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Relationship among economic crisis, stock market crashes and accounting scandals

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Abstract

Purpose: This work investigates the relationships between stock exchange crashes and accounting scandals.

Design/methodology: We analyze the main accounting scandals and stock exchange crashes that occurred between 1980 and 2020.

Findings: First of all, it was verified that a stock market crash occurred in the years in which most of the accounting scandals took place (or within the next three years). This evidence is consistent with much of the previous literature. Second, an average of 5.4 years has been estimated as the period of time that elapses between the time a company starts engaging in accounting deception and the moment when it is discovered and the scandal breaks out. Third, it has been found that accounting deception is more likely to occur in years with stock market crashes and in the years immediately following. The literature review revealed no evidence supporting the two latter hypotheses.

Research limitations/implications: This exploratory work has several limitations. First of all, only scandals that have been reported on websites in Spanish and English have been analyzed. Therefore, the sample may be biased, giving more weight to companies from Anglo-Saxon and Spanish-speaking countries. Second, the sample was made up of a small number of companies (53), which are those that have met the search criteria used.

Practical implications: The findings of this work are relevant today, since a major stock exchange crash has occurred as a result of the coronavirus. Therefore, if the pattern of the most recent decades is repeated, it would be expected that more accounting scandals will come to light in the coming years.

Social implications: The conclusions obtained are of great relevance for the different users of the financial information from companies, and also for auditors, consultants and supervisory bodies, since due to the stock exchange crash triggered by COVID-19, they will need to exercise extreme caution in the coming years in relation to financial information.

Originality/value: The work provides evidence on the relationship between stock market crashes and accounting scandals, which is a highly relevant topic. The literature review revealed no study using the same methodology or a similar sample of companies.

Keywords: Accounting deception, Accounting manipulation, Accounting scandal, Economic crisis, Stock Exchange Crash

Jel Codes: M41, M42

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1. Introduction

Accounting information is essential in order to know the situation and prospects of a company; it is also is crucial in order to make decisions that allow the desired objectives to be met. However, scandals often occur that reveal situations in which accounting deception has occurred. A scandal is considered to be an immoral or condemnable event that causes indignation and has a great public impact. When the event causing indignation is related to accounting deceit, it is referred to as accounting deception.

Accounting deception, also called 'window dressing' or 'massaging the accounts', consists of providing information that does not correspond to the real situation of the company's accounts. According to Gisbert, Garcia Osma and Noguer (2005), accounting deception: "*involves any practice performed intentionally by management for opportunistic and/or informational purposes, to report the desired profit and loss figures, which differ from the real ones.*" Along the same lines, Amat (2017) states: *"Accounting deception consists of interfering in the process of the preparation of the financial information with the objective of ensuring that the accounts present a different image than they would otherwise offer if they had not been manipulated. It constitutes an important problem, because it affects the reliability of the accounts. Account manipulation is carried out in order to make the accounts reflect what is in the interests of the directors and managers. They thus do not report the real situation, and the users of the accounts are deceived.*"

Accounting deception may be carried out through both accounting manipulation and real transactions, since both are capable of modifying the company's figures. In the first case, the deception is carried out through changes in the valuation criteria or by altering the accounts, increasing or decreasing income, expenses, assets and liabilities. One very common practice, for example, is the discretionary use of accrual adjustments to increase or decrease the company's profit. The second case involves real transactions that modify the figures by anticipating or postponing operations or by conducting transactions that do not have a reasonable economic justification, but that alter the profit, for example, when it is decided to sell to a client with a poor credit history. In this case, the company can increase its sales and profits for a few months, but this must later be corrected.

There are several reasons why the management of a company might be interested in offering an economic/financial image that is different from the real situation of the company (Putra, Pagalung & Habbe, 2018), including: the need to obtain bank financing; the search for new investors; entrance into the stock market; to pay less taxes; to distribute dividends among shareholders or to enable management to collect incentives in connection with achieving certain target returns.

