ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis Financial Accounting

The effect of the COVID-19 crisis on goodwill impairments in the U.S.

Abstract

In this study, I examine the effect of the COVID-19 crisis on reported goodwill impairments in the U.S. by applying ordinary least squares regression to two samples of observations from listed U.S. firms during 2019 and 2020. The first sample consists of 860 firm-year observations, with the reported goodwill impairments as the dependent variable. Due to limited data availability, I analyze a second sample of 8,473 firm-year observations. In this sample, the dependent variable is the change in the book value of goodwill, which is a proxy for goodwill impairments. Ultimately, results from the regressions do not depict a significant effect of the crisis on goodwill impairments. This study shows that even though the COVID-19 pandemic led to a crisis, it did not necessarily affect goodwill impairments immediately. However, I argue that the effect of the COVID-19 crisis on goodwill might be delayed by several years.

Keywords: goodwill impairment, COVID-19, economic crisis, U.S, ordinary least squares regression.

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1. Introduction

In December 2019, the first cases of a then unknown virus were reported in Wuhan, China (WHO, 2020b). Not even a month later, on January 23, 2020, the city of Wuhan and other cities in the province of Hubei went into lockdown, restricting the movement of millions of people to prevent the spread of the virus (BBC News, 2020). In the weeks and months after, the so-called SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) and the disease it caused (COVID-19) spread across the world (Coronaviridae Study Group, 2020). On March 11, 2020, the World Health Organization (WHO) declared the spread of the coronavirus to be a pandemic, mentioning that this is likely to have significant economic consequences (WHO, 2020a).

What followed was a year of restrictions, lockdowns and mandatory quarantines. During the beginning of the pandemic, the International Monetary Fund (2020) projected a global GDP contraction of 3% in 2020. Because firms all around the world are increasingly integrated, this crisis was predicted to affect many firms (Barua, 2020; Fernandes, 2020).

One of the balance sheet items that is heavily affected by external circumstances is goodwill, which is an intangible asset that represents expected future economic benefits that arise from the synergy effects in a business combination. The value of goodwill must be evaluated annually, or more often when certain triggering events happen that might lower the value of goodwill. One of these indicators of a possible impairment in goodwill is a significant adverse change in the business climate (FASB, 2001).

In this thesis, I examine the possible effects of the COVID-19 crisis on goodwill impairments by concentrating on the following research question:

What is the relationship between the COVID-19 crisis and reported goodwill impairments in listed U.S. companies?

Prior research on the determinants of goodwill impairments concludes that a crisis, measured by GDP growth, is one of the determinants in goodwill impairments (Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). Besides, studies show that firm-level economic indicators like market-to-book ratio of equity, return on assets, change in cash flows, pre-impairment losses and firm size explain reported impairments. Because of the discretionary nature of goodwill accounting, requiring managers to use their expertise can lead to opportunistic behavior, which can affect goodwill impairments. Thus, besides economic characteristics, some other indicators explain goodwill impairments. Prior results also depict that acquisition characteristics affect goodwill impairments. Lastly, many studies find that when corporate governance is stronger, opportunistic behavior through goodwill impairment accounting is limited.

Based on this prior literature, I hypothesize that during 2020, the COVID-19 pandemic and subsequent crisis had an effect on the reported amount of goodwill impairments.

To test this hypothesis, I analyze two ordinary least squares (OLS) regressions in two different samples. Both samples consist of observations from U.S. listed firms during 2019 and 2020, taken from the Compustat North America database from Wharton Research Data Services (WRDS). The first initial sample contains 860 firm-year observations from 714 unique firms. The dependent variable in this model is the reported goodwill impairment divided by the total assets of the previous year. The advantage of this dependent variable is that it precisely describes the actual goodwill impairments, which I am interested in during this research. The main disadvantage is the limited data availability for this variable, possibly making the size of the sample too small to accurately represent the population of U.S. listed firms. Because of this, I examine another sample from the same database, consisting of 8,473 firm-year observations from 4,539 unique firms. For this second model, the dependent variable is the change in book value of goodwill divided by total assets of the previous year, which proxies for goodwill impairments. The main advantage of using this dependent variable is the higher data availability, which increases the chance that the sample reflects the population of U.S. listed firms. A drawback is that the change in book value of goodwill does not solely consist of goodwill impairments, but also of increases and decreases of goodwill as a result of business acquisitions and sales of businesses. Therefore, it could potentially be a less than ideal proxy for goodwill impairments.

Overall, the results of this study indicate that the effect of the COVID-19 crisis on the amount of reported goodwill impairments is not (economically) significant. In both OLS regressions applied to the two samples, the crisis is the variable of interest. The results of the first regression depict that the effect of the crisis on goodwill impairments is not statistically significant. In the second sample, I find the effect of the crisis on goodwill losses to be statistically significant. However, because the absolute effect is small, I cannot conclude that this has any real economic significance. Even though the effect of some firm-level economic performance indicators on goodwill impairments is significant in both samples, it is not likely that during 2020 the crisis affected goodwill impairments through these variables. That is because contrary to expectations, the descriptive statistics of these variable show that on average, performance of firms in terms of these variables was not necessarily worse during the crisis (2020) compared to the year before.

This research adds to existing literature, because current literature is not focused on the COVID-19 crisis. Most prior studies examine the determinants of goodwill impairments under non-crisis circumstances. Some research focuses on goodwill impairment accounting during the 2007-2008 financial crisis, but the

COVID-19 crisis is not necessarily similar to the 2007-2008 crisis, partially because uncertain government regulations, like lockdowns, play a big role in firms' activity during the COVID-19 crisis (McCormick, Goodman & Ainger, 2020; Strauss-Kahn, 2020; Osterland, 2020). Therefore, the COVID-19 crisis may have a different effect on goodwill impairments, compared to the crisis of 2007-2008.

The results of this study should be of interest to investors and auditors. Goodwill impairments are important to investors when making investment decisions, as they view goodwill impairment decisions as value relevant (AbuGhazaleh, Al-Hares and Haddad, 2012). Auditors can benefit from the results of this research, as it gives insight into the response of firms to the crisis, which is important in auditing processes.

The largest limitation of this study is the difference in meaning between the two dependent variables of the regression models. As previously mentioned, the response variable in the first sample accurately reflects actual goodwill impairments. However, the response variable in the second sample, which is based on changes in book value of goodwill, may not be a good representation of goodwill impairments. Because of this, it may be hard to interpret and compare the results of both the models. Another limitation is the low data availability for several variables. Many observations for the goodwill impairments are missing, which results in a smaller sample for the first model. Moreover, many potentially important variables, like acquisition characteristics and variables that proxy for the strength of governance mechanisms, are not included. The disadvantage of this is that it could lead to omitted variable bias, making the coefficient of the variable of interest (crisis) inaccurate. The last limitation is that I examine only two years, namely 2019 and 2020. This is done to prevent an imbalance between sample sizes of the two periods, but this unfortunately results in a rather small sample. This decreases the chances that the samples reflect the total population of listed U.S. firms, possibly making the statistical inference unreliable.

An idea for future research is to come back to this topic several years after the COVID-19 crisis and pandemic has been over. Research has shown that goodwill impairments may lag behind economic events, implying that the effect of the COVID-19 crisis on goodwill impairments may only become apparent at a later time (Hayn & Hughes, 2006; Ji, 2013; Knauer & Wöhrmann, 2016; Gunn, Khurana & Stein, 2017).

The remainder of this study is structured as follows. Chapter 2 discusses the theoretical background of goodwill accounting and contains a literature review on prior research about the determinants of goodwill impairments. Chapter 3 contains the hypothesis based on the prior literature. The methodology is clarified in section 4. The results are depicted in chapter 5. Finally, section 6 includes the conclusion and discussion.

2. Theoretical background and literature review

In this chapter, I introduce the two main topics, namely the COVID-19 crisis and goodwill impairment. First, I will briefly explain the theoretical background of goodwill impairment accounting. After that, I discuss the existing literature about the determinants of goodwill impairment. Then the COVID-19 crisis and its implications for both the economy as a whole and for firms specifically are explained. It must be noted that even though the focus of this study is on the United States, in which publicly listed firms must follow the U.S. Generally Accepted Accounting Principles (U.S. GAAP), some of the existing literature examines goodwill impairments under the International Financial Reporting Standards (IFRS), which is a different accounting standard. However, this is not a large problem, as U.S. GAAP and IFRS are very similar when it comes to (the determinants of) goodwill impairments, supported by the fact that much of the existing literature bases its research on both standards (Verriest & Gaeremynck, 2009; AbuGhazaleh, Al-Hares & Roberts, 2011; Ji, 2013; Avallone & Quagli, 2015; Malijebtou Hassine & Jilani, 2017; Gros & Koch, 2019).

