UNIVERSIDADE CATÓLICA PORTUGUESA

The Impact of Data Security Breaches on Earnings Management

by

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The Impact of Data Security Breaches on Earnings Management

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Resumo

Atualmente, o crescente volume the informação presente *online* e o tempo gasto no digital aumentaram o risco de incidentes de segurança cibernética. Este fenómeno está a afetar tanto os investidores como as empresas, pelo que é relevante perceber como estão a mitigar este risco.

Embora os mencionados eventos sejam geralmente causados por deficiências nos controlos internos, a verdade é que a gestão empresarial se tem preocupado em perceber como essas falhas de segurança afetam o desempenho de uma empresa.

A manipulação de resultados financeiros pode representar uma motivação para camuflar resultados indesejáveis, perdas financeiras e divulgar uma imagem legítima dos resultados da empresa, para investidores e demais *stakeholders*.

Assim, para testar se uma empresa afetada por violações de dados implementou políticas de manipulação de resultados, analisamos uma amostra de empresas norte-americanas cotadas. A ideia principal é perceber se as entidades que sofreram danos causados por um incidente de violação de dados aproveitam para manipular os resultados financeiros, pelo menos para recuperar os danos. Adicionalmente, quisemos verificar de que forma a atenção do investidor afeta o impacto de um acidente de violação de dados na manipulação de resultados.

Os resultados deste estudo demonstram que a ocorrência de um acidente de violação de dados não influencia a manipulação de resultados e que a atenção do investidor não afeta o impacto de um acidente de violação de dados na manipulação de resultados.

Palavras-chave: Manipulação de Resultados; Violação de Segurança de Dados; Atenção dos Investidores; Divulgações.

Número de Palavras: 11,790

Abstract

Nowadays, the increasing volume of big data and the time spent by all everyone online increased the risk to incur in cybersecurity incidents. This phenomenon is affecting both investors and firms, thus it is relevant to understand how the latter are behaving to respond to this risk.

Although these events are usually caused by deficiencies in internal controls and supervision, the truth is that corporate management has been concerned about how these security breaches can impact a company performance.

The manipulation of financial results could represent a motivation to camouflage undesirable outcomes, financial losses and to report a legitimate image of the firm's results, to investors and to other stakeholders.

Thus, to test whether the company affected by data breaches implemented earnings management policies, we analysed a sample of US public companies. The main idea is to understand whether the entities which suffered damages caused by a data breach incident take the opportunity to manipulate the financial results at least to recover damages. Further, we examine how investor's attention affects the impact of data security breaches on earnings management.

Results of the empirical analysis demonstrate that data security breaches do not affect earnings management and investor's attention does not affect the impact of a data breach accident on earnings management.

Keywords: Earnings Management; Data Security Breach; Investor's Attention; Corporate Disclosure.

Number of Words: 11,790

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Abbreviations List

ACFE – Association of Certified Fraud Examiners

AEM - Accrual-based Earnings Management

CA – Creative Accounting

CEO - Chief Executive Officer

CF – Corporate Finance

CRSP – Center for Research in Security Prices, LLD

DSB(s) – Data Security Breaches

EQ - Earnings Quality

EU – European Union

GAAP – Generally Accepted Accounting Principles

GDPR – General Data Protection Regulation

IPO – Initial Public Offering

IT – Information Technology

M&A – Merger and Acquisition

NIS - Network and Information Security

NYSE – New York Stock Exchange

REM - Real Earnings Management

ROA - Return On Assets

SEC - Securities and Exchange Commission

USA/US – United States of America

WRDS – Wharton Research Data Service

1. Introduction

We live in a world where technological innovation is pervasive and is present in all areas of our life. As companies increasingly use virtual platforms to store and collect data, the potential of Data Security Breaches (DSBs) incidents increases every year. A DSB is a cybersecurity occurrence in which confidential data is made public or stolen by unauthorized individuals, corporations or organized groups (Xu et al., 2019). This kind of violations can compromise the confidentiality, integrity and availability of an organization's information assets (Romanosky et al., 2011).

Cybersecurity is becoming a crucial pillar to companies. According to the Identity Theft Resource Canter's (ITRC), there were, from January to September 2021, 1,291 data exposure breach firms. This number represents an increase of nearly 17%, in comparison to breaches occurred in 2020. [1]

Cybersecurity incidents may threat both companies and individuals' personal information, affecting debit and credit cards, provoking loss of documents or even stealing technological assets. Anecdotal evidence also suggests that companies which have suffered from a DSB occurrence experience substantial earnings decline. The significant, instantaneous and long-term expenses associated with this cyber incident provide firms incentives to engage in earnings management practices (Xu et al., 2019).

We take the same issue and examine how DSB influence earnings management decisions at US public firms.

In addition, Garel et al. (2017) stated that managers in companies with distracted investors, engage more in earnings manipulation, since the temporary looser

[1] Consulted in https://www.idtheftcenter.org/post/identity-theft-resource-center-to-share-latest-data-breach-analysis-with-u-s-senate-commerce-committee-number-of-data-breaches-in-2021-surpasses-all-of-2020/ on the 4th of June 2022.

monitoring, induced by the inattention, makes earnings management more difficult to detect. Furthermore, entities with attentive investors engage less in earnings manipulation, because investors control managers' behaviours.

To the best of our knowledge, nobody examined the effect of investor's attention on the impact of DSB on earnings management. With that being said, this is our second research question and our contribute to the literature.

In order to respond to the mentioned objectives, this dissertation adopts a quantitative methodology applied to American public corporations present in CRSP dataset, which contains security-level historical descriptive information and market data on more than 32,000 securities for inactive and active companies from the following markets: NYSE, NYSE American, NASDAQ, and NYSE Arca exchanges. [2]

To answer research questions, we estimated an OLS equation where the dependent variable is a measure of earnings management and two independent variables of interest: a breach dummy, which captures whether the firms suffered a data breach from 2010:Q1 to 2021:Q3, and the interaction of breach and attention. In the equation formularization we also included a series of control variables which affect earnings manipulation: firm's characteristics, operating performance outcome and financial measures, corporate governance as well as quarter and firm fixed effects.

Our main findings highlighted that, for the first research question, DSB do not impact earnings manipulation practices. Regarding the effect of investor's attention on the impact of DSB on earnings management, our second research question, we concluded that the attention does not affect the mentioned impact.

[2] Consulted in https://www.crsp.org/products/research-products/crspcompustat-merged-database on the 26th of June 2022.

To answer the mentioned research questions, the remainder of this thesis is structured as follows: Chapter 2 presents a literature review on earnings management, DSB and investor's attention; Chapter 3 presents the theoretical hypotheses to be tested, the methodology applied and describes the data; Chapter 4 presents the estimation results; and Chapter 5 highlights the conclusions of this dissertation, as well as the limitations found and suggestions for future investigations.

