IS PREDICTING GOODWILL IMPAIRMENT ROLLING A LOADED DICE?

AN EXAMINATION OF GOODWILL IMPAIRMENT PREDICTION MODELS

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Abstract:

This study examines the predictability of goodwill impairments in a U.S. GAAP setting. Using the methodology developed by Hayn and Hughes (2006), we first analyze whether the predictability of goodwill impairments has increased since the implementation of SFAS 141 and SFAS 142. We then proceed to integrate corporate governance variables to investigate their potential contribution in detecting these events. Our results suggest that the predictability of goodwill impairments using accounting information has improved since Hayn and Hughes' (2006) original study. However, we do not discern a better performance of previously developed prediction models when extending them with new independent variables related to boards of directors and CEOs. Our study contributes to previous literature assessing the reliability of goodwill accounting and the effects of corporate governance mechanisms on goodwill impairment decisions.

Keywords:

Goodwill impairment, segment reporting, SFAS 141, SFAS 142, CEO retention, survival analysis

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1. Introduction

Nowadays, goodwill is typically one of the most significant intangible assets on companies' balance sheets (Wen & Moehrle, 2016). Technically speaking, goodwill is measured as the difference between the purchase price and the acquired fair value of identifiable net assets in a business combination. However, since goodwill is measured as a residual, its nature is inherently abstract and poses significant leeway for decision-makers.

Resulting from an extensive project initiated by the Financial Accounting Standards Board (FASB), two standards altering goodwill accounting were published in 2001. Both SFAS 141 and SFAS 142 introduced significant changes in the treatment of goodwill assets for firms applying U.S. GAAP. While standard setters intended to improve the reliability of goodwill accounting, serious concerns were expressed over these standards' impacts on the quality of financial reporting. By imposing an impairment-only approach, the FASB was criticized for introducing managerial discretion in an already complex area of accounting.

Because the fair value of goodwill assets is challenging to assess, goodwill impairment decisions are exposed to managerial opportunism (Ramanna & Watts, 2012). Previous studies have documented managerial motives to delay or opportunistically impair goodwill (Beatty & Weber, 2006; Masters-Stout, Costigan, & Lovata, 2008). This exposure is troublesome since market reactions are typically associated with impairment announcements (Z. Li et al., 2011). Therefore, there is a necessity for reliable and relevant goodwill accounting disclosure.

The purpose of this study is to investigate the predictability of goodwill impairment in a post-SFAS 141 and SFAS 142 context. By applying the methodology of Hayn and Hughes (2006), we first investigate whether users of financial statements are better able to predict goodwill impairments. Second, we examine if the inclusion of corporate governance variables proxying the effectiveness of the monitoring role of boards enhances the predictability of these impairments. Lastly, we examine whether the retention of a former CEO as director restricts their successors' abilities to impair goodwill assets. Our results suggest that predicting goodwill impairments using public

accounting information has improved since Hayn and Hughes' (2006) original study. However, our analysis does not provide conclusive evidence that the addition of new variables related to boards and CEOs leads to better prediction outcomes.

Our study contributes to the existing literature about goodwill impairment prediction and corporate governance in two main aspects. First, we apply Hayn and Hughes' (2006) original model and investigate if their findings are still observable in a contemporary setting. Second, we assess whether the inclusion of corporate governance variables proxying the effectiveness of corporate governance mechanisms improves the predictability of these uncharacteristic events.

2. Literature Review

In this section, we first provide a brief history of goodwill accounting under U.S. GAAP. We then discuss the nature of goodwill, its recognition in financial statements and the current accounting guidance to reflect the deterioration of its fair value. Next, we review the critique of current goodwill accounting, notably the impairment decision's exposure to managerial opportunism. We then examine the monitoring role of the board of directors and the concept of CEO Retention Light. Finally, we discuss relevant empirical studies.

2.1. History of goodwill accounting

"Goodwill (...) represents competitive advantages that are expected to enable the company to generate earnings in excess of a "normal" return on investment. Goodwill may be developed internally by building customer loyalty, developing human resources, or using assets more efficiently than competitors. Or goodwill may be purchased "whole" when one company acquires another." (R. Jennings, LeClere, & Thompson, 2001)

Under U.S. GAAP accounting, goodwill is only recognized in business combinations, and cannot be capitalized outside of these events. It is measured as the difference between the consideration transferred and the fair values of the acquired net assets at the acquisition date.

Because of goodwill's increasing weight in financial statements, its accounting has long been an area of interest for the FASB. In 1996, the FASB initiated a project to improve the accounting for both business combinations and goodwill. While previous attempts were sterile, the surge in M&A activity during the nineties and eighties exacerbated the need for more consistent information about these transactions. At that time, the accounting guidance was allowing the use of two different methods to record business combinations: the *pooling method* and the *purchase method*. Because these methods were leading to different accounting outputs, the U.S. Securities and Exchange Commission (SEC) suspected that preferences for the pooling method were affecting M&A behaviors and increasing acquisition costs (Wen & Moehrle, 2016). Unlike the purchase method, the pooling method did not produce any accounting goodwill, but could only be applied under a specific set of requirements. Because most companies did not want to recognize

goodwill given the impact of its amortization on future earnings (Johnson & Petrone, 1998), there was an alleged incentive to engage in inefficient economic behavior to be eligible to use this method. As perhaps one of the most notorious examples is AT&T's acquisition of NCR in 1991 for which an amount between $50 and $500 million was paid to qualify for the pooling method (Lys & Vincent, 1995). Accordingly, the SEC and the FASB were concerned about using extensive resources to enforce an accounting regulation that was creating both adverse economic incentives and information with limited relevance and comparability (Anantharaman, 2015).

The FASB project resulted in the publication of two new statements in 2001: *SFAS 141 Business Combinations* and *SFAS 142 Goodwill and other intangible assets.* These statements were superseding the accounting policies specified in *Opinion 16 Business Combinations, Opinion 17 Intangible Assets* and *SFAS 121 Accounting for the Impairment of Long-Lived Assets and for Long-Lived Assets to Be Disposed Of.* They significantly altered goodwill accounting by eliminating the pooling method and replacing the systematic goodwill amortization with an annual goodwill impairment test. Their joint publication was seen as a first step to improve the accounting guidance for business combinations and goodwill. Revised versions for SFAS 141 and SFAS 142 were released in 2007 and 2011, respectively. SFAS 141 (R) replaced the purchase method with the *acquisition method* that is, in essence, identical but includes all acquired assets and liabilities (Financial Accounting Standards Board, 2007). SFAS 142 (R) was aimed to simplify the initial goodwill impairment test that was deemed unnecessarily complicated by accountants.

Although significant changes were implemented over the last two decades, goodwill accounting remains on the FASB agenda. The difficulties in representing this asset in financial statements are likely to originate from its abstract nature.

2.2. Goodwill definition and SFAS 141

Despite extensive accounting literature, the definition of the nature of goodwill remains obscure. Brännström and Giuliani (2011) describe goodwill as a *black box* and an *awkward composite* whose constitution has fostered academic attention while mainly being ignored by accounting practitioners. The concept of goodwill has been discussed

as far as the nineteenth century, but the debate about its inherent nature appears to remain mostly open (Ratiu & Tudor, 2013).

Gynther (1969) argues that goodwill is often described using a conceptualization of the method used to determine its value rather than a true depiction of its intrinsic nature. Equivalently, Johnson and Petrone (1998) denote that goodwill can be viewed using a *top-down perspective* or a *bottom-up perspective*. The top-down perspective views goodwill as the remainder of the consideration transferred over the fair values of identifiable net assets acquired. The more comprehensive bottom-up perspective views goodwill as an aggregation of its distinct elements. Under this view, Johnson and Petrone (1998) list six possible elements of goodwill that can then be divided into three different groups. The first group is composed by two elements that relate directly to the acquired company: (1) *the excess of the fair value over the book values of the acquiree's recognized net assets*, and (2) *the fair values of other net assets unrecognized by the acquiree*. The second group relates to the consideration transferred and is also composed of two elements: (3) *the overvaluation of the consideration paid by the acquirer*, and (4) *overpayment (or underpayment) by the acquirer*. Finally, the group identified as the *core goodwill* is composed of: (5) *the pre-existing goodwill of the acquiree*, and (6) *the fair value of synergies combining the acquirer's and acquiree's businesses*.

Using the bottom-up classification, the study conducted by Henning et al. (2000) presents evidence that investors value the components of goodwill differently. They find that the excess of the fair value over the acquiree's book values and the core goodwill, respectively Johnson and Petrone's (1998) first and third group, are positively related to equity market values. However, the overvaluation or overpayment of the acquiree (second group) has a negative relation with this variable. Overall, this study illustrates that investors do not consider the latter group as an asset but rather as an expense (Henning, Lewis, & Shaw, 2000). Their findings also expose goodwill as a complex composite.

The top-down perspective is aligned with the current FASB definition of goodwill. SFAS 141 defines goodwill as *"the excess of the consideration transferred plus the fair value of any noncontrolling interest in the acquiree at the acquisition date over the fair values of the identifiable net assets acquired"* (Financial Accounting Standards Board, 2001b). According to this definition, goodwill is measured as a residual at the acquisition date.

SFAS 141 also requires that all business combinations should be accounted for using the acquisition method, effectively eliminating the pooling method and leading to the recognition of goodwill in almost all business combinations (R. Jennings, LeClere, & Thompson II, 2001).

SFAS 141 provides accounting guidance to recognize goodwill in a business combination. However, its effects on financial reporting are not dissociable from SFAS 142.

2.3. Goodwill impairment and SFAS 142

While SFAS 141 provides the necessary guidance to recognize goodwill at the acquisition date, SFAS 142 defines how goodwill should be accounted for subsequently. As previously mentioned, these concurrent statements were simultaneously published as they both were a part of a long-term initiative started by the FASB in 1996 (K. Li & Sloan, 2017). The changes introduced by SFAS 142 reflect that goodwill is not considered a *wasting-asset* by the FASB anymore.

Three significant changes in goodwill accounting were introduced by SFAS 142 (Bens, 2006). First, this new statement substitutes the standard goodwill amortization by an annual impairment test. Before its implementation, goodwill was amortized under APB Opinion No. 17 and subjected to impairment under SFAS 121. Compared to these superseded statements, SFAS 142 offers more tailored guidance for accounting goodwill after the acquisition date. Second, goodwill is now assigned to a specific operating segment or reporting unit to simplify these mandatory annual impairment tests. Finally, SFAS 142 introduces a structured framework to perform goodwill impairment testing.