Accounting deception is an issue of great relevance, due to the negative impact that it has on the confidence of investors, creditors, employees and any party interested in the accounting information of an organization. When accounting deception is made public, an accounting scandal occurs with important and very negative consequences: economic losses for shareholders, workers, creditors and the Public Administration, among other interested parties. In many cases, it also leads to the disappearance of the company, job loss and important criminal consequences for those responsible for the crimes, which can result in fines or even prison sentences. Often, another negative consequence is the imposition of important penalties for the account auditors, in cases in which it is believed that they have not done their job properly. Other negative consequences of the accounting scandals are the loss of confidence on the part of users with regard to the accounting information and with all the participants who take part in the account preparation process, such as company management, regulatory and supervisory bodies and account auditors. In some cases, the gravity of the situation has triggered important changes in legislation in order to try to prevent the repetition of negative events. In fact, some of the accounting scandals of the last century have generated changes in the regulatory framework regarding financial information and should be analyzed in further detail (Camfferman & Wielhouwer, 2019), because scandals such as the Enron scandal evidence accounting improprieties in which people with different responsibilities participate (Akhigbe, Madura & Martin, 2005), as well as the need for ethics training programs in this area, with appropriate controls (Kreismann & Talaulicar, 2020).

It is thus a problem that it is as old as humanity; and as we have seen, there have been documented episodes of accounting deception that occurred more than 3,000 years ago in ancient Mesopotamia (Jones, 2012). And, since then, multiple cases have occurred that have alarmed to the population.

This work proposes to find out more about the nature of accounting deception, and it will investigate whether there are any relationships between stock market crashes and accounting scandals. In doing so, we will analyze the main accounting scandals of the last forty years and the stock market crashes that occurred during this period. This work begins with a literature review that will allow us to know the status of this issue. Next, we will present the methodology that will be used. Following this, an empirical study will be carried out, consisting of analyzing the characteristics of the major scandals that have occurred over the last forty years. Once the analysis has been completed, we will proceed to present the conclusions of the study that has been conducted, as well as the limitations and proposals for future research. This is an exploratory work, and the intention is to continue it with future works that make it possible to delve deeper into the topic of study.

2. Review of the literature

In order to determine the status of the question being studied, the academic literature will be reviewed concerning the relationship between stock market crashes and accounting deception. Due to the fact that stock market crashes usually anticipate periods of economic crisis (Callao & Jarne, 2021) we will begin this literature review by studying the research that has been conducted on accounting deception and its relationship with economic crises. And we will also review whether there are any works that analyze the relationship between other events (natural disasters, price increases, etc.) or other characteristics of the companies and accounting deception.

2.1. Relationship between economic crisis and accounting deception

Economic crisis is understood to mean a period in which an economy experiences difficulties. In recent decades, the world economy has undergone several important economic crises, such as the Dot-com crisis of 2000, the real estate crisis of 2008 and the COVID crisis of 2020. There have been other moments of political tensions, including the Gulf War in the 1990s and even natural disasters such as hurricanes, earthquakes and tsunamis that have affected countries as diverse as the United States, Japan and Chile.

In the previous literature, works predominate that reveal that a period of economic crisis produces an increase in accounting deception in order to alter the company's accounts. Accordingly, several works have documented the relationship between the point in the economic cycle at which a company finds itself and the propensity by its management to engage in accounting deception. Smith et al. (2001) analyzed traded Australian companies and found that more accounting deception occurredin a period of economic crisis.

Lin and Shih (2003) reached a similar conclusion after studying the practice of accounting deception by companies during the 1990-1991 crisis. They found evidence that company directors postpone income in periods with lower profits (when there is no possibility of receiving any bonus associated with said profits) and also when profits are very high (when have already reached the limit to obtain the incentives), in such a way that they transfer the profits to future periods, since investors in crisis periods react less harshly toward the company directors. The result can be that company management has an incentive to postpone the profits until future periods. Beyer et al. (2018) also observed that small companies engage in the same deceptions in crisis years. Ho et al. (2001) analyzed Korean companies during the 1995-1998 period, and they found evidence that accounting deception significantly decreased in the years prior to the economic crisis.