2. Literature Review

2.1. Earnings Management and informativeness of accounting disclosure

2.1.1. Definition of Earnings Management

Earnings are the central item in financial statements, which are represented by the bottom line in the statement of Profit or Loss, in this way summarizing the financial performance of an organization (Toumeh and Yahya, 2019). Despite earnings being one of the key items in the financial statement, it is not the most trustworthy one, aa net cash-flow is a more reliable measure of the company's performance (Stephen, 2019). Entity's net income, or in other words, profit after tax, is considered to be an arbitrary figure, after taking into account a number of suppositions regarding expenses and revenues. Cash flow is a more objective measure, as is not subject to any personal criterion (Fernández, 2006).

Furthermore, and in an ideal economic situation, net cash-flows and earnings are, and ought to be, identical. However, practice has shown that they are not exactly the same. Earnings are created through accounting efforts based on disclosures, measurements and treatments, which are fairly subjective and untrustworthy (Stephen, 2019).

Hepworth (1953), the earliest researcher study earnings management, coined the term "income smoothing", which is the shifting of revenue and expenses, by resorting to accounting methods, among distinct reporting periods, in order to present the illegitimate impression of steady earnings. Hepworth discovered that the potential to economize tax charges could be an incentive for managers to engage in such practices.

Guo and Ying (2015) defined earnings management as the mechanism used by operators to alter and to influence financial reports using accounting or arranging transactions to mislead stakeholders' understanding of the firm's performance,

leading to poor quality of accounting information (Cohen and Zarowin, 2010). According to Ronen & Yaari (2011), there are different definitions and classifications of earnings management:

a) Beneficial (White) earnings management, which enhances the transparency of reports, as it takes advantage of the flexibility in the choice of accounting treatment to signal the administrator's information on upcoming cash flows;
b) Pernicious (Black) earnings management, which involves outright misrepresentation and fraud. It is the practice of using tricks to misrepresent, mislead or reduce the accuracy of financial reports;
c) "Gray" earnings management, which entails financial manipulation within the restrictions of compliance with bright-line standards, which could be opportunistic or efficiency enhancing.

It is also necessary to define Creative Accounting (CA). CA and earnings management are euphemisms for accounting practices that should respect the rules of standard accounting practices, which, however, deviate from the essence of these rules (Ita Asuquo, 2011). In order to make arrangements which result in profit or earnings, or maximization/costs reduction to improve a firm's performance and liquidity, CA is used to create the desired image of the company. It is a phenomenon that was developed in the 80s, causing conflicts between legal and economic substance accounting (Ramona et al., 2012). The main difference between these two practices resides in the fact that earnings management focuses on manipulating earnings through accruals and deferrals, whereas CA can be earnings management with the addition of fictitious transactions.

Information is one of the most important objectives of corporate governance (Yu, 2008), even if also executives can take advantage of control provided by the

accounting system and use their judgment while preparing financial statements and determining earnings. The earnings management phenomenon has become a worldwide problem for economies, and it has increased remarkably over the last few decades. According to the Current Fraud Statistics report - Association of Certified Fraud Examiners (ACFE) [May 9, 2022], American businesses have a tendency to lose an average of 5% of their gross revenues to fraud.

According to Dechow & Skinner (2005) there is difficulty in distinguishing earnings management from financial fraud because earnings management and fraud share similar incentives and elements, most notably, to "aim to mislead and harm the shareholders through providing deceptive information" (Toumeh and Yahya, 2019). "Earnings Management" is often associated with fraud, however fraudulent earnings manipulation has to be differentiated from earnings management, which is allowed between the boundaries of regulations (Vries, 2012). Independently of this difference, Agostini (2013) noted that fraud disclosure normally leads organizations to bankruptcy very rapidly.

The National Association of Certified Fraud Examiners described financial fraud as being the intentional and deliberate "misstatement or omission of material facts, or accounting data, which is misleading and, when considered with all the information made available, would cause the reader to change or alter his or her judgment or decision". The dilemma now resides in how to reveal the managerial intent of these practices, in order to understand if managers are legitimately exercising their judgments and estimates or if they are engaging in fraud. (Toumeh and Yahya, 2019)

Several studies have demonstrated that earnings management practices decrease the quality of earnings, in the sense that they become a less accurate indicator of long term entity performance (Hirshleifer and Teoh, 2006). As earnings manipulation may not reflect the real and legitimate performance of an entity,

the investor will not be able to evaluate their economic decisions correctly (Stephen, 2019).

Because of financial information manipulation, the real financial positions and operating results of companies cannot be gleaned from financial information provided by users, as the information disclosed is unreliable. For investors, this means a loss of confidence in the system, and mis-allocated resources to wrong and inefficient fields due to investment decisions in the firms, and buying and selling decisions about securities. As a consequence, additional costs are brought to the economy (Yurt and Ergun, 2015). According to Arthur Levitt, the former president of the Securities and Exchange Commission, "Investors need relevant, useful information to make their investment decisions – and that is what high quality accounting standards deliver" (Levitt, 1998). To mitigate this problem, Merton (1987) highlighted that the organization should be well-recognized or front-line investors should be well-informed about the firm before making investments, establishing that investors' attention is a mandatory condition for a company to be recognized. With that being said, companies with more educational and informative earnings announcements have a lower cost of capital (Strobl, 2013).

According to Healy and Wahlen (1999), earnings management occurs when administrators use judgment in financial reporting and execute transactions to modify financial reports, in order to mislead interested parties about the firm's underlying economic performance. Field et al. (2001) mentioned that the occurrence of earnings management happens when executives exercise their pleasure over accounting records, with or without boundaries. In addition, Chai and Tung (2002) mentioned that companies which announce earnings reports later than expected, engage in earnings manipulation based on the fact that those announcements are related to good news, and reporting delays are normally associated with market anticipation of bad news.

As such, as there is less than total agreement on how the term should be defined, and in a summarized form, earnings management can be considered to occur when administrators use personal judgment in financial reporting and in structuring transactions to alter financial reports to mislead stakeholders about the underlying economic performance of the company or to influence contractual outcomes which depend on reported accounting records. This definition, according to Ronen & Yaari (2011), highlights the costly-contracting approach (earnings management used to influence contractual outcomes) and the informational approach (earnings management used to mislead stakeholders).

It is also relevant to distinguish earnings management from Earnings Quality (EQ), as both terms have a lot in common. Earnings manipulation practices focus only on the discretionary aspects of financial reporting and does not consider factors outside management control, such as errors. In contrast, EQ measures the overall relevance of earnings for stakeholders in order to make decisions, whether that quality was related to management discretion or not. Additionally, EQ is a measure of the extent to which reported earnings reflect net cash flows (Stephen, 2019). After exposing this difference, Lo (2008) believed that highly managed earnings have low quality. Nevertheless, the nonexistence of earnings management is not sufficient to guarantee earnings which are high-quality earnings, because other features contribute to the proper quality of earnings.

2.1.2. Earnings Management and Corporate Disclosure

Traditionally, the value of accounting information has a dual role: it needs to be informative and guiding (Ronen & Yaari, 2011). As financial reporting has been seen as a central infrastructure for the development of markets, profits are a measurement tool of an organization's financial performance, and provides relevant information for the decision-making of many shareholders, such as current investors and potential customers and managers (Cornejo-saavedra, 2018).