The goodwill impairment test introduced by the initial version of SFAS 142 is a two-step process. The first step requires a company to determine if goodwill needs to be impaired on an annual basis. Goodwill is only subject to impairment if the carrying book value of its reporting unit is superior to its fair value. If the first step is found to be true, a second step requires the company to estimate the impairment loss by comparing the fair value of goodwill to the carrying book value assigned to its reporting unit. This complex task is done by allocating the reporting unit fair value to its underlying assets and liabilities, and

then determining the new goodwill value. The impairment loss then impacts the income statement as an operating expense.

Because of the clear difficulties in applying this framework, the two-step impairment test was later modified with an additional step. Under the revised SFAS 142 issued in 2011, an entity has the option to investigate if its goodwill needs to be impaired using qualitative factors. While this statement states that an entity should consider all relevant circumstances, it does not provide entities with an exhaustive list. Examples of such circumstances are the deterioration of the general economic environment, a change in management, a contemplation of bankruptcy, or a decrease in share price (Financial Accounting Standards Board, 2011). If the entity determines that no reasonable circumstances are indicating a more than likely decrease in fair-value of goodwill, it is not required to apply the two-step impairment test described above. This additional step was added to reduce the cost and complexity associated with the annual goodwill impairment test.

Overall, the changes introduced by SFAS 141 and SFAS 142 were aimed at improving the quality of financial reporting. However, these statements have faced significant criticism.

2.4. Criticism of SFAS 141 and SFAS 142

"The shift from amortization to periodic reviews places a new and continuous responsibility on management to determine the fair value of goodwill and a new burden on auditors, regulatory bodies, and investors to evaluate management's determination" (Hayn & Hughes, 2006).

SFAS 141 and SFAS 142 significantly altered the accounting guidance for business combinations and goodwill. By effectively eliminating the pooling method and goodwill amortization in favor of exclusive use of the acquisition method and goodwill impairment, both statements imposed a more extensive application of fair-value accounting. The FASB board argues that the changes introduced by SFAS 141 enhance "*the comparability of reported financial information"* (Financial Accounting Standards Board, 2001b), and that SFAS 142 improves financial reporting because *"financial statements of entities that acquire goodwill and other intangible assets will better reflect*

the underlying economics of those assets." (Financial Accounting Standards Board, 2001a)

Despite these assertions, these two statements also raised criticism and concern about their impact on the relevance and reliability of financial statements. Sloan and Li (2017) suspect that their joint implementation has deteriorated the quality of financial reporting for three reasons: (1) the replacement of goodwill amortization by a subjective impairment test, (2) the inclusion of a higher degree of managerial discretion, and (3) the elimination of the pooling method. The combined effects of SFAS 141 and SFAS 142 appear to have increased the risk of inflated goodwill values and untimely goodwill impairment (Hayn & Hughes, 2006; K. Li & Sloan, 2017).

First, Sloan and Li (2017) deplore that the decline of future economic benefits encompassed in goodwill is now solely recorded by a subjective impairment test. Despite the evident imperfections of amortization in reflecting fair-value deterioration of assets with *indefinite useful life*, this accounting mechanism lead to a systematic annual write-down of goodwill directly displayed in the income statement. Unlike amortization, the SFAS 142 goodwill impairment test is deemed highly subjective because of difficulties in determining and verifying fair-value estimates of goodwill (Watts, 2003). Given these arguments, Sloan and Li (2017) argue that *"the systematic amortization of goodwill paired with a periodic impairment test may lead to accounting that better reflects the underlying economics of goodwill."* (K. Li & Sloan, 2017). However, it is important to view this criticism in the light of well-known concerns over the usefulness of goodwill amortization (Henning et al., 2000; R. Jennings et al., 2001). Before the implementation of SFAS 142, Jennings et al. (2001) denoted that investors did not appear to integrate goodwill amortization when capitalizing accounting earnings to assess equity values. Conducted on a sample of 32,626 company-years of publicly listed U.S. firms between 1993 and 1998, their study suggested that *"eliminating goodwill amortization from the computation of net income will not reduce its usefulness to investors and analysts as a summary indicator of share value"* (R. Jennings et al., 2001).

Second, Sloan and Li (2017) highlight the challenge to apply fair-value accounting to goodwill because impairment decisions are exposed to *managerial opportunism*. SFAS 142 requires management to conduct an annual impairment test to determine if goodwill

carrying book value is superior to its fair value. However, the fair value of goodwill is assessed using management's estimates. These are particularly difficult to verify because *"the current fair value of goodwill is a function of management's future actions, including managers' conceptualization and implementation of firm strategy."* (Ramanna & Watts, 2012). This criticism is consistent with the argument that fair-value estimates produced with unverifiable valuation methods are more likely to lead to opportunistic accounting disclosure (Holthausen & Watts, 2001). It appears that the implementation of SFAS 142 has led to significant delays between goodwill impairment and the actual economic deterioration of its reporting unit (Hayn & Hughes, 2006; K. Li & Sloan, 2017). Furthermore, Masters-Stout et al. (2008) also express concerns over the possibility to use goodwill impairment as a tool to manage earnings.

Lastly, Sloan and Li (2017) express concern with the suppression of the pooling method to record business combinations that would have been eligible under the prior accounting guidance. As previously mentioned, the pooling method was preferred to the purchase method because it did not produce any accounting goodwill. Therefore, goodwill amortization or impairment loss were not impacting future earnings for business combinations applying this method. The authors argue that *"managers facing strong incentives to boost earnings, who could previously have structured deals to qualify for pooling-of-interests accounting, must now recognize goodwill and may be more likely to delay impairment."* (K. Li & Sloan, 2017). Accordingly, the new accounting guidance seems to introduce issues related to managerial opportunism in situations where they were previously non-existent. However, this third criticism could be balanced with the observation that the previous goodwill accounting was incentivizing ineffective economic behaviors to qualify for the pooling method.

Criticisms about SFAS 141 and SFAS 142 primarily concern the degree of managerial discretion in goodwill impairment decisions. Previous studies have documented motives to delay these events but also opportunistic behaviors in writing-off goodwill assets.

2.4.1. Managerial opportunism and delayed goodwill impairment

"Standard setters imply that the fair-value estimates will, on average, allow managers to convey private information on future cash flows, while agency theory predicts managers

(all else equal) will, on average, use the unverifiability in goodwill accounting rules to manage financial reports opportunistically." (Ramanna & Watts, 2012)

Based on agency theory and a landmark study by Beatty and Webber (2006), Ramanna and Watts (2012) identify three motives potentially influencing management to delay goodwill impairment: (1) contracting, (2) reputation, and (3) equity market consideration. Using a sample of U.S. firms between 2003 and 2006, these authors provide evidence that managers benefit from *"the unverifiable discretion in SFAS 142 to avoid timely goodwill write-offs in circumstances where they have agency-based motives to do so"* (Ramanna & Watts, 2012). Hayn and Hughes (2006) also reach a similar conclusion by showing that impairment decisions typically trail the fair value deterioration of goodwill by an average of three to four years.

First, contracting motives originate from the utilization of financial statements in agreement with third-parties. They can be decomposed into three distinct groups: debt covenants, accounting-based delisting requirements, and accounting-based compensation (Ramanna & Watts, 2012). With respect to debt covenants, management is unlikely to proceed with a goodwill impairment decision that would result in breaching agreed terms. A similar incentive is also present in delisting requirements incorporating the accounting-value of goodwill (Beatty & Weber, 2006). Finally, accounting-based compensation schemes incorporating special items are likely to result in management delaying goodwill impairment decisions. Beatty and Webber (2006) highlight that *"the probability of taking a write-off is smaller for firms that have earnings-based bonus plans that do not exclude the effects of special items."* (Beatty & Weber, 2006).

Second, because goodwill impairments are generally interpreted as overpayments of expected synergies in a given business combination (K. Li & Sloan, 2017; Z. Li, Shroff, Venkataraman, & Zhang, 2011), a company's management is inclined to protect its reputation from such events. These motives are categorized as reputation motives by Ramanna and Watts (2012). Beatty and Webber (2006), and Masters-Stout et al. (2008) have shown that long-tenure executives are less likely to impair goodwill. A potential explanation for this observation might be executives' unwillingness to write-off goodwill associated with their strategic decisions in fear that their reputation might be tarnished.

Lastly, equity market motives arise from concerns related to the effect of goodwill impairment on a company's valuation. Executives of companies with higher earning response coefficient (ERC) might be less inclined to impair goodwill. ERC denotes the sensitivity of a company's equity market value to variation in reported earnings. Despite a lack of strong empirical support for this assertion, Ramanna and Watts (2012) hypothesized that ERC might affect management's decision relative to goodwill accounting.

It appears that executives have strong motives to postpone goodwill impairments. Interestingly, SFAS 141 and SFAS 142 might also lead to opportunistic behaviors in writing-off goodwill.

2.4.2. Managerial opportunism and opportunistic goodwill impairment

"From a practical perspective, SFAS 142 could therefore result in more aggressive accounting, (...). Such accounting would cause the initial overstatement of assets and earnings and later understatement of earnings when the aggressive accounting is reversed through large and untimely "big bath" asset impairments." (K. Li & Sloan, 2017)

The big bath theory of earnings management is founded on the idea that companies are willing to take larger one-time losses to increase their ability to improve future earnings (Jordan CE & Clark SJ., 2004). In 1998, the chairman of the SEC, Arthur Levitt Jr held a speech and addressed the question of why companies are tempted to engage in such behavior: *"When earnings take a major hit, the theory goes Wall Street will look beyond a onetime loss and focus only on future earnings."* (Levitt, 1998). Riahi-Belkaoui (2004) identified three circumstances under which companies are likely to "take a bath": (1) when accounting earnings are weak, (2) when significant non-recurring gains are recorded, and (3) when there is a change in management. Because SFAS 141 and SFAS 142 likely inflated goodwill values and increased managerial discretion, goodwill accounting could be seen as "*a new tool for earnings management*" (Masters-Stout, Costigan, & Lovata, 2008).