Accounting deception during crisis periods is more evident when the company is in a special situation (entry into the stock market, for example). For instance, Ahmad-Zaluki et al. (2009) observed that during the crisis period at the end of the nineties in Malaysia, companies that entered the stock market (with OPIs or Initial Public Offers) during that period increased their accounting manipulation practices in order to increase their profits. In these cases, they were companies that were previously interested in offering a good image to future investors before entering the stock market.

During the period of the Asian financial crisis, Davis-Friday et al. (2006) analyzed the importance of the economic environment when it comes to improving the quality of accounting information. Specifically, they focused on Indonesia, South Korea, Malaysia and Thailand, observing that, in general, during periods of economic crisis, the quality of accounting information decreased.

The relationship between accounting deception and economic crisis was also investigated by Jin (2005), who concluded that during times of crisis, company management use discretionary period adjustments to increase profits. In periods of strong growth, on the other hand, management tried to smooth out (reduce) company profits through larger accrual adjustments.

García (2008) concluded that in times of economic crisis, companies use accounting deception to camouflage their numbers and Callao and Jarne (2011) analyzed the impact of the crises on the accounting manipulation in Spanish traded companies, reaching the conclusion that the quality of the financial information is affected during periods of crisis, increasing their results through the use of discretionary accrual adjustments. They also came to the conclusion that accounting deception is not due to the crisis itself, rather this factor strengthens other incentives that exist in companies that do contribute to manipulation, such as indebtedness or the company's liquidity situation, for example.

Kumar and Vij (2017) also reached similar conclusions when observing the behavior of Indian companies during the 2008 worldwide financial crisis, compared with the period before and after this crisis. In doing so, they utilized the financial data of 500 S&P CNX companies from the period 2007-2012 and evaluated the variation in discretionary accrual adjustments (discretionary accruals), reaching the conclusion that during the period prior to the crisis, companies present a high level of accounting deception, which decreases during the period of economic crisis and increases once again afterwards.

Works have also been found in the literature reviews that reach the opposite conclusions. In this sense, Dimitras et al. (2015) concluded that Greek and Spanish companies reduce their accounting deception during years of economic crisis. Papadaki and Tzovas (2017) come to a similar conclusion after analyzing companies in 19 countries of the European Union during the 2005-2014 period to determine whether in periods of financial crisis companies are more likely to engage in accounting deception. The observation is made taking into account both accounting manipulation techniques through accrual adjustments and real transactions. They came to the conclusion that in periods of economic crisis, companies engage in less use of discretionary accrual adjustments in order to manipulate their accounts. They also found evidence that the more profitable companies and those audited by large auditing firms are less likely to perform real transactions in order to manipulate company figures. Along these lines, Filip and Raffournier (2014) examined the impact of the 2008 financial crisis on the behavior of listed companies in Europe, noting that accounting deception decreased in crisis years in the majority of the 16 countries that were studied. Reguera-Alvarado (2012) studied the behavior of listed companies from the United States, the United Kingdom, Korea, Japan, Italy, Germany, France, Spain, Canada and Australia during the 2005-2009 period and found evidence that crisis influences the opportunistic behavior of management by using discretionary accrual adjustments. However, greater accounting deception only occurred in Spain and Canada during the crisis, which is probably a consequence of the fact that in both countries the most representative economic sectors were those most affected by the crisis (housing and banking). On the other hand, in the United Kingdom and Australia, the study shows the existence of a relationship between the financial crisis and the level of accounting deception by companies. The remaining countries show a lower level of accrual accounting adjustments during the crisis period than before it, which can be the consequence of the fact that by lowering the level of income, owners keep a tighter control over the management by directors, who have less of a margin to engage in discretionary practices. In a similar study, Franceschetti (2018) concluded that there is no direct relationship between economic crisis and accounting deception.

All of the above makes it clear that a significant part of the authors have found evidence that during years of economic crisis, an increase in accounting deception occurs, but there is also a smaller number of authors who indicate just the opposite.