The opportunity to engage in earnings manipulation arises in part because reported income contains cash flows and changes in firm value which are not reflected in current cash flows. While cash flows are relatively easy to measure, computing the change in company value which is not reflected in current cash flows normally involves discretion. The accruals components of income drive the wedge between entities' cash flows and reported income (Bergstresser and Philippon, 2006).

As already stated, earnings management practices occur when management uses discretion in preparing financial reports, and structures transactions to alter a corporation's financial statements, in order to deceive those interested in their economic performance or to influence the results which depend on the reported accounting statistics. (Cornejo-saavedra, 2018)

According to Franceschetti (2018), there are three main scenarios in which companies have incentives to manipulate earnings in order to affect the market price:

- Beating a Benchmark: Benchmark-driven earnings management happens when executives opportunistically use their judgment to alter financial reports, either to mislead all the interested parties of accounting information about the company's underlying financial performance, or to obtain private benefits (Marai et al., 2020) (Dechow et al., 2010);
- Initial Public Offerings (IPO): According to Breinlinger and Glogova (2002), when a company goes public, it could be seen as reducing its bankruptcy risk, as they increase the equity ratio and reduce leverage. An IPO, is therefore, the process of offering shares of a private organization to the public in a new stock issuance, which allows the organization to raise capital from public investors.

- Mergers and acquisitions (M&A): A merger occurs when two or more firms agree to pool resources under a unique entity. An acquisition involves the exercising of effective control by an entity over the assets or management of another firm, without physically combining their businesses. This is a crucial strategy to achieve a long-term competitive advantage (Rodríguez-Sánchez et al., 2020).

However, accounting numbers have no meaning of not compared to a benchmark (Franceschetti, 2018). Consequently, companies are incentivized to manage earnings to exceed benchmarks such as zero earnings, in order to avoid reporting losses.

Earnings management also exists in M&A and is common in IPO. In this context, the incentives of executives are stronger for IPOs because of the high level of information asymmetry between inside managers and outside investors (Gounopoulos and Pham, 2017). When a corporation decides to go public, information known about the firm's performance is scare, as future cash-flow information, investment opportunities, managerial skills and the ability to control future agency costs are privy to management (Franceschetti, 2018). Moreover, according to Pinto (2016), companies which present higher levels of earnings management have a higher probability of IPO failure and lower survival rates in succeeding periods.

Merger and Acquisitions (M&A) are considered growth strategies, which allow firms to enter into either new potential markets or to new business areas. They increase the firm's influence by helping them as much as possible to be powerful, profitable, competitive, and wealthy to shareholders (Coelho and Gonçalves, 2019).

The price of acquiring a firm's stock is important, and according to Franceschetti (2018), with an acquisition, firms have incentives to inflate earnings in order to

transfer as little stock as possible to finance the transaction. Franceschetti highlighted the importance of this strategy, as a purchasing organization's shareholders have to approve the deal, and an earnings manipulation strategy is consistent with the intent to avoid diluting their ownership.

There are also other events behind company announcements, such as media attention. When managers engage in opportunistic earnings management, they risk their actions being detected and exposed by the media to the market, resulting in negative consequences, such as increased litigation risk or drops in stock price. To avoid this, managers may engage in less opportunistic earnings management activities. Nevertheless, the media can impose short-term performance pressure on executives, driving them to manipulate their earnings (Yangya et al., 2020).

2.1.3. Earnings Management detection: Accruals vs Real Activity Models

In accounting, earnings management is detected via two different models: Accrual-based Earnings Management (AEM) and Real Earnings Management (REM). AEM can disguise the firm's performance, but does not involve altering its underlying operations. On the other hand, REM can be exemplified by managers changing either the timing or structure of operations, or even financing transactions to influence earnings (Xu et al., 2019).

Financial statements, which are prepared to present information to interested parties need on time, in a proper and accurate form, are presented on the accrual basis. An accrual is generally defined in accounting language as the recording of a financial occurrence on time to the relevant account with regard to the periodicity principle no matter of cash inflow or outflow (Yurt and Ergun, 2015). They are used in financial reporting to match revenues and expenses to the exact

period. Changes in revenue recognition policy and provision for bad debt accounts examples of Accrual Manipulation (Toumeh and Yahya, 2019).

However, according to Yurt and Ergun (2015), as accruals are an important indicator of a company's performance, they tend to be a means for executives to make performance look different than it really is. Thus, managers or entities can use the accrual component to manage earnings and influence market valuations (Vries, 2012).

There are two types of Accruals: Non-Discretionary Accruals (NDA) and Discretionary Accruals (DA). NDA (also called Normal Accruals) are related to the normal activity of the entity. This category of accruals is the portion of total accruals that managers cannot manipulate because accounting standards have fixed rules, which do not involve any discretion. According to Healy (1985), non-discretionary accruals are accounting adjustments to the company's cash-flows mandated by regulators and accounting standard setting bodies.
DA (also called Abnormal Accruals) are the portion of total accruals over which managers can exercise discretion. These accruals are adjustments to cash-flows selected by managers, such as depreciation methods, accelerate or delay impairments.

Regarding DA, the literature states that there are models to detect the presence of earnings management, such as:

- the Healy (1985) model, which was the first model developed in the literature. It posits that systematic earnings manipulation will exist in every period (Yurt and Ergun, 2015).
- the Jones (1991) model, which confirms the assumption that non-discretionary accruals are not constant, unlike the Healy (1985). This approach added the change in sales and the gross amount of fixed assets in order to control the effects of the changes that may happen in non-

discretionary accruals, as a result of a company's economic situation (Yurt & Ergun, 2015). In this model, according to Dechow et al. (1995), revenues are non-discretionary: "if earnings are managed through discretionary revenues, then the Jones Model will remove part of the managed earnings from the discretionary accrual *proxy*".

- the Modified Jones Model (1995), which was designed to remove the conjectured tendency of the Jones Model to detect and measure discretionary accruals with error when discretion is exercised over revenue recognition, as in this model non-discretionary accruals are estimated during the event year (Yurt & Ergun, 2015).

Roychowdhury (2006) defined Real Activities Manipulation as departures from normal operational practices, motivated by executives' desire to misinform, at least some interested parties into trusting certain financial reporting objectives have been met in the normal sequence of operations. According to Roychowdhury, if managers engage in activities such as price discounts and reduction of discretionary expenditures more extensively than is normal given their economic conditions, with the objective of meeting an earnings target, "they are engaging in real activities manipulation".

In contrast to AEM, REM occurs in normal operating practices, so an acceleration of sales by changing credit terms and providing impulse discounts to buyers, or overproducing to decrease the cost of products sold, are examples of Real Activities Manipulation (Toumeh and Yahya, 2019). Xu et al. (2019) noted that this model has a direct impact on current and future operating activities.

There are two main models related to Real Activities:

- the Discretionary Revenues (Stubben, 2010) Model, which focuses on the manipulation of real activities, more specifically on premature revenues recognition (such as channel stuffing, accelerated revenues, and the wrong

application of the revenues recognition principle). This model is more powerful than Accrual Models, as Revenue Models are more likely to detect a combination of revenue and expense manipulation, than Accrual Models.