First, executives of a company recording substandard performance might be motivated to further lower accounting earnings. Such behavior arises from management's belief that

they will not suffer proportionally from the additional accounting losses, earnings improvements will be more achievable, and performance expectations will be lowered (Jordan CE & Clark SJ., 2004; Moore, 1973). Correspondingly, Kirschenheiter and Melumad (2002) assert that *"for sufficiently "bad" news (i.e., for sufficiently low levels of cash flows), the manager under-reports earnings by the maximum amount possible, preferring to take a big bath in the current period in order to report higher earnings in the future."*(Kirschenheiter & Melumad, 2002)

Second, when a company records non-recurring gains uncharacteristically high, its management might attempt to reduce their effects on accounting earnings. Because markets tend to prefer steady profits, executives have an incentive to smooth earnings in these situations (Kirschenheiter & Melumad, 2002). Glaum et al. (2018) managed to show that managers willingness to report smooth earnings significantly affect goodwill impairment decisions. Despite this study being conducted on companies applying IFRS, there are reasons to believe that a similar phenomenon also exists under U.S. GAAP due to the similarities in goodwill accounting between the two accounting systems[1].

Lastly, while long-tenure executives typically want to shield their reputation from the adverse effect of goodwill impairment, incoming CEOs appear more inclined to impair goodwill as a signal of poor past performance and to lower future expectations (Masters-Stout et al., 2008). Because a goodwill impairment makes earning improvement simpler to achieve, there is an incentive for new CEOs to impair goodwill and blame previous managements' acquisition strategies. However, Masters-Stout et al. (2008) also denote that new CEOs might assess the fair value of goodwill more objectively than their predecessors. Because former CEOs could have intentionally delayed goodwill impairments, incoming CEOs might write-off goodwill to indicate an actual deterioration of the fair value of goodwill, and not opportunistically.

Because of the exposure of goodwill accountings to managerial opportunism, it is essential to consider the role of the board of directors since *"effective governance*

[1]In March 2004, the IASB published IFRS 3 (Business combinations) which provides the accounting guidance to record business combination and goodwill. Seeking convergence with U.S. GAAP, this standard eliminated the amortization of goodwill in favor of a mandatory impairment test (AbuGhazaleh, Al-Hares & Roberts, 2011).

mechanisms are likely to restrict managers' ability to report goodwill impairments that differ from predicted economic losses" (AbuGhazaleh, Al-Hares, & Roberts, 2011).

2.5. The role of the board of directors

"The board is viewed as a market-induced institution, the ultimate internal monitor of the set of contracts called a firm, whose most important role is to scrutinize the highest decision makers within the firm" (Fama, 1980)

The board of directors faces the challenge to monitor the present while having an eye on the future (Van & Levrau, 2004). Its primary duties are establishing the long-term corporate strategy together with hiring, monitoring, and dismissing executives (Fama, 1980; Van & Levrau, 2004).

Boards are a crucial mechanism in corporate governance because they are responsible for addressing agency problems between a firm's management and its shareholders (Fama, 1980). In modern corporations, there is typically a separation between ownership and management. Through extensive literature, this separation is presented as a fertile environment for managerial opportunism and incentive misalignments. A firm could be seen as a set of contracts between agents under which *"one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent"* (Jensen & Meckling, 1976). Agency problems arise because management is likely to encounter opportunities to maximize its utility at the expense of the firm's shareholders. Boards are responsible for mitigating and reducing these instances of managerial opportunism.

Interestingly, the relationship between management and the board is inherently complicated due to management's apparent control over the board's composition (Hermalin & Weisbach, 1998). Because shareholders almost always approve management's slate of directors and have limited capabilities even to challenge it (Cai, Garner & Walking, 2009; Hermalin & Weisbach, 1998), there are legitimate uncertainties about the board's abilities to act as a monitoring unit. However, Kaplan and Reishus (1990) have shown that directors are generally concerned about their reputation as effective monitors. This reputational concern is likely to originate from the observation that *"directors of poorly performing firms, who therefore may be perceived to have done*

a poor job overseeing management, are less likely to become directors at other firms." (Hermalin & Weisbach, 1998). Because directors do not wish to be perceived as lenient with management, they have an incentive to monitor its actions effectively.

Despite the importance of monitoring management's actions to prevent managerial opportunism, there are also negative consequences associated with harsh monitoring. For instance, Goranova et al. (2017) examine the relationship between CEOs and the board of directors to investigate whether there is a dark side to monitoring. These authors found that a high level of control in M&A activities lead to CEOs being constrained, which ultimately translates into smaller losses but also smaller profits from these activities (Goranova, Priem, Ndofor, & Trahms, 2017). Accordingly, harsh monitoring might affect executives' abilities to create value and execute strategic initiatives. Furthermore, this study illustrates the influence of the board of directors on executives' decision-making authority.

Former CEOs might remain in a company as a director after stepping down. With this interesting transition to the monitoring unit of the company, the former CEO is responsible for overseeing their successor.

2.6. The board of directors and CEO retention light

"The former CEO's presence [on the board of directors] makes it difficult to review past decisions and earlier practices openly and candidly. Even with the best will in the world, it is hard for any former CEO to be entirely objective about decisions made on his [or her] watch." (Bowen, 2008)

The concept of CEO Retention Light refers to situations when former CEOs remained on the board of directors and consequently, retain *"decision rights that are significant but less than they held as CEO."* (Evans III, Nagarajan & Schloetzer, 2010). In their new role as a director, former CEOs have the ability to affect their successor and the future of the company.

From a company perspective, having a former CEO serving on the board has both positive and negative implications. They are likely to bring valuable insights to conduct the board's monitoring and advising responsibilities by leveraging their knowledge of the company's operations and environment. As a consequence, their presence can mitigate

instances of managerial opportunism by current executives. However, former CEOs might also use their decision-making authority for personal benefits and negatively impact the company's performance (Evans III et al., 2010). Quigley and Hambrick (2012) find evidence that their presences tend to constrain their successors and consequently, diminish organizations' abilities to adapt to environmental changes. For instance, their retention is found to have a negative association with resource reallocation and divestitures. Eventually, when a former CEO entirely exit a company, these authors observed *"an abrupt increase in changes of four types: resource reallocation, divestitures, executive additions, and executive departures."* (Quigley & Hambrick, 2012). Accordingly, retaining a former CEO on the board of directors appears to affect its successor decision-making and delay common consequences associated with CEO turnovers. As previously noted, one of these consequences is typically the impairment of goodwill associated with acquisitions made by previous management. Accordingly, CEO Retention Light affect goodwill impairment decisions.

Although the shareholders almost always approve management's slate of directors (Hermalin & Weisbach, 1998), departing CEOs generally need to earn their place as a director. Brickley et al. (1999) showed that the likelihood of former CEOs remaining on the board strongly increased if they had performed well in office. This observation is consistent with the findings by Evans III, Nagarajan and Schloetzer (2010) that pre-turnover financial performance and CEO power are positively associated with a former CEO transitioning to the board. However, it also indicates that CEOs have an incentive to enhance financial performance in their last years in office, which could be seen as an instance of managerial opportunism. This incentive might lead them to take actions that are beneficial for their careers to the detriment of the company's long-term success. Because goodwill impairments directly affect accounting earnings, departing CEOs might be inclined to postpone legitimate impairments.

These implications of having a former CEO as a part of the board has inspired researchers to study the circumstances leading to these situations. In 1999, Brickley et al. (1999) examined CEOs' career concerns and they established that these concerns extend beyond retirement. A post-retirement board service might give the former CEO significant economic benefits as well as non-economic advantages such as status and prestige. Two years after retirement, the average CEO holds about two board seats and, in almost 16%

of the cases, also remains as chairman in their former company (Brickley, Linck, & Coles, 1999). More recent studies such as (Hoitash & Mkrtchyan, 2018) provide evidence that this phenomenon still exists in a more contemporary business environment.

2.7. Previous empirical studies

In this subsection, we first examine existing goodwill impairment prediction models. We then review relevant studies investigating the association between corporate governance and goodwill impairments.

2.7.1. Goodwill impairment prediction models

Unlike bankruptcy, goodwill impairment prediction appears to have attracted limited attention from academics. From previous literature, we identify two relevant goodwill impairment prediction models derived by Hayn and Hughes (2006) and Olante (2013). Despite being conducted in different time periods, both studies aim to determine whether users of financial reports possess sufficient information to assess the value of goodwill assets.

First, Hayn and Hughes (2006) investigate if goodwill impairments could be predicted on a sample of U.S. acquisitions between 1988 and 1998. These authors use a comparable methodology to previous studies forecasting corporate bankruptcy and financial distress. Their prediction model is composed of variables indicating an acquisition overpayment and its associated financial performance after the acquisition date.

Second, Olante (2013) examines the predictability of goodwill impairments solely based on variables indicating an acquisition overpayment on U.S. acquisitions between 1999 and 2007. This study incorporates additional variables likely reporting acquisition overpayment such as the size of the book value premium paid by the acquiring firms. Unlike Hayn and Hughes (2006), Olante (2013) does not integrate time-varying financial performance variables after the acquisition date.

Compared to bankruptcy prediction models such as Altman (1968) or Shumway (2001), both Hayn and Hughes (2006) and Olante's (2013) models have a limited ability to predict goodwill impairments. The former model correctly predicts 42.2% of the impairments and the latter only 37.4%. While some factors related to acquisition overpayment seem to

offer some predictive power in both studies, it appears challenging to predict goodwill impairment using solely public accounting information produced after the acquisition date. These findings are troublesome because of goodwill's increasing weight in financial statements.

2.7.2. Corporate governance and goodwill impairments

Although not investigating goodwill impairment predictability, AbuGhazaleh and Al-Hares (2011) denote an association between variables proxying the effectiveness of corporate governance and the amount of impaired goodwill. The variables used to proxy corporate governance effectiveness are related to board characteristics and ownership. These authors' research appears to show that effective corporate governance is significantly associated with the amount of goodwill impaired under an IFRS setting. Indeed, stronger corporate governance mechanisms appear to limit the extent to which managers can act opportunistically in goodwill impairment decisions.

Interestingly, bankruptcy prediction models have been further developed to include additional variables such as corporate governance (Liang, Lu, Tsai, & Shih, 2016). However, this inclusion seems to be relatively underdeveloped in goodwill impairment prediction models. Given the importance of corporate governance in bankruptcy prediction and AbuGhazaleh and Al-Hares (2011) findings, the inclusion of corporate governance proxies might improve the predictability of goodwill impairments.