2.2. Relationship between stock market crashes and accounting deception

As has been shown in the previous section, the relationship between accounting deception and the drop in share prices of the affected company has been thoroughly addressed in the literature. However, the relationship between accounting deception and stock market crashes has been studied to a lesser extent. In any case, several authors have found evidence of a relationship between the two phenomena (accounting deception and stock market crashes). This research has been carried out especially in relation to companies in Asian countries. For example, Jawad et al. (2022) analyzed the relationship between accounting deception and stock market crashes in several Asian countries and they found evidence that accounting deception contributes to increasing the risk of a stock market crash. Dai et al. (2019) reached the same conclusion in a study focused exclusively on Chinese companies. The same can be said of Fatima et al. (2020) in relation to companies in Pakistan.

In the United States, Khurana et al. (2018) also reached the same conclusion, analyzing the deceptive practices with real transactions involving a sample of companies from the United States. In relation to other types of information, based on accounting information, Murata and Hamori (2021) conclude that a greater quantity and quality of information from European, American and Asian companies in terms of ESG (economic, social, governance) aspects reduces the risk of stock market crashes. In all these cases, a direct relationship has been found between accounting deception and the risk of stock market crashes.

On the other hand, there are other works, although fewer and far between, that come to the opposite conclusion. This is the case of Neifar and Utz. (2019) and Amat & Lloret (2020) who analyzed cases of German companies that engaged in accounting deception, and they reached the conclusion that these practices did not have an influence on the risk of stock market crashes.

Therefore, although the greater part of the research concludes that there is a relationship between stock market crashes and accounting deception, there is also some evidence in the opposite direction. Furthermore, this is an issue that has been less investigated, especially in the case of European companies.

2.3. Other events and accounting deception

To have a more complete vision of the type of events that can be related to accounting deception, the previous literature is reviewed that analyzes the relationship between other economic events and accounting deception. We refer to events such as price increases. Wang and Han (1997) analyzed whether companies that expect an increase in profits as a result of unexpected increases in the prices of their products use accounting deception to reduce their profits in order to minimize possible costs to their image. With this purpose in mind, they analyzed the accrual adjustments of the oil companies that saw an increase in the price of oil during the Persian Gulf Crisis of 1990. In their study, they observed that those oil companies that expected to profit from the crisis used accrual adjustments to reduce their profits during the Gulf Crisis period.

A relaxation in terms of the accounting information is also perceived at times when the economy experiences turbulence as the result of a currency devaluation. Accordingly, Graham et al. (2000) observed how the devaluation of the currency in Thailand brought about a loss in the quality of financial information from companies.

There are other unexpected events, such as natural disasters, that can affect the quality of financial information. Byard et al. (2007) analyzed the impact on the financial information of North American oil companies following hurricanes Katrina and Rita, which devastated the coast of the United States in 2005. They showed that the large oil companies reduced their income in the fiscal quarter through accrual adjustments immediately following the impact of the hurricanes.

2.4. Other characteristics that can have an effect on accounting deception

In addition to the topics discussed in the previous sections, other circumstances have also been identified that can have an effect on accounting deception. First of all, the characteristics of accounting professionals when it comes to taking a certain action when it is possible to engage in accounting deception is another aspect to take into account. Racko (2019) found evidence of a direct relationship between the professionalism of the accountant and accounting deception. Agrawal and Chadha (2005) and Agrawal and Cooper (2015) have shown that having privileged information triggers accounting deception, and independent members of the board of directors with financial experience are valuable resources to avoid falling into the trap of accounting deception.

Another relevant aspect is the relationship between accounting deception and the size of the auditing firm. According to Dimitras et al. (2015), European companies audited by a large auditing firm show fewer discretionary accrual adjustments. With regard to the control over and auditing of financial information, Ruben, Adwa and Zakaria (2020) show evidence that accounting scandals require better auditing quality and talent on behalf of the external auditor. Specifically, as indicated by Toms (2019), audits can mitigate fraud in every sector, in spite of the proliferation of fraud and scandals since the mid-19th century.