- the Roychowdhury (2006) Model, which detects real activities manipulation, in order to avoid losses. This model investigates patterns in cash-flow, discretionary expenses, and production costs for firms near the zero earnings benchmark. The model focuses on three manipulation methods and their effects on the abnormal levels of sales manipulation, overproduction (or increasing production to report lower cost of goods sold), and the reduction of discretionary expenditure.

Manipulation based on Real Activities, can reduce an entity's value as actions taken in the current period to increase earnings can have a negative effect on cash flows in the future. Notwithstanding, and despite the costs associated with RAM, administrators are unlikely to trust accrual manipulation exclusively to manage earnings (Roychowdhury, 2006).

Despite financial managers showing greater willingness to manipulate earnings through REM rather than Accruals (Roychowdhury, 2006), both models carry negative consequences for an organization's long-term performance, possibly leading to bankruptcy. The adoption of earnings management practices degrades the information quality of earnings used by external investors (Garel et al., 2017).

2.1.4. Evidence of Investors' Attention around Company Disclosure

Shevlin et al. (2015) suggested three required conditions for an effective strategy of hiding or highlighting earnings. Firstly, to be able to hide bad news, administrators must frequently change the timing of their earnings announcement. Secondly, there must be fluctuation in market's attention which

is predictable and obvious to the manager. Lastly, consumers and the general public must observe managers' announcing other negative/positive earnings news during periods of lower/higher market attention.

However, as an integral part of financial reporting, there is a time where the company needs to give disclosure. Earnings reports must be announced after the end of a company's first three quarters. Additionally, a company also needs to announce their results for the period through quarterly and annual reports after the fiscal-year ends. This kind of announcement is considered to be a mandatory disclosure (or disclosure required by law) because it is information that needs to be presented in the financial statements as set by the Securities and Exchange Commission (SEC). In other words, disclosure is an essential part of financial reporting and is the final stage in the accounting process, in the form of the presentation of information through financial statements (Gunawan and Lina, 2015).

Managers can also disclose earnings freely. Gunawan and Lina (2015) defined "voluntary disclosure" as "the free choice of management company for decision making by the users of annual reports". Thus, the announcement timing of earnings may be motivated by an organization's desire to be informative, yet prior research highlights that the timing of earnings news could reflect the opportunism of management arising from various incentives (Brown et al., 2012). According to Graham et al. (2005) corporations voluntarily disclose information to facilitate clarity and understanding to investors. Managers believe that the deficiency of clarity or even a reputation for not constantly providing exact and accurate information, can lead to the under-pricing of a firm's stock (Graham et al., 2005).

Therefore, voluntary disclosure is a report of information above the minimum required by the applicable capital market principles. A company has the

discretion to make intentional disclosures in the annual report (Gunawan and Lina, 2015). As reported by Brown et al. (2012), the timing of trimestral earnings announcements which contain adjusted earnings, or in other words "pro forma" earnings, measures and explores whether managers' timing decisions are consistent with opportunistic motives or are an attempt to appropriately inform shareholders. The authors' opinion is that the timing of news releases is an important component of a firm's corporate disclosure practices.

Studies have shown that these two forms of disclosure are substitutes, or complements. Despite this, Noh et al. (2019) suggested that the description of the connection between free and mandatory disclosures normally depends on the context and disclosure characteristics being taken into account. Their results are consistent with companies' choices over voluntary and mandatory disclosures, depending on their similarities, in terms of both content and timeliness.

While some authors suggest that the timing of earnings disclosure may reflect management's effort to better inform shareholders, others suggest that managers, in an opportunistic way, schedule their earnings announcements in an effort to alter investors' perceptions of entity performance (Brown et al., 2012). According to Simpson (2013), administrators overstate earnings in periods when Investors' Sentiment is higher and report relatively conservatively in periods when it is lower. As such, and in agreement with Shevlin et al. (2015), executives are likely able to restrict attention to damaging news by announcing earnings on busy days, after closing, and with little advance notice. However, as they found that attention is given on a Friday is the same as other weekdays, they concluded that the majority of bad news announced on a Fridays is motivated by, for example, managers having incorrect beliefs about market attention.

One way to improve the trustworthiness of a firm is by helping investors to understand the business strategy management. Corporations that make

voluntary disclosures voluntarily choose to communicate other accounting information considered relevant in the support of decision-making by users of annual reports (Gunawan and Lina, 2015).

The creation of financial statements following the Generally Accepted Accounting Principles (GAAP), has simplified the accurate and clear analysis of financial performance, and firms engage in such analysis to present information in an efficient market (Kwag and Stephens, 2009).

However, according to Kwag and Stephens (2009), if earnings manipulation prevents investors from making rational expectations about a company's forecasts, then accrual earnings will fail because they will not transfer true relevant information to investors.

For diverse reasons, a corporation's manager may have motivations to manipulate reported earnings to "influence investor's perceptions of the firm's value" (Fischer and Stocken, 2004). As claimed by Gavious (2007), investors use, in the market, opportune information provided by analysts to reconsider the quality and integrity of reported earnings, and this reassessment is normally associated with a significant stock price alteration. Various studies have reported that earnings management decreased the occurrence of negative earnings surprises, but which, nevertheless, resulted in negative market reactions. However, Kwag and Stephens (2009) emphasised that this argument is counterintuitive. In their study, the evidence suggested that investors may have distinct perceptions toward different types of earnings management. Moreover, they posited that those who invest in highly managed companies seem to under-adjust for earnings manipulation.

Therefore, and according to Garel et al. (2017), investors' inattention influences earnings management occurrence because the momentary monitoring failure encouraged by distracted investors does not modify executives' earnings

manipulation decisions. The authors also stated that managers who manage companies with unfocussed investors engage less in earnings management, as they feel released from the pressure of reporting the company's performance.

2.2. Data Security Breaches and Earnings Management

With the continuous increase in the number of firms that conduct their businesses online, information protection has become a major concern for top executives (Ko and Dorantes, 2006). Associated with this, and as previously mentioned, practices around earnings management tend to avoid earnings decreases and economic losses.

Companies engage in earnings management to mislead stakeholders about the factual economic performance after a DSB. However, market participants perceive these events as a negative event. The relation between these two terms will be discussed in the following chapters.

2.2.1. Data security breaches: definition of the phenomenon

The accelerated progress in communication, networks and information technologies has brought many advantages and disadvantages for all firms' interested parties (Juma'h and Alnsour, 2020). Management is worried about the way DSB can impact a company's financial performance, as it is known that companies which are a victim of a DSB may suffer significant financial losses and reputation damage (Xu et al., 2019). Due to the consequences that these incidents entail for the company, they motivate earnings management practices which sacrifice future productivity in order to conceal a firm's short-term poor performance (Xu et al., 2019).

Many researchers have attempted to define a DSB occurrence. According to Xu et al (2019), a DSB can be defined as a cybersecurity occurrence in which confidential data is made public or stolen by unauthorized individuals,

corporations or an organized group. These violations can therefore compromise the confidentiality, integrity or availability of an organization's information assets (Rosati et al., 2019). Romanosky et al. (2011) also defined a DSB stating that it occurs when "personally identifiable information such as names, social security numbers and credit card numbers are accidentally lost or maliciously stolen".

