International Journal of
Financial Studies

MDPI

Article

Management's Discretionary Assessments of Goodwill Impairments—Evidence from STOXX Europe 600

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Abstract: The main issues of accounting reporting regarding goodwill are whether a firm's management reliably conveys their private information about future earnings, and whether they disclose value-relevant and useful information to accounting users. In the current International Financial Reporting Standards (IFRS) regulations, the goodwill impairment test is based on management's discretionary assessments. This study examines how goodwill impairment is reported under IFRS considering company- and industry-specific economic factors, proxies for earnings management, and macroeconomic crisis years. We extend previous research using tobit and logit regressions by employing a fixed-effects model. This approach is possible because of a panel dataset comprising 449 of 600 active companies sampled from the STOXX Europe 600 index from 2005 to 2018. We find that goodwill impairments are largely concentrated in certain companies, industries, and years. The regression models show a significant negative correlation between companies' return on total assets and goodwill impairments. Moreover, we discover that goodwill impairments have a significant positive correlation with goodwill intensity, debt ratio, and the proxy for reporting a one-off big bath charge. In addition, we find that the global financial crisis in 2008–2009 and the European debt crisis in 2011 differ significantly from other fiscal years.

Keywords: goodwill impairment; IFRS; earnings management; company-specific factors; fixed effects

Citation: Kjærland, Frode, Kristian Forbord, Are Oust, and Håkon Stephani. 2023. Management's Discretionary Assessments of Goodwill Impairments—Evidence from STOXX Europe 600. *International Journal of Financial Studies* 11: 81. https://doi.org/10.3390/ijfs11020081

Academic Editor: Giovanni Cardillo

Received: 12 May 2023
Revised: 15 June 2023
Accepted: 16 June 2023
Published: 20 June 2023

1. Introduction

Goodwill is a significant item on the balance sheet of entities that follow International Financial Reporting Standards (IFRS). It is crucial to ensure that the accounting information related to goodwill is relevant and reliable for accounting users. However, this accounting item is complex due to the subjective and discretionary assessments involved in its initial recognition and subsequent measurements. Even after more than 15 years since the mandatory adoption of IFRS among listed companies, the treatment of goodwill remains controversial.

This study examines how goodwill impairment (GI) is related to company- and industry-specific economic factors, as well as proxies for earnings management. Our contributions are threefold. Firstly, we analyze a large panel dataset spanning several years, gathering accounting figures from the mandatory adoption of IFRS regulations for European listed companies from 2005 to 2018, which is a longer time span than previous research considered. This time series includes major events such as the global financial crisis in 2008–2009, the European debt crisis in 2011–2012, and the decline in oil and natural gas prices in 2014–2015. Secondly, this extensive dataset allows us to examine the effects of crisis years and recession periods on GI in the European market. Thirdly, we extend previous research by incorporating a fixed-effects (FE) model that takes into account company-specific conditions in the panel data, which can affect the regression models.

The STOXX Europe 600 index represents a wide range of European listed companies based on country, industry, and market capitalization. Out of the 600 companies in the

index, we obtained a sample of 449 companies, with annual data from 1 January 2005 to 31 December 2018. This study is limited to existing IFRS reporting entities and includes all industries except the financial sector.

Examining the impact of IFRS implementation on GI decisions, particularly when more flexibility is allowed, is an empirical question (Bepari and Mollik 2017). Therefore, we analyze the extent of consecutive GI resulting from business combinations by studying companies' key financial figures, proxies for earnings management, and whether the fiscal years are characterized by macroeconomic recessions. Empirical studies have yielded inconsistent results on these issues, as discussed in Section 3. However, our study combines previous research on profitability measures with metrics related to opportunistic behavior and the impact of various crises during the chosen time span. This contributes to understanding GI assessments in the post-IFRS European context. Our findings reveal that GI was significantly higher in the years following the transition to new regulations in 2005, the global financial crisis in 2008–2009, and the European debt crisis in 2011–2012. From 2013 onwards, GI stabilized at a lower level. Descriptive statistics show a wide variation between the average GI of 9% and the median of 1.7% among companies reporting GI. The average is driven by significant GI in crisis years and by individual companies and industries with substantial GI. This study confirms the findings of the European Securities and Markets Authority (ESMA 2013) that a relatively small number of companies, primarily concentrated in a few industries, account for most of the reported GI. The telecommunications services industry stands out as the sector reporting the highest extent of GI, both in terms of magnitude and capitalized goodwill. From 2005 to 2018, capitalized goodwill, on average, represented 43% of total equity and 14% of total assets for the entire sample.

Our study further confirms the variation in GI across years through multivariate analysis. The empirical results also indicate that companies with a higher return on assets tend to report GI to a lesser extent. Additionally, companies with higher debt ratios and opportunities to implement a one-off significant charge (referred to as a "big bath" charge in Section 3) report GI to a greater extent. The findings from the FE model align closely with the results obtained from the tobit and logit regressions.

The outcomes of this study can enhance accounting users' awareness of the factors related to GI. The findings pertaining to crisis years and significant charges are particularly relevant in the context of the recent COVID-19 pandemic. We also believe that this study can contribute to the efforts of supervisory authorities in addressing impairment issues.

The remainder of the paper is organized as follows. Section 2 surveys the accounting treatment of goodwill in accordance with IFRS. Section 3 presents previous research on the topic and develops hypotheses. Section 4 presents the data and descriptive statistics, while Section 5 elaborates on the methodology. In Section 6, we present and discuss the findings from the multivariate analyses. In Section 7, we present conclusions, limitations, and implications.

2. Accounting Treatment of Goodwill in Accordance with IFRS

IFRS became mandatory for listed companies in the European Union and European Economic Area from 1 January 2005. IFRS 3 introduced the requirement that goodwill should be assessed for impairment following the impairment-only approach. The standard replaced IAS 22, which mainly required amortization of goodwill, but had an element of impairment. This change was mainly due to the difficulties of credibly estimating goodwill lifetime under an amortization model (André et al. 2016; Amel-Zadeh et al. 2021). In the case of full IFRS, goodwill must be tested annually for impairment, as well as for ongoing indications of impairment in accordance with IAS 36 Impairment of Assets. The impairment test examines whether the recoverable amount of a cash-generating unit (CGU) is lower than the amount in the balance sheet[1]. The recoverable amount has the highest value in use or net sales value. Meanwhile, the impairment test cannot test goodwill directly as a separable asset and is not designed to signal whether an acquisition is successful.

The impairment test relies on management's discretionary estimates of uncertain future cash flows.

According to Scott (2015), reporting goodwill in accordance with international accounting standards means that accounts could have increased decision-making relevance for accounting users, as GI can present managements inside information on expectations related to future earnings. Hence, it can mitigate information asymmetry and opportunities for principal–agent problems between management and investors and creditors (Knauer and Wöhrmann 2016). Our study focuses on the subsequent measurement of goodwill. One of the challenges with the impairment-only model is the unintended problem of self-developed goodwill replacing acquired goodwill. This is contrary to the general prohibition on capitalizing in-house-developed goodwill in accordance with IAS 38.48, and the prohibition on reversing GI in accordance with IAS 36.124. However, companies can allocate goodwill to units with good economic growth and can allocate parts of the acquisition cost of depreciable assets to achieve evenly distributed depreciation. Therefore, the regulations can lead to incentives to both postpone and avoid GI to varying degrees.

During Europe's weak economy after the global financial crisis of 2008–2009 and subsequent debt crises, the ESMA published a report in January 2013 summarizing the practice of impairment of goodwill and other intangible assets, based on a survey of 235 companies. Approximately 36% of the companies in the survey reported GI. The impairment for 2011 as a share of capitalized goodwill at the beginning of the year was 5.1%. Moreover, the ESMA pointed out that goodwill was impaired by only a few players, which could indicate differences and biases across companies and industries. Only 5% of the companies in the sample accounted for as much as 75% of the total GI (ESMA 2013). The ESMA pointed out that companies with net assets greater than the market value of the company did not implement GI, and thus, the reduction in market value did not fully reflect the level of GI. This situation was further exacerbated during economic crises and situations with weak future prognoses, when a company might have lower future cash flows than was the case when first recognizing the goodwill.

The national regulatory authorities followed up the ESMA's recommendations. To identify impairment problems among companies, financial authorities typically use a model in which they weight several impairment indicators given in IAS 36. Although we do not examine all these key indicators as separate explanatory variables in this study, doing so provides information that company-specific economic factors are important to supervisory authorities, and that their controls have led to demand for increased impairments.

In June 2015, the IASB published the Report and Feedback Statement—Post-Implementation Review of IFRS 3 Business Combinations. Relevant findings were that investors had different views on topics, such as the consecutive measurement of goodwill, but also separate recognition of other intangible assets. According to the IFRS Foundation (2015), several accounting users considered that IFRS 3 had implementation challenges, including, among other things, the impairment test for goodwill. Many stakeholders found the impairment test to be complex, time-consuming, and costly and to involve significant discretionary assessments, especially in determining the assumptions related to value in use and allocations of goodwill to CGUs. At the same time, the IASB mapped research in this area and found that the impairment-only model has continued to replace the previous amortization model, the main argument being that the impairment-only model provides more value-relevant information. Reported GI provides relevant and decision-making information for accounting users, with a focus on investors and creditors. Nevertheless, the IASB has stated that the current regulations, which involve subjective and discretionary assessments by management, could facilitate opportunistic reporting (IFRS Foundation 2015).

The issues from this report and the feedback from stakeholders were taken up in the IASB's project Goodwill and Impairment. The main goal is to improve the information provided about business combinations in companies' notes to the financial statements and in the subsequent measurement of goodwill. The project indicates the importance

and complexity associated with the accounting treatment of goodwill and impairments according to the IFRS 3 and IAS 36 standards. In March 2020, the IFRS Foundation conducted a Global Preparers Forum in which the IASB board presented preliminary views. On goodwill, the board considers that the impairment test cannot be made more efficient, and that the rule on annual impairment testing should be continued. Thus, the previous amortization model will not be reintroduced. However, the board considers that the test can be simplified by deviating from the requirement for an annual impairment test. Moreover, the board's preliminary view is that companies' equity should be presented, excluding goodwill, as a separate line under the balance sheet (IASB 2020), which would draw attention to companies whose booked goodwill constitutes a significant proportion of the booked equity.