2.1 Goodwill impairments

Before discussing the views of current literature on the determinants of goodwill impairments, I will explain the concept of goodwill (accounting) under the U.S. GAAP.

2.1.1 Theoretical background of goodwill accounting

In short, goodwill is created when a company (the acquirer) obtains control of another company (the acquiree). This transaction is also called a business combination. Goodwill is an intangible asset and is the difference between the consideration paid by the acquirer and the acquirer's interest in the fair value of the net identifiable assets of the acquiree. The net identifiable assets are the sum of the total assets minus the liabilities assumed by the acquirer (FASB, 2007). Therefore, goodwill can be seen as a residual.

However, goodwill represents more than just a residual. Often, the reason for why the acquirer pays more than the fair value of the net identifiable assets of the acquiree lies in the expectations of the future. Hence, goodwill represents the expected future economic benefits that arise from the synergy effects in a business combination, which would be able to realize more future cash flows than the two companies individually could achieve combined (FASB, 2001).

Because goodwill is assumed to have an indefinite useful life, it is not amortized annually, but rather tested for impairment. As goodwill is intangible, it cannot be identified separately. To be able to test goodwill for impairment, it is assigned to a reporting unit. A reporting unit is an operating segment, or one level below an operating segment and is described as being a part of a company that engages in activities from which

revenues are earned and discrete financial information is available (FASB, 2001). An important note is that under IFRS, firms allocate goodwill instead to cash-generating units, which are similar in definition to reporting units (IAS Plus, n.d.).

The actual impairment test involves comparing the carrying amount (book value) to the fair value of the reporting unit. If the carrying value exceeds the fair value, a goodwill impairment is recognized. Subsequent reversals of goodwill impairments are prohibited (FASB, 2014). The best measure of fair value is the amount at which the unit could be sold in a transaction between willing parties. However, these market prices are often not available, making this measure of fair value difficult to apply (Verriest & Gaeremynck, 2009; Carlin & Finch, 2011). If market prices are not available, firms can estimate the fair value based on the present value of the future cash flows of the reporting unit (FASB, 2001).

Firms must test for the impairment of goodwill at least annually, but more often if there are any indications that goodwill may be impaired. External indicators of goodwill impairments include macroeconomic changes, like change in GDP growth or a decline in demand. Another external indicator of an impairment is a market-to-book value of equity of less than one, which implies that the book value of a firm exceeds its market value. Internal indicators of impairment can include worse performance of the reporting unit (in terms of cash inflows or profits) than expected or physical damage to the asset (FASB, 2014).

Overall, theoretically, according to the standard setters the determinants of the magnitude of goodwill impairments are rather straightforward and mostly economic in nature.

2.1.2 Economic determinants of goodwill impairments

Kabir and Rahman (2016) find that GDP growth is an indicator of goodwill impairment. A crisis is measured by the GDP growth. Malijebtou Hassine and Jilani (2017) research the effect of the 2007-2008 financial crisis on goodwill impairments and conclude that firms that experienced the financial crisis reported higher goodwill impairments. An explanation of this is that during a crisis, expected future cash flows may decline, leading to a lower fair value of the reporting unit and a higher (chance of a) goodwill impairment.

Even though the market-to-book ratio is sometimes differently defined (some use the market-to-book ratio of equity, others use the market-to-book ratio of total assets), all existing literature supports the abovementioned theory that when the market-to-book ratio falls below one, reported goodwill impairments increase significantly (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Gunn et al., 2017; Gros & Koch, 2019). This relationship is quite easy to understand: when the market-to-book ratio of assets (or equity) falls below one, it means that the market value of assets (or

equity) is lower than the book value of assets (or equity). This could signify that the value of goodwill has decreased. Chalmers et al. (2011) further use market-to-book value of assets and market-to-book value of equity as proxies for investment opportunities for firms. They argue that if these ratios increase, so do the investment opportunities for firms, giving less indication that goodwill is impaired.

As previously mentioned, because market prices for reporting units are not always readily available, firms may use the present value of future expected cash flows as an estimate of the fair value of the reporting units. Unsurprisingly, Avallone and Quagli (2015) find evidence that higher growth rates of future cash flows lead to significantly lower goodwill impairments. This is very intuitive, as the fair value will be higher if cash flows are expected to be higher. Then, the amount at which the book value exceeds the fair value of the reporting unit will be lower, leading to a lower goodwill impairment. Similar results are found by others who include change in operating cash flows as an explanatory variable (AbuGhazaleh et al., 2011; Kabir & Rahman, 2016; Gros & Koch, 2019).

Overall, most of the findings from existing literature include that return on assets (from now on ROA) is also negatively related to goodwill impairments (Hayn & Hughes, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Chalmers, Godfrey & Webster, 2011; Avallone & Quagli, 2015). More specifically, Chalmers et al. (2011) argue that firms with a higher (better) ROA have less indication that goodwill has lost its value. For these firms, cash inflows are usually higher, leading to a smaller goodwill impairment. Others find the effect of ROA on goodwill impairments to be insignificant (Malijebtou Hassine & Jilani, 2017; Gros & Koch, 2019).

Another firm-specific performance measure that potentially influences goodwill impairments is the change in sales. However, no prior study finds change in sales to have a significant effect on the magnitude of goodwill losses (Hayn & Hughes, 2006; AbuGhazaleh et al., 2011; Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). However, Kabir and Rahman (2016) do find that the relationship between change in sales and goodwill impairments strengthens when strong governance is introduced (more on this later).

Pre-impairment losses may be a trigger for firms to recognize an impairment loss, as operating losses could lead to a lower expectation of future cash flows and thus a lower fair value of the reporting unit. Existing research confirms that when firms experience an operating loss, goodwill impairments are generally higher (Hayn & Hughes, 2006; Gros & Koch, 2019).

Results about the effects of firm size on goodwill impairments are ambiguous. Researchers state that larger firms report larger goodwill impairments, because these companies generally obtain more managerial

expertise and possess more money, which in turn leads to higher quality of financial reporting (Chalmers et al., 2011). Other researchers state that larger firms prefer larger goodwill impairments, as it leads to lower earnings and lower political costs like taxes (Avallone & Quagli, 2015). A positive significant relationship between firm size and goodwill losses is found in some cases (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; Malijebtou Hassine & Jilani, 2017). Results of other studies do not indicate a significant (positive) effect of firm size on goodwill impairments (AbuGhazaleh et al., 2011; Chalmers et al., 2011; Avallone & Quagli, 2015). Gros and Koch (2019) even find a significant negative effect of firm size on goodwill impairments. However, this result is neither interpreted nor explained.

2.1.3 Other determinants of goodwill impairments

Because the expertise of managers is needed in goodwill accounting, they have a certain level of discretion. Therefore, economic aspects are not the only determinants of goodwill impairments (Beatty & Weber, 2006; Verriest & Gaeremynk, 2009; AbuGhazaleh, et al., 2011; Chalmers et al., 2011; Li, Shroff, Venkataraman & Zhang, 2011; Ji, 2013; Avallone & Quagli, 2015; Kabir & Rahman, 2016; Gunn et al., 2017; Malijebtou Hassine & Jilani, 2017; Gros & Koch, 2019).

The research on how this discretion is used is conflicting. Some find that goodwill impairments are value relevant, meaning that the discretion is used to convey private information about underlying economic characteristics (AbuGhazaleh et al., 2011; Li et al., 2011; AbuGhazaleh et al., 2012). Others state that managers use the discretionary nature of goodwill impairment accounting for opportunistic purposes.

Opportunistic behavior can arise in the identification of reporting units and the allocation of goodwill to those units. When fewer units are identified, these are usually larger as they combine income streams. This leads to more possibilities to offset decreases in the fair value of these units, resulting in lower impairment losses (Carlin & Finch, 2011). Besides, defining fewer reporting units lowers the total costs of impairment testing, as each unit must be tested separately (Chalmers et al., 2011). Some prior studies do not find evidence that the number of reporting units affects the amount of reported goodwill impairments (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Malijebtou Hassine & Jilani, 2017). Others do find a significant relationship (Kabir & Rahman, 2016; Gros & Koch, 2019).

The actual impairment testing process is also prone to manipulation, as many factors must be considered. Because goodwill impairments are irreversible, managers may be inclined to wait with the recognition of a goodwill impairment in the hope that future (economic) developments offset the impairment (Knauer &

Wöhrmann, 2016). There has been evidence that firms delay recognition of goodwill impairments, especially during the financial crisis of 2007-2008 (Hayn & Hughes, 2009; Ji, 2013; Gunn et al., 2017).