Other causes that lead to accounting deception include the poor quality of corporate governance, ethical standards and sustainability policies (Ramos Montesdeoca, 2019). Along the same lines, Martínez-Ferrero et al. (2013) conclude that the more intense the sustainable practices are, the less accounting deception will occur. Kim, Park and Wier (2012) and Neubaum and Zahra (2006) also concluded that there is a positive relationship between sustainable business practices and the quality of accounting results. However, there is research, such as that by Prior, Surroca and Tribó (2008), that shows that practices related to Social Corporate Responsibility often mask manipulations of accounting results, and that companies mainly comply with regulations because they are mandatory, not out of any sense of responsibility to society (Rendón & García, 2015).

2.5. Summary of the contributions from the literature review

The literature review allows us to conclude that there is no unanimity with regard to the relationship between stock market crashes and accounting deception. On the other hand, there are other phenomena, such as price increases, currency devaluation and natural disasters, as well as other company characteristics (professionalism, the size of auditing firms and the independence of accountants and members of the board of directors, corporate governance, sustainability and Corporate Social Responsibility policies) that can have an influence on the motivation to engage in accounting deception. The most commonly used technique to investigate the existence of accounting deception is the analysis of discretionary accrual adjustments. Table 1 summarizes these contributions.

Relationship between accounting deception and other events (economic crisis, stock market crashes, etc.)	Authors	Study results
Relationship between economic crisis and accounting deception	Smith, Kestel and Robinson (2001), Ahmad-Zaluki, Campbell and Goodacre (2009), Davis-Friday, Eng and Liu (2006), García (2008), Callao and Jarne (2011), Jin (2005), Lin and Shih (2003), Beyer, Nabar and Rapley (2018)	In years of economic crisis, there is more accounting deception.
	Ho, Liu and Sohn (2001), Kumar and Vij (2017), Dimitras, Kyriakou and Iatridis (2015), Papadaki and Tzovas (2017), Filip and Raffournier (2014)	During crisis years, there is less accounting deception.
	Reguera-Alvarado et al. (2012), Franceschetti (2018)	There is no clear evidence of the relationship between economic crisis and accounting deception.
Relationship between stock market crashes and accounting deception	Jawad, Awan and Khan (2022), Dai, Lu and Qi (2019), Fatima, Haque and Usman (2020), Khurana, Pereira and Zhang (2018), Murata and Hamori (2021)	There is a relationship between stock market crashes and accounting deception.
	Neifar and Utz (2019)	There is no relationship between accounting deception and stock market crashes.
Other events related to accounting deception.	Wang and Han (1997)	Price increases
	Graham, Bailes and King (2000)	Currency devaluation
	Byard, Hossain and Mitra (2007)	Natural disasters
Characteristics that can reduce accounting deception	Racko (2019)	Greater professionalism by accountants
	Dimitras et al. (2015)	Companies audited by large auditing firms
	Agrawal and Cooper (2015)	Independent members of the board of directors
	Ramos Montesdeoca, Sanchez Medina and Blazquez Santana (2019)	Good corporate governance, ethical standards
	Martínez-Ferrero, Prado-Lorenzo and Fernández-Fernández (2013), Kim et al. (2012), Neubaum and Zahra, 2006	More actions in terms of sustainability and sustainability policies

Table 1. Summary of the main contributions of the literature concerning relations between economic crisis and other circumstances that have an effect on accounting deception

Once the review of the literature has verified that the relationship between economic crisis and accounting deception is a topic that has been the subject of a great deal of study, and although the results do not always agree, there is a predominance of evidence that there is a relationship between economic crisis and accounting deception. In turn, the relationship between stock market crashes and accounting deception is a topic on which less research has been done. In fact, the relationship between accounting deception and the evolution of the share prices of companies that have engaged in accounting deception has been analyzed more often than the general market evolution. For this reason, this work will attempt to find evidence that makes it possible to evaluate the relationship between stock market crashes and accounting manipulation, since current research, such as that by Nguyen, O'Connell, Kend and Vesty (2021), indicate the need to investigate in this sense, due to the frequency with which accounting deception occurs in emerging economies, or as Suh, Sweeney, Linke and Wall (2020) indicate, due to the socialization of financial fraud in companies, all of this in spite of the existence of cutting-edge automatic fraud prediction models, as indicated by Bao, Ke, Li, Yu and Zhang (2020).