In addition, a survey on CFOs (Ferramosca and Allegrini 2021), where more than 50% were from Europe, showed that more than half of the respondents agree that alternative accounting treatments of impairment testing might provide more useful information. However, almost two-thirds still prefer goodwill impairment testing to the amortization process. This support that there is controversy around the treatment of goodwill.

Hence, there are several issues to be resolved regarding goodwill and GI. The ESMA has addressed the concern that GI does not seem to follow clear indications for value decline by pointing out that most GI is reported by only a few companies. The IASB confirms the issues surrounding GI but is reluctant to disclose information on the level of impairment rates. To solve these puzzles, we examined explanatory variables that may be related to companies' GI. The results are useful for accountants carrying out impairment tests and for investors and creditors analyzing accounts for decision making. To explain the extent of consecutive GI from a business combination, we chose to focus on companies' key financial figures, management's use of earnings management, and the possible correlation with years of macroeconomic recession.

3. Relevant Studies and Hypothesis Development

As a basis for our work, we used elements from Abughazaleh et al. (2011), who focused on GI according to IFRS with UK data. We also relate to, and acknowledge, the studies of André et al. (2016), Glaum et al. (2018) and Gros and Koch (2020). The second study examined whether discretionary assessments represent management's opportunistic reporting or sharing of inside information about the company. They hypothesized that GI is a function of economic factors that form the basis for a company's results, reporting incentives from management, or the corporate governance mechanisms to which the company is subject. Their findings suggest that IFRS 3 provides companies with a framework for reliably reflecting their underlying financial attributes. The IFRS and Financial Accounting Standards Board (FASB) regulations are currently largely harmonized regarding the accounting treatment of goodwill.

Relevant explanatory variables on impairments, including proxies for the company's and industry's historical equity returns, book-to-market, and return on assets, are significant in explaining the extent and timing of impairments (Francis et al. 1996). Standard setters claim that the impairment model improves the accounting treatment of goodwill and provides users with more useful and value-relevant information about the underlying economic value of goodwill. However, this approach has largely been criticized on the basis that management's discretion is inherent in the impairment testing of goodwill (Abughazaleh et al. 2011). Ramanna and Watts (2012) addressed the same issue and found that estimates of the fair value of goodwill were based on unverifiable assumptions, such as management's expectations about the future. The problem was whether the value estimates could indicate the management's opportunistic reporting, or whether the management actually presented the inside information they possessed about the company's future cash flows, in accordance with the intention of the standard setters.

Although the FASB wants to improve financial reporting, the lack of verifiability of many value estimates gives management an opportunity to introduce bias and noise in

the estimates (especially concerning distressed firms, see Nagar and Sen 2017). However, Watts (2003) was critical of the impairment regime and considered the regulations to motivate earnings management and opportunistic behavior. In their support, Beatty and Weber (2006) considered financial incentives to affect unverifiable fair value estimates. Watts (2003) argued that the FASB's transition to an impairment regime under SFAS 142 had led to increased incidence of fraudulent financial reporting. In summary, impairment testing for goodwill is a complex accounting task when it comes to defining CGUs, allocating goodwill to CGUs, and determining the fair value of CGUs. In addition, there are challenges related to companies' compliance and note information in accordance with the accounting standard, so that the market can rely on the underlying economic value of goodwill (Bepari et al. 2014).

Below, we present three hypotheses related to the relationship between GI and company-specific economic factors (key financial figures), earnings management, and macroeconomic crisis years.

Hypothesis 1a. *There is a connection between companies' net profitability and reported goodwill impairments.*

Hypothesis 1b. *There is a connection between companies' cash flow and reported goodwill impairments.*

Hypothesis 1c. *There is a connection between companies' goodwill and reported goodwill impairments.*

Hypothesis 1d. *There is a connection between companies' price-book ratio and reported goodwill impairments.*

Previous research is consistent with the negative relationship between net profitability and GI (Abughazaleh et al. 2011; Francis et al. 1996; Glaum et al. 2018; Zang 2008). Change in turnover is a frequently used parameter for measuring a company's performance over time (Riedl 2004). Despite different definitions of turnover growth, neither Abughazaleh et al. (2011) nor Francis et al. (1996) found a significant covariation between revenue growth and reported GI.

The parameter change in cash flow from operations reflects company-specific historical results and changes in performance. Cash flows are a driver of any loss in value decline for goodwill. Consequently, lower cash flows increase the likelihood of impairment decisions. This seems to be intuitive and logical. Previous research has documented that cash flows from operations have a negative relationship with future cash flows (Bostwick et al. 2016; Jarva 2009). Bostwick et al. (2016) found that GI has a more significant relationship with future cash flows than the sum of all other non-recurring items in the accounts. Jarva (2009) also found that GI according to SFAS 142 was associated with expectations of future cash flows. The GI according to SFAS 142 had a significant ability to predict cash flows 1 and 2 years ahead.

Goodwill, as a share of the company's total assets, is a widely used explanatory variable. Zang (2008) expected that a high proportion of goodwill in the balance sheet would lead to a higher GI, as a larger part of the total goodwill would be exposed to impairment assessments. Meanwhile, it can be assumed that goodwill-intensive companies with a higher debt ratio may have incentives to avoid GI to avoid conflicting with loan agreements (Chalmers et al. 2011).

Abughazaleh et al. (2011) used the book-to-market ratio as an independent variable in their study and predicted that companies with a high book value of equity in relation to market value reported GI. As expected, the analysis yielded a positive sign and significant correlation with GI. The book-to-market ratio is an inverse variable to the price-to-book ratio. The ESMA refers to a book-to-market ratio above 100% as an external impairment indicator, and this should be considered when testing realistic value estimates in the assumptions used in impairment testing (ESMA 2013).

Hypothesis 2a. *There is a connection between debt ratio and reported goodwill impairments.*

Hypothesis 2b. *There is a connection between big bath and reported goodwill impairments.*

Hypothesis 2c. *There is a connection between income smoothing and reported goodwill impairments.*

Earnings management, a well-studied topic in accounting research, can result in either overestimation or underestimation of goodwill by postponing or accelerating GI, for the purpose of manipulating the result (Bepari and Mollik 2017; Han et al. 2021). The proxies for earnings management in our study are debt ratio, big bath, and income smoothing.

On one hand, Zang (2008) found that companies with a high debt ratio reported smaller GI, which implies a negative correlation between debt share and GI. Likewise, Ramanna and Watts (2012) discovered that management's opportunistic behavior is reflected in the lack of GI when the company risks violating the accounting-based terms of a loan agreement. However, Gros and Koch (2020) find a connection between debt ratio and (negative) GI. Beatty and Weber (2006) and Chalmers et al. (2011) also concluded that a company's loan agreements constitute an incentive to postpone or accelerate GI. Bepari et al. (2014), on the other hand, found that the debt ratio was not significantly associated with compliance with IFRS for impairment testing of goodwill, as contracts normally exclude intangible assets and goodwill from measuring the debt ratio.

A big bath occurs during periods of organizational stress and restructuring (Scott 2015). If the company must report a loss in financial statements, management may feel that they might as well report an even larger loss. GI and other asset write-downs are accounting decisions that can be used in a big bath strategy. Scott (2015) stated that the recognition of large write-downs means that future earnings are put "in the bank" (p. 405). Impairment losses on goodwill, meanwhile, cannot be reversed in subsequent periods in accordance with IAS 36.124. Nevertheless, a big bath would reduce the value of booked goodwill and corresponding GI in the future. This makes it possible to show a significantly weaker result than what is real in the current year, and stronger results in years to come.

Income smoothing is another form of earnings management. Management that aims to achieve artificial profit equalization utilizes the room to maneuver within accounting standards to achieve stable positive results, such as to provide stable bonuses (Scott 2015). This is a principal–agent problem and has been extensively described in contract theory. Another incentive is to avoid volatility in key financial figures so as not to violate the company's loan terms. Finally, there is an incentive to meet investors' return expectations and hence to avoid stock market punishment. GI cannot be reversed in subsequent periods, in contrast to, for example, loss provisions and other accruals. We can then assume that GI is not as suitable as a tool for income smoothing as big bath reporting is.

Riedl (2004) concluded that increased flexibility for management in accounting standards, such as IFRS 3 and IAS 36, leads to increased reporting of big baths, and that write-downs, to a lesser extent, reflect the company's underlying financial performance and financial position. Rees et al. (1996) concluded that management impaired assets in years when earnings were already weaker than industry medians. Kirschenheiter and Melumad (2002) argued that companies use a big bath and income smoothing to achieve stable high earnings in the long term. However, Francis et al. (1996), concluded that expected write-downs are reduced by abnormally weak and abnormally strong results for the company, contrary to their own predictions. These findings contradict the expectations of arguments for big baths and income smoothing.

Hypothesis 3. *There is a connection between macroeconomic crisis years and reported goodwill impairments.*

Bepari et al. (2014) examined whether there were significant differences between companies' compliance with IFRS regulations related to impairment testing of goodwill before and after a financial crisis. They found evidence that the degree of compliance increased significantly during the global financial crisis (2008–2009) from the period before the financial crisis (2006–2007). This confirms the findings of previous studies that companies provide more information when the need for transparency about impairment

decisions is greater among investors. This applies especially when companies have a high goodwill share in the balance sheet, large GI, and risk of lawsuits.

Several researchers have examined the timeliness of GI in financial crises. The timeliness of impairments can be defined as the frequency of write-downs when there are financial indications for write-downs. André et al. (2016) compared the timeliness of write-downs between the US and Europe. They examined companies that had reported GI and found that American companies reported it to a significantly greater extent than European companies during the 2008–2009 financial crisis. There was also evidence that European companies implemented GI over a longer period but did not accumulate the same impairment rates as US companies.

4. Data and Descriptive Statistics

4.1. Data

The data used in this study are obtained from the Thomson Reuters Eikon financial database for the fiscal years 2005–2018. The data are obtained on an annual basis for active listed companies registered on the STOXX Europe 600 index on March 2020. The index consists of large, medium-sized, and small listed companies across 17 European countries (Stoxx.com 2020). Based on the original list of 600 unique companies, we chose to exclude the financial industry, following similar studies. This industry is subject to regulatory conditions that result in different financial reporting requirements to those faced by companies in the rest of the sample. The Thomson Reuters Business Classification (TRBC) was used to categorize industries. Companies that were not reported in accordance with the IFRS during the investigation period were also excluded. For a complete overview of the sample of 449 companies, see Table 1.