Contrary to that, Malijebtou Hassine and Jilani (2017) suggest that because earnings are down in general during crises, firms could overstate goodwill losses to lower earnings more, as this could reduce future impairments and therefore lead to higher future earnings. This is called 'big bath' accounting. AbuGhazaleh et al. (2011) provide further evidence for this. Besides, they find that when pre-impairment earnings are higher than expected, firms recognize larger impairment losses, to avoid earnings surprises. This is referred to as income smoothing. Findings from Gros and Koch (2019) do not support this notion.

Research shows that goodwill impairments are higher in years in which a new CEO is installed (Beatty & Weber, 2006; AbuGhazaleh et al., 2011; Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). New CEOs can blame these losses on the old management for failing to materialize the synergy effects arising from business combinations. Only Avallone and Quagli (2015) find this effect to be insignificant.

In firms where managers' payment (partially) consists of earnings-based bonuses, managers may report lower goodwill losses to increase earnings and therefore increase their bonuses (Beatty & Weber, 2006).

Firms with higher leverage (liabilities divided by assets) have a higher chance to violate a debt covenant when earnings are too low and therefore are expected to understate goodwill impairments, to avoid such a violation. Gros and Koch (2019) find leverage to be a significant indicator of goodwill impairments. Others only detect an insignificant effect (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Chalmers et al., 2011; Avallone & Quagli, 2015; Malijebtou Hassine & Jilani, 2017).

Characteristics of the acquisition of other firms also play a role in determining goodwill impairments. Hayn and Hughes (2006) and Li et al. (2011) discover that when there are indications of overpayment during the acquisition, meaning too much goodwill is recognized, higher impairment losses are reported.

Overall, opportunistic behavior decreases when corporate governance mechanisms are stronger. Proxies for strong governance are the amount of independent (non-executive) members on the board of directors (Verriest and Gaeremynck, 2009; AbuGhazaleh et al., 2011; Kabir & Rahman, 2016), being audited by a big-4 firm (Kabir & Rahman, 2016; Gunn et al., 2017; Malijebtou Hassine & Jilani, 2017), separation of CEO and chairman (Verriest & Gaeremynck, 2009; Kabir & Rahman, 2016) and frequency of board meetings (Kabir & Rahman, 2016). Kabir and Rahman (2016) conclude that when governance mechanisms are stronger, the economic determinants become more significant in explaining goodwill impairments.

2.2 COVID-19 crisis and its effect on goodwill impairments

When the WHO declared the spread of the coronavirus to be a pandemic on March 11, 2020, the organization stated that the economic effects of the pandemic and the subsequent measures to prevent further spread of the virus would be large (WHO, 2020a). Given that these events occurred relatively recently, not much research has been done on the actual economic effects of COVID-19.

Around March and April of 2020, some researchers developed models to estimate different scenarios of the effect of the (then) Chinese epidemic on the global economy and found that even in mild scenarios, the Gross Domestic Product (GDP) was likely to decrease severely (McKibben & Fernando, 2020; Fernandes, 2020). Demand drastically decreased in the first quarter of 2020 due to fear among customers who started saving money instead of spending it (McKibben and Fernando, 2020). Because of lockdowns and travel restrictions, supply was also affected. Firms were forced to close their offices and factories and shut down operations, leading to losses in productive capacity. Because the world is heavily integrated, this led to disruptions of supply chains worldwide, due to delayed deliveries (Barua, 2020; Fernandes, 2020). Through these mechanisms, real GDP in the U.S. decreased with 3.5 percent in 2020, indicating that a crisis occurred. In 2019, real GDP increased with 2.2 percent (BEA, 2021). Another important effect of the COVID-19 pandemic is the increase of credit and default risk. This could lead to lower investments by firms and individuals, since they would rather not invest in such risky times (Barua, 2020).

During 2020, firms were advised to assess whether, due to the global pandemic, triggering events had taken place that negatively affected firms' asset value or cash flows (KPMG, 2020; PwC, 2020; Deloitte, 2021). Because the COVID-19 pandemic led to cautiousness among investors, the market value of firms may fall below the carrying value of the net assets (Barua, 2020; KPMG, 2020; PwC, 2020; Deloitte, 2021). This is one of the previously discussed determinants of goodwill impairments (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Gunn et al., 2017; Gros & Koch, 2019). Decreased demand and supply and overall deterioration of economic conditions may lead to lower expected cash flows due to lower revenues and profits. Subsequently, this implies a lower fair value of reporting units when the present value method to estimate that fair value is used, possibly leading to larger impairments of goodwill. Moreover, the COVID-19 pandemic led to an increase in risk, causing investment opportunities for firms to be lower. This can result in larger goodwill losses (Chalmers et al., 2011). Lastly, Deloitte (2021) also states that firms need to assess the debt covenants, which could be violated. This may motivate firms to use the discretion of goodwill impairments to avoid infringement of the covenant (Gros & Koch, 2019).

3. Hypothesis

In summary, there are several causes of goodwill impairments. Examples of economic indicators of impairments are lower cash flow growth rates (Avallone & Quagli, 2015), a market-to-book value below one (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Gunn et al., 2017; Gros & Koch, 2019), low investment opportunities (Chalmers et al., 2011), a low ROA (Avallone & Quagli, 2015; AbuGhazaleh et al., 2011; Chalmers et al., 2011; Hayn & Hughes, 2006; Verriest & Gaeremynck, 2009) and GDP contraction or a crisis (Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). These economic indicators are likely to be affected by the COVID-19 pandemic and subsequent crisis via, for example, decreased demand and supply, and lower investments due to higher risks (Barua, 2020; Fernandes, 2020; KPMG, 2020; McKibben & Fernando, 2020; Deloitte, 2021).

Besides economic factors, acquisition characteristics and opportunistic behavior can also influence the amount of goodwill impairment that is reported. Furthermore, during uncertain times like the COVID-19 crisis, firms might delay the recognition of goodwill impairments to wait for economic performance to increase again which would make impairments unnecessary (Knauer & Wöhrmann, 2016). Nevertheless, Malijebtou Hassine and Jilani (2017) provide evidence that during the financial crisis of 2007-2008, goodwill impairments actually increased.

Overall, during the COVID-19 crisis, economic indicators are expected to be more important than opportunistic behavior in influencing reported goodwill impairments. That is because, on the condition that corporate governance is strong, goodwill impairments are often value relevant and managers use the discretion to convey private information about the economic performance, rather than using it for opportunistic ends (AbuGhazaleh et al., 2011; Li et al., 2011; AbuGhazaleh et al., 2012; Kabir & Rahman, 2016). Therefore, it is likely that the crisis leads to an increase in reported goodwill impairments. This results in the following hypothesis:

During 2020, the COVID-19 crisis had an effect on firms' recognition of goodwill impairments.

4. Methodology and regression equations

In this chapter, the methodology will be discussed. First, I define the variables. Then, the regression equation is introduced. Finally, I explain the sample selection process. A more detailed overview of the definitions of all variables is available in table 1 (see appendix).

4.1 Methods and variables

To test the hypothesis, an ordinary least squares (OLS) regression will be applied. The dependent variable 'Goodwill_Imp$_{it}$' is the amount of reported goodwill impairment in year t scaled by lagged total assets for firm i (AbuGhazaleh et al., 2011; Kabir & Rahman, 2016; Malijebtou Hassine & Jelani, 2017; Gros & Koch, 2019). Since a lot of observations have missing data for the variable 'Goodwill_Imp$_{it}$', an alternative measure for goodwill impairment can be used. In a second regression, the dependent variable 'ΔGoodwill$_{it}$' measures the change in book value of goodwill for firm i from year t-1 to year t, deflated by total assets in year t-1. An advantage of using this variable is that data for the book value of goodwill is available for substantially more firms, meaning that the sample is likely to better represent the total population of U.S. listed firms. However, the main drawback is that change in goodwill may be a poor reflection of goodwill impairments. That is because the book value of goodwill is not only affected by goodwill impairments, but also by acquisitions and sales of acquired firms that previously lead to a recognition of goodwill.

The independent variable 'Crisis$_t$' is a binary variable with value one if the observation takes place in 2020, a year in which a crisis occurred, and zero if it is observed in 2019, a year without a crisis. Prior research shows that a positive relationship between a crisis (or low/negative GDP growth) and the magnitude of goodwill impairments exists (Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). Therefore, I too expect to see this positive relationship during the COVID-19 crisis.