3. Hypotheses

Since 2002, public U.S. companies apply SFAS 141 and SFAS 142 under U.S. GAAP. These two standards were expected to "*improve financial reporting because financial statements of entities that acquire goodwill and other intangible assets will better reflect the underlying economics of those assets."*(Financial Accounting Standards Board, 2001a). However, concerns regarding the reliability of the information produced under the two standards are still present. In particular, the movement towards fair value appears to have added considerable managerial discretion in goodwill accounting. Hence, there are reasons to believe that possible disruptive forces still hinder financial statement users from evaluating the value of goodwill accurately. The contrasting views on the reliability of the accounting information produced under current accounting standards led us to our first hypothesis:

Hypothesis 1: The ability to predict goodwill impairments with the use of public accounting information has increased after the implementation of SFAS 141 and SFAS 142.

Because goodwill is accounted at fair value, the quality of accounting disclosures is of the utmost importance (Hayn & Hughes, 2006). In an IFRS setting, AbuGhazaleh and Al-Hares (2011) denote that effective corporate governance mechanisms are generally associated with higher disclosure quality. These two authors also conclude that *"effective governance mechanisms are likely to restrict managers' ability to report goodwill impairments that differ from predicted economic losses, resulting in the recognition of more timely impairments that better reflect the firm's underlying economics."* (AbuGhazaleh et al., 2011). Effective corporate governance mechanisms and the monitoring role of the board seems to limit some of the issues associated with managerial opportunism. These findings led us to believe that including corporate governance variables that proxy its effectiveness might improve the predictability of goodwill impairments for U.S. GAAP firms:

Hypothesis 2: The inclusion of corporate governance variables increases the predictability of goodwill impairments.

Finally, previous studies have established CEOs' apparent influence on decisions regarding goodwill impairments (Masters-Stout et al. 2008). While incoming CEOs appear more inclined to impair goodwill assets generated under previous leadership, factors counteracting this phenomenon might exist. In particular, the presence of a former CEO on the board of directors appears to restrict their successors' ability to evaluate past decisions and implement strategic changes (Quigley & Hambrick, 2012). Accordingly, having a former CEO on the board might affect the accounting treatment of goodwill. While former CEOs likely enhance boards' monitoring ability, it might hinder succeeding CEOs from impairing goodwill assets. The possible impacts of CEO changes and former CEOs retention on the board of directors led us to our third hypothesis:

Hypothesis 3: The inclusion of variables indicating CEO changes and the presence of a former CEO on the board of directors increase the predictability of goodwill impairments.

4. Method

In this section, we first review the five prediction models used to test our hypotheses. We then examine our choice of independent variables together with their expected effects on goodwill impairment decisions. Finally, we discuss considerations and potential limitations regarding our prediction models.

4.1. Predicting goodwill impairment

To investigate our first hypothesis, we use the methodology outlined by Hayn and Hughes (2006). These authors denote that predicting goodwill impairment is akin to predicting corporate bankruptcies since both events are typically triggered by a deterioration in the performance of a reporting unit or firm. Because goodwill arises directly from acquisitions, they also stressed the importance of acquisition characteristics in predicting goodwill impairments. Accordingly, Hayn and Hughes' goodwill impairment prediction models are multi-period binary logit regression structured around two different sets of variables: *acquisition characteristics* and *performance indicators*. The latter are collected for every fiscal year following an acquisition until an impairment, a divestiture of the acquired entity, or the latest financial statements available. We reproduce these models to investigate whether the predictability of goodwill impairment has improved since the implementation of SFAS 141 and SFAS 142, and Hayn and Hughes' original study. The following models will be used to test our first hypothesis.

Model 1 estimates the probability of a goodwill impairment using acquisition characteristics:

$$Pr(Goodwill\ Impairment_{i,t}) = f([Acquisition\ Characteristics]_{i,A})$$

$$GoodwillImpairment_{i,t} = \alpha + \beta_1 * Prem_{i,A} + \beta_2 * Bid_{i,A} + \beta_3 * GW\%_{i,A} + \beta_4 * Stock_{i,A} + \beta_5 * AnnRet_{i,A} + \beta_6 * Acqn_{i,A} + \epsilon_{i,A} \quad (1)$$

where Subscript i: Firm I; Subscript A: Acquisition year; Subscript t: Time period; $GoodwillImpairment_{i,t}$: Dichotomous variable indicating if goodwill has been impaired; $Prem_{iA}$: Premium paid as a percentage of the acquisition price; Bid_{iA}: Dichotomous variable indicating the presence of multiple bidders; $GW\%_{iA}$: Percentage of the acquisition cost as the recognized goodwill; $Stock_{iA}$: Percentage of the purchase

price paid using stock; $AnnRet_{iA}$: Acquiring company's cumulative abnormal returns around the acquisition date; $Acqn_{iA}$: Number of acquisitions in the two years preceding the acquisition.

Model 2 estimates the probability of a goodwill impairment using performance indicators. It is used to test Hypothesis 1:

$$Pr(Goodwill\ Impairment_{i,t}) = f([Performance\ Indicators]_{i,t-1})$$

$$GoodwillImpairment_{i,t} = \alpha + \beta_1 * ROA_{i,t-1} + \beta_2 * \Delta ROA_{i,t-1} + \beta_3 * Loss_{i,t-1} + \beta_4 * \Delta Sales_{i,t-1} + \beta_5 * \Delta Comp_{i,t-1} + \beta_6 * FirmROA_{i,t-1} + \beta_7 * FirmRet_{i,t-1} + \epsilon_{it-1} \quad (2)$$

where $ROA_{i,t-1}$: Associated operating segment's return on identifiable assets; $\Delta ROA_{i,t-1}$: Associated operating segment's yearly change in ROA; $Loss_{i,t-1}$: Dichotomous variable indicating if the associated segment's operating income is negative; $\Delta Sales_{i,t-1}$: Associated operating segment's yearly change in sales; $\Delta Comp_{i,t-1}$: Associated operating segment's yearly change in Herfindahl index; $FirmROA_{i,t-1}$: Firm's return on assets; $FirmRet_{i,t-1}$: Firm's annual cumulative abnormal returns.

Model 3 is the complete Hayn and Hughes' goodwill impairment prediction model integrating both acquisition characteristics and performance indicators:

$$Pr(Goodwill\ Impairment_{i,t}) = f([Acquisition\ Characteristics]_{i,A}, [Performance\ Indicators]_{i,t-1})$$

$$GoodwillImpairment_{i,t} = \alpha + \beta_1 * Prem_{i,A} + \beta_2 * Bid_{i,A} + \beta_3 * GW\%_{i,A} + \beta_4 * Stock_{i,A} + \beta_5 * AnnRet_{i,A} + \beta_6 * Acqn_{i,A} + \beta_7 * ROA_{i,t-1} + \beta_8 * \Delta ROA_{i,t-1} + \beta_9 * Loss_{i,t-1} + \beta_{10} * \Delta Sales_{i,t-1} + \beta_{11} * \Delta Comp_{i,t-1} + \beta_{12} * FirmROA_{i,t-1} + \beta_{13} * FirmRet_{i,t-1} + \epsilon_{it-1} \quad (3)$$

To test our second hypothesis, we include a set of corporate governance variables in Model 3. Liang et al (2016) denote that corporate governance indicators are important input variables in bankruptcy prediction models together with financial performance indicators. Because of the presence of considerable managerial discretion in goodwill impairment decisions and corporate governance indicators' relevance in predicting bankruptcies, we extend Hayn and Hughes' model by adding relevant corporate governance variables previously used by AbuGhazaleh and Al-Hares (2011). In the same

fashion as for the financial indicators, these variables are gathered for every year following an acquisition. Model 4 is used to test our second hypothesis:

$$\Pr(Goodwill\ Impairment_{i,t}) = f([Acquisition\ Characteristics]_{i,A}, [Performance\ Indicators]_{i,t-1}, [Corporate\ Governance]_{i,t-1})$$

$$GoodwillImpairment_{i,t} = \alpha + \beta_1 * Prem_{i,A} + \beta_2 * Bid_{i,A} + \beta_3 * GW\%_{i,A} + \beta_4 * Stock_{i,A} + \beta_5 * AnnRet_{i,A} + \beta_6 * Acqn_{i,A} + \beta_7 * ROA_{i,t-1} + \beta_8 * \Delta ROA_{i,t-1} + \beta_9 * Loss_{i,t-1} + \beta_{10} * \Delta Sales_{i,t-1} + \beta_{11} * \Delta Comp_{i,t-1} + \beta_{12} * FirmROA_{i,t-1} + \beta_{13} * FirmRet_{i,t-1} + \beta_{14} * Bindep_{i,t-1} + \beta_{15} * Bactivity_{i,t-1} + \beta_{16} * SepChair_{i,t-1} + \epsilon_{it} \quad (4)$$

Where additional variables are $Bindep_{i,t-1}$: Number of independent directors over the total number of directors; $Bactivity_{i,t-1}$: Frequency of board meetings during the year; $SepChair_{i,t-1}$: Dichotomous variable indicating if the role of chairman and CEO are separated.

Finally, we investigate our third hypothesis by integrating two additional corporate governance variables proxying CEO influence on goodwill impairment decisions. Model 5 is used to test our third and final hypothesis:

$$\Pr(Goodwill\ Impairment_{i,t}) = f([Acquisition\ Characteristics]_{i,A}, [Performance\ Indicators]_{i,t-1}, [Corporate\ Governance\ Extended]_{i,t-1})$$

$$GoodwillImpairment_{i,t} = \alpha + \beta_1 * Prem_{i,A} + \beta_2 * Bid_{i,A} + \beta_3 * GW\%_{i,A} + \beta_4 * Stock_{i,A} + \beta_5 * AnnRet_{i,A} + \beta_6 * Acqn_{i,A} + \beta_7 * ROA_{i,t-1} + \beta_8 * \Delta ROA_{i,t-1} + \beta_9 * Loss_{i,t-1} + \beta_{10} * \Delta Sales_{i,t-1} + \beta_{11} * \Delta Comp_{i,t-1} + \beta_{12} * FirmROA_{i,t-1} + \beta_{13} * FirmRet_{i,t-1} + \beta_{14} * \mathrm{Bindep}_{i,t-1} + \beta_{15} * \mathrm{Bactivity}_{i,t-1} + \beta_{16} * \mathrm{SepChair}_{i,t-1} + \beta_{17} * \mathrm{CEOret}_{i,t-1} + \beta_{18} * \mathrm{CEOchange}_{i,t-1} + \epsilon_{it} \quad (5)$$

Where additional variables are $\mathrm{CEOret}_{i,t-1}$: Dichotomous variable indicating if a former CEO is present on the board of directors; $\mathrm{CEOchange}_{i,t-1}$: Dichotomous variable indicating whether the acquiring company has experienced a change in the CEO position

4.2. Dependent variable

The dependent variable in the five models, $GoodwillImpairment_{i,t}$, is a dichotomous variable indicating whether goodwill generated by a specific acquisition has been

impaired or the disposition of an acquired entity has led to a loss in year *t*. This dependent variable is assigned a value of one if goodwill has been impaired and zero otherwise.