Table 1. Sample of this study.

	Firm-Year Observations	Firms
Stoxx Europe 600 Index (retrieved active firms as of 15 March 2020 from Thomson Reuters Datastream) for fiscal years 2005–2018	9046	600
Observations related to the financial industry	−2152	−143
Observations of firms without IFRS reporting	−884	−7
Observations with missing data and inactive fiscal years	−342	−1
Final sample	5668	449
Number of firms with goodwill in the balance sheet	5357	441
Number of firms with goodwill impairments	1038	284
Number of firms with goodwill impairments of capitalized goodwill ($t-1$)	951	272

To minimize currency effects associated with the figures, reporting currency and ratios were used in the multivariate analysis. However, in the descriptive part of the analysis, where we also considered nominal values, the reporting currency was converted to euro.

We encountered challenges in collecting complete data from only one database. Hence, several different databases from Thomson Reuters were used. The data were mainly obtained from Eikon Excel, but due to lack of access to certain accounting data, the other material was obtained from Datastream. These databases do not categorize reporting currencies on an equal footing for all firms. Therefore, for companies with inconsistent currency management across the databases, currency conversion was performed. Different uses of exchange rates in the companies' annual reports and Datastream led to currency differences for parts of the data. To investigate the effect of this, multivariate regression was carried out both including and excluding the companies that defined the reporting currency differently. The results of this test show that the currency difference has a relatively similar effect to the robustness test shown later in this manuscript. This is because some companies in the telecommunications services industry are excluded from both tests. Thus, the management of currency differences has no effect on the data and regression analyses beyond this industry effect.

Moreover, all observations were obtained for 31 December, which means that there are some companies with deviating fiscal years. This may lead to incomparability between accounting data and market data for some companies, but it is not considered a significant factor in this study. We followed up companies with missing values for the accounting item goodwill with manual collection and registration of data. This was mainly because goodwill in some cases was registered as an item under intangible assets. Missing data were obtained in annual reports from company websites.

4.2. Descriptive Statistics

Table 2 provides an overview of the data. We observe the frequency among companies reporting GI and the variation between the years. GI was clearly higher in the initial years after the regulation change in 2005, during the financial crisis in 2008–2009, and in subsequent years when several European countries struggled with high government debt. Based on findings in the note information of annual reports from 2011 and 2012, it appears that several of the impairments in these years are related to CGUs from countries that were hit hard by the debt crisis. This finding is also reflected in the fact that the largest GI rates in the share of both goodwill and total assets was reported in 2011 and 2012. Since 2013, the proportion of companies with GI has stabilized at a low level, with 2018 being the lowest at 14%.

Table 2. Shares and goodwill impairments over years.

Year	Sample	Firms with GW in BS Year (t)	Firms with GI	Share of Firms with GI of GW (t − 1)	Share of Firms with 75% av GI	GW % of Eq	GW% of TA	GI in % of GW (t − 1)	GI in % of TA (t − 1)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	357	328	78	24%	10%	43%	14%	-	-
2006	376	346	84	24%	1%	40%	13%	5.5%	0.8%
2007	382	355	77	22%	1%	41%	13%	2.5%	0.3%
2008	383	360	100	28%	12%	47%	14%	2.5%	0.3%
2009	389	367	90	25%	9%	47%	14%	1.8%	0.3%
2010	395	374	73	20%	12%	43%	14%	0.9%	0.1%
2011	398	379	82	22%	9%	42%	14%	3.2%	0.5%
2012	401	382	82	21%	9%	42%	14%	2.7%	0.4%
2013	409	391	57	15%	5%	39%	13%	2.1%	0.3%
2014	422	401	60	15%	8%	41%	13%	1.5%	0.2%
2015	431	409	64	16%	14%	42%	13%	1.6%	0.2%
2016	437	416	70	17%	13%	45%	14%	0.9%	0.1%
2017	441	422	63	15%	11%	44%	14%	0.9%	0.1%
2018	447	427	58	14%	12%	45%	15%	0.7%	0.1%
Total	5668	5357	1038	-	-	43%	14%	-	-

Note: Descriptive overview of data material divided into periods. Column 2 is the total sample of company years, column 3 represents companies that have reported goodwill at the end of the fiscal year, and column 4 represents companies that have reported GI in the same year. Column 5 is column 4 divided by column 3 and shows the proportion of companies that have written down goodwill from the opening balance. Moreover, column 6 shows the proportion of companies that constitute 75% of these write-downs. In 2006 and 2007, these proportions were very low, as larger companies in Telecommunication Services reported large write-downs. Columns 7 and 8 show booked goodwill as a share of equity and total assets, respectively. Columns 9 and 10 show the impairment rates of goodwill as a percentage of goodwill and total assets (TA) in the opening balance, respectively.

The descriptive statistics on impairment rates in Table A7 of Appendix A show a large difference between the average GI of 9% and the median of 1.7% among the fiscal years in which goodwill was impaired. Of the 4928 fiscal years with incoming capitalized goodwill, 951 fiscal years reported GI. This accounted for 19.3% of the sample. A total of 951 fiscal years with goodwill write-downs were reported by 272 unique companies, representing a share of 28.6%. As the table shows, approximately 10% of the fiscal years have impairment rates of more than 20%.

We used descriptive statistics to examine the difference between the equity ratio including and excluding book goodwill (see Table A8 of Appendix A). The equity ratio for all companies was on average 39.3% with a median of 38.6%, but if we exclude goodwill, the average was 23.6% and the median was 24.8%. Moreover, companies that wrote down

goodwill had lower equity ratio than companies that did not. For equity excluding goodwill especially, the difference in solvency was significant, with a difference of 5 percentage points on average and 5.3 percentage points in the median, which is disadvantageous to companies with GI. It is noteworthy that 16.6% of companies have a negative equity ratio when excluding booked goodwill. For companies with GI in the actual year, 21.3% had an equity ratio excluding goodwill lower than 0.

We further examined the effect of recession periods on GI by observing the observations across years and industries (see Table A5 of Appendix A). The table reveals the extent of goodwill write-downs that were implemented in the energy and utilities industries during the fall of oil and gas prices in 2014–2015 (see Kjærland et al. 2021). Total GI in these industries accounted for as much as 62% of the total GI in the sample for 2015. The energy industry accounted for the largest proportion of write-downs (27%) among companies with goodwill write-downs in 2014–2015. At the same time, this industry had the largest GI in the share of opening goodwill, with 7% in 2014 and 6% in 2015. In turn, the utilities industry had by far the largest goodwill write-downs with 10% of opening capitalized goodwill in 2015.

The ESMA pointed out that significant GI was limited to only a handful of accounting producers (ESMA 2013). In their findings on accounting figures from 2011, they concluded that 5% of the companies in the survey accounted for as much as 75% of total GI. For our dataset, Table 2 shows that this proportion was 9% for 2011. Especially in 2006 and 2007, the percentage was low due to large GI in the telecommunications services industry. Moreover, Table 2 shows that goodwill constituted a stable high share of equity and total assets of the companies in the sample, where 2018 has the largest goodwill share of total assets.

Table 3 shows key figures at industry level. The industrials industry had the most observations and the most GI during the period. The telecommunications services industry had the largest share of GI; goodwill constituted the largest share of equity for both telecommunications services and consumer non-cyclicals. Telecommunications services constituted the largest share of the total sample both for the size of capitalized goodwill and GI. This industry also had the largest write-down rate of 5.2%; by comparison, healthcare had a low write-down rate of 0.4%. In four of nine industries, the goodwill share accounted for more than 25% of total assets.

Table 3. Shares and goodwill impairments across industries.

Industry (TRBC)	Firm Years	Firm Years with GW	Firm Years with GI	Firm Years with GI in % av Firm-Year Observations	GW in % of Total Sample GW	GI in % of Total Sample GI	GI in % of GW (t − 1)	GW in % of Eq	GW in % of TA
n	**5668**	**5357**	**1038**	**1038**	**5357**	**1038**	**4928**	**5357**	**5357**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Basic Materials	12%	12%	13%	21%	8%	11%	2.8%	27%	11%
Consumer Cyclicals	20%	19%	21%	20%	14%	10%	1.3%	38%	11%
Consumer Non-Cyclicals	11%	11%	10%	18%	19%	5%	0.5%	77%	26%
Energy	6%	6%	5%	14%	3%	4%	3.1%	7%	3%
Healthcare	11%	11%	5%	8%	12%	2%	0.4%	59%	25%
Industrials	24%	24%	26%	20%	15%	6%	0.8%	61%	14%
Technology	7%	7%	4%	12%	3%	2%	1.2%	52%	25%
Telecom. Services	5%	5%	8%	29%	17%	48%	5.2%	77%	25%
Utilities	6%	5%	7%	23%	8%	12%	2.6%	38%	8%
Total	100%	100%	100%	-	100%	-	-	-	-

Note: Column 1 shows industries according to Thomson Reuters Business Classification. For details of the main industries, see Table A5 of Appendix A. Columns 2 and 3 show the number of firm-year observations and firm observations with goodwill in the balance sheet, respectively. Column 4 shows which industry has the most firm years with GI, while column 5 weights this based on the number of company years with goodwill in the balance sheet. Column 6 shows which industry has the largest share of total goodwill in the sample, and column 7 shows the same figure for GI. Column 8 shows the write-down rate in relation to goodwill at the beginning of the year, and columns 9 and 10 show the share of equity and total assets (TA), respectively.

5. Methodology

5.1. Elaboration on the Variables

In the multivariate analysis, the dependent variable is GI, expressed as a positive value, as a share of total assets in the previous year, referred to as GWIMPA%, following Abughazaleh et al. (2011), Francis et al. (1996), and Riedl (2004). This dependent variable does not consider GI acquired in the actual year, which is reasonable to believe is not affecting the results in any considerable degree. To measure the effects of the actual impairment decisions, we also model a logistic regression with a dichotomous dependent variable GWIMP, where the value 1 corresponds to the fiscal year with GI, and 0 otherwise.