The included control variables represent firm-level performance, the potential for opportunistic behavior and governance strength. Based on prior research, some economic factors are added to the regression models. 'ROA$_{it}$' indicates the return on assets for firm i, calculated as net income divided by total assets in year t (Avallone & Quagli, 2015). The expected sign for the coefficient of this variable is negative, as previously mentioned (Hayn & Hughes, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Chalmers et al., 2011; Avallone & Quagli, 2015).

Another economic variable is the market-to-book ratio (Market-Book$_{it}$), which is defined as the market value of equity divided by the book value of equity (Kabir & Rahman, 2016). Prior research finds that when the market-to-book ratio increases, the reported amount of goodwill impairments decreases (Beatty &

Weber, 2006; Verriest & Gaeremynck, 2009; AbuGhazaleh et al., 2011; Gunn et al., 2017; Gros & Koch, 2019). Consequently, I expect the relationship between market-to-book value of equity and goodwill impairments to be negative.

The binary variable '$Pre\_Imp\_Loss_{it}$' represents the pre-impairment loss of firm i in year t. It takes on value one if the current year net income is negative and zero otherwise (Gros & Koch, 2019). I expect the sign to be positive, as in general, pre-impairment losses lead to larger goodwill impairments.

Another economic control variable is '$\Delta Sales_{it}$' which indicates the change in sales for firm i from year t-1 to current year t, deflated by total assets of year t-1 (AbuGhazaleh et al., 2011; Kabir & Rahman, 2016). The expected sign of the coefficient is negative, as a growth in sales gives less indication that goodwill has been impaired.

Consistent with prior literature, change in operating cash flows is included. '$\Delta Cashflow_{it}$' represents the change in operating cash flows from year t-1 to year t scaled by total assets at the end of year t-1 (AbuGhazaleh et al., 2011; Kabir & Rahman, 2016). I predict its effect on reported goodwill impairments to be negative, meaning that a more positive change in cash flows leads to lower impairments.

The size of the firm is included as the variable '$Size_{it}$', defined as the natural logarithm of total assets in year t (Verriest & Gaeremynck, 2009; Chalmers et al., 2011, Avallone & Quagli, 2015; Kabir & Rahman, 2016). Some prior studies find firm size to positively affect the magnitude of goodwill losses (Beatty & Weber, 2006; Verriest & Gaeremynck, 2009; Malijebtou Hassine & Jilani, 2017), so I expect a positive sign as well.

Three variables are added to the regression that represent the potential opportunistic behavior that managers can engage in as a result of the discretion of goodwill impairment testing. The first variable that captures the potential for opportunistic behavior is the variable for leverage of firm i in year t ($Leverage_{it}$), which is calculated as long-term debt plus debt in current liabilities divided by total assets in year t (Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). As I state in chapter 2, the anticipated effect of leverage on goodwill impairments is negative, because highly-leveraged firms are more inclined to report lower goodwill impairments to avoid violating debt covenants.

To represent the possibility for firms to engage in 'big bath' accounting, the binary variable 'Big_Bath_{it}' is included. It is the change in the earnings before interest and tax (EBIT) from year t-1 to year t deflated by total assets at the end of year t-1. It takes on value one if this (negative) change is larger than the median of non-zero negative changes for all observations in year t, and zero otherwise (Gros & Koch, 2019). Based

on existing literature, I expect the effect on the reported amount of goodwill impairments to be positive, meaning that when the negative change in EBIT is larger than the median of negative changes, firms on average report higher goodwill impairments (AbuGhazaleh et al., 2011; Malijebtou Hassine & Jilani, 2017; Gros & Koch, 2019).

As previously discussed, some firms can smooth income if their pre-impairment net income is higher than expected. This is reflected by the variable '$Smoothing_{it}$', which is the change in EBIT of firm i from year t-1 to year t, deflated by total assets at the end of year t-1. This binary variable takes on value one if this positive change is above the median of non-zero positive changes for all observations in year t, and zero otherwise (Gros & Koch, 2019). I expect the effect on goodwill impairments to be positive (AbuGhazaleh et al., 2011; Malijebtou Hassine & Jilani, 2017; Gros & Koch, 2019).

A governance variable is also added to the regression. The variable '$Big4_{it}$' is a binary variable with value one if firm i is audited by a big-4 firm in year t and zero otherwise, consistent with prior research. According to the existing literature, being audited by one of the big-4 auditors constrains managerial opportunism through goodwill impairments. However, because it is not necessarily clear whether managers would use the discretion of impairments to either overstate or understate goodwill losses, there is no expectation on the sign of the coefficient (Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017).

Ideally, change in CEO is included as prior studies discover that this is an important determinant of goodwill impairments. Unfortunately, due to data limitations, the sample would become too small to accurately represent U.S. firms, so it is excluded. Furthermore, certain variables that represent the strength of the corporate governance mechanisms, like separation of CEO and chairman, number of independent members of the board or frequency of board meetings are excluded due to inaccessibility of the appropriate databases. This is also the case for a variable that represents the number of segments as a proxy This confirms something mentioned earlier, namely that a lot of observations contain missing data for the variable 'Goodwill_Impit', resulting in a smaller samplefor the number of reporting units. A drawback of excluding these variables is that it could cause omitted variable bias, leading to a biased parameter of the variable of interest '$Crisis_t$'.

Lastly, industry effects are controlled for based on the Standard Industrial Classification (SIC) system.

For testing the hypothesis, the 5% significance level is used. The calculated standard errors are heteroscedasticity-robust, which allows the use of OLS for calculating a fitted line even if the residuals are heteroskedastic (i.e. unequal variance of the residuals ε_{it}).

4.2 Regression equations

This results in the following OLS regression equations to test the hypothesis:

$$1.\ Goodwill\_Imp_{it} = \beta_0 + \beta_1 Crisis_t + \beta_2 ROA_{it} + \beta_3 Market\text{-}Book_{it} + \beta_4\ Pre\_Imp\_Loss_{it} + \beta_5 \Delta Sales_{it} + \beta_6 \Delta Cashflow_{it} + \beta_7 Size_{it} + \beta_8 Leverage_{it} + \beta_9 Big\_Bath_{it} + \beta_{10} Smoothing_{it} + \beta_{11} Big4_{it} + \sum \beta_k Industry + \varepsilon_{it}$$

$$2.\ \Delta Goodwill_{it} = \beta_0 + \beta_1 Crisis_t + \beta_2 ROA_{it} + \beta_3\ Market\text{-}Book_{it} + \beta_4\ Pre\_Imp\_Loss_{it} + \beta_5 \Delta Sales_{it} + \beta_6 \Delta Cashflow_{it} + \beta_7 Size_{it} + \beta_8 Leverage_{it} + \beta_9 Big\_Bath_{it} + \beta_{10} Smoothing_{it} + \beta_{11} Big4_{it} + \sum \beta_k Industry + \varepsilon_{it}$$

4.3 Sample construction

Table 2 depicts the sample construction process for the two samples. The sample is taken from the Globustat North America database from Wharton Research Data Services (WRDS). Data is extracted for the years 2019 and 2020. The sample originally consists of 15,075 firm-year observations for listed U.S. firms. After the data is transformed and all relevant variables are created, observations with missing data for at least one of these variables are deleted. This results in a sample of 860 firm-year observations, belonging to 714 unique firms across 2019 and 2020, when the dependent variable is '$Goodwill\_Imp_{it}$'. However, when '$\Delta Goodwill_{it}$' is considered as the dependent variable, the final sample consists of 8,473 firm-year observations from 4,539 unique firms across 2019 and 2020. This confirms that a lot of observations have missing data for the variable '$Goodwill\_Imp_{it}$', resulting in a smaller sample.

Table 2: Sample construction process

Sample construction step	**Firm-year observations *'$Goodwill\_Imp_{it}$'***	**Firm-year observations *'$\Delta Goodwill_{it}$'***
U.S. listed firm-years	15,075	15,075
Observations with missing data	-14,215	-6,602
Final sample	860	8,473
Final sample (unique firms)	714	4,539

Notes: table 2 contains information about how the final sample is constructed. Column 2 shows the sample selection in the case where the dependent variable is '$Goodwill\_Imp_{it}$' (model 1). Column 3 depicts the sample construction process in the case where the dependent variable is '$\Delta Goodwill_{it}$' (model 2). These samples are used in the OLS regression analysis.

