), whereas most research only focuses on forecasts of Earnings Per Share. Furthermore, as stated above, other confounding factors could play a role in forecasting accuracy after a spin-off. Knowing this could help future research.

In future research a larger sample size should be used. Also, other variables besides Earnings Per Share, Sales and Capital Expenditure can be investigated. Furthermore, spin-offs from other countries can be researched to get a bigger picture of potential causality between spin-offs and forecasting accuracy.

Moreover, there are many interesting questions that could be examined in future research. As stated in section 2.2, spin-offs are just one form of corporate restructurings. Do other forms of corporate restructurings lead to more accurate forecasts? Also, it could be interesting to investigate whether other proxies for simplification can be used. Are there other proxies available to measure the complexity of companies? In future research, these questions could be answered.

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11. Appendices

Appendix 1: Dummy variable frequencies

	Frequency	
Variable	0	1
Spin-off (0/1)	97	101
Loss (0/1)	145	12
Point forecast (0/1)	159	39
Good news (0/1)	103	95

Appendix 2: Correlation table

	Spin-off (0/1)	Size (log)	MB	Leverage	Loss (0/1)	Horizon	Analyst count (log)	Analyst dispersion	Herfindahl index	Point forecast (0/1)	Good news (0/1)
Spin-off (0/1)	1.000										
Size (log)	-0.053	1.000									
MB	0.172	-0.066	1.000								
Leverage	0.090	0.028	0.674	1.000							
Loss (0/1)	0.039	-0.246	-0.079	-0.054	1.000						
Horizon	-0.024	0.202	-0.031	0.015	0.087	1.000					
Analyst count (log)	-0.059	0.582	-0.048	0.023	-0.006	0.148	1.000				
Analyst dispersion	0.195	-0.217	-0.000	0.044	0.172	0.033	-0.069	1.000			
Herfindahl index	-0.061	-0.131	0.033	-0.004	0.040	0.133	-0.063	0.032	1.000		
Point forecast (0/1)	0.028	0.088	-0.024	-0.040	0.033	-0.223	-0.019	0.025	-0.056	1.000	
Good news (0/1)	0.031	-0.023	0.040	0.053	0.201	0.132	-0.017	0.238	0.018	-0.094	1.000

Appendix 3a: Descriptive statistics of management forecasts for EPS:
3 years before until 3 years after spin-off

This table shows descriptive statistics for time frame 1, which consists of data starting from three years before the spin-off until three years after the spin-off and excludes the year of the spin-off itself. Forecasting error is the management error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The dummy variable Spin-off is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective financial year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts.

Variable	N	Mean	Standard Deviation	25%	Median	75%
Forecasting error	290	0.36	2.69	0.02	0.07	0.19
Spin-off (0/1)	290	0.52	0.50	0.00	1.00	1.00
Size (log)	230	8.84	1.50	7.82	8.77	10.06
MB	216	4.52	9.65	1.68	2.47	4.08
Leverage	230	4.03	9.50	2.11	2.57	3.73
Loss (0/1)	230	0.10	0.29	0.00	0.00	0.00
Horizon	290	278.05	84.56	249.00	313.50	334.00
Analyst count (log)	290	3.87	0.79	3.47	4.03	4.44
Analyst dispersion	290	0.09	0.13	0.03	0.05	0.10
Herfindahl index	282	4162.72	2375.21	2399.21	4114.13	5293.56
Point forecast (0/1)	290	0.19	0.40	0.00	0.00	0.00
Good news (0/1)	290	0.45	0.50	0.00	0.00	1.00

Appendix 3b: Descriptive statistics of management forecasts for EPS: 1 year before until 1 year after spin-off

This table shows descriptive statistics for time frame 3, which consists of data starting from one year before the spin-off until one year after the spin-off and excludes the year of the spin-off itself. Forecasting error is the management error of earnings per share (EPS), which is calculated by |forecast - actual| / |actual|. The dummy variable Spin-off is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective financial year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts.