4.3. Independent variables: acquisition characteristics

Acquisition characteristics are seen as indicative of overpayment. These variables are incorporated since *"in the event the acquiring firm pays "too much" for the acquired business, the goodwill arising from the acquisition will be overstated and, as a result, is likely in subsequent periods to be impaired relative to its carrying value"* (Hayn & Hughes, 2006). These characteristics are composed of four indicators listed in the FASB 1999 Exposure Draft of SFAS 142 and two additional variables derived from previous literature.

$Prem_{iA}$ represents the premium paid in an acquisition. Acquisitions characterized by a significant premium over the acquired entity's market value are deemed more likely to lead to goodwill impairment (Hayn & Hughes, 2006). This variable is defined as the standardized difference between the acquisition cost, defined as the total of the acquisition price including assumed liabilities, and the average market value of the acquired entity. The latter is determined over a period of 100 trading days ending 50 days before the acquisition announcement.

$Bid_{iA}$is a dichotomous variable assigned a value of one if there were multiple bidders and zero otherwise. This variable is aimed at representing the degree of competition in the process of acquiring a target since negotiations in settings with numerous bidders are more likely to lead to an overpayment.

$GW\%_{iA}$ represents the percentage of the acquisition cost compared to the recognized goodwill. If this indicator is relatively high, it is likely to indicate an overpayment and consequently, a higher probability of goodwill impairment.

$Stock_{iA}$ represents the percentage of the purchase price paid using the acquiring firm's stock. A higher percentage of stock in the consideration transferred could indicate an overpayment because *"acquiring firms may have a greater tendency to overpay when using stock"* (Hayn & Hughes, 2006). This observation is consistent with the findings by

Gu and Fend (2011) that overpriced shares create incentives for managers to acquire companies, potentially leading to overpayments and subsequent goodwill impairments.

$AnnRet_{iA}$ represents the acquiring company's cumulative abnormal returns over a period starting 15 days before the acquisition announcement and ending five days after this event. Using the market model, expected returns are determined over a period of 250 trading days ending 30 days before the announcement date. This indicator is aimed at measuring the market's reaction to an acquisition. Hayn and Hughes (2006) denote that low abnormal returns might be indicative of an acquisition overpayment.

$Acqn_{iA}$ represents the number of acquisitions in the two years preceding an acquisition. If a firm implements a strategy with multiple acquisitions in a short period, it might lack the resources to properly evaluate and integrate the acquired entity (Hayn & Hughes, 2006). Accordingly, intense acquisition periods are seen as more likely to lead to overpayments.

4.4. Independent variables: performance indicators

The performance indicators' explanatory value is derived from their representation of possible deteriorations in the fair value of goodwill. While SFAS 141 and SFAS 142 do not provide examples of such indicators, they offer a non-exhaustive list of events that might impact the fair value of goodwill. From these examples and previous researches on bankruptcy prediction, Hayn and Hughes (2006) selected seven indicators capturing the performance of the operating segment or firm. Five of these variables are computed using data assigned to the segment associated with the acquisition, and the remaining two are defined at the firm-level.

It is important to mention that some common financial indicators used in bankruptcy predictions have not been incorporated into these models because they cannot be computed at a segment-level. Most notably, indicators related to capital structure and working capital have been excluded. The two firm-level indicators ($FirmROA_{i,t-1}$ and $FirmRet_{i,t-1}$) have been included since they are deemed to provide relevant information about circumstances affecting the firm.

$ROA_{i,t-1}$ represents the return on identifiable assets for the operating segment associated with the acquisition, and its numerator is defined as the operating income generated. ROA_{in} is a measure of the segment's profitability and appears to be an important factor in goodwill impairment decision (Godfrey & Koh, 2009; Hayn & Hughes, 2006). A higher ROA is expected to decrease the likelihood of an impairment.

$\Delta ROA_{i,t-1}$ represents the yearly change in ROA for the segment associated with the acquisition. This variable illustrates variations in the profitability experienced by the segment, which likely affect goodwill impairment decisions. A significant reduction in profitability might lead to a higher probability of goodwill impairment.

$Loss_{i,t-1}$ is a dichotomous variable assigned a value of one if operating income is negative for the segment associated with the acquisition, it has a value of zero otherwise. A segment recording losses is deemed more likely to experience a goodwill impairment.

$\Delta Sales_{i,t-1}$ represents the yearly change in sales for the segment associated with the acquisition. Sales are essential to generate positive cash flows, and therefore the annual change in sales could illustrate meaningful changes in the performance of the segment. An acquisition assigned to a segment experiencing a decrease in sales is deemed more likely to be impaired.

$\Delta Comp_{i,t-1}$ represents the yearly change in the Herfindahl index for the segment associated with the acquisition. The Herfindahl index is commonly used to analyze the concentration of an industry, and its variations depict changes in the competitive environment. In most oligopoly models, *"concentration is a major driver behind the intensity of competition."* (Keil, 2017) An acquisition assigned to a segment facing an increase in competition is deemed more likely to be impaired. The Herfindahl index is defined as follows:

$$H = \sum_{i=1}^{N} (\frac{S_{ij}}{S_j})^2$$

Where $s_{ij}$is the revenue for firm i in industry j and S_j is the total revenue generated in industry j. In other words, the Herfindahl index is the summation of the squared market share of each firm competing a specific industry. It ranges from one to 10,000 points with

high values indicating highly concentrated markets. An industry is defined using the four-digit SIC assigned to each operating segment in Compustat.

$FirmROA_{i,t-1}$ represents the return on assets for the firm. This indicator is deemed representative of the overall performance of the firm which could *"provide more general information about the acquired entity's profitability in the hands of the acquiring firm."* (Hayn & Hughes, 2006). A firm experiencing high levels of ROA is seen as less likely to impair goodwill from previous acquisitions.

$FirmRet_{i,t-1}$ represents the annual cumulative abnormal returns using the previous year to determine the expected returns. Abnormal returns reflect changes in the firm's valuation and therefore, they can be seen as a market's assessment of the circumstances affecting the firm's performance. Accordingly, this variable might be *"indicative of factors that would affect the performance of a particular reporting unit or units."* (Hayn & Hughes, 2006). Therefore, a positive level of cumulative abnormal returns should decrease the probability of a goodwill impairment.

4.5. Independent variables: corporate governance and CEO retention

Because of the relevance of corporate governance variables in predicting bankruptcy and goodwill impairments' exposure to managerial opportunism, we extend Hayn and Hughes' original prediction model by including corporate governance variables. Under an IFRS setting, AbuGhazaleh and Al-Hares (2011) show that robust corporate governance mechanisms are restricting executives' abilities to act opportunistically in goodwill impairment decisions. Motivated by their research and previous literature, we include three variables proxying the effectiveness of a board's monitoring role. We further expand our prediction model with two additional variables indicating if there is a change in CEO and if a former CEO is retained on the board of directors. This last variable is included due to its possible implication on the board's ability to effectively monitor management and goodwill impairment decisions.

$Bindep_{i,t-1}$ represents the number of independent directors relative to the total number of directors. Companies with boards composed of a higher level of independent directors are deemed less likely to engage in earnings management or fraudulent behavior (AbuGhazaleh et al., 2011; Xie, Davidson, & DaDalt, 2003). As previously mentioned,

goodwill impairment has been presented as a new tool for earnings management (Masters-Stout et al., 2008). Generally, the presence of independent directors is associated with a better oversight and reduced instances of managerial opportunism. Therefore, we expect less impairments for companies with higher percentage of independent directors.

$Bactivity_{i,t-1}$ represents the number of board meetings in one year. While the effectiveness of the board's monitoring role is challenging to quantify, the number of board meetings is often used as a proxy to represent it. The rationale is that boards have to meet regularly to carry out their responsibility of monitoring executives. Increased monitoring might lead to less opportunistic behaviour in goodwill impairment decisions (AbuGhazaleh et al., 2011). Accordingly, we expect this variable to lower the probability of a goodwill impairment.

$SepChair_{i,t-1}$ is a dichotomous variable assigned the value of one if the role of chairman and CEO are separated, and zero otherwise. The case where the functions are not separated, commonly referred to as CEO duality, has been shown to promote strong leadership. However, it can also undermine a board's ability to effectively monitor a company's management (Finkelstein & D'Aveni, 1994). Therefore, we believe that firms with the roles separated are less exposed to instances of managerial opportunism, thereby lowering the probability of impairments.

$CEOret_{i,t-1}$ is a dichotomous variable assigned the value of one if a former CEO is present on the board of directors, and zero otherwise. Having a former CEO on the board makes it challenging to review past decisions openly (Quigley & Hambrick, 2012). In particular, incoming CEOs might be restricted in their ability to impair goodwill if a former CEO holds a seat on the board.

$CEOchange_{i,t-1}$ is a dichotomous variable assigned the value of one if there is a change in CEO, and zero otherwise. Newly appointed CEOs appear to have incentives to criticize previous acquisition strategies and use impairment charges as a tool for earnings management (Masters-Stout et al. 2008). Intuitively, companies with recent CEO changes would then be more likely to impair goodwill.

4.6. Considerations regarding goodwill impairment prediction models

4.6.1. Multi-period binary logit regression

"By ignoring the fact that firms change through time, static models produce bankruptcy probabilities that are biased and inconsistent estimates of the probabilities that they approximate."(Shumway, 2001)

Consistent with previous literature about bankruptcy and goodwill impairment prediction (Hayn & Hughes, 2006; Shumway, 2001), we use a multi-period binary logit regression to develop our five prediction models. Such models are typically preferred to static models because goodwill impairments are likely to arise from a progressive decline in the financial performance of the acquired entity. These models have been widely used to conduct survival analysis in bankruptcy or clinical prediction research (Hayn & Hughes, 2006; Shumway, 2001; van Smeden et al., 2018).

Based on survival model specification, we do not continue to collect firm-year observations for an acquisition once its goodwill has been impaired. Therefore, an acquisition experiencing a goodwill impairment in year *t* cannot have been impaired in year *t-1*.