5. Results

In this section, the results are presented. First, the descriptive statistics are discussed, including the Pearson correlation coefficients. Finally, the regression results are presented. An important note, which is also explained in table 1 (appendix), is that the variable '$\Delta Goodwill_{it}$' must be interpreted in a similar way as '$Goodwill\_Imp_{it}$'. When '$\Delta Goodwill_{it}$' (so change in book value of goodwill as a percentage of lagged total assets) is positive, it actually means that the book value in year t is lower than in year t-1. Similarly to '$Goodwill\_Imp_{it}$', this 'goodwill loss', which proxies for actual goodwill impairments, is depicted as a positive value.

5.1 Descriptive statistics

Table 3 depicts the descriptive statistics for the relevant variables included in the regression where the dependent variable is '$Goodwill\_Imp_{it}$'. All continuous variables are winsorized by year at the 1st and 99th percentiles, to prevent the results from being affected by extreme values. Panel A shows the descriptive statistics for 2019, when variable '$Crisis_t$' has value zero. Panel B contains the descriptive statistics for 2020, when the binary variable '$Crisis_t$' takes on value one. Panel C depicts the results from the t-test of the differences in means between 2019 and 2020. Table 4 contains similar information, but for the situation in which the dependent variable is '$\Delta Goodwill_{it}$'. Table 5 (see appendix) contains descriptive results for both of the full samples.

The first noticeable result in table 3 is that the average goodwill impairment as a percentage of total lagged assets is significantly lower during the crisis in 2020. Furthermore, based on the existing theory, it is expected that during a crisis, some economic performance measures are negatively affected. However, both the average return on assets (ROA) and average change in operating cash flows as a percentage of lagged total assets are negative both before and during the crisis, but are less negative and thus higher during the crisis. The average market-to-book ratio of equity is also significantly higher during the crisis than before.

Some results are more in line with the expectation that a crisis negatively affects economic measures. In 2020, 66.2% of the firms experienced a pre-impairment loss, against 59.7% in 2019. Note, however, that this proportion is not significantly higher during 2020. On average, changes in sales were negative in 2020, whereas in 2019, they were (slightly) positive. Furthermore, the proportion of firms that have a higher chance of applying 'big bath' accounting is higher during the crisis. This implies that on average, a larger

proportion of firms have a change in EBIT that is more negative than the median of non-zero negative values, which may be a result of the crisis and the subsequent lower income streams.

The results are very similar for the larger sample with dependent variable '$\Delta Goodwill_{it}$'. The results depicted in table 4 show that in both years, book value of goodwill as a percentage of lagged total assets actually increased (depicted by the negative values). In 2020, however, the average increase in book value of goodwill is significantly lower than during 2019.

Table 3: Descriptive statistics sample 1

Variable	Obs	Mean	Median	Std. Dev.	Minimum	Maximum
Panel A: 2019						
Goodwill_Imp	357	0.076	0.018	0.176	0.000	1.253
ROA	357	-0.145	-0.025	0.374	-2.16	0.187
Market-Book	357	1.609	1.219	6.351	-38.931	30.617
Pre_Imp_Loss	357	0.597	1	0.491	0	1
ΔSales	357	0.009	-0.001	0.234	-0.724	1.095
ΔCashflow	357	-0.021	-0.003	0.108	-0.612	0.251
Size	357	7.202	7.450	2.418	0.526	11.695
Leverage	357	0.379	0.322	0.384	0	2.999
Big_Bath	357	0.246	0	0.432	0	1
Smoothing	357	0.151	0	0.359	0	1
Big4	357	0.655	1	0.476	0	1

	Obs	Mean	Median	Std. Dev.	Minimum	Maximum
Panel B: 2020						
Goodwill_Imp	503	0.053	0.023	0.078	0.000	0.432
ROA	503	-0.098	-0.036	0.227	-1.351	0.208
Market-Book	503	2.546	1.522	4.835	-11.633	29.357
Pre_Imp_Loss	503	0.662	1	0.473	0	1
ΔSales	503	-0.092	-0.049	0.243	-0.914	0.902
ΔCashflow	503	-0.004	-0.001	0.091	-0.409	0.320
Size	503	7.617	7.819	2.083	1.876	12.113
Leverage	503	0.393	0.370	0.257	0.005	1.261
Big_Bath	503	0.340	0	0.474	0	1
Smoothing	503	0.151	0	0.358	0	1
Big4	503	0.732	1	0.444	0	1

	Difference in mean	Two-sided p-value of t-test
Panel C: t-tests		
Goodwill_Imp	0.023	0.022**
ROA	-0.047	0.035**
Market-Book	-0.937	0.019**
Pre_Imp_Loss	-0.065	0.051*
ΔSales	0.102	0.000***
ΔCashflow	-0.017	0.018**
Size	-0.415	0.009***
Leverage	-0.013	0.585
Big_Bath	-0.093	0.003***
Smoothing	0.000	0.994
Big4	-0.076	0.018**

*Notes: this table shows the descriptive statistics for the variables used in the first regression model, in which the dependent variable is 'Goodwill_Imp$_{it}$'. Panel A depicts the descriptive statistics for 2019, a year with no crisis. Panel B shows the statistics for 2020, in which a crisis occurred. The first column shows the variable name, the second column contains the number of observations. Panel C contains information about the t-test on the differences in the means of 2019 and 2020 from the relevant variables. A description of the variables is given in table 1. ***Significant at the 1 percent level, ** significant at the 5 percent level, *significant at the 10 percent level, using a two-sided test. All continuous variables are winsorized by year at 1% and 99%.*

Table 4: Descriptive statistics sample 2

Variable	Obs	Mean	Median	Std. Dev.	Minimum	Maximum
Panel A: 2019						
ΔGoodwill	4,286	-0.014	0	0.083	-0.642	0.160
ROA	4,286	-0.516	0.009	2.600	-22.828	0.330
Market-Book	4,286	2.692	1.652	10.930	-57.403	57.870
Pre_Imp_Loss	4,286	0.459	0	0.498	0	1
ΔSales	4,286	0.053	0.009	0.264	-0.785	1.570
ΔCashflow	4,286	-0.027	0.000	0.355	-2.368	1.338
Size	4,286	6.222	6.660	2.855	-2.718	11.969
Leverage	4,286	0.472	0.239	1.321	0	11.508
Big_Bath	4,286	0.233	0	0.423	0	1
Smoothing	4,286	0.245	0	0.430	0	1
Big4	4,286	0.561	1	0.496	0	1

	Obs	Mean	Median	Std. Dev.	Minimum	Maximum
Panel B: 2020						
ΔGoodwill	4,187	-0.009	0	0.070	-0.503	0.173
ROA	4,187	-0.313	0.001	1.365	-11.632	0.306
Market-Book	4,187	3.287	1.833	11.834	-61.329	63.251
Pre_Imp_Loss	4,187	0.513	1	0.500	0	1
ΔSales	4,187	0.002	0	0.274	-0.914	1.421
ΔCashflow	4,187	-0.000	0.002	0.354	-2.110	1.695
Size	4,187	6.424	6.813	2.744	-2.354	12.046
Leverage	4,187	0.421	0.252	0.924	0	7.877
Big_Bath	4,187	0.283	0	0.450	0	1
Smoothing	4,187	0.255	0	0.436	0	1
Big4	4,187	0.578	1	0.494	0	1

	Difference in mean	Two-sided p-value of t-test
Panel C: t-tests		
ΔGoodwill	-0.005	0.002***
ROA	-0.203	0.000***
Market-Book	-0.595	0.016**
Pre_Imp_Loss	-0.055	0.000***
ΔSales	0.051	0.000***
ΔCashflow	-0.026	0.001***
Size	-0.203	0.001***
Leverage	0.052	0.034**
Big_Bath	-0.050	0.000***
Smoothing	-0.010	0.284
Big4	-0.018	0.098*

*Notes: this table shows the descriptive statistics for the variables used in the second regression analysis, in which the dependent variable is '$\Delta Goodwill_{it}$'. Panel A depicts the descriptive statistics for 2019, a year with no crisis. Panel B shows the statistics for 2020, in which a crisis occurred. The first column shows the variable name, the second column contains the number of observations. Panel C contains information about the t-test on the difference in the means of 2019 and 2020 from the relevant variables. A description of the variables is given in table 1. ***Significant at the 1 percent level, ** significant at the 5 percent level, *significant at the 10 percent level, using a two-sided test. All continuous variables are winsorized by year at 1% and 99%.*

Table 6 contains information about the Pearson correlation coefficients between the dependent variable, the independent variable and the control variables. Table 7 shows the Pearson correlation coefficients for the larger sample in which the dependent variable is '$\Delta Goodwill_{it}$'.

For the first sample, correlations between the dependent variable and independent and control variables are largely consistent with the expectations. Examples for this are the negative correlation between goodwill impairments and ROA and change in operating cash flow, and the positive correlation between goodwill impairments and pre-impairment losses, leverage, 'big bath' accounting and income smoothing.