Cyber-attacks are the fastest growing crime in the US and are increasing in size, sophistication and cost (Morgan, 2019). It is therefore essential to protect and preserve confidential information and databases of clients and stakeholders, and is the reason why the administration of information systems is increasingly considering information security and privacy due to their potential serious issues for all corporation activities (Juma'h and Alnsour, 2020). Besides these events happening and increasing yearly, and happening worldwide, the potential costs of information loss to firms and society has also increased. In spite of this, cybersecurity incidents are often difficult to detect, quite expensive to solve and hard to explain to stakeholders (Rosati et al., 2019).

There are both direct and indirect impacts that a cyber-attack has on an organization. The direct impact on the organization is mostly financial and is reflected on the means put in place to implement procedures or services to protect the victims' identity. The indirect impact is represented by the establishment of a group with the responsibility of contacting and investigating the breached system (Hammouchi et al., 2019).

Hammouchi et al. (2019) concluded that hacking is the most prevalent type of breach and that it is the most important in terms of leaked data and financial impact. However, there are a lot of different types of cybersecurity threats, such as debit and credit card fraud, loss of documents, or even stolen technological assets (Xu et al., 2019).

As stated by Lafuente (2015), big data normally contains huge amounts of personal and confidential information. The major challenge for big data from a security point of view is the protection of user's privacy. Because of the large quantity of data stored, breaches affecting big data can have more devastating consequences than "normal" DSB. Lafuente also highlighted that this happens because a big DSB will "potentially affect a much larger number of people", with consequences that go beyond the reputational prism.

2.2.2. USA and EU regulations on cybersecurity incidents

As mentioned previously, a DSB is an occurrence that results in the unauthorized access of data, services or/and networks by circumvention of an entity's security systems. This occurs when an individual or even an application, illegitimately enters a private, confidential or unauthorized platform. It is also popularly known as a security violation.

In order to reduce these crimes, Romanosky et al. (2011) proposed that various US states adopt DSB disclosure (security breach notification) laws, requiring organizations to inform individuals when their private information has been compromised. However, no empirical investigation has yet examined the success of such legislative initiatives in reducing identity theft.

In October 2011, the Securities and Exchange Commission (SEC) acknowledged the increasing concern of the threat of cyber-incidents on corporate America, by issuing corporate associates' guidance on when publicly traded companies should divulge information about cybersecurity consequences and attacks in their annual public reports (Ferraro, 2013). This independent federal government regulatory agency, which is responsible for protecting investors by maintaining the fair functioning of the securities markets and facilitating capital information, published the CF Disclosure Guidance: Topic No. 2 Cybersecurity (SEC, 2011) to provide higher transparency concerning cybersecurity-related topics, leading to

the promotion of security in the digital domain (Romanosky et al., 2011). For the first time, it was established by the SEC, that information related to cybersecurity was "material" and required disclosure (Ferraro, 2013).

This led to a rapid increase in cybersecurity disclosures by entities, as the Commission has made it essential for public firms to take all required actions in order to provide information for investors about material cybersecurity risks and incidents, including those companies that are subject to material cybersecurity risks but may not yet have suffered a cyber-attack (SEC, 2018).

Politicians have considered the SEC cybersecurity guidance as an important step to the improvement of U.S. cybersecurity (Ferraro, 2013). Since the guidelines' exposure, corporations' disclosure regarding to DSB and cybersecurity has increased (Jin, 2015). However, the guidance fails to solve the information asymmetry problem among corporations' stakeholders. It overreaches because it is not a legislative regulation, yet still carries the equivalent weight as legislation laws (Jin, 2015).

In the European Union, the increasing development of European cyber security policy has attempted to establish basic standards for all state members with regard to prevention, resilience and international cooperation (Bendiek, 2012).

Since 2002, legislation with varying grades of relevance to cybersecurity has been adopted in the European Union. The first legislation for the protection of network and information systems across the Union was Directive 2016/11481 – the NIS Directive – on cybersecurity and information systems. Despite being published in July 2016, the EU has been addressing cyber security matters since 2004. This Directive affects two groups of undertakings: operators of essential services and digital service providers. In addition, in the EU, there is also the General Data Protection Regulation (GDPR), which became applicable on 25 May 2018, and whose main objective is to protect individuals through the processing of their

personal data and the warranting of free movement of such data in the EU (Markopoulou et al., 2019). According to the cited authors, and in spite of these two legal instruments largely coinciding, their law-making processes took place independently and in parallel.

As suggested by Berkman et al. (2018), investing in information security can help protect companies against negative cybersecurity incidents. However, the significant costs related with DSBs has encouraged managers to engage in income-increasing earnings management decisions to alleviate the negative financial impacts and to maintain the organization's appearance of legitimacy (Xu et al., 2019). Therefore, and according to Xu et al., it is essential to understand the impact DSBs have on financial accounting information.

Nonetheless, and regarding specific attacks, firms should disclose the nature, occurrence, cost, as well as all the consequences of the attack. Furthermore, in disclosing the costs of actual attacks, companies should also disclose the costs of potential attacks, despite being this difficult to estimate, with the inclusion of remediation, cybersecurity, lost revenues, regulatory fines, litigation costs, and reputational damages (Jin, 2015).

2.2.3. Data Breach disclosure and cybersecurity risks in annual reports

Nowadays, IT security is a top priority for administrators and market participants in advanced economies, as a consequence of the major increase in cyber-attacks in recent years (Florackis et al., 2020). As claimed by Richmond (2017), the point is no longer if or when companies will be breached, but how often and how severe the breaches will be. In addition, Richmond highlighted that it is extremely important to know if firms will be sufficiently prepared to detect those attacks, recognize them as a breach, quickly as possible, remediate the attack, and assess the damages in an accurate manner. According to Robert

Herjavec - Founder and CEO at Herjavec Group, the dramatic rise of damage costs, related to these occurrences, has only strengthened the sharp growth in the number of firms that are unprepared for a cyber incident (Morgan, 2019).

Cybersecurity risk was defined as the "risk of financial loss, disruption or damage to the reputation of a firm, as a result of a failure in its information technology systems due to external attacks", such as the risk of losing sensitive data, disruption in a firm's network, systems, and services, and physical electronic damage. (Florackis et al., 2020). Cybersecurity risk management involves not only improving and developing internal controls, but also an extensive variety of factors including "strategy, IT management, investment decisions, human behaviour, disaster recovery/business continuity, and technical solutions to actual implementation and practices" (Janvrin and Wang, 2019).

Frank et al. (2019) observed whether a prior cyberattack influences the effectiveness of cybersecurity risk management reporting and independent assurance. They concluded that providing a report from management without assurance, is more effective when a company has not disclosed a prior cyberattack, as well as that issuing an independent cybersecurity assurance report can increase a firm's ability to attract new investments.

Regarding the annual report, the Security and Breach reporting requirements are covered in Articles 32-34 of the GDPR. According to this regulation implemented in the EU, all companies need to report certain types of personal DSB within 72 hours of the entity becoming aware of the breach. In the case of the notification to the supervisory authority being given after this time, the data controller must explain the reasons for the delay (Article 33). The report must describe in clear and plain language the nature of the personal DSB and include the:

- Description of the nature of the personal DSB including, if possible, the categories and estimated number of data subjects concerned and categories and approximate number of personal data records concerned;
- Communication of the name and contact details of the data protection officer or other contact capable of providing more details and information;
- Listing of the possible consequences of the breach;
- Description of the procedures taken or proposed to be taken by the controller to address the personal DSB.