To test Hypothesis 1, we used proxies for company-specific financial conditions such as the financial results, growth, financing, and cash flows of the companies. The first three variables, ROA, ΔREV, and ΔOCFA, measure a company's financial performance. ROA, or return on assets, is a measure of net profitability that measures a company's annual profit as a share of total assets. We relied on the studies of Abughazaleh et al. (2011), Francis et al. (1996), and Zang (2008) and calculated the key figure as an annual result as a share of total assets at the beginning of the year. To measure gross profitability and the growth of the company's turnover, we used the variable ΔREV. Abughazaleh et al. (2011) considered a change in turnover as a share of total assets at the beginning of the year. We used their interpretation of revenue growth for concise use of total assets, as mentioned in our profitability parameters. They also measured changes in cash flow from operations (ΔOCFA) as the company's cash flow-related performance, while Riedl (2004) referred to this as a net measure of performance, such as ROA. According to Riedl (2004), cash flows from operations reflect the return on investment in assets. Here, too, we used a change in cash flow from operations as a share of total assets, following the argument above. Companies with good financial performance are expected to have less GI (Glaum et al. 2018).

The last two variables for measuring company-specific economic conditions are described as proxies for the characteristics of goodwill, including goodwill share and the book-to-market ratio. Francis et al. (1996) and Beatty and Weber (2006) also used book-to-market versions as proxies for goodwill characteristics. We used the price-book (P/B) ratio and expected a low ratio to lead to increased GI. As a measure of companies' goodwill intensity, we included goodwill as a share of the company's total assets at the beginning of the year (GWA), such as, for example, Chalmers et al. (2011) and Zang (2008). This is because, in most cases, this goodwill item is tested for impairments at the end of the year. Abughazaleh et al. (2011) and Zang (2008) expected that a high proportion of goodwill in the balance sheet would lead to increased GI, as a larger part of total goodwill would be exposed to impairment assessments. The prediction of the sign of this variable is associated with uncertainty, as it can also be assumed that companies with a high goodwill share of total assets refuse to write down goodwill.

To test Hypothesis 2, three proxies were used to investigate whether key financial figures facilitate earnings management: debt ratio (DEBT), big bath (BATH), and income smoothing (SMOOTH). We followed several previous studies by including debt ratio as a proxy for earnings management (Abughazaleh et al. 2011; Chalmers et al. 2011; Ramanna and Watts 2012; Zang 2008). DEBT represents a company's total debt as a share of total capital and is used to investigate whether there is a connection between the company's debt share and GI. The debt ratio can also be an expression of solvency and not exclusively a proxy for earnings management. A high debt ratio can be assumed to involve an increased risk of insolvency for the company, which indicates weaker key financial figures.

According to Abughazaleh et al. (2011), Francis et al. (1996), and Riedl (2004), a sign of a big bath could be, on the one hand, that the company reports GI in periods when it has weak profitability. On the other hand, income smoothing could occur in cases in which a company reports GI despite strong profitability. To address this ambiguity, we introduced two dichotomous variables. The dichotomous variable BATH is expressed as a value of 1 if the company has operating profit this year (t) below 0, and the change in operating profit is lower than the industry median, and 0 otherwise. Conversely, the value of SMOOTH

is expressed as a value of 1 for companies with an operating profit this year (t) above 0 and where the change in operating profit is higher than the industry median. We also tested the semi-dichotomous variables GOOD and POOR from Francis et al. (1996) as a robustness test of the findings of the previous proxies for earnings management. These explanatory variables refer to unexpectedly good operating results after write-downs and unexpectedly weak operating results. The intuition behind this approach was to measure whether accounting figures facilitate write-downs.

To investigate the effect of crisis years, we included dummy variables for the fiscal years (YEAR). We expected crisis years and years with recessions to have a greater effect on GI and to be significantly different from years without special economic downturns. In the regression models, the reference year was set to 2018, as this is the last fiscal year in our dataset that does not contain known macroeconomic crises.

For a complete overview of the variables, see Table A1 of Appendix A. As our continuous explanatory variables are largely divided by total assets, or measured in the form of change, there is low risk of lack of stationarity. To confirm stationarity in the dataset, we selected 20 companies that carried out a visual check of the time-series graphs of all variables. In addition, the panels were tested using a Fischer test, as shown in Table A4 of Appendix A. The controls indicate that the variables and panels were stationary.

5.2. Statistics on the Independent Variables

Before introducing the models, we present more information on the independent variables. Table 4 shows the statistics for continuous explanatory variables in the multivariate analyses in this study. Using a two-tailed t-test and a two-tailed Mann–Whitney U-test, we measured whether average values and medians were significantly different between the sample of companies with GI versus those that did not. Consistent with Abughazaleh et al. (2011) and Glaum et al. (2018), we found that companies with GI had weaker financial performance and financial position than companies that did not report any GI. In our study, this was proved by significantly lower medians and averages of profitability, changes in sales revenues, and changes in cash flows from operations. The debt ratio was also significantly higher for companies with GI than for those that did not report it. In addition, the goodwill share was significantly higher for companies that wrote down goodwill than for those that did not.

Table 4. Continuous variables.

	Sample (n = 5668) Share			GI. (n = 1038) Share			Not GI (n = 4630) Share			Test of Differences (Impairments versus No Impairments)	
Variable	**Aver.**	**Med.**	**SE**	**Aver.**	**Med.**	**SE**	**Aver.**	**Med.**	**SE**	**Aver. p-Value**	**Median p-Value**
PB	3.354	2.440	9.770	2.629	2.090	3.181	3.540	2.520	11.073	0.010 ***	0.000 ***
GWA	0.170	0.137	0.146	0.192	0.163	0.134	0.165	0.129	0.148	0.000 ***	0.000 ***
ΔREV	0.066	0.041	0.219	0.046	0.027	0.168	0.071	0.044	0.228	0.002 ***	0.000 ***
ΔOCFA	0.011	0.007	0.062	0.006	0.004	0.040	0.012	0.008	0.066	0.012 **	0.001 ***
ROA	0.087	0.070	0.123	0.055	0.053	0.081	0.095	0.075	0.130	0.000 ***	0.000 ***
DEBT	0.607	0.614	0.183	0.646	0.649	0.171	0.599	0.608	0.185	0.000 ***	0.000 ***

Note: This table shows statistics for continuous independent variables used in the multivariate analyses for companies that report GI and those that do not. A two-tailed t-test examines differences on average, and a two-tailed Mann–Whitney U-test examines differences in medians. The p-values indicate the significance levels for the differences in the tests (** significant at $p < 0.05$, *** significant at $p < 0.01$).

Moreover, Table 5 shows the results of a test of the dichotomous explanatory variables BATH, SMOOTH, and YEAR, which tested whether there were differences in the frequency of observations distributed between the sample of companies with and without GI. Here, we used a two-tailed chi-square test to test the significance level of differences in the occurrence of observations between the two samples. For the dichotomous explanatory variable BATH (as a proxy for earnings management using big bath), the incidence of these observations is significantly greater for companies with GI. For the variable SMOOTH, the frequency of observations is greatest for companies that did not implement GI, which is contrary to the findings of previous research. For the variable YEAR, the years 2005–2006 and 2008–2009 had significantly more frequent GI, while the opposite case held for most years after 2013, as discussed previously. In Table A6 of Appendix A, we present a Pearson correlation matrix that shows the correlation between the independent variables in the regression models[2].

Table 5. Dichotomous variables.

	Sample n = 5668		**GI n = 1038**		**Not GI n = 4630**		**Test of Differences (Impairments versus No Impairments)**
n		**5668**		**1038**		**4630**	
Variable	**Obs.**	**%**	**Obs.**	**%**	**Obs.**	**%**	***p*-Value**
BATH	206	3.6	89	8.6	117	2.5	0.000 ***
SMOOTH	2420	42.7	370	35.6	2050	44.3	0.000 ***
Y2018	446	7.9	58	5.6	388	8.4	0.003 ***
Y2017	441	7.8	63	6.1	378	8.2	0.023 **
Y2016	437	7.7	70	6.7	367	7.9	0.197
Y2015	431	7.6	64	6.2	367	7.9	0.053 *
Y2014	422	7.4	60	5.8	362	7.8	0.024 **
Y2013	409	7.2	57	5.5	352	7.6	0.018 **
Y2012	401	7.1	82	7.9	319	6.9	0.251
Y2011	398	7.0	82	7.9	316	6.8	0.221
Y2010	395	7.0	73	7.0	322	7.0	0.929
Y2009	389	6.9	90	8.7	299	6.5	0.011 **
Y2008	383	6.8	100	9.6	283	6.1	0.000 ***
Y2007	382	6.7	77	7.4	305	6.6	0.335
Y2006	376	6.6	84	8.1	292	6.3	0.037 **
Y2005	357	6.3	78	7.5	279	6.0	0.074 *

Note: The table shows statistics for dichotomous independent variables used in the multivariate analyses for companies with GI and those without. A two-tailed chi-square test was used to investigate the differences in the frequency of observations between the samples. The *p*-values indicate significance levels for the differences in the test (* significant at $p < 0.10$, ** significant at $p < 0.05$, *** significant at $p < 0.01$).

5.3. Two-Way Fixed-Effects Model

The companies in our dataset reported financial accounts annually, giving us a panel data structure. Since the companies joined the STOXX Europe 600 at different times, the dataset was unbalanced. Panel data models have the advantage that they can be used to control for time-invariant variables using FE models. This enables us to test for variables that cannot be observed or measured. At the same time, the models check for variables that change over time, but not across units. In cases in which unobserved effects are likely to correlate with the included explanatory variables, an FE transformation may be preferable to exclude the time-invariant component of the error term. During the FE transformation, the variables are time-demeaned for each unit, and thus, the estimator explores the relationship between GI in a year (t) as a share of total assets ($t - 1$) and the exponential variables within units.

If, we assume that the error term is not correlated with the included explanatory variables, a random-effects (RE) transformation might be preferable. We estimate both the FE and RE models. However, the FE model seems to be more reasonable because of

unobserved effects, such as firm culture, which are likely to be constant over time and therefore, correlated with the included explanatory variables.

Although we used the Hausman specification test (Hausman 1978), we compared the consistent FE model with the efficient RE model. Note that the time-invariant explanatory variables dropped out during the FE transformation.