Notable discrepancies between the results and the expectations are the negative correlation between goodwill impairment and crisis, the positive correlation between leverage and goodwill impairments and the positive correlation between goodwill impairment and change in sales. These correlations are all significant, meaning that they are likely different than zero.

The results depicted in table 7 are slightly different. In that sample, a positive correlation coefficient between crisis and change in goodwill is found. Moreover, a significant positive correlation between change in operating cash flows and change in goodwill exists. The correlation between pre-impairment loss and change in book value of goodwill is significantly negative in that sample. Other differences in the sign of correlation are found between the dependent variable and change in sales, 'big bath' accounting and income smoothing.

However, it must be noted that from this, it is not possible to infer causal relationships between the variables. A regression analysis must be applied for inference to be possible.

The largest correlation (0.623) between the control variables in the first sample is between '$Big4_{it}$' and '$Size_{it}$'. In the second sample, the largest correlation is -0.669 between 'ROA_{it}' and '$Leverage_{it}$'. This indicates that multicollinearity is not present in these samples.

Table 6: Pearson correlation matrix

	Variable	1	2	3	4	5	6	7	8	9	10	11	12
1	Goodwill_Imp	1.000											
2	Crisis	-0.087**	1.000										
3	ROA	-0.540***	0.078**	1.000									
4	Market-Book	-0.057*	0.084**	0.064*	1.000								
5	Pre_Imp_Loss	0.274***	0.067**	-0.424***	-0.070**	1.000							
6	ΔSales	0.124***	-0.205***	0.073**	0.101***	-0.212***	1.000						
7	ΔCashflow	-0.260***	0.083**	0.202***	0.081**	-0.138***	0.178***	1.000					
8	Size	-0.329***	0.092***	0.509***	0.012	-0.325***	0.078**	0.119***	1.000				
9	Leverage	0.155***	0.020	-0.182***	-0.086**	0.083**	-0.025	-0.020	0.010	1.000			
10	Big_Bath	0.113***	0.100***	-0.244***	0.004	0.329***	-0.341***	-0.393***	-0.227***	-0.012	1.000		
11	Smoothing	0.087**	-0.000	-0.031	0.076**	-0.064*	0.283***	0.259***	-0.125***	-0.026	-0.277***	1.000	
12	Big4	-0.143***	0.082**	0.283***	0.039	-0.196***	0.021	0.030	0.623***	0.043	-0.101***	-0.071**	1.000

*Notes: table 6 depicts the correlations between the variables that are researched, in the case where the dependent variable is 'Goodwill_Imp$_{it}$'. ***Significant at the 1 percent level, ** significant at the 5 percent level, *significant at the 10 percent level.*

Table 7: Pearson correlation matrix

	Variable	1	2	3	4	5	6	7	8	9	10	11	12
1	ΔGoodwill	1.000											
2	Crisis	0.033***	1.000										
3	ROA	-0.030***	0.049***	1.000									
4	Market-Book	-0.052***	0.026**	0.168***	1.000								
5	Pre_Imp_Loss	-0.158***	0.055***	-0.232***	-0.002	1.000							
6	ΔSales	-0.259***	-0.094***	0.016	0.075***	-0.034***	1.000						
7	ΔCashflow	0.025**	0.037***	0.056***	0.008	-0.097***	0.076***	1.000					
8	Size	-0.037***	0.036***	0.476***	0.093***	-0.443***	-0.043***	0.042***	1.000				
9	Leverage	0.026**	-0.023**	-0.699***	-0.137***	0.142***	-0.014	0.062***	-0.346***	1.000			
10	Big_Bath	-0.015	0.057***	-0.102***	0.004	0.406***	-0.159***	-0.271***	-0.265***	-0.000	1.000		
11	Smoothing	-0.038***	0.012	-0.119***	0.019*	0.062***	0.233***	0.216***	-0.275***	0.142***	-0.340***	1.000	
12	Big4	-0.035***	0.018*	0.193***	0.090***	-0.123***	-0.013	0.021*	0.573***	-0.111***	-0.061***	-0.091***	1.000

*Notes: table 7 depicts the correlations between the variables that are researched, in the case where the dependent variable is 'ΔGoodwill$_{it}$'. ***Significant at the 1 percent level, ** significant at the 5 percent level, *significant at the 10 percent level.*

5.2 Regression analysis

Table 8 depicts the results of the OLS regression analysis of the two models, which will be used to test the hypothesis. The first model uses '$Goodwill\_Imp_{it}$' as a dependent variable, whereas the second model's dependent variable is '$\Delta Goodwill_{it}$'. The hypothesis states that during 2020, the COVID-19 crisis had an effect on firms' recognition of goodwill impairments. This leads to a null-hypothesis that states that the crisis has no effect and an alternative hypothesis that the crisis does have an effect on the reported goodwill impairments.

For the first model, the coefficient of the independent variable '$Crisis_t$' is positive, but not significantly different from zero at the 5% level, meaning the hypothesis that the effect is zero cannot be rejected. However, as is discussed in chapter 2, the crisis may affect goodwill impairment through firm-specific performance indicators. These potential indicators are included as control variables.

Return on assets (ROA) has a significantly negative effect on the reported goodwill impairments, implying that when ROA increases, the goodwill impairments decrease. This confirms the expected effect. More specifically, all else being equal, a one standard deviation increase in ROA (0.298, see table 5) results in an average decrease in the goodwill impairments as a percentage of lagged assets of 4.74% ((0.298*-0.159)*100%).

Another control variable that has a significant coefficient is '$Pre\_Imp\_Loss_{it}$', which takes on value one if the firm experiences a pre-impairment loss and zero otherwise. The coefficient is positive, consistent with expectations. This means that when firms (in the sample) experience a pre-impairment loss, the reported goodwill impairments as a percentage of lagged total assets increases by 2.9% on average.

Even though the results depict no significant effect (at the 5% level) of the control variable '$\Delta Sales_{it}$' on goodwill impairments, the result is still interesting to mention. That is because, contrary to expectations, the sign of the coefficient is positive rather than negative. This implies that when the change in sales (divided by lagged total assets) increases, the reported goodwill impairments also increase on average. I expected this effect to be negative, because in theory, higher sales lead to lower goodwill losses. This is caused by a higher income stream, which indicates a more positive outlook of the future performance and cash inflows.

The coefficients of the other control variables are not significant, implying that their effect on reported goodwill impairments is not significantly different from 0 in this sample. Moreover, the R^2 of the model is 0.480, meaning that 48% of the total variation in the dependent variable is explained by the variables in

the model. However, a better measure is the adjusted R^2, which does not automatically increase when more control variables are added. The adjusted R^2 is only 0.238, which is less than half of the R^2. This indicates that actually, the variables included explain 23.8% of the total variation in '$Goodwill\_Imp_{it}$'. This could indicate that some of the added control variables do not fit the model and should be excluded.

As mentioned before, a higher value of '$\Delta Goodwill_{it}$' must be interpreted as a higher 'goodwill impairment', as change in book value of goodwill is a proxy for goodwill impairments. Interestingly, the results for model 2, in which the dependent variable is '$\Delta Goodwill_{it}$', are rather different. Firstly, in this sample, the effect of the crisis on change in book value of goodwill is statistically significant. In this sample, the change in goodwill as a percentage of lagged total assets is on average 0.5% higher when '$Crisis_t$' takes on value one, which is the case in 2020. So for this sample, the hypothesis that the effect of the crisis on the dependent variable is zero, can be rejected. However, an important note is that this is statistical significance. When we look at the actual effect, an increase in 0.5% is not necessarily economically significant. So even though the effect is statistically significant, in the real world it may be barely noticeable.

Other differences between the two models lie in the coefficients of the control variables. An example is ROA, of which the coefficient is very close to zero in model 2, whereas it was significantly negative in model 1. Another difference is that although similarly to model 1, the effect of a pre-impairment loss ($Pre\_Imp\_Loss_{it}$) on the change in book value of goodwill is significant, the sign is negative instead of positive. Specifically, when a firm experiences a pre-impairment loss in the sample, the change in goodwill as a percentage of total lagged assets is on average 3.8% lower. The prediction was that this variable would have a positive effect on goodwill impairments, as a loss could theoretically trigger a goodwill impairment due to more gloomy future expectations, which lowers expected cash flows of the reporting unit.

In model 2, the effect of change in sales ($\Delta Sales_{it}$) on the dependent variable is more in line with what was expected beforehand. All else being equal, a one standard deviation increase in '$\Delta Sales_{it}$' (0.270, see table 5) leads to an average decrease of 1.94% ((0.270*-0.072)*100%) in the change in book value of goodwill as a percentage of total lagged assets, which is the dependent variable.