Because our sample is composed of multiple firm-years for each acquisition, these separate observations are not statistically independent. Accordingly, we have adjusted our multi-period binary regression models to account for the lack of independence in firm-year observations linked to the same acquisition.

4.6.2. Right-truncation

Because our research period ranges from 2010 to 2018, our sample is subject to a right-truncation. This right-truncation occurs since we collect financial and corporate governance information from the acquisition year until the latest year available or an impairment. Accordingly, acquisitions effective in later years contribute with less firm-year observations to our sample. Such sample characteristics are common in survival analysis such as bankruptcy and medical studies where observations cannot be gathered after the time of the analysis (Barnard & Meng, 1999).

4.6.3. Operating segment association

To derive the financial performance variables, each acquisition is assigned to an operating segment in the acquiring firm. Fortunately, SFAS 142 requires disclosure about the allocation and fair-value changes of goodwill assets at a segment level (Financial Accounting Standards Board, 2011). Using the segment information provided in Form 10-K and Compustat Historical Segments Daily, we tracked each acquisition's segment performance until the latest Form 10-K available, a divestiture, or an impairment.

It should be mentioned that a limited number of acquiring firms experienced a restructuration during our research period. In these particular situations, we determined the new operating segment using the information provided by the acquiring firm about the reallocation of goodwill assets. We excluded firm-year observations following a restructuration if it was not possible to clearly identify the new operating segment associated to a specific acquisition.

4.6.4. Herfindahl Index

Herfindahl indexes are typically computed using data gathered on the Compustat database. However, using this data source appears to be problematic because of *"the exclusion of incumbents with stocks listed on foreign exchanges only, the aggregation of company sales from different geographic regions, the membership of a company in multiple industries, the issues in classifying companies, and the duplication of subsidiaries in the Compustat file."* (Keil, 2017) As an alternative, Keil (2017) recommends using data retrieved by the U.S. Economic Census to build industry concentration indicators. Unfortunately, these data points appear unavailable for non-manufacturing industries and the period after 2012. Consequently, we proxied the yearly change in Herfindahl indexes using the Compustat database despite the weaknesses documented by Keil (2017). We used segment data retrieved in Compustat Historical Segments Daily because it produces closer Herfindahl estimates to the ones generated by the U.S. Economic Census (Keil, 2017).

4.7. Test design

In this subsection, we first review the methodology used to create the two random samples necessary to conduct our analysis. We then explain the method applied to create dichotomous prediction of impairment for each firm-year observation. Finally, we detail the method used to analyze our models' predictive performance.

4.7.1. Sampling

In order to regress and assess the predictive power of our goodwill impairment prediction models, we created two random samples namely the *"estimation sample"* and the *"hold-out sample"*. Following the methodology outlined by Hayn and Hughes (2006), both samples are composed of half of the acquisitions resulting in impairment and half of those that have not yet experienced such an event.

The estimation sample is used to regress our prediction models. In other words, it is used to estimate the coefficients for each of the independent variables and the intercept of each model. The hold-out sample enables us to assess the predictive power of our multi-period binary logit models.

4.7.2. Dichotomous prediction

Using the prediction models regressed from our estimation sample, we create a dichotomous prediction of goodwill impairment for each firm-year observation. This dichotomous prediction is generated using three distinct steps. First, we apply each model on the hold-out sample to estimate probabilities of impairment. Second, we partition the estimated probabilities into deciles with the first decile containing the observations most likely to experience an impairment. Third, these probability deciles are used to create dichotomous predictions of goodwill impairment. Based on an arbitrary cut-off decile, we classify each firm-year observation above this cut-off as predicted impairments. The remaining firm-years are predicted not to be impaired.

4.7.3. Prediction classification analysis

To determine the predictive performance of our models, we reproduce the prediction classification analysis used by Chen (2011) to compare the performance of various

financial distress prediction models. This analysis is structured on five different metrics derived from the comparison between a model's dichotomous predictions and the outcomes observed in the hold-out sample. Each of these five classification metrics contributes to a different understanding of a model's predictive performance. The metrics are defined as follows:

$$Overall\ Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Precision = \frac{TP}{TP + FP}$$

$$Sensitivity = \frac{TP}{TP + FN}$$

$$Specificity = \frac{TN}{TN + FP}$$

$$F1\ Score = \frac{2 * Precision * Sensitivity}{Precision + Sensitivity}$$

Where variables are True Positive (TP): Number of correctly classified positive outcomes; True Negative (TN): Number of correctly classified negative outcomes; False Positive (FP): Number of incorrectly classified positive outcomes; False Negative (FN): Number of incorrectly classified negative outcomes.

The five metrics defined above are interpreted as follows. First, the *Overall Accuracy* is the percentage of correctly predicted outcomes over the total number of predictions. Second, *Precision* is the number of correctly predicted positive outcomes over the total of predicted positive outcomes. In other words, it measures the percentage of correct positive predictions. Third, the *Sensitivity* represents the number of correctly predicted positive outcomes over the total of observed positive outcome. Thereby, it is a metric representing the effectiveness of a model to detect positive outcomes. Fourth, the *Specificity* is the number of correctly predicted negative outcomes over the total of observed negative outcomes. Then, it measures the effectiveness of a model to detect negative outcomes. Lastly, the *F1 Score* represents *"the performance of classification in a precision-sensitive space"* {{93 Chen,Mu-Yen 2011;}}.

5. Empirics

Our study is delimited to U.S. acquisitions conducted between 2010 and 2015 and recorded on the SDC Platinum database. The extraction of these transactions led to an initial sample of 2,919 effective acquisitions. This acquisition selection period is chosen for three reasons. First, it enables us to analyze goodwill impairment decisions on recent transactions. Second, it excludes the 2008 financial crisis which *"dramatically altered the capital market environment in the US"* (Ramanna & Watts, 2012). Third, it enables us to gather a consequent number of years to observe whether goodwill arising from a transaction has been impaired or not.

Importantly, each of these transactions needs to meet the following four criteria to be included in our sample:

1. The acquiring and acquired firms are both publicly traded on U.S. stock exchanges.
2. The transaction generated goodwill with the amount of purchased goodwill and acquisition characteristics are publicly disclosed.
3. The associated segment discloses sufficient information to derive the performance indicators.
4. Information about the board of directors of the acquiring firm is publicly disclosed.
5. The firm discloses sufficient information to derive the CEO retention and CEO change variables.

First, since our models incorporate information derived from the acquired and acquiring firms' market values, we require both firms to be publicly traded on a U.S. stock exchange. More precisely, the market information needs to be available on the CRSP/Compustat Merged database. Due to some acquisitions not having both parties traded on an U.S. stock exchange or insufficient information to determine related variables, we exclude 2,365 acquisitions from our initial sample.

Second, we require the amount of purchased goodwill and the acquisition characteristics to be publicly available. The formers are directly extracted from the SDC Platinum database, and the latter is collected using Form 10-K stored in the Electronic Data

Gathering, Analysis, and Retrieval system (EDGAR) database. Based on this criteria, we exclude 68 acquisitions from our sample because of insufficient information to determine these variables.

Third, the segment associated with each acquisition is required to disclose sufficient accounting information to determine the models' performance indicators. We require the sales revenue, operating income, and total identifiable assets to be available in Compustat Historical Segments Daily for all firm-year observations. Based on this criteria, we exclude 205 acquisitions from our sample.

Fourth, we require the number of yearly board meetings, the separation between CEO and chairman, and the number of independent directors to be publicly disclosed. We collect this information using either Thomson Reuters DataStream or Form Def 14A in the EDGAR database. Based on this criteria, we exclude 13 acquisitions from our sample.

Finally, we require CEO retention and CEO changes to be derived from available databases. We collect this information using Compustat Director Compensation, Compustat Executive Compensation and Form Def 14A in the EDGAR database. Based on this final criteria, we did not exclude any acquisitions from our sample.

Table 1. Acquisition Sample Selection

		Number of acquisitions
Initial sample: U.S. acquisitions recorded in SDC Platinum database		2 919
Criteria	Adjustments	Number of acquisitions
1. Acquiring and acquired firms are publicly traded. Information is available in CRSP/Compustat Merged database.	-2 365	554
2. Acquisitions generate goodwill and acquisition characteristics are publicly disclosed. Information is available in SDC Platinum and EDGAR databases.	-68	486
3. Associated segment information is sufficient to determine the performance indicators. Information is available in Compustat Historical Segments Daily.	-205	281
4. Boards information is sufficient to determine corporate governance variables. Information is available in either Thomson Reuters or EDGAR database.	-13	268
Final Sample: U.S. Acquisitions recorded in SDC Platinum database respecting criteria 1, 2, 3, and 4.		268
Final Sample: Firm-year observations		1 173

Accordingly, our final sample is composed of 268 acquisitions representing 1,173 firm-year observations. Consistent with Hayn and Hughes' (2006) methodology, we gather time-varying variables from the year following the acquisition until a goodwill impairment, a divestiture, or the latest Form 10-K available. Consequently, our research period ranges from 2010 to the end of 2018 and is subject to right-truncation as most survival analysis. We only retain firm-year observations containing all models' variables.

6. Analysis

In this section, we present the distribution of our acquisition sample and descriptive statistics for the time-constant variables. We then examine the prediction results generated by replicating Hayn and Hughes' (2006) methodology. Finally, we conduct a classification performance analysis to test our hypotheses.

6.1. Sample distribution

In Table 2, we observe that our final sample of 268 acquisitions is somewhat evenly distributed across our acquisition selection period. However, compared to the number of transactions recorded in the SDC Platinum database, we have a limited number per year due to our extensive selection criteria.

Overall, 21% percent of the acquisitions in our final sample experienced a goodwill impairment by the end of our research period. Although no clear pattern can be established, the percentage of acquisitions resulting in a goodwill impairment ranges from 13% for transactions effective in 2013 to 33% for the ones in 2011. Compared to Hayn and Hughes (2006) and Olante (2013), we do not observe a decline in impairments by acquisition year. The absence of such distribution is likely to originate from our smaller sample and our different research period.

Table 2. Distribution of acquisitions by acquisition year

Acquisition Year	SDC Platinum # of acquisitions	Final sample # of acquisitions	Final sample # of acquisitions impaired by end of 2018	Final sample - % of acquisitions impaired by end of 2018
2010	416	40	6	15%
2011	403	48	16	33%
2012	494	37	8	22%
2013	436	45	6	13%
2014	533	36	10	28%
2015	637	62	10	16%
Total	2919	268	56	21%

In Table 3, we observe a general increase in the number of goodwill impairments per impairment year. Interestingly, there is a substantial increase in 2015 and decrease in 2018. This particular distribution is likely caused by three principal factors.