Variable	N	Mean	Standard Deviation	25%	Median	75%
Forecasting error	106	0.18	0.28	0.02	0.08	0.23
Spin-off (0/1)	106	0.51	0.50	0.00	1.00	1.00
Size (log)	83	8.86	1.57	7.70	8.82	10.13
MB	76	3.49	4.28	1.62	2.42	3.56
Leverage	83	3.28	2.42	2.04	2.54	3.50
Loss (0/1)	83	0.08	0.28	0.00	0.00	0.00
Horizon	106	286.69	78.10	253.00	312.00	335.00
Analyst count (log)	106	3.91	0.73	3.58	4.01	4.42
Analyst dispersion	106	0.09	0.13	0.03	0.05	0.11
Herfindahl index	104	4128.21	2367.78	2357.45	4457.83	5600.81
Point forecast (0/1)	106	0.23	0.42	0.00	0.00	0.00
Good news (0/1)	106	0.50	0.50	0.00	0.50	1.00

Appendix 3c: Descriptive statistics of management forecasts for Sales:
2 years before until 2 years after spin-off

This table shows descriptive statistics for time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. Forecasting error is the management error of sales, which is calculated by |forecast - actual| / |actual|. The dummy variable Spin-off is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective financial year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts.

Variable	N	Mean	Standard Deviation	25%	Median	75%
Forecasting error	133	0.14	0.26	0.02	0.04	0.10
Spin-off (0/1)	133	0.55	0.50	0.00	1.00	1.00
Size (log)	107	8.45	1.56	7.59	8.49	9.51
MB	105	2.64	1.50	1.73	2.32	3.01
Leverage	107	3.44	4.35	1.89	2.36	3.44
Loss (0/1)	107	0.17	0.38	0.00	0.00	0.00
Horizon	133	272.04	89.49	243.00	309.00	328.00
Analyst count (log)	80	3.99	0.91	3.64	4.22	4.55
Analyst dispersion	80	0.06	0.10	0.01	0.02	0.05
Herfindahl index	122	5087.33	2153.85	3670.65	4842.10	6073.92
Point forecast (0/1)	133	0.28	0.45	0.00	0.00	1.00
Good news (0/1)	133	0.36	0.48	0.00	0.00	1.00

Appendix 3d: Descriptive statistics of management forecasts for CAPEX:
2 years before until 2 years after spin-off

This table shows descriptive statistics for time frame 2, which consists of data starting from two years before the spin-off until two years after the spin-off and excludes the year of the spin-off itself. Forecasting error is the management error of capital expenditure (CAPEX), which is calculated by |forecast - actual| / |actual|. The dummy variable Spin-off is one after the spin-off and zero otherwise. Size is calculated as the natural logarithm of total assets. MB is market to book, which is calculated as market value of equity divided by book value of equity. Leverage is calculated as total assets divided by the book value of equity. Loss is a dummy variable and equals one if net income is negative and zero otherwise. Horizon is the number of days between the day of the forecast and the end of the respective financial year. Analyst count is the natural logarithm of the number of analyst estimates. Analyst dispersion is the standard deviation of the analyst forecasts scaled by the mean of the analyst forecasts. Herfindahl index is a proxy for industry concentration and is calculated as the sum of the market shares squared. Point forecast is a dummy variable and equals one if the management forecast is a point forecast and zero if the forecast is a range forecast. Good news is a dummy variable and equals one if the management forecast is greater than the average of the analyst forecasts.

Variable	N	Mean	Standard Deviation	25%	Median	75%
Forecasting error	126	0.25	0.32	0.07	0.16	0.28
Spin-off (0/1)	126	0.52	0.50	0.00	1.00	1.00
Size (log)	109	8.59	1.62	7.50	8.43	9.76
MB	107	2.75	2.17	1.53	2.03	3.16
Leverage	109	3.83	4.65	1.98	2.45	3.73
Loss (0/1)	109	0.14	0.35	0.00	0.00	0.00
Horizon	126	278.79	78.44	245.00	309.00	330.00
Analyst count (log)	59	2.56	0.90	1.95	2.71	3.33
Analyst dispersion	58	0.20	0.22	0.08	0.13	0.25
Herfindahl index	116	4578.33	2482.48	2771.79	4140.13	5940.41
Point forecast (0/1)	126	0.60	0.49	0.00	1.00	1.00
Good news (0/1)	126	0.33	0.47	0.00	0.00	1.00