We estimated the following equation:

$$Y_{it} = \theta_i + \delta_t + \beta X_{it} + \varepsilon_{it} \quad (1)$$

where Y_{it} is the GI for firm i in year t, θ_i is the firm FE for firm i, the term δ_t represents the year dummy coefficients for year t, X_{it} are independent exponential variables for company i at time t, β_{it} are the accompanying coefficients, and ε_{it} is the error term.

5.4. Tobit Model

We followed Abughazaleh et al. (2011) and applied a multivariate tobit model, where negative observations on the dependent variable were censored and unobservable, while the explanatory variables were available for all observations (Maddala 1991). Previous research, such as Francis et al. (1996), used the tobit model to censor negative observations of the dependent variable, as negative observations of general write-downs are not of interest. In accordance with IAS 36.124, GI losses cannot be reversed, and thus, the dependent variable GI losses cannot have values below 0.

Negative observations of the latent dependent variable were given a value of 0, while positive values remain the actual percentage GI as a proportion of total assets. This can be expressed in the following form:

$$y_i^* = \begin{cases} yi, \ if \ c < yi \\ c, \ if \ yi \leq c \end{cases} \quad (2)$$

where c is the censored value of yi. We remove negative observations of the value yi manually, because in practice, reversals of goodwill write-downs are not permitted.

The final formula is as follows:

$$y_i^* = Xi^T \beta + \varepsilon_i \quad (3)$$

where y_i^* is the GI for firm i's share of all firms' total assets the year before, Xi^T constitutes the various independent variables, β is the corresponding regression coefficient, and ε_i is the error term. In our case, tobit models with FE are likely to produce biased results, and thus, we report only results with RE.

5.5. Logit Model

Beatty and Weber (2006) applied a logit model in addition to a tobit model. They examined what was behind management's impairment decisions using a dichotomous dependent variable for GI. The model cannot analyze the amount of the write-down, but it can be used as an overall indicator of whether the company should carry out impairment tests or, ultimately, GI. The dichotomous value 1 was assigned if the company had written down goodwill, while 0 was assigned if the company had not done so.

We defined the probability P_i for $y_i = 1$ for the logit model with FE as follows:

$$P_{it} = \frac{1}{1 + e^{-(\theta_i + \delta_t + \beta X_{it} + \varepsilon_{it})}} \quad (4)$$

where P_i is the probability that company i reports a goodwill write-down, θ_i is the firm FE for firm i, δ_t represents the year dummy coefficients for year t, X_{it} are independent exponential variables for company i at time t, β_{it} are the accompanying coefficients, and ε_{it} is the error term. We modeled the logit model with both FE and RE and conducted a Hausman test.

6. Results

6.1. Fixed-Effects Model

In Table 6, we present the multivariate analysis with the results from the FE and RE models. These models include all industries. After conducting a Hausman test, we rejected the hypothesis that RE is the best model; thus, we focused on the FE models. One version of the model consisted of only explanatory variables on company-specific key financial figures, while another version also included proxies for earnings management. After including these proxies, we found that the findings from the company-specific key financial figures had the same sign, but a somewhat changed level of significance. At the same time, the degree of explanation of the model increased.

Table 6. Multivariate analysis—fixed effects and random effects.

	Fixed Effects (within)				Random Effects (GLS)	
Variables	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
ROA	−0.0649 ***	0.020	−0.044 **	0.017	−0.029 ***	0.010
ΔREV	0.004	0.003	0.003	0.002	0.002	0.002
ΔOCFA	0.017 **	0.007	0.016 ***	0.005	0.014 ***	0.004
GWA	0.021 *	0.012	0.023 *	0.012	0.010 ***	0.003
P/B	9.16×10^{-6}	0.00001	6.33×10^{-6}	0.00001	0.00001	0.00002
DEBT			0.008 *	0.005	−0.002	0.002
BATH			0.017 ***	0.004	0.018 ***	0.004
SMOOTH			−0.0007 **	0.0003	−0.0006 **	0.0003
YEAR2006	0.002 *	0.001	0.001	0.0009	0.0009	0.0007
YEAR2007	0.002 **	0.001	0.002 *	0.0009	0.001 *	0.0006
YEAR2008	0.005 ***	0.002	0.004 **	0.001	0.004 ***	0.001
YEAR2009	0.0002	0.0008	−0.0002	0.0008	0.0005	0.0007
YEAR2010	0.0001	0.0005	0.0000269	0.0005	0.00004	0.0004
YEAR2011	0.002 **	0.0006	0.001 **	0.0006	0.001 **	0.0006
YEAR2012	0.0003	0.0005	0.0002	0.0005	0.0005	0.0005
YEAR2013	−0.0002	0.0005	−0.0001	0.0005	−0.00004	0.0005
YEAR2014	0.0008	0.0008	0.0005	0.0008	0.0006	0.0007
YEAR2015	0.0008	0.0009	0.0005	0.0008	0.0008	0.0008
YEAR2016	0.0008	0.0007	0.0007	0.0007	0.0008	0.0007
YEAR2017	−0.00006	0.0004	0.0002	0.0004	0.0002	0.0004
Constant	0.002	0.002	−0.005	0.003	0.002 *	0.002
R-Squared						
Within	0.099		0.155		0.145	
Between	0.054		0.048		0.077	
Overall	0.065		0.110		0.137	
Rho	0.266		0.289		0.047	
No of obs.	4586		4586		4586	
No of groups	406		406		406	

Note: Time dummies from 2006 to 2017, with 2018 as the reference year. Dependent variable: goodwill impairment in year (t) as a share of total assets ($t-1$). See Appendix A for the list of variables. * Significant at $p < 0.10$; ** significant at $p < 0.05$; *** significant at $p < 0.01$.

Return on total assets had a negative sign and was significant at the 5% level. However, change in turnover as a share of total assets turned out to be positive and non-significant. We found a strong significant positive correlation with GI at the 1% level for changes in operating cash flow from operations as a share of total assets. The share of goodwill in the share of total assets was positively associated with increased GI, with a significance level of 10%. Price-book was non-significant.

The variable debt ratio was positively correlated with GI and significant at the 10% level. The proxies for a big bath and income smoothing were significant, where BATH was strongly and significantly positively correlated with GI, while SMOOTH was negatively correlated. The dummy variable year reveals that there were three accounting years that were significantly different from the reference year 2018. The years 2008 and 2011 were

significantly different from 2018 at the 5% level, while 2007 was significantly different at the 10% level. The connection between the years was examined in more detail through an extended Wald test, as shown in Table A2 of Appendix A.

6.2. Tobit and Logit Regressions

Table 7 presents the findings from the other two regression models: tobit and logit. The tobit model has the same continuous dependent variable as the FE model, while the logit model has a dichotomous dependent variable that measures the actual write-down decision.

Table 7. Multivariate analysis—tobit and logit regressions.

	Logistic Regression (Logit)				**Tobit**	
	FE		**RE**		**RE**	
Variables	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
ROA	−5.001 ***	1.162	−5.2922 ***	1.009	−0.135 ***	0.013
ΔREV	−0.245	0.367	−0.333	0.325	0.002	0.004
ΔOCFA	1.124	1.213	1.014	1.139	0.031 *	0.016
GWA	0.627	1.041	1.058 *	0.605	0.035 ***	0.008
P/B	−0.004	0.009	−0.007	0.011	−0.00004	0.0001
DEBT	1.913 ***	0.723	1.553 ***	0.489	0.017 ***	0.006
BATH	0.967 ***	0.249	1.118 ***	0.245	0.027 ***	0.003
SMOOTH	−0.107	0.104	−0.115	0.102	−0.002	0.001
YEAR2006	1.103 ***	0.246	1.175 ***	0.242	0.014 ***	0.003
YEAR2007	1.016 ***	0.245	1.039 ***	0.242	0.012 ***	0.003
YEAR2008	1.181 ***	0.239	1.222 ***	0.235	0.018 ***	0.003
YEAR2009	0.690 ***	0.247	0.713 ***	0.247	0.007 **	0.003
YEAR2010	0.654 ***	0.247	0.650 ***	0.242	0.006 *	0.003
YEAR2011	0.904 ***	0.242	0.886 ***	0.238	0.010 ***	0.003
YEAR2012	0.725 ***	0.241	0.721 ***	0.237	0.007 **	0.003
YEAR2013	0.115	0.255	0.104	0.251	0.0005	0.003
YEAR2014	0.184	0.253	0.163	0.247	0.003	0.003
YEAR2015	0.141	0.250	0.144	0.245	0.003	0.003
YEAR2016	0.307	0.246	0.301	0.241	0.004	0.003
YEAR2017	0.256	0.245	0.243	0.242	0.003	0.003
Constant	-	-	−3.354 ***	0.405	−0.047 ***	0.005
Log likelihood	−1059.349		−1816.397		950.434	
chi2	161.67		178.52		469.30	
Prob > chi2	0.000		0.000		0.000	
Total obs.	3026		4567		4586	
Uncensured	-		-		900	
Censured	-		-		3686	
No groups	250		406		406	

Note: Time dummies from 2006 to 2017, with 2018 as the reference year. Dependent variable logit: dichotomous variable, where the value 1 corresponds to the company having reported GI, and 0 otherwise. Dependent variable tobit: goodwill impairment in year (t) as a share of total assets ($t-1$). Model 4 does not provide a constant term, as the concept of a constant term does not exist in the underlying statistical model. See Appendix A for a list of the variables. * Significant at $p < 0.10$; ** significant at $p < 0.05$; *** significant at $p < 0.01$.

The Hausman test rejected RE using the logit model. Nevertheless, we could assess the extent to which FE by logit was applicable, as several groups and observations were excluded from the FE model owing to lack of company-specific changes over time. However, Table 7 shows that the findings from the logistics models correspond to a large extent. Only the variable that measures goodwill share deviated. ROA stood out as the only variable with a strong significant negative correlation with GI at the 1% level. DEBT and BATH also had a significant positive correlation with GI. We found that the years 2006 to 2012 were significantly different from the reference year 2018 regarding impairment decisions.

The tobit regression also reflected these findings, despite the use of different dependent variables between the models. GWA was significantly correlated with GI in the tobit regression, but with a higher level of significance. Another common feature of the three models in Table 8 is that GI was not significantly correlated with ΔREV, P/B, and SMOOTH.

Table 8. Robustness test—excluded telecommunications services.