First, our acquisition sample is only composed of transactions effective between 2010 and 2015. The lower number of impairments from 2010 and 2014 is not surprising given that we do not include impairments from acquisitions completed prior to 2010. Furthermore, companies are deemed inclined to wait a period of two to three years of poor financial performance before impairing goodwill assets (Hayn & Hughes, 2006). This factor might also contribute to the higher numbers in subsequent years.

Second, goodwill impairments are likely to be caused by external circumstances such as a deterioration of the general economic environment (Financial Accounting Standards Board, 2011). The economic slowdown in China and the falling oil prices affecting U.S. stock markets in 2015 (Irwin, 2015) might explain the surge of impairments observed this specific year. This observation is coherent with Olante's (2013) suspicion that share price decline impacts segments' fair value, leading to numerous goodwill impairments during the 2008 financial crisis. However, Olante (2013) also suspects that some impairments during that period might have been what academics refer to as big-bath charges.

Third, the lower number of impairments for 2018 is also caused by the limited availability of segment and corporate governance information on Compustat databases. At the time of our study, some information was not available for 2018. Unfortunately, this right-truncation is a common limitation of survival analysis.

Table 3. Distribution of impairments by impairment year

	Impairment Year								
Acquisition Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
2010	0	3	1	0	1	1	0	0	0
2011		1	0	1	0	2	6	4	2
2012			2	1	1	3	0	1	0
2013				0	0	4	1	1	0
2014					0	3	4	3	0
2015						4	0	5	1
Total Impairment by year	0	4	3	2	2	17	11	14	3
Percentage total impairment	0%	7%	5%	4%	4%	30%	20%	25%	5%

6.2. Descriptive statistics

The descriptive statistics of our time-constant variables are presented in Table 4. With a mean-comparison test, we investigate whether there are statistically significant differences in mean values between the impairment group and the non-impairment group. While the acquisition characteristics are constant, the performance indicators and corporate governance variables vary with time. Therefore, we do not conduct such mean-comparison tests on the time-varying variables.

The most notable differences in mean values are observed for *PREM* and *Stock.* First, transactions resulting in a goodwill impairment appear to pay a higher premium: 66,3% for the impairment group and 47,7% for the non-impairment group (significant at the 1% level). This result is not surprising since this variable has been identified as a signal of overpayment by the FASB 1999 Exposure Draft of SFAS 142 and previous literature (Hayn & Hughes, 2006; Olante, 2013). Second, the consideration transferred is on average composed of 30,26% of the acquirer's stock for the impairment group and 18,95% for the non-impairment group. These averages lead to a difference in mean values of 11,31% and significant at the 5% level. Consistent with the findings of Gu and Fend (2011), it appears that goodwill arising from acquisitions paid with a more substantial portion of the acquirer's stock are more likely to be impaired.

Contradictory to the results presented by Hayn and Hughes (2006) and our initial expectations, *GW%* does not seem to differ between the two groups. These authors found a significant difference in mean values of almost 14% which is not observable in our final sample. Additionally, the difference in mean values for *AnnRet* and *Acqn* are not statistically significant.

Although all differences in mean values are not significant, these mean-comparison tests suggest that indications of future goodwill impairments might be present already at the time of an acquisition.

Table 4. Descriptive statistics and mean comparison test for time constant variables

	Impairment Group (n=56)	Non-impairment group (n=212)		
Acquisition Characteristics	Mean	Mean	Difference	t-statistic
Prem	0,6631	0,4766	-0,1865	-3,3658***
Bid	0,0357	0,0377	0,0020	0,0707
GW%	0,5310	0,5202	-0,0108	-0,2955
Stock	0,3026	0,1895	-0,1131	-2,2449**
AnnRet	0,0006	0,0070	0,0065	0,475
Acqn	1,7500	1,6840	-0,0660	-0,4031

Note: Significantly different at the 1% level (***), the 5% level (**), or the 10% level (*)

6.3. Estimation of the prediction models

To conduct our study, five prediction models are regressed using the estimation sample. An analysis of the variables' coefficient and statistical significance for each model is presented below, and in Table 5.

In Model 1, *Prem* and *Stock* have positive coefficients and are significant at the 5% level. It is coherent with our expectation that a more substantial premium and a higher percentage of the purchase price paid in stock increase the likelihood of future goodwill impairment. The remaining four variables (*Bid*, GW%, *AnnRet*, and *Acqn*) also raise this probability but are not significant. All coefficients are similar to the model regressed by Hayn and Hughes' (2006), and are aligned with our expectations with the exception of *AnnRet*.

In Model 2, both ΔROA and $\Delta Sales$ carry negative coefficients and are significant at the 5% level. $\Delta Comp$ and *Loss* are positively associated with goodwill impairment with significance at the 5% and 10% level respectively. While *ROA* and *FirmROA* are insignificant, they have a negative association with impairments. All variables except *FirmRet* contribute to the probability of goodwill impairments as expected from Hayn and Hughes' (2006) study. Accordingly, a deterioration of the financial performance of a firm and an acquisition's segment contribute to a higher likelihood of goodwill impairments.

In Model 3, we observe that $\Delta Comp$, $\Delta Sales$, and *Loss* are significant with unchanged coefficient signs. All variables have the same association with the probability of goodwill

impairment as Hayn and Hughes' (2006) study except for *AnnRet* and *FirmRet*. However, these two last variables together with *Prem, Bid, GW%, Stock, Acqn, ROA, ΔROA* and *FirmROA* are not statistically significant. Furthermore, none of the acquisition characteristics contribute meaningfully to predict goodwill impairment in Model 3.

In Model 4, *SepChair* is negatively associated with the probability of goodwill impairment and is significant at the 5% level. Hence, the separation seems to restrict executives from impairing goodwill assets. It is consistent with AbuGhazaleh and Al-Hares' (2011) suggestion that this separation enables boards to monitor management more effectively, somewhat limiting opportunistic behaviors. Furthermore, while statistically insignificant, *Bactivity* has a positive association with goodwill impairment and *Bindep* a negative one. The former observation appears to contradict our expectation that an increase in board meetings would likely restrict executives from impairing goodwill assets.

In Model 5, the extended corporate governance variables (*CEOret* and *CEOchange*) are behaving as expected, although statistically insignificant. Coherent with Masters-Stout et al. (2008) findings that newly appointed CEOs appear more inclined to impair goodwill, we observe a positive association between *CEOchange* and goodwill impairment. However, the negative coefficient assigned to *CEOret* indicates that having a former CEO sitting on the boards of directors seems to limit current management from engaging in such behavior.

Table 5. Estimation of the prediction models

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-4.114***	-3.000***	-4.703***	-3.652	-4.448
	(0.680)	(0.726)	(1.475)	(2.347)	(3.019)
Acquisition Characteristics					
Prem	0.988**		1.344	1.126	1.560
	(0.424)		(0.865)	(0.918)	(1.130)
Bid	0.394		0.0383	0.0901	-0.0718
	(1.067)		(1.379)	(1.526)	(1.982)
GW%	0.0324		0.154	0.722	0.630
	(0.900)		(1.189)	(1.343)	(1.750)
Stock	1.141**		1.422	1.506	2.109
	(0.541)		(0.882)	(1.049)	(1.348)
AnnRet	1.722		2.670	3.217	4.060
	(2.242)		(3.037)	(3.451)	(4.140)
Acqn	0.114		0.121	0.150	0.194
	(0.148)		(0.210)	(0.235)	(0.310)
Performance Indicators					
ROA		-1.605	-2.741	-5.063	-6.595
		(3.517)	(4.608)	(5.455)	(6.524)
ΔROA		-8.118**	-5.614	-5.865	-5.062
		(3.856)	(4.453)	(4.872)	(5.899)
Loss		1.351*	1.711*	1.546	1.694
		(0.734)	(0.881)	(0.941)	(1.166)
ΔSales		-3.734**	-3.757**	-4.360**	-4.708**
		(1.463)	(1.675)	(1.874)	(2.161)
ΔComp		1.423**	1.672**	1.691**	1.865**
		(0.661)	(0.691)	(0.823)	(0.930)
FirmROA		-5.347	-5.420	-2.433	-2.222
		(3.989)	(4.098)	(4.163)	(5.133)
FirmRet		0.306	0.404	0.640	0.898
		(0.707)	(0.673)	(0.716)	(0.765)
Corporate Governance					
Bindep				-0.523	-0.264
				(2.147)	(2.666)
Bactivity				0.0368	0.0235
				(0.0627)	(0.0772)
SepChair				-1.961**	-2.417**
				(0.866)	(1.033)
CEOret					-1.750
					(1.675)
CEOchange					1.149
					(0.878)
Wald Chi2	8,46	20,40	15,57	16,09	14,07
Firm-year observations	578	578	578	578	578
Number of impairments	28	28	28	28	28
Number of acquisitions	134	134	134	134	134

Note: Significance at the 1% level (***), the 5% level (**), or the 10% level (*).Standard errors in parentheses

6.4. Prediction results

As mentioned in section 4.7.2, the firm-year observations in the hold-out sample are grouped into deciles based on the probabilities of impairment estimated with the different models. In this subsection, we examine the proportion of observed impairments belonging to each decile. This distribution gives a first indication of the models' predictive performance.

A model with no predictive power should produce an even distribution of observed impairments across deciles (Hayn & Hughes, 2006; Shumway, 2001). Interestingly, such distribution does not appear to be displayed in Table 6, denoting some predictive ability for each model. However, differences between the models are clearly discernable. While Model 2, 3, 4 and 5 predict a higher number of impairments, Model 1 records lower percentages of observed impairments in the top deciles. Consequently, Model 1 also assigns a larger number of impairments to the lowest deciles (42,9% in decile 6-10).

The above observations are surprising since they seem to contradict Hayn and Hughes' (2006) findings that acquisition characteristics (Model 1) have more predictive power than performance indicators (Model 2). However, these results are coherent with the statistical significance of the different models' parameters displayed in Table 6. When regressing Model 3, we observe that some financial performance indicators have statistical significance ($Loss$, $\Delta Sales$, $\Delta Comp$) while it is not the case for any of the acquisition characteristics.

Furthermore, the inclusion of corporate governance variables in Model 4 and 5 only marginally impacts the number of impairments in the highest and lowest deciles. It indicates that the addition of corporate governance variables might not significantly improve the predictability of goodwill impairments. Similar to the conclusion above, these additional variables appear to suffer from a lack of statistical significance with the exception of $SepChair_{i,t-1}$.