Furthermore, the size of the firm ('$Size_{it}$') has a statistically negative effect on change in goodwill in the second sample. In particular, a one standard deviation increase in the natural logarithm of the size of a firm (2.802, see table 5) results on average in a decrease in change in book value of goodwill as a percentage of total lagged assets of 1.40% ((2.802*-0.005)*100%). However, the sign of this effect is different than what was predicted.

Finally, the coefficient of the variable '$Big4_{it}$' is significantly positive. This means that when firms are audited by one of the big-4 auditors, they are expected to on average have a 0.5% higher change in book value of goodwill as a percentage of lagged total assets. Although this effect is not large in an economic way, it could indicate that during a crisis, the existence of a strong governance mechanism (like being audited by a big-4 auditor) may motivate firms to report higher impairment losses.

Many differences between the results of the two models exist, both in terms of signs and significance of the coefficients of the included variables. This is likely caused by the inconsistency in meaning of the dependent variable. Although '$Goodwill\_Imp_{it}$' contains the information we are interested in, namely goodwill impairments divided by lagged total assets, it results in a rather small sample. As mentioned before, a second model is included, in which I regress the variable '$\Delta Goodwill_{it}$' on the same independent and control variables. '$\Delta Goodwill_{it}$' is used as a proxy for goodwill impairments and is calculated as the change in the book value of goodwill divided by lagged total assets. However, change in the book value of goodwill is not only affected by goodwill impairments, but also by acquisitions of other businesses and the sale of previously acquired businesses. This also means that even though '$Goodwill\_Imp_{it}$' can never take on a negative value, '$\Delta Goodwill_{it}$' can (see tables 3, 4 and 5). Therefore, it could be argued that '$\Delta Goodwill_{it}$' is a poor proxy for goodwill impairments. This could lead to a not so straightforward relationship between the control variables and the dependent variable '$\Delta Goodwill_{it}$' in this study, complicating the statistical inference.

Overall, the results show that the crisis itself does not seem to influence goodwill impairments that much, as its coefficient is either not significantly different from zero (model 1), or very close to zero (model 2). However, I discover that some firm-level performance measures, like ROA, change in sales or pre-impairment losses, do have significant effects on the reported goodwill impairments. In the next section, I explore several potential reasons why the results do not indicate a significant effect of the crisis on reported goodwill impairments.

Table 8: Regression results

	Predicted sign	Goodwill_Imp (1)	ΔGoodwill (2)
Crisis	+	0.001	0.005***
		(0.009)	(0.002)
ROA	-	-0.159**	-0.000
		(0.062)	(0.000)
Market-Book	-	-0.002	-0.000
		(0.002)	(0.000)
Pre_Imp_Loss	+	0.029**	-0.038***
		(0.014)	(0.003)
ΔSales	-	0.100*	-0.072***
		(0.057)	(0.007)
ΔCashflow	-	-0.324*	0.007*
		(0.180)	(0.004)
Size	+	-0.007	-0.005***
		(0.006)	(0.001)
Leverage	-	0.037	-0.001
		(0.067)	(0.001)
Big_Bath	+	-0.010	-0.005*
		(0.019)	(0.003)
Smoothing	+	0.032	-0.002
		(0.026)	(0.002)
Big4	?	0.020	0.005**
		(0.016)	(0.002)
Constant		0.092	0.071***
		(0.064)	(0.017)
Industry controls		Yes	Yes
Number of observations		860	8,473
R^2		0.480	0.187
Adjusted R^2		0.238	0.146

*Notes: table 8 depicts the results for two OLS regression models. In the first model, the dependent variable is '$Goodwill\_Imp_{it}$'. The second model includes '$\Delta Goodwill_{it}$' as the dependent variable. In both models, industry controls are included. Below the coefficients, the corresponding heteroscedasticity-robust standard errors are presented in parentheses. The descriptions of all variables are included in table 1 (appendix) and all continuous variables are winsorized at 1% and 99%. ***Significant at the 1 percent level, ** significant at the 5 percent level, *significant at the 10 percent level, using a two-sided test.*

6. Conclusion, discussion and limitations

6.1 Conclusion and discussion

This research focuses on goodwill accounting during the COVID-19 crisis. More specifically, the effect of the COVID-19 crisis, caused by a pandemic, on reported goodwill impairments is examined. To research this relationship, I analyze two samples of 860 and 8,473 firm-year observations during 2019 and 2020 from listed U.S. firms. The following research question is proposed:

What is the relationship between the COVID-19 crisis and reported goodwill impairments in listed U.S. companies?

Previously, the effect of a crisis on goodwill impairments is examined (Kabir & Rahman, 2016; Malijebtou Hassine & Jilani, 2017). Besides, many papers have been written about the possible determinants of goodwill impairment. These include economic firm-level performance measures. Additionally, due to the discretionary nature of accounting rules for goodwill impairments, firms can use goodwill impairments opportunistically. Strong corporate governance is found to affect goodwill losses in the sense that the stronger these governance mechanisms are, the more goodwill impairments are explained by economic indicators instead of opportunistic behavior. However, these previous research papers either do not focus on the COVID-19 crisis, or on the situation of a crisis at all.

Based on the existing literature, the hypothesis is developed, which states that an effect of the crisis on reported goodwill impairments is expected. To test this hypothesis, two OLS regression models are used. In the first model, the dependent is goodwill impairments. Because of the small size of the sample (860 firm-years) in the first model, another model is added with change in book value of goodwill as a proxy for goodwill impairments as the dependent variable. For that model, considerably more observations are available, resulting in a sample of 8,473 firm-years.

In the first sample, the relationship between the crisis and goodwill impairments is statistically insignificant. So, at first sight, the crisis does not seem to have an effect on the reported goodwill losses. However, as discussed in chapter 2.2, the crisis may affect goodwill impairments through firm-level performance measures. I discover that some of those performance indicators significantly affect goodwill impairments in the first sample. The coefficient for ROA is significantly negative, which is in line with the expectation that when the return on assets increases, the reported impairment loss decreases. Moreover, firms that experience a pre-impairment loss on average record higher impairment losses, which is consistent with the predictions.

Nonetheless, the results of the descriptive statistics show that during 2020, a year in which a crisis occurred, ROA is actually less negative on average than in 2019. And even though the proportion of firms facing a pre-impairment loss is higher during 2020 than in 2019, this proportion was not significantly higher during the crisis (table 3). It is unlikely that during 2020, the crisis had an effect on goodwill impairments through these performance measures, as firms' performance in terms of these variables was not significantly worse during 2020 compared to 2019. However, I must note that from the results, I am not able to infer whether a causal relationship between the crisis and these performance measures exists, as that is not the focus of this study. The descriptive statistics merely give an indication that during 2020, firms' performance was not significantly worse on average compared to 2019.

The results of model 2 indicate that the crisis has a statistically significant, positive effect on change in book value of goodwill, which is a proxy for goodwill impairments. Initially, one might say that this indicates an effect of the crisis on goodwill impairments. However, it is important to stress that although the effect is statistically significant, it is not economically significant, as it is very close to zero. This means that I cannot confirm that during 2020, the crisis had an actual noticeable effect on reported goodwill losses.

In the second sample, the coefficients of pre-impairment losses and change in sales are significantly negative. However, I expected the coefficient of pre-impairment losses to be positive, as when firms report a loss, they are in theory more likely to report higher goodwill impairments due to worsened future expectations. Furthermore, the size of a firm has a significantly negative effect on reported goodwill impairments. Lastly, being audited by a big-4 auditor results in larger impairment losses, although this effect is small. Nevertheless, I cannot confirm that these results indicate that the COVID-19 crisis had an effect on goodwill impairments through these variables. That is partially because of the inconsistencies between the expectations and the actual signs of the regression coefficients of those variables. Furthermore, since the dependent variable in this second model may not accurately represent actual goodwill impairments, the relationship between the control variables and actual goodwill impairments in the second model is not straightforward (see limitations).

Even though from these regressions, it is impossible to conclude why no significant relationship between the crisis and goodwill impairments is found, I will now elaborate on several possible explanations. One possible reason is that the effect of the COVID-19 crisis on goodwill impairments only becomes apparent at a later time. Beforehand, I did not expect this to happen in these samples, as auditing firms advised companies to test their goodwill immediately during 2020 due to triggering events that potentially led to a potential impairment (KPMG, 2020; PwC, 2020; Deloitte, 2021). However, prior research has shown that

in general, goodwill impairments lag behind economic circumstances by several years (Hayn & Hughes, 2009). In this case, firms might wait with assessing the effect of the COVID-19 crisis on the value of goodwill until the pandemic and crisis are fully over.