	Fixed Effect (within)		**Random Effects (GLS)**	
Variables	**Coef.**	**SE**	**Coef.**	**SE**
ROA	−0.045 **	0.018	−0.027 ***	0.010
ΔREV	0.003	0.002	0.002	0.002
ΔOCFA	0.015 ***	0.006	0.013 ***	0.004
GWA	0.016	0.012	0.008 ***	0.003
P/B	5.72×10^{-6}	0.00001	0.00002	0.00002
DEBT	0.009 *	0.005	−0.001	0.002
BATH	0.016 ***	0.004	0.017 ***	0.004
SMOOTH	−0.0006 *	0.0003	−0.0005 *	0.0003
YEAR2006	0.0005	0.0008	0.0003	0.0005
YEAR2007	0.001	0.0008	0.0007	0.0005
YEAR2008	0.004 **	0.002	0.004 ***	0.002
YEAR2009	−0.0004	0.0008	0.0004	0.0007
YEAR2010	−0.00004	0.0005	-5.09×10^{-7}	0.0004
YEAR2011	0.0007	0.0005	0.0008	0.0005
YEAR2012	−0.0002	0.0005	0.00007	0.0004
YEAR2013	−0.0003	0.0005	−0.0001	0.0004
YEAR2014	0.0005	0.0008	0.0006	0.0008
YEAR2015	0.0007	0.0009	0.001	0.0009
YEAR2016	0.0005	0.0007	0.00076	0.0007
YEAR2017	0.0002	0.0004	0.0002	0.0004
Constant	−0.004	0.003	0.002 *	0.001
R-Squared				
Within	0.149		0.139	
Between	0.045		0.069	
Overall	0.105		0.129	
Rho	0.279		0.033	
No obs.	4351		4351	
No groups	385		385	

Note: Time dummies from 2006 to 2017, with 2018 as the reference year. Dependent variable: goodwill impairment in year (t) as a share of total assets ($t-1$). See Appendix A for the list of variables. * Significant at $p < 0.10$; ** significant at $p < 0.05$; *** Significant at $p < 0.01$.

Thus, the findings from the tobit and logit regressions build on the findings from the FE model (Table 6). Specifically, the tobit model provides the same findings apart from the proxy for income smoothing. By not including company-specific factors, we found that all years between 2006 and 2012 were significantly different from the reference year 2018. In the logit models especially, this indicated more frequent GI in the years before 2013.

6.3. Robustness Test

Table 3 shows that goodwill constitutes a large proportion of total assets for the Consumer Non-Cyclicals, Healthcare, Technology, and Telecommunications Services industries after GI was completed. Telecommunications Services accounted for a large share of the total GI in the dataset and had a significant impact on the data used in the multivariate analyses. The industry accounted for a large proportion of both total GI and goodwill share. Thus, a robustness test was carried out with the regressions excluding this industry (see Table 8).

By comparing the findings from the robustness test in Table 8 with those in Table 7, we observe that the FE models are essentially unchanged. Nevertheless, the robustness test reveals that by excluding a goodwill-intensive industry, the significant connection between the companies' goodwill share (GWA) disappears. We further observe that the significance level of the proxy for income smoothing reduced from 5% to 10%. When excluding the Telecommunications Services industry, we found that the years 2007 and 2011 were no longer significantly different from the reference year 2018. The differences between the years were further investigated through a new Wald test that excluded Telecommunications Services. These findings are shown in Table A3 of Appendix A; we observe that 2008 is still significantly different from all years, while 2011 is significantly different from four of the other twelve years. The effect of the 2008−2009 financial crisis was maintained in this robustness test, while the effect of the debt crisis of 2011−2012 was somewhat reduced.

6.4. Discussion

The findings regarding ROA were robust, as all models exhibited a negative and highly significant correlation. The trend indicates that companies with higher net profitability tend to write down goodwill to a lesser extent compared to unprofitable companies. One possible explanation is that GI is reported simultaneously with write-downs of other assets, accruals, and extraordinary items. Therefore, ROA has been confirmed as a highly relevant variable in explaining the factors associated with GI and the decision to report it. On the other hand, ΔREV was found to be nonsignificant, which aligns with the findings of Glaum et al. (2018), Abughazaleh et al. (2011), Francis et al. (1996), and Riedl (2004). These studies also concluded that revenue growth does not have a significant correlation with write-downs, despite employing different approaches to calculate this key figure. In both the tobit and logit regressions, ΔREV did not show significance, further reinforcing the finding that gross profitability targets, as reflected in revenue growth, do not play a particularly important role in relation to GI, unlike net profitability.

Interestingly, our findings indicate a positive correlation between ΔOCFA and GI, which contradicts the expectations based on previous research regarding net profitability. This finding goes against the findings of Abughazaleh et al. (2011). Our results suggest that this company-level economic factor is not relevant to GI losses. Studies by Bostwick et al. (2016) and Jarva (2009) found that GI in the current year was only linked to cash flow from operations in subsequent years. From a financial theory perspective and financial intuition, GI should be reflected in expectations of weaker future cash flows, resulting in a reduction in the recoverable amount during the impairment test. Bostwick et al. (2016) investigated the relevance of GI in predicting future cash flows and found a significant negative correlation between GI and cash flows one and two years ahead. However, the interpretation of this variable varied across the regression models. The FE model consistently showed a strong and significantly positive correlation, even after the robustness test. The tobit model yielded a slightly significant positive correlation, while the logit model indicated no significant correlations. Thus, the strength of this finding may be questioned, as the results imply that changes in cash flows from operations in the previous year may not necessarily have any connection with GI.

Regarding one of the other variables used to test Hypothesis 1, GWA, we observed a positive and weakly significant correlation at the 10% level, which is in line with our expectations. This aligns with the findings of Zang (2008), who anticipated that a higher share of goodwill on the balance sheet would lead to increased GI, as a larger portion of the total goodwill would be subject to impairment assessments.

The robustness test results using the FE model (Table 8) indicate that the significance of the goodwill share as an explanatory variable for GI disappears when excluding the Telecommunications Services industry. This finding contradicts the results of Zang (2008) but aligns with the findings of Abughazaleh et al. (2011). The higher frequency of GI and larger goodwill shares in the Telecommunications Services industry influenced the multivariate analysis results. Thus, the share of goodwill appears to have the greatest

impact on write-downs in industries with a high concentration of goodwill. In contrast, the tobit model results indicate a strong and significant connection between GI and companies' goodwill shares, contradicting the findings of Abughazaleh et al. (2011).

Furthermore, the results indicate that P/B (price-to-book ratio) has no significant correlation with GI according to IFRS 3. Similar to other explanatory variables in our study, P/B was treated as if the company were a cash-generating unit (CGU). Our findings suggest that GI does not have a relationship with market value in the current year. Additionally, according to IAS 36.12, asset impairment occurs when the book value of a company's net assets exceeds its market capitalization. Therefore, we tested the dichotomous independent variable of a P/B ratio under 1, but no significant correlation with GI was observed.

Regarding Hypothesis 2, we discovered a significant positive correlation between the debt ratio and GI, which differs from the findings of several other studies. The literature in this area has produced inconsistent results, and therefore, we did not anticipate any specific relationship in our study. Our findings indicate that an increased debt ratio is associated with higher levels of GI. This finding contradicts the results of both Zang (2008) and Ramanna and Watts (2012). Accounting-based contracts create incentives for earnings management, which is a well-known principal-agent problem. Beatty and Weber (2006) also concluded that a company's debt agreements provide incentives to delay or accelerate GI. Gros and Koch (2020) found a higher negative discretionary GI associated with leverage, linking it to the incentive of avoiding covenant breaches.

Our results for the debt ratio support those of Bepari et al. (2014), who noted that loan contracts typically exclude goodwill when calculating the debt ratio. Similarly, Chalmers et al. (2011) concluded that the debt ratio does not play a significant role in explaining GI, suggesting that traditional debt contracts have limited impact on write-downs of goodwill. However, our study demonstrates a significant positive relationship with the debt ratio. Companies with weak solvency may have faced more challenging economic and financial situations. This could have increased pressure from investors and creditors to accurately document and report the company's asset values, in order to avoid overestimating capitalized goodwill in the financial statements. This pressure may have contributed to the increase in write-downs.

We also confirmed a significant positive correlation between the proxy for Big Bath and GI. However, it is crucial to note that this variable should not be interpreted in isolation, and we cannot conclude that it indicates accounting manipulation. Impairment losses resulting from unexpectedly weak operating results and lower growth compared to the industry median may indicate that management adjusted their assumptions about future earnings in the "value in use" calculations during the impairment test based on acquired knowledge of the future. This is in contrast to using subjective judgment for accounting manipulation and opportunistic reporting. Therefore, we could not confirm the occurrence of earnings management, even though the Big Bath variable showed a significant positive correlation with GI. Nonetheless, it is a significant finding that GI exhibited a significant positive correlation with unexpectedly weak operating results. We also tested the variable POOR, similar to Francis et al. (1996), and obtained the same sign and level of significance as when testing the Big Bath variable. This further supports our evidence that companies write down goodwill when their results are unexpectedly weak, in line with their own expectations, and is consistent with previous research on big bath reporting.

However, we did not observe the expected correlation in the proxy for income smoothing, particularly considering predictions and findings from previous research, which anticipated income smoothing in the case of unexpectedly good operating results. This indicates that our hypothesis was not supported. However, it is important to consider potential measurement challenges with the explanatory variable. This study is limited by the fact that this key financial figure alone may not fully capture the possibility of income smoothing. We also tested the variable GOOD, similar to Francis et al. (1996), and found no significant connection with GI. Our findings suggest that there was no income smoothing associated with GI. This may seem logical, as many studies consider write-downs in general, rather

than specifically focusing on goodwill write-downs. Since GI cannot be reversed according to IAS 36.124, we suggest that goodwill write-downs may not be as effective a tool for achieving income smoothing as write-downs of other types of fixed assets.

Hypothesis 3 aimed to explore the timing of GI. Bepari et al. (2014) found that compliance with regulations significantly improved during the financial crisis of 2008–2009. Our findings indicate that companies' GI also exhibited covariation with crisis years and recession years, both in terms of frequency and magnitude of GI. Additionally, reported GI was concentrated in specific industries during recession periods, particularly notable in the Energy and related industries when oil and natural gas prices experienced a decline in 2014 and 2015.