Table 6. Predictive ability of models with respect to observed goodwill impairments

Decile of the models' estimated probabilities	Decile	Model 1	Model 2	Model 3	Model 4	Model 5
Highest probability	1	17,9%	28,6%	32,1%	32,1%	32,1%
	2	14,3%	25,0%	21,4%	17,9%	14,3%
	3	7,1%	10,7%	10,7%	17,9%	21,4%
	4	7,1%	3,6%	7,1%	7,1%	7,1%
	5	10,7%	7,1%	7,1%	0,0%	7,1%
Lowest probability	6-10	42,9%	25,0%	21,4%	25,0%	17,9%
Total		100%	100%	100%	100%	100%

Note: This table presents the distribution of the observed goodwill impairments across decile based on each model's predictions. For instance, the first decile in Model 1 contains 17,9% of the observed impairments in the hold-out sample.

6.4.1. Prediction classification

As specified in section 4.7.2, we classify firm-year observations above a cut-off decile as predicted impairments. The remaining firm-year observations belonging to lower deciles are therefore predicted not to be impaired. Thereby, we obtain dichotomous predictions comparable with the observed goodwill impairments in the hold-out sample. While Hayn and Hughes (2006) only use a cut-off decile of 20%, Table 7 presents a prediction classification based on three different cut-offs. The benchmark models refer to the original results obtained by Hayn and Hughes (2006) for Model 1, 2, and 3.

It is apparent that changes in the cut-off decile affect the number of correctly predicted impairments and non-impairments by each model. An increase in the cut-off decile translates into a higher percentage of correctly predicted impairments, but a lower number of correctly predicted non-impairments. Consequently, such change also increases the amount of Type I errors, namely the number of incorrectly predicted impairments by the models. The reverse relation is valid for Type II errors, defined as the number of incorrectly predicted non-impairments. Therefore, we observe an evident trade-off in the choice of the cut-off decile in predicting goodwill impairments.

Independently of the choice of cut-off decile, Model 1 appears to perform worse than models including performance indicators. Interestingly, this observation differs from Hayn and Hughes' (2016) findings that acquisition characteristics possess more predictive power than the performance indicators. Similar to the inferences in the previous section, the inclusion of variables related to board of directors and CEOs (Model 4 and

5) seem to only add marginal predictive power. However, the similar performance of Model 3, 4 and 5 might also be a result of the limited number of observed impairments in our hold-out sample.

Table 7. Prediction classification by models

	Correctly predicted impairments	Type I Error	Correctly predicted non-impairments	Type II Error
Cut-off = 1st decile				
Model 1	17,9%	9,5%	90,5%	82,1%
Model 2	28,6%	9,0%	91,0%	71,4%
Model 3	32,1%	8,8%	91,2%	67,9%
Model 4	32,1%	8,8%	91,2%	67,9%
Model 5	32,1%	8,8%	91,2%	67,9%
Cut-off = 2nd decile				
Model 1	32,1%	19,4%	80,6%	67,9%
Model 2	53,6%	18,3%	81,7%	46,4%
Model 3	53,6%	18,3%	81,7%	46,4%
Model 4	50,0%	18,5%	81,5%	50,0%
Model 5	46,4%	18,7%	81,3%	53,6%
Benchmark Model 1	36,7%	33,2%	66,8%	63,3%
Benchmark Model 2	32,2%	36,3%	63,7%	67,8%
Benchmark Model 3	42,2%	30,3%	69,7%	57,8%
Cut-off = 3rd decile				
Model 1	39,3%	29,5%	70,5%	60,7%
Model 2	64,3%	28,2%	71,8%	35,7%
Model 3	64,3%	28,2%	71,8%	35,7%
Model 4	67,9%	28,0%	72,0%	32,1%
Model 5	67,9%	28,0%	72,0%	32,1%

Note: The Type I Error refers to the percentage of incorrectly predicted impairments and the Type II error the percentage of incorrectly predicted non-impairments.

6.4.2. Prediction classification performance analysis

Using four of the classification metrics in section 4.7.3, we first evaluate the results of the prediction models (Table 8) based on the 2nd cut-off decile. This analysis enables us to assess our hypotheses and obtain comparable results to Hayn and Hughes (2006). Although displayed in Table 8, the *F1 Score* is not discussed since it does not alter our conclusions.

To test the first hypothesis, we compare the prediction performance of Model 2 to Hayn and Hughes' (2006) study (Benchmark Model 2). In terms of *Overall Accuracy*, we observe that Model 2 performs significantly better than Benchmark Model 2. The former

accurately predicts 80,3% of observed outcomes in the hold-out sample versus 59,2% for the latter. Furthermore, it also records superior performance in *Sensitivity* (53,6% compared to 32,2%) denoting a better effectiveness in predicting impairments. This observation is also valid for *Specificity* where Model 2 correctly forecasts 81,7% of non-impairment observations versus 63,7% for Benchmark Model 2. However, both model produces similar percentages in term of *Precision*. These results indicate that predicting goodwill impairments using public accounting information has improved since Hayn and Hughes' (2006) study and the implementation of SFAS 141 and SFAS 142. Hence, we can accept our first hypothesis.

To evaluate our second hypothesis, the classification performance of Model 4 is benchmarked against Model 3. The choice of Model 3 is motivated by its superior predictive ability in Hayn and Hughes' (2006) study compared to their partial models (Benchmark Model 1 and Benchmark Model 2). Surprisingly, the inclusion of corporate governance variables slightly decreases the *Overall Accuracy* by 0.3%. *Sensitivity* is also negatively impacted with fewer goodwill impairments correctly predicted. Consistent with the above results, *Specificity* and *Precision* experiences a limited decrease of 0,2% and 0,8% respectively. Therefore, the addition of these variables appears to reduce prediction performance. Thereby, our second hypothesis is rejected.

To test our final and third hypothesis, we benchmark Model 5 to Model 4. We observed a slight decrease in all four classification metrics when including *CEOchange* and *CEOret* to Model 4. These results are unanticipated because goodwill impairment decisions are exposed to a level of managerial discretion (K. Li & Sloan, 2017; Ramanna & Watts, 2012). However, they are coherent with the statistical insignificance characterizing both variables in Model 5 (Table 5). Hence, our third hypothesis is rejected.

Our conclusions for the second and third hypotheses also hold at a 1st decile cut-off. Additionally, we can accept our second hypothesis at a 3rd decile cut-off since *Overall Accuracy, Precision, Sensitivity,* and *Specificity* all improve when adding corporate governance variables to Model 3. However, we observe that the performance of all prediction models deteriorate since a higher number of firm-year observations are incorrectly predicted to be impaired.

Table 8. Classification performance metrics by models

	Overall Accuracy	Precision	Sensitivity	Specificity	F1 Score	Type I Error	Type II Error
Cut-off = 1st decile							
Model 1	87,1%	8,5%	17,9%	90,5%	0,115	9,1%	82,1%
Model 2	88,1%	13,6%	28,6%	91,0%	0,184	8,6%	71,4%
Model 3	88,4%	15,3%	32,1%	91,2%	0,207	8,4%	67,9%
Model 4	88,4%	15,3%	32,1%	91,2%	0,207	8,4%	67,9%
Model 5	88,4%	15,3%	32,1%	91,2%	0,207	8,4%	67,9%
Cut-off = 2nd decile							
Model 1	78,3%	7,6%	32,1%	80,6%	0,122	18,5%	67,9%
Model 2	80,3%	12,6%	53,6%	81,7%	0,204	17,5%	46,4%
Model 3	80,3%	12,6%	53,6%	81,7%	0,204	17,5%	46,4%
Model 4	80,0%	11,8%	50,0%	81,5%	0,190	17,6%	50,0%
Model 5	79,7%	10,9%	46,4%	81,3%	0,177	17,8%	53,6%
Model 1 - Benchmark	62,5%	15,3%	36,7%	66,8%	0,216	33,2%	63,3%
Model 2 - Benchmark	59,2%	12,7%	32,2%	63,7%	0,182	36,3%	67,8%
Model 3 - Benchmark	65,8%	18,6%	42,2%	69,7%	0,259	30,3%	57,8%
Cut-off = 3rd decile							
Model 1	69,1%	6,2%	39,3%	70,5%	0,107	28,1%	60,7%
Model 2	71,4%	10,1%	64,3%	71,8%	0,175	26,9%	35,7%
Model 3	71,4%	10,1%	64,3%	71,8%	0,175	26,9%	35,7%
Model 4	71,8%	10,7%	67,9%	72,0%	0,184	26,7%	32,1%
Model 5	71,8%	10,7%	67,9%	72,0%	0,184	26,7%	32,1%

7. Conclusion

The objective of this study is to assess the predictability of goodwill impairments in a modern setting. Previous studies have denoted challenges in predicting these events (Hayn & Hughes,2006; Olante 2013). We first analyze the performance of existing prediction models and then investigate if the addition of corporate governance variables enhances prediction accuracy.

Since their implementation in 2001, SFAS 141 and SFAS 142 have been widely criticized as failing to improve the usefulness of financial reporting in evaluating goodwill assets. These standards' exposure to managerial opportunism was deemed worrisome given the increasing weight of goodwill assets in companies' balance sheets. However, we find that the predictability of goodwill impairments using public accounting information appears to have improved. In line with standard setters' intent, our first finding indicates that users of financial reports seem better equipped to assess the fair value of goodwill assets.

Despite our expectations, the addition of variables proxying the effectiveness of the monitoring role of boards does not appear to enhance the predictability of goodwill impairments. A conclusion based on this finding is challenging to reach since managerial opportunism might either lead to delayed or opportunistic impairments. However, the separation of the role of chairman and CEO is negatively associated with goodwill impairments which denotes that CEOs appear less likely to impair goodwill in these settings.

The inclusion of variables denoting the presence of former CEOs on boards and CEO changes does not improve the results of our prediction models. Accordingly, CEO retention does not seem to restrict executives from impairing goodwill assets generated under a predecessor's tenure. Our finding about CEO changes is surprising given the extensive literature about big-bath accounting and its association with CEO turnover.

The above findings should be considered integrating the limitations of our study. Most importantly, our results are obtained from a limited sample generated with extensive selection criteria. However, our findings highlight the potential for further research on the impacts of SFAS 141 and SFAS 142 or the influence of former CEOs with respect to goodwill impairment.

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