Article 34 of the General Data Protection Regulation (GDPR) imposes an obligation, when it is probable of the personal breached information brings consequences in a high risk to the rights and freedoms of natural persons, on data controllers to inform the personal DSB to the data subject without any delay.

In order to handle these events, and taking into account SEC policies, firms are required to form and maintain appropriate and effective disclosure controls and measures which allow them to make accurate and timely disclosures of material events, including those related to cybersecurity. Such disclosure controls and procedures support firms in satisfying their disclosure obligations under federal securities laws (SEC, 2018).

2.2.4. Investors' Attention around Data Security Breaches

Nowadays, cyber-attacks cost firms millions in direct and indirect losses, such as the lack of confidence from customers and employees in the company when their personal information is exposed. After the exposition of the consequences of a DSB on a company, it is necessary to analyse society's reaction to data breaches. Satkofsky (2019) examined this matter and found that data breach declarations generate negative stock returns for companies. When privacy breaches occur, and are exposed to the market, there is a decrease in consumers' and investors' assurance in the company, affecting the sales of its products (Gay, 2017).

After that being said, the entity should be well recognized by the market or vanguard investors should be alerted to the firm's prior investments, which indicates that investor's attention is a mandatory condition for a firm to be recognized (Merton, 1987).

Regarding investor behaviour around a DSBs, the results of Andoh-Baidoo's (2013) study acknowledge that investors are more likely to answer negatively to statements involving internet companies, particularly to those firms with higher growth prospects (Gatzlaff and McCullough, 2010). Andoh-Baidoo (2013) also found that investors understand breaches as "management's inaction to deter potential computer abusers from violating organizational security policies". In line with this, recent cybersecurity events in public firms have intensified the sensitivity of investors to these incidents and amplified the demand for information around the company's cybersecurity risk management programs (Perols & Murthy, 2021).

However, DSB can also have a positive consequence. Companies can be affected by short term public relations backlash due to the privacy breach, but might actually obtain more investors and customers later on, due to their positive handling of the crisis (Gay, 2017).

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3. Theoretical Hypothesis, Method, Data and Sample

3.1. Theoretical Hypotheses

This chapter presents the theoretical hypotheses regarding the impact of DSBs incidents on earnings management.

Although DSBs typically occur due to weaknesses in the internal firm controls, management is increasingly concerned about how they impact a firm's financial performance, since companies which suffer from DSB experience significant earnings declines. According to Xu et al. (2019) , the costs associated with a DSB provide firms incentives to manipulate earnings to reduce the public attention and send positive signals to the market.

Consistent with the above mentioned, the first research hypothesis formulated is the following:

Theoretical Hypothesis 1: *Earnings management increases after DSBs.*

Garel et al. (2017) mentioned that administrators in firms with inattentive investors, engage more in earnings manipulation, since the temporary looser monitoring, induced by the distraction, makes earnings management more difficult to identify. Following the same reasoning as above, entities with attentive investors engage less in earnings manipulation, because investors control managers' behaviours.

As such, the second research hypothesis is the following:

Theoretical Hypothesis 2: *Earnings management after DSBs increases relatively less in firms with more attentive investors.*

3.2. Model Development

There are many methods to detect earnings management practices. The accrual-based models are the most common approach, as investigators estimate the discretionary (managed) components of reported revenue (Tianran, 2010). As previously defined, accruals are commonly used in the accounting language as the recording of a financial event on time to the relevant account with regard to the periodicity principle regardless of cash inflow or outflow. In other words, are revenues earned or expenses incurred which impact a firm's net income, though cash related to the transaction has not yet received.

According to Healy (1985) total accruals, are computed as follows:

$$TA_{it} = \Delta CA_{it} - \Delta CL_{it} - \Delta Cash_{it} - \Delta STD_{it} - Dep_{it},$$

where TA_{it} is the total accruals for firm i in quarter t; ΔCA_{it} is the change in current assets for firm i in quarter t; ΔCL_{it} is the change in current liabilities for firm i in quarter t; $\Delta Cash_{it}$ is the change in cash and cash equivalents for firm i in quarter t; ΔSTD_{it} is the change in debt included in current liabilities for firm i in quarter t; and Dep_{it} is the depreciation and amortization expenses for firm i in quarter t.

As described in the Chapter 2, there are two types of accruals: non-discretionary (unmanaged) and discretionary (managed). As such, we can decompose the total accruals as follows:

$$TA_{it} = NDA_{it} + DA_{it},$$

where NDA_{it} is the non-discretionary accruals of firm i in quarter t; and DA_{it} is the discretionary accruals of firm i in quarter t.

The most frequently used methods to decompose total accruals into their discretionary and non-discretionary components are the standard Jones model and the modified Jones model (Peasnell et al., 2000).

We resort to the modified Jones model. We selected this model, over the others mentioned on the literature review because this approach mend the limitation of the standard Jones model by capturing the impact of sales-based manipulation, because changes in sales are assumed to give rise to non-discretionary accruals (Dechow et al., 2010b). In addition, and according to Bartov et al. (2001), this approach provides the most powerful test of earnings manipulation.

In particular, the following equation will be used to decompose the total accruals into their discretionary and non-discretionary components:

$$\frac{TA_{it}}{A_{it-1}} = \beta_{j1}\left(\frac{1}{A_{it-1}}\right) + \beta_{j2}\left(\frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}}\right) + \beta_{j3}\left(\frac{PPE_{it}}{A_{it-1}}\right) + \mathcal{E}_{it},$$

where A_{it-1} is the total assets for firm *i*, present in industry *j*, on quarter *t-1*; ΔREV_{it} is the change in revenues for firm *i* between quarter *t* and *t-1*; ΔREC_{it} is the change in net receivables for firm *i* between quarter *t* and *t-1*; PPE_{it} is the gross property plant and equipment for firm *i* on quarter *t*; $\mathcal{E}_{it}$ is the error term associated to firm *i* on quarter *t*, which captures the discretionary accruals; and β_{j1}, β_{j2} and β_{j3} are industry-specific parameters.

We estimate the equation above for each industry and obtain $\widehat{\beta_{J1}}$, $\widehat{\beta_{J2}}$ and $\widehat{\beta_{J3}}$, which we then use to compute an estimate of the non-discretionary accruals, as follows:

$$\frac{\widehat{NDA}_{it}}{A_{it-1}} = \widehat{\beta_{J1}}\left(\frac{1}{A_{it-1}}\right) + \widehat{\beta_{J2}}\left(\frac{\Delta REV_{it} - \Delta REC_{it}}{A_{it-1}}\right) + \widehat{\beta_{J3}}\left(\frac{PPE_{it}}{A_{it-1}}\right),$$

where $\widehat{NDA}_{it}$ is the estimate of the non-discretionary accruals, of firm *i* in quarter t, which we then use to compute an estimate of the discretionary accruals:

$$\frac{\widehat{DA}_{it}}{A_{it-1}} = \frac{TA_{it}}{A_{it-1}} - \frac{\widehat{NDA}_{it}}{A_{it-1}},$$

where $\widehat{DA}_{it}$ is the estimate of the discretionary accruals, of firm *i* in quarter *t*. Finally, we use these estimates to construct the following measure of earnings management:

$$\frac{EM_{it}}{A_{it}} = \frac{|\widehat{DA_{it}}|}{A_{it-1}} \frac{A_{it-1}}{A_{it}},$$

where EM_{it} is our measure of earnings management; and $|\widehat{DA_{it}}|$ is the absolute value of discretionary accruals associated to firm *i* in quarter *t*.