We demonstrated that the financial crisis of 2008, the debt crisis of 2011, and the year 2007 were the only years significantly different from the reference year of 2018. The results of the Wald test (refer to Table A2 of Appendix A) further reinforced these findings by indicating significant differences between 2008 and 2011. All years were significantly different from 2008, at least at the 10% level, highlighting the impact of the financial crisis compared to other years. However, in comparison to seven other years in the sample, 2011 showed significant differences at the 10% level, with the effect being attenuated when excluding the Telecommunications Services industry. The Wald test confirmed the multivariate regression findings that 2008 was particularly distinct from years without known macroeconomic recessions and crises. The test also revealed that despite the decline in oil and gas prices, the years 2014–2015 were not significantly different from other years, which can be attributed to the event primarily affecting specific industries rather than the overall macroeconomic landscape.

Therefore, we suggest that macroeconomic crisis years exhibit significant distinctions from other years and appear to have an amplified effect on GI. Metaphorically speaking, this implies that the macroeconomic consequences of the COVID-19 pandemic could have a comprehensive impact on GI in 2020 and the subsequent years. The crisis is expected to affect the global economy as a whole and substantially alter economic prospects in the coming years. If the crisis resembles those in 2008 and 2011, we can anticipate an increased frequency and magnitude of GI in the foreseeable future.

Furthermore, our descriptive statistics reveal very low impairment rates for most firm-year observations in the sample. Considering that the economic value of goodwill is derived from expectations of future excess returns, this may indicate that the observed impairment rates do not accurately reflect the lifespan of the goodwill item. This concern has been raised by stakeholders in the IASB reports PIR 3 and Goodwill and Impairment, suggesting that too little goodwill has been written down since the introduction of IFRS 3 and the impairment-only model. Impairment testing and the associated calculation of the recoverable amount involve a significant degree of managerial subjectivity and discretion in the assumptions, which can facilitate opportunistic accounting reporting by management. In our view, the main challenge with the current IFRS regulations is that acquired goodwill is effectively replaced by internally developed goodwill, which the impairment test in IAS 36 does not prevent under the current guidelines. Additionally, we propose that this issue creates an incentive for management to pursue business combinations to have internally developed goodwill capitalized in subsequent periods. Moreover, the results from the descriptive statistics provide a basis for supporting the IASB's emphasis on equity excluding goodwill as an important solvency indicator, given the challenges associated with the goodwill item. In our study, companies that wrote down goodwill exhibited significantly lower equity ratios excluding goodwill compared to those that did not. Thus, we support the IASB's efforts to enhance the information provided in the financial statement notes to achieve more reliable and relevant accounting information regarding goodwill (see also Han et al. 2021) by ensuring adequate disclosure of subsequent acquisitions and assumptions made in the impairment test.

7. Conclusions, Limitations, and Implications

7.1. Conclusions

Our comprehensive empirical study considered GI in accordance with the IFRS and enhances the existing knowledge base on this topic. Specifically, our study explores the relationship between crisis years and goodwill impairment (GI), which is an aspect that previous studies with shorter time spans have not extensively investigated. Additionally, we extend previous research by incorporating a fixed-effects (FE) model to analyze the association between GI and company-specific economic factors and proxies for earnings management.

We found a significant negative correlation between GI and return on total assets, while the results for other economic factors were inconclusive. Moreover, we observed significant positive correlations between GI and proxies for earnings management such as debt ratio and Big Bath. These findings suggest that GI losses may be influenced by opportunistic reporting. The positive correlation with the Big Bath variable also indicates that management gains new insights into expected future earnings, leading to the reporting of GI due to changes in assumptions during impairment tests based on management's revised expectations regarding future cash flows, growth, and risk for use in the "value in use" calculations.

7.2. Limitations

We acknowledge several limitations in our study. The observations might be influenced by other (un)observable factors that we did not include, such as CEO characteristics and other variables related to corporate governance as used in studies such as Glaum et al. (2018) and Gros and Koch (2020). Furthermore, we recognize that macroeconomic effects play a role in GI decisions, potentially mitigating the impact of managerial discretion. Nonetheless, we believe these limitations do not diminish the overall contribution of our study.

7.3. Implications

Our descriptive statistics reveal that goodwill represents a substantial proportion of both equity and total assets. The impairment rates, in terms of the frequency, average, and median of GI, are low when considering the index. Similar to the IASB's Board of Directors, our study found no compelling basis for significantly changing the impairment test in accordance with IAS 36 or abolishing the impairment-only model in accordance with IFRS 3. However, we recommend that the IASB focuses on improving the information provided in the financial statement notes concerning business combinations and write-downs, particularly in terms of subsequent performance of acquisitions and management's assumptions used in the "value in use" calculations. Furthermore, we support the IASB's preference for considering equity excluding goodwill as a separate key financial figure for solvency, as our findings indicate that companies that write down goodwill have a significantly lower equity ratio excluding goodwill compared to those that do not.

The results of the multivariate analysis highlight significant differences between crisis years and other years. This distinction is particularly evident during the financial crisis in 2008–2009 and the debt crisis in 2011, which stand out in the dataset. This finding suggests a covariation between crisis years and GI. Given the current COVID-19-induced economic crisis, it is important for accounting users to note the potential significant increase in GI losses. This realization provides a basis for further research into the actual consequences of the pandemic on GI. Additionally, it would be interesting to investigate the interaction between big bath reporting and crisis years in more depth, as well as to examine the timeliness of GI in the financial statements for 2020 and subsequent periods. Furthermore, studying companies that have gone bankrupt and analyzing the history related to GI in their financial statements, considering some of the explanatory variables used in our study, may offer valuable insights. This investigation can help identify red flags in financial statements

related to overvalued goodwill by determining whether GI occurs too infrequently or too late, even after controlling for our determinants.

Author Contributions: Conceptualization, K.F. and H.S.; methodology, A.O.; software, A.O.; validation, K.F., A.O. and H.S.; formal analysis, K.F. and H.S.; writing—original draft preparation, K.F. and H.S.; writing—review and editing, F.K.; supervision, F.K.; project administration, F.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data is available as described in the data section (Section 4.1).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Variables used in this study.

Dependent Variables	Definition	Description
GWIMPA%	$GWIMP = \frac{Goodwill\ impairments\ (t)}{Total\ assets\ (t-1)}$	Impairment of goodwill in year (t) as a share of total assets previous year ($t-1$)
GWIMP		Dichotomous variable equal to 1 if the company reports GI, and 0 if no impairments.
Independent variables	Definition	Description
ROA	$ROA = \frac{Net\ Income\ (t)}{Total\ assets\ (t-1)}$	Net income year (t) as share of total assets year ($t-1$)
ΔREV	$\Delta REV = \frac{Revenue\ (t) - Revenue\ (t-1)}{Total\ assets\ (t-1)}$	Change in turnover between year (t) and ($t-1$) as a share of total assets year ($t-1$)
ΔOCFA	$\Delta OCFA = \frac{\Delta Cash\ Flow\ from\ operations}{Total\ assets\ (t-1)}$	Change in cash flow from operating activities between year (t) and ($t-1$) as a proportion of total assets year ($t-1$)
GWA	$GWA = \frac{Goodwill\ (t-1)}{Total\ assets\ (t-1)}$	Net booked goodwill year ($t-1$) as a share of total assets year ($t-1$)
P/B	$P/B = \frac{Market\ Cap.\ per\ share\ (t)}{Booked\ equity\ per\ share\ (t)}$	Price-book. Market cap. per share year (t) as share of booked equity per share year (t)
DEBT	$DEBT = \frac{Total\ debt\ (t-1)}{Total\ assets\ (t-1)}$	Total debt year ($t-1$) as a share of total assets year ($t-1$)
BATH		Dichotomous variable equal to 1 if operating profit in year (t) is below 0, and the change in operating profit is lower than the industry median.
SMOOTH		Dichotomous variable equal to 1 if operating profit in year (t) is above 0, and the change in operating profit is higher than the industry median
YEAR		Dichotomous variable equal to 1 if the year is the reference year, 0 otherwise.

Table A2. Wald test between years—all industries.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2006												
2007	0.372											
2008	0.027 **	0.033 **										
2009	0.207	0.117	0.024 **									
2010	0.097 *	0.021 **	0.005 ***	0.795								
2011	0.936	0.701	0.069 *	0.076 *	0.008 ***							
2012	0.289	0.147	0.022 **	0.562	0.672	0.063 *						
2013	0.103	0.035 **	0.008 ***	0.974	0.705	0.013 **	0.425					
2014	0.501	0.299	0.041 **	0.467	0.515	0.368	0.717	0.351				
2015	0.556	0.358	0.067 *	0.534	0.557	0.441	0.755	0.442	0.992			
2016	0.617	0.384	0.051 *	0.410	0.381	0.478	0.596	0.285	0.885	0.881		
2017	0.227	0.081 *	0.012 **	0.647	0.688	0.051 *	0.917	0.469	0.635	0.662	0.472	
2018	0.180	0.069 *	0.010 ***	0.830	0.957	0.029 **	0.622	0.767	0.477	0.521	0.315	0.606

Note: Findings across years using the Wald test for 2006–2017. The figures for 2018 are estimated with *p*-values from the FE model in Table 7, where 2018 is the reference year in constant terms. * Significant at $p < 0.10$; ** significant at $p < 0.05$; *** significant at $p < 0.01$.

Table A3. Wald test between years—excluding telecommunications services.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2006												
2007	0.076 *											
2008	0.002 ***	0.008 ***										
2009	0.446	0.209	0.023 **									
2010	0.373	0.074 *	0.007 ***	0.677								
2011	0.730	0.571	0.027 **	0.185	0.055 *							
2012	0.421	0.154	0.013 **	0.801	0.768	0.087 *						
2013	0.348	0.106	0.010 ***	0.885	0.635	0.069 *	0.862					
2014	0.997	0.559	0.047 **	0.409	0.536	0.784	0.424	0.334				
2015	0.868	0.708	0.089 *	0.385	0.444	0.970	0.366	0.312	0.838			
2016	0.991	0.556	0.046 **	0.417	0.489	0.798	0.399	0.329	0.988	0.864		
2017	0.655	0.222	0.016 **	0.518	0.648	0.283	0.479	0.361	0.673	0.541	0.625	
2018	0.532	0.183	0.013 **	0.648	0.941	0.202	0.705	0.581	0.533	0.444	0.461	0.668

Note: Findings across years using the Wald test for 2006–2017. The figures for 2018 are estimated with *p*-values from the FE model in Table A1, where 2018 is the reference year in constant terms. * Significant at $p < 0.10$; ** significant at $p < 0.05$; *** significant at $p < 0.01$.