Furthermore, managers may have used their discretion to avoid recognition of goodwill impairments during 2020, hoping that the economy would recover soon, which would make a goodwill impairment unnecessary. Especially during the COVID-19 crisis, activity of firms (and therefore the possibility to generate income streams) depends heavily on the government's efforts to reduce the spread of the coronavirus. As soon as lockdowns are lifted, firms can quickly return to their pre-crisis levels of activity. This was the case in the third quarter of 2020 (Carlsson-Szlezak, Swartz & Reeves, 2020). This may have influenced the results in such a way that I could not find a significant effect of the COVID-19 crisis on goodwill impairments.

Besides, a $2 trillion stimulus bill was accepted by the U.S. government in March 2020 (Pramuk, 2020). Potentially, this financial aid influenced the income streams of U.S. listed firms in such a way that goodwill impairments were not necessary to report. This might also explain why the descriptive statistics (table 3 and 4) show that firm-level performance in terms of certain economic measures (like pre-impairment loss, change in operating cash flows, ROA and market-to book ratio of equity) was, on average, not significantly worse during 2020 compared to 2019.

Overall, the answer to the main research question is that in these two samples, no evidence is found that there is a relationship between the reported goodwill impairments and the COVID-19 crisis in listed U.S. companies.

6.2 Limitations and further research

One of the main reasons why the results for the two models are so different is likely because of the discrepancy between the meanings of the dependent variables. Change in book value of goodwill (model 2) includes more than just the actual goodwill impairments (model 1), so it potentially is a poor proxy for goodwill impairments. This brings forth an important limitation of this research. Since the change in book value of goodwill might not be a good proxy for goodwill impairments, the regression results are hard to interpret. Some variables have a significant effect on change in book value of goodwill, but it cannot be concluded that this effect then also holds for actual goodwill impairments in that sample. So even though the second regression is done on a much larger sample, it is not clear whether this can be interpreted in terms of goodwill impairments.

Another limitation of this research is the amount of missing data for many of the variables, specifically for the variable 'Goodwill_Imp$_{it}$'. As previously stated, this results in a rather small sample, which may not be an accurate representation of the total population of U.S. listed firms. If this is the case, the results found in this research are also not representative, making the statistical inference unreliable.

Moreover, not all potential variables are included in the regression analysis due to data limitations. Some variables representing the strength of governance mechanisms or acquisition characteristics, number of segments, CEO change or bonus pay are not available in accessible databases. In existing research, data for many of these variables are hand-collected from annual reports of the firms. Unfortunately, due to time constraints, this was not possible for this thesis. Excluding these important variables may have led to omitted variable bias, meaning that the coefficient of the variable of interest 'Crisis$_t$' would not be accurate. A possible solution for this problem would be to invest more time in a study on this subject which would allow for hand-collection of data for these variables.

The last limitation is that the research only covered 2 years, 1 year before and one year during the crisis. This is done to avoid an imbalance in the before and after period. A disadvantage of this is that it results in a small sample size, which may not represent the total population well enough.

Furthermore, a limitation is that I did not investigate the causal relationships between the COVID-19 crisis and firm-level performance measures, which are used as control variables. Therefore, I can only assume whether or not the crisis affected goodwill impairments through these variables, without supporting these claims by empirical evidence.

Even though no relationship between the crisis and goodwill impairments is found, the results of this study can be helpful for auditors in understanding how firms deal with goodwill impairments during the COVID-19 crisis.

Further research should be done on the causal relationships between the COVID-19 crisis and firm-level performance indicators. That is because the crisis may affect goodwill impairments through these variables. Moreover, my research should be done again, a few years after the COVID-19 crisis or pandemic has been over. One reason for this is that it allows to use a larger sample, because the before and after period is larger, as opposed to just two years in total. Another reason is that the results in terms of goodwill impairments may lag behind economic circumstances (Hayn & Hughes, 2006; Ji, 2013; Knauer & Wöhrmann, 2016; Gunn et al., 2017). In a couple of years, a better view can be given of the actual effect of the COVID-19 crisis on reported goodwill impairments.

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8. Appendix

Table 1: Variable descriptions

Variable	Description
Dependent variables	
$Goodwill\_Imp_{it}$	Goodwill impairments of firm i in year t, divided by total assets at the end of year t-1
$\Delta Goodwill_{it}$	Alternative measure for goodwill impairments. Calculated as change in book value of goodwill from year t-1 to year t, divided by total assets at the end of year t-1. To make it similar in interpretation to the other dependent variable '$Goodwill\_Imp_{it}$', the negative value of change in book value of goodwill was taken. This means that when book value of goodwill has increased, '$\Delta Goodwill_{it}$' depicts a negative value, similar to a negative goodwill impairment
Independent variable	
$Crisis_t$	Binary variable, takes on value 1 during 2020 (crisis) and 0 during 2019
Control variables	
ROA_{it}	Return on assets for firm i in year t. Calculated as net income divided by total assets in year t
$Market\text{-}Book_{it}$	Describes the market-to-book value of equity of a firm
$Pre\_Imp\_Loss_{it}$	Pre-impairment losses, calculated as net income plus goodwill impairments. Binary variable, takes on value 1 if pre-impairment losses are negative
$\Delta Sales_{it}$	Change in sales for firm i from year t-1 to year t, scaled by total assets at the end of year t-1
$\Delta Cashflow_{it}$	Change in operating cash-flow for firm i from year t-1 to year t, scaled by total assets at the end of year t-1
$Size_{it}$	Natural logarithm of total assets in year t
$Leverage_{it}$	Long-term debt plus debt in current liabilities divided by total book assets in year t
Big_Bath_{it}	Binary variable. Takes on value 1 if the change in EBIT from year t-1 to year t scaled by lagged total assets is more negative than the median of non-zero negative changes for all observations. So, for this variable only negative changes in EBIT are considered
$Smoothing_{it}$	Binary variable. Takes on value 1 if the change in EBIT from year t-1 to year t scaled by lagged total assets is more positive than the median of non-zero positive changes for all observations. So, for this variable only positive changes in EBIT are considered
$Big4_{it}$	Binary variable, takes on value 1 if a firm is audited by one of the big-4 auditing firms and 0 otherwise

Notes: table 1 contains definitions of all variables that are included in this research

Table 5: Descriptive statistics full samples

Variable	Obs	Mean	Median	Std. Dev.	Minimum	Maximum
Panel A: Model 1						
Goodwill_Imp	860	0.063	0.020	0.129	0.000	1.253
ROA	860	-0.117	-0.031	0.298	-2.160	0.208
Market-Book	860	2.157	1.401	5.531	-38.931	30.617
Pre_Imp_Loss	860	0.635	1	0.482	0	1
ΔSales	860	-0.050	-0.026	0.245	-0.914	1.095
ΔCashflow	860	-0.011	-0.002	0.099	-0.612	0.320
Size	860	7.445	7.669	2.237	0.526	12.113
Leverage	860	0.387	0.348	0.316	0	2.999
Big_Bath	860	0.301	0	0.459	0	1
Smoothing	860	0.151	0	0.358	0	1
Big4	860	0.700	1	0.459	0	1

	Obs	Mean	Median	Std. Dev.	Minimum	Maximum
Panel B: Model 2						
ΔGoodwill	8,473	-0.012	0	0.077	-0.642	0.173
ROA	8,473	-0.415	0.006	2.086	-22.828	0.330
Market-Book	8,473	2.986	1.744	11.389	-61.329	63.251
Pre_Imp_Loss	8,473	0.486	0	0.500	0	1
ΔSales	8,473	0.028	0.004	0.270	-0.914	1.570
ΔCashflow	8,473	-0.014	0.001	0.355	-2.368	1.695
Size	8,473	6.322	6.722	2.802	-2.718	12.046
Leverage	8,473	0.447	0.246	1.143	0	11.508
Big_Bath	8,473	0.258	0	0.437	0	1
Smoothing	8,473	0.250	0	0.433	0	1
Big4	8,473	0.569	1	0.495	0	1

Notes: this table shows the descriptive statistics for the variables used both regression models. Panel A depicts the descriptive statistics for the sample in which the dependent variable is 'Goodwill_Imp$_{it}$' Panel B depicts the descriptive statistics for the sample in which the dependent variable is 'ΔGoodwill$_{it}$'. The first column shows the variable name, the second column contains the number of observations. All continuous variables are winsorized by year at 1% and 99%.