Having a measure of earnings management, we can address our theoretical hypotheses. To do so, we readapt the equations from Garel et al. (2017) and Xu et al.'s (2019) as follows:

$$\frac{EM_{it}}{A_{it}} = \alpha_0 + \alpha_1 Breach_{it} + \alpha_2 Attention_{it} Breach_{it} + \alpha_3 Attention_{it} + \alpha_4 \frac{LEV_{it}}{A_{it}} + \alpha_5 \frac{MV_{it}}{A_{it}} + \alpha_6 \frac{AssetGrowth_{it}}{A_{it}} + \alpha_7 \frac{Profit_{it}}{A_{it}} + \alpha_8 ZSCORE_{it} + \alpha_9 Big4_{it} + \alpha_{10} \log(A_{it}) + \alpha_{11} Momentum_{it} + \alpha_{12} Volatility_{it} + v_t + w_i + \mu_{it},$$

where $Breach_{it}$ is a dummy variable that equals 1 if firm *i* reports a DSB in the quarter *t* and 0 otherwise; $Attention_{it}$ is the institutional investors' ownership of firm *i* in quarter *t*, expressed as a percentage of a company's shares owned by insurance companies or investment firms; LEV_{it} is the total liabilities of firm *i* in quarter *t*; MV_{it} is the market value of firm *i* in quarter *t*; $AssetGrowth_{it}$ is the change in total assets of firm *i* in quarter *t*; $Profit_{it}$ is the income before extraordinary items for firm *i* in quarter *t*; $ZSCORE_{it}$ is the Altman's *Z-SCORE*, which predicts the risk of bankruptcy of firm *i* in quarter *t*;[3] $Big4_{it}$ is a dummy variable that equals 1 if firm *i* in quarter *t* is audited by a Big 4 accounting firm and 0 otherwise; $\log(A_{it})$ is the a *proxy* for audit fees for firm *i* in quarter *t*;[4] $Momentum_{it}$ is the abnormal cumulative returns (including dividends) of firm *i* in the months of quarter *t*; $Volatility_{it}$ is the standard deviation of the abnormal

[3] $ZSCORE_{it}$ is computed as follows: [1.2 $\left(\frac{CA_{it}-CL_{it}}{A_{it}}\right)$ + 1.4 $\frac{RE_{it}}{A_{it}}$ + 3.3 $\frac{EBIT_{it}}{A_{it}}$ + 0.6 $\frac{MV_{it}}{LEV_{it}}$ + 0.999$\frac{S_{it}}{A_{it}}$], where CA_{it} is the current assets of firm *i* in quarter *t*; CL_{it} is the current liabilities of firm *i* in quarter *t*; RE_{it} is retained earnings of firm *i* in quarter *t*; $EBIT_{it}$ is the earnings before interest and taxes of firm *i* in quarter *t*; and S_{it} is the sales of firm *i* in quarter *t*.

[4] According to Tsui et al. (2001), the variables of ROA, auditor firm and size are used to control audit-related factors, namely, respectively, overall audit risk, auditor quality in terms of the Big 5 and non-Big 5 firms and size for auditee's scopes. Hay et al. (2006) exposed that there is a positive association of the size's company, measured by natural logarithm of total assets with audit fees. In other words, the natural logarithm of assets, is the de factor standard functional form for estimating audit fees (Marc Picconi and Reynolds, 2015).

cumulative returns (including dividends) of firm i in the months of quarter t; v_t and w_i are the quarter and firm fixed effects, respectively.

Taking into account the hypotheses formularization presents on 3.1. subchapter, α_1 will answer our fist hypothesis, which we expect to have a positive sign, and α_2 will answer our second hypothesis, which we expect to have a negative sign.

3.3. Data and Sample

In order to test the hypotheses and apply the method described above, information was collected from two databases: Wharton Research Data Services (WRDS) and Maryland Information Security Breach Notices.

From WRDS we collected accounting and market information. Our main accounting data was provided from Compustat database, from 2010:Q1 to 2021:Q3. To complement this data, we extracted information related to the auditor from Fundaments Annual database. Finally, market information regarding returns was collected from Monthly Stock File database and market information regarding institutional ownership were collected from Thomson Reuters.

From Maryland Information Security Breach Notices, we extracted information from DSB incidents.

Our sample totalized, 98,413 firm-quarter observations, for the first estimation equation, and 78,059 firm-quarter observations for the second estimation equation.

In order to minimize the effect of possibly spurious outliers we use a winsorization process to limit extreme values in the statistical data.

4. Empirical Application

4.1. Inferring Earnings Management

4.1.1. Earnings Management: Descriptive Statistics

Table 1 presents descriptive statistics of our first equation variables.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
TA/A	0.008	-0.012	0.847	-0.318	0.411
⊿REV/A	0.052	0.128	0.420	-1.671	0.903
⊿REC/A	0.003	0.000	0.029	-0.986	0.132
PPE/A	0.574	0.427	0.597	0.000	2.676

Note: The statistics presented are computed across 98,413 observations.

Table 1: Descriptive statistics of inferring earnings management
Source: Self Elaboration

The statistics in Table 1 suggest that the median firm, in the median quarter in the data has a negative total accrual of 1.2%, a positive revenue's variation of approximately 13%, a 0% of receivables' variation and gross property plant and equipment of 42,7%, all of the previous quarter total assets.

4.1.2. Estimation Results

In this subchapter we describe the results of the estimation of our first equation. Table 2 presents, for each industry, the estimation results.

The R-squared (R^2) is a statistical measure which represents the proportion of the variance, for a dependent variable, that is explained by an independent variable(s) in a given regression model. In other words, the R-squared measures the explanatory power of a particular model. As the modified Jones model explains the non-discretionary accruals, the R-squared measures the ability of non-discretionary accruals to explain the variance of total accruals.

The results suggests that the mining is the industry which the non-discretionary accruals explain a greater proportion of total accruals' variance (0.118), followed by the transportation, communications, electric, gas and sanitary service industry

(0.081) and the retail trade industry (0.072). In contrast, for the public administration industry the non-discretionary accruals explain a minor proportion of the variance of total accruals (0.007), below the agriculture, forestry and fishing industry (0.008) and the manufacturing industry (0.014).

With very similar values we can observe the construction industry (0.054) and the finance, insurance and real estate industry (0.045). The wholesale trade industry and the services have exact results, meaning that the non-discretionary accruals explain the exact proportion of total accruals' variance.