Table A4. Fisher test for stationarity.

	Inverse Chi-Squared		Inverse Normal		Inverse Logit		Modified Inverse Chi-Squared	
Variables	**Statistic**	***p*-Value**	**Statistic**	***p*-Value**	**Statistic**	***p*-Value**	**Statistic**	***p*-Value**
ROA	2533.126	0.000	−21.066	0.000	−28.165	0.000	40.919	0.000
ΔREV	4556.816	0.000	−43.548	0.000	−59.046	0.000	88.685	0.000
ΔOCFA	8619.648	0.000	−73.351	0.000	−114.609	0.000	186.301	0.000
GWA	1920.449	0.000	−7.542	0.000	−14.816	0.000	25.337	0.000
P/B	1473.421	0.000	−9.055	0.000	−11.477	0.000	16.066	0.000
DEBT	2639.063	0.000	−15.338	0.000	−26.013	0.000	42.026	0.000

Note: The results from the Fisher test reject the null hypothesis that all panels contain unit roots.

Table A5. Descriptive statistics—goodwill impairments by industry and year.

Year	Basic Materials			Consumer Cyclicals			Consumer Non-Cyclicals			Energy			Healthcare			Industrials			Technology			Telecom. Services			Utilities		
	Applied Resources, Chemicals, Mineral Resources			Automobiles and Auto Parts, Cyclical Consumer Products, Cyclical Consumer Services, Retailers			Food and Beverages, Food and Drug Retailing, Personal and Household Products and Services			Energy—Fossil Fuels, Renewable Energy			Healthcare Services and Equipment, Pharmaceuticals and Medical Research			Industrial and Commercial Services, Industrial Conglomerates, Industrial Goods, Transportation			Software and IT Services, Technology Equipment			Telecommunications			Electric Utilities and IPPs, Multiline Utilities, Natural Gas Utilities, Water and Related Utilities		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
			4%			8%			11%			1%			0%			17%			0%			43%			15%
2006	32%	1%	1%	25%	1%	3%	32%	0%	1%	11%	0%	0%	11%	0%	0%	29%	0%	1%	17%	0%	0%	41%	15%	93%	28%	1%	1%
2007	35%	2%	5%	18%	0%	3%	18%	0%	1%	24%	0%	0%	10%	0%	0%	28%	0%	2%	6%	0%	0%	53%	8%	89%	5%	0%	0%
2008	39%	9%	29%	26%	6%	33%	32%	1%	5%	19%	1%	1%	10%	0%	1%	34%	1%	9%	23%	1%	1%	37%	0%	4%	26%	5%	17%
2009	37%	2%	7%	25%	2%	17%	24%	0%	1%	23%	6%	7%	10%	0%	0%	27%	1%	10%	23%	4%	5%	37%	4%	53%	20%	0%	0%
2010	19%	0%	2%	23%	1%	9%	21%	0%	9%	17%	0%	0%	0%	0%	0%	24%	1%	20%	13%	0%	1%	32%	2%	39%	29%	1%	20%
2011	20%	7%	18%	15%	1%	3%	20%	1%	7%	18%	0%	0%	7%	1%	4%	27%	1%	4%	20%	4%	3%	42%	9%	56%	48%	1%	5%
2012	29%	11%	31%	24%	1%	3%	24%	0%	0%	21%	0%	0%	13%	0%	1%	19%	1%	6%	0%	0%	0%	35%	7%	47%	38%	3%	11%
2013	11%	0%	1%	17%	1%	4%	19%	0%	4%	8%	20%	22%	12%	0%	1%	14%	1%	6%	11%	0%	0%	20%	5%	37%	24%	5%	25%
2014	13%	1%	3%	23%	1%	6%	7%	1%	10%	27%	7%	12%	7%	1%	4%	15%	0%	3%	7%	3%	8%	14%	5%	50%	29%	1%	4%
2015	20%	3%	14%	22%	1%	11%	11%	0%	3%	27%	6%	10%	3%	0%	0%	16%	1%	10%	7%	0%	1%	4%	0%	0%	32%	10%	52%
2016	19%	0%	4%	26%	3%	46%	9%	0%	4%	12%	1%	3%	12%	0%	1%	14%	0%	5%	13%	0%	2%	30%	1%	21%	19%	2%	15%
2017	13%	1%	13%	24%	0%	2%	13%	1%	28%	4%	0%	0%	5%	0%	8%	15%	1%	9%	13%	2%	11%	17%	1%	18%	26%	1%	11%
2018	6%	0%	1%	20%	1%	24%	10%	0%	5%	4%	0%	0%	7%	1%	17%	16%	0%	6%	9%	0%	0%	30%	2%	33%	17%	2%	14%

Note: Column 1: percentage of companies in the industry that have implemented write-downs of goodwill at the beginning of the year. Column 2: industry's impairment rate, defined as the industry's goodwill impairment in % of capitalized goodwill at the beginning of the year. Column 3: industry's share of total goodwill write-downs in the fiscal year.

Table A6. Pearson correlations between independent variables.

	ROA	ΔREV	ΔOCFA	GWA	P/B	DEBT	BATH	SMO *	Y2006	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018
ROA	1																				
ΔREV	0.279	1																			
ΔOCFA	0.277	0.34	1																		
GWA	0.003	−0.002	0.001	1																	
P/B	0.121	0.034	0.016	0.036	1																
DEBT	−0.292	−0.02	−0.039	−0.004	0.016	1															
BATH	−0.325	−0.071	−0.081	−0.04	−0.03	0.008	1														
SMO *	0.248	0.173	0.163	−0.01	0.044	−0.037	−0.178	1													
Y2006	0.059	0.1	0.026	−0.038	0.003	0.018	−0.018	0.009	1												
Y2007	0.082	0.066	0.039	−0.031	0.009	0.016	−0.03	0.005	−0.072	1											
Y2008	−0.017	0.061	−0.025	−0.014	0.003	0.051	0.041	−0.001	−0.073	−0.076	1										
Y2009	−0.069	−0.12	0.069	−0.006	−0.04	0.021	0.039	0.003	−0.074	−0.077	−0.078	1									
Y2010	0.016	0.02	−0.031	0.003	−0.024	−0.01	−0.015	0	−0.075	−0.078	−0.079	−0.08	1								
Y2011	0.016	0.041	−0.068	0.004	−0.021	−0.008	0.002	0.007	−0.076	−0.079	−0.08	−0.081	−0.082	1							
Y2012	−0.017	−0.008	−0.002	0.007	−0.015	−0.011	0.006	−0.006	−0.076	−0.079	−0.08	−0.081	−0.082	−0.083	1						
Y2013	−0.016	−0.041	−0.003	0.004	0.006	−0.023	−0.008	0.006	−0.077	−0.079	−0.081	−0.082	−0.082	−0.083	−0.084	1					
Y2014	−0.015	−0.049	−0.022	0.001	0.03	−0.008	0.016	0	−0.078	−0.081	−0.083	−0.083	−0.084	−0.085	−0.085	−0.086	1				
Y2015	−0.025	−0.02	0.041	0.012	0.04	−0.006	0.028	−0.006	−0.079	−0.081	−0.083	−0.084	−0.085	−0.086	−0.086	−0.086	−0.088	1			
Y2016	−0.013	−0.053	−0.014	0.013	−0.004	−0.002	−0.007	−0.01	−0.079	−0.082	−0.084	−0.085	−0.085	−0.086	−0.087	−0.087	−0.089	−0.089	1		
Y2017	0.007	0.016	−0.003	0.017	0.001	−0.019	−0.038	−0.002	−0.08	−0.083	−0.084	−0.085	−0.086	−0.087	−0.087	−0.088	−0.09	−0.09	−0.091	1	
Y2018	0.001	−0.001	−0.002	0.022	0.01	−0.012	−0.014	−0.001	−0.081	−0.084	−0.085	−0.086	−0.087	−0.088	−0.088	−0.089	−0.091	−0.091	−0.092	−0.093	1

Note: Pearson Correlations between independent variables in the years 2006–2018. The year 2005 is excluded owing to lack of a reference year (2004). SMO * = SMOOTH.

Table A7. Descriptive statistics—impairment rates.

Percentiles	Impairment Rates		
1%	0.01%	Firm years with IB Goodwill	4928
5%	0.05%	Firm years with GI	951
10%	0.10%		
25%	0.42%	Average impairment rates	9.02%
50%	1.68%		
75%	7.16%	SD	36.44%
90%	20.19%	Variance	13.28%
95%	36.62%		
99%	94.80%		

Note: The descriptive statistics show impairment rates for the fiscal year with impairment of capitalized goodwill at the beginning of the year.

Table A8. Descriptive statistics—equity shares.

Percentile Firm Years	Equity Share Incl. Goodwill	Equity Share Excl. Goodwill	Firm Year	Obs.	Equity Share Incl. Goodwill	Equity Share Excl. Goodwill
1%	−5.1%	−55.8%	Average			
5%	12.4%	−24.3%	Firm years without GI	4319	39.4%	23.1%
10%	18.2%	−9.1%	Firm years with GI	1038	35.4%	18.0%
25%	27.1%	8.1%				
50%	38.6%	24.8%	Median			
75%	50.5%	41.7%	Firm years without GI	4319	38.8%	24.6%
90%	63.1%	57.8%	Firm years with GI	1038	35.1%	19.3%
95%	70.5%	66.7%				
99%	85.0%	83.5%				
Aver.	39.3%	23.6%				

Note: The descriptive statistics in the left table show equity ratios including and excluding goodwill divided into percentiles for the fiscal years. The descriptive statistics in the right table show average and median equity investments including and excluding goodwill divided into companies that have written down goodwill and companies that have not written down goodwill.

Notes

[1] GI is presented at the company level, and not at the level of CGUs, owing to lack of data for CGUs. According to IAS 36, GI must occur at the CGU level. Previous research adopts the same approach as this study.

[2] All variables have a low or very low correlation with each other (0.340 is the highest). Hence, there is little degree of linear covariation between the independent variables, and multicollinearity does not seem to be a problem in our regression models.

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