Using these estimation we constructed a measure of earnings management.

Variables	AFF	MI	C	MA	TCEGS	W	R	FIR	S	P
$\frac{1}{A}$	-0.104 (0.366)	0.007 (0.330)	-0.038 (0.124)	-0.053*** (0.010)	-0.062*** (0.008)	0.136*** (0.081)	0.006* (0.051)	-0.083*** (0.021)	-0.003*** (0.001)	-0.046* (0.122)
$\frac{\Delta REV - \Delta REC}{A}$	-0.002 (0.018)	-0.023*** (0.003)	-0.013*** (0.003)	-0.018*** (0.001)	-0.005*** (0.001)	-0.007*** (0.001)	-0.012*** (0.001)	-0.031*** (0.003)	-0.016*** (0.001)	-0.027** (0.013)
$\frac{PPE}{A}$	-0.009 (0.007)	-0.155*** (0.000)	-0.016*** (0.004)	-0.012*** (0.001)	-0.013*** (0.000)	-0.013*** (0.002)	-0.017*** (0.001)	-0.001*** (0.003)	-0.018*** (0.001)	-0.005 (0.006)
R-Squared	0.008	0.118	0.054	0.014	0.081	0.027	0.072	0.045	0.027	0.007
Prob>F	0.428	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.108
Overall F-Test	0.93	392.87	15.49	206.17	359.02	28.22	135.10	48.27	149.45	2.03
Number of observations	334	8818	819	44904	12233	3064	5207	3100	16241	831

Note:

AFF – Agriculture, Forestry and Fishing; MI – Mining; C – Construction; MA – Manufacturing; TCEGS – Transportation, Communications, Electric, Gas and Sanitary Service; W – Wholesale Trade; R – Retail Trade; FIR – Finance, Insurance and Real Estate; S – Services; P – Public Administration.

Table 2: Estimation results of inferring earnings management

Standard-errors in parenthesis. *** denote p-values <0.01, ** denote p-values <0.05, and * denote p-values <0.10.

Source: Self Elaboration

4.2. Earnings Management and Data Security Breaches

4.2.1. Data Description

The Table 3 presents the descriptive statistics of our second equation variables.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
EM/A	0.046	0.022	0.067	0.000	0.415
Breach	0.002	0.000	0.049	0.000	1.000
Attention	0.601	0.699	0.325	0.000	1.141
LEV/A	0.543	0.533	0.277	0.061	1.572
MV/A	1.563	1.019	1.661	0.061	9.631
AssetGrowth/A	0.011	0.007	0.101	-0.332	0.444
Profit/A	0.218	0.178	0.141	0.028	0.816
ZSCORE	3.402	2.525	6.041	-17.879	33.857
Big4	0.721	1.000	0.449	0.000	1.000
Momentum	-0.003	-0.005	0.229	-0.675	0.798
Volatility	0.102	0.077	0.087	0.007	0.490

Note: The statistics presented are computed across 78,059 observations.

Table 2: Descriptive statistics of earnings management and DSB

Source: Self Elaboration

The results suggests that the median firm, in the median quarter, engages in earnings management of approximately 2.2% of total assets, is not a victim of any DSB, has 0.7% of the capital held by insurance companies or investment firms, has total liabilities of 53% of the total assets and a market value of 102% of total assets.

The median firm, in the median quarter, has also asset growth close to 0, has a profit of approximately 18% of total assets, has a Z-SCORE of 2.525 which means that is in the grey zone regarding the risk of bankruptcy, is audited by a Big 4, has negative 0.5% of abnormal cumulative returns (including dividends) and a standard deviation of those returns of 0.077.

4.2.2. Estimation Results

Table 4 presents the estimation results of four specifications of our second equation. The first specification has breach as sole independent variable. The second specification includes adds the interaction of breach and attention. The third specification adds the control variables, and the last specification adds the fixed effects.

Variables	(1)	(2)	(3)	(4)
$Breach$	-0.009* (0.005)	-0.039*** (0.016)	-0.015 (0.015)	-0.016 (0.013)
$AttentionBreach$		0.042** (0.021)	-0.032* (0.019)	0.026 (0.017)
$Attention$			-0.005*** (0.001)	-0.005*** (0.002)
$\frac{LEV}{A}$			-0.004*** (0.001)	0.007*** (0.002)
$\frac{MV}{A}$			0.007*** (0.000)	0.001*** (0.000)
$\frac{AssetGrowth}{A}$			-0.020*** (0.002)	-0.017*** (0.002)
$\frac{Profit}{A}$			0.060*** (0.002)	0.051*** (0.003)
$ZSCORE$			0.000*** (0.000)	0.001^{+}*** (0.000)
$Big4$			0.004*** (0.001)	0.001^{+}* (0.001)
$\log A$			-0.007*** (0.000)	-0.010*** (.0007)
$Momentum$			-0.009*** (0.001)	0.001^{+} (0.001)
$Volatility$			0.059*** (0.003)	0.001 (0.003)
Firm Fixed Effects				Yes
Quarter Fixed Effects				Yes
R-Squared	0.000	0.000	0.138	0.434
Overall F-Test	3.66*	3.85**	958.43***	259.07***
Number of observations	78,059			

Table 3: Estimation results of earnings management and DSB

Standard-errors in parenthesis. *** denote p-values <0.01, ** denote p-values <0.05, and * denote p-values <0.10. $^{+}$ denotes a value smaller than 0.001.

Source: Self Elaboration

The first specification suggests that DSBs have no impact on earnings management.

The second specification suggests that DSBs have an impact on earnings management, since we can infer that DSB significantly decrease earnings management practices. Moreover, the result also suggests that investor's attention decreases the negative impact of DSBs on earnings management.

The third specification, which adds the control variables, suggests that DSBs have no impact on earnings management and that investor's attention does not affect the impact of DSBs on earnings management.

Finally, the fourth specification, which adds the fixed effects, maintains the same conclusion: DSBs have no impact on earnings management and investor's attention does not affect the impact of DSBs on earnings management.

5. Conclusion

DSBs are growing more prevalent and expensive. When a company suffers from a cyberattacks experience, it impacts all companies' levels leading to significant earnings declines. Thus, the main aim of this project is to estimate and analyse, for a sample of entities among 2010:Q1 and 2021:Q3, whether the occurrence DSBs impact earnings management and if investor's attention affects the impact of DSBs on earnings management.

The obtained results show that breached entities do not alter earnings management and that investor's attention does not affect the impact of DSBs on earnings manipulation.

We acknowledge certain limitations of our analyses. We are unable to investigate the behaviour of public's breached firms that were not reported on the Maryland database, since businesses that retain consumer records are only required to notify consumers who are residents of Maryland if his or her information is compromised. Further, may exist other factors that can be associated with DSB and earnings manipulation that we are unable to consider and measure, such as digital property dimension. The impact of DSB on earnings management can have more effect on entities with more digital property dimension.

For future investigations, we encourage to explore the limitations above mentioned and increase the sample for US public firms, listed on other markets (as, for example, the European stock market), in order to obtain more reliable results. In addition, we recommend the use of other approaches, to estimate earnings management to evaluate the sensitivity of the results to the adopted methodology.

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