According to the proposed objectives (the relationship between stock market crashes and accounting manipulation and the time elapsed before the accounting deception is discovered), this work will attempt to answer three research questions:

- Question 1: When there is a stock market crash, is there a greater probability that accounting scandals will occur?
- Question 2: In the years immediately before and after a stock market crash, is there a greater probability that companies will engage in accounting deception?
- Question 3: How many years elapse between the time when a company begins to engage in accounting deception until the accounting scandal becomes public?

3. Methodology

This section presents the methodology used to conduct the study, consisting of investigating the accounting scandals that have had an important impact in the mass media over the last forty years. The relationship between these scandals and stock market crashes is analyzed below.

In order to know the companies that had an accounting scandal during the period in question, two searches were carried out on the Google Internet search engine in mid-January 2021, using the terms: "*escándalo contable*" and "accounting scandal". The first 50 entries for each of the two searches were analyzed. This specific method of selecting the companies that have been the subjects of accounting scandals had not been previously used in the analyzed literature. In the reviewed literature, the most common method for identifying companies that manipulate their accounting records with the intent of engaging in accounting deception is to analyze whether any variations occur in the accounting of accrual adjustments. In contrast, in this study, companies were selected based on news about accounting scandals that appeared in the results of Google searches. In these cases, it was also verified that accounting deception actually took place, which was determined by the existence of fines or sanctions from supervisory bodies or courts of law.

The forty-year period considered (1980-2020) is relatively uncommon in the analyzed literature, but it is similar to that used by Khurana et al. (2018). This broad period has allowed us to detect a sufficient number of companies affected by accounting scandals. Of all the companies identified through the search criteria presented above, only those were considered in which the scandal occurred between 1980 and 2020. In this manner, the names of the companies were obtained that have been in the news as the result of an accounting scandal. It should be pointed out that in all cases, these were audited companies, and in most cases, by large auditing firms, as can be seen in Appendix 1. Table 2 lists the details of the 53 companies identified based on the above-mentioned search criteria.

Company (alphabetical order)	Activity sector
Abengoa	Industry. Renewable energies
AIG (American International Group)	Services. Insurance
Anglo Irish Bank	Services. Financial institution
Astroc	Real estate
Autonomy Corp.	Industry
Banco Popular	Services. Financial institution
Bankia	Services. Financial institution
BHS	Distribution. Department stores
Biovail	Pharmaceuticals
Caterpillar and Siwei	Industry
Celadon Group	Truckload shipping
Cendant	Services
Constructora Carrillion	Construction company
Crazy Eddie	Distribution. Electrical product chain
DIA	Distribution. Supermarkets
Enron	Services. Energy

Company (alphabetical order)	Activity sector
Fannie Mae	Services. Financial institution
Freddie Mac	Services. Financial institution
Global Crossing	Telecommunications
Gowex	Telecommunications
Halliburton	Services. Oilfield service company
Health South	Healthcare
Kanebo	Textile and cosmetics
Lehman Brothers	Services. Financial institution
Lernout Hauspie	Technology
Luckin Coffee	Hospitality services
Merck	Pharmacy
Microstrategy	Services.
Mini Scribe	Computers and Accessories
Monsanto	Biotechnology
Olympus	Photography
Parmalat	Food industry
Pastisserie Valerie	Hospitality services
Pescanova	Food industry
Polly Peck	Distribution. Fashion
Ricoh India	Industry
Royal Ahold (USA division)	Distribution. Supermarkets
Satyam	Telecommunications
Stein Hoff International	Distribution
Swissair	Airline
Tal Education China	Education
Taylor Bean Whitaker	Services. Financial institution
Ted Baker	Distribution. Fashion
Tesco	Distribution. Supermarkets
Toshiba	Industry
Tyco International	Industry
Under Armour	Industry. Sports equipment
Valeant Pharmaceuticals (Bausch Health Companies, Inc.)	Pharmacy
Waste Management	Services. Waste management
Weattherford International	Industry. Oil
Wirecard	Services. Financial services
Wordcom	Telecommunications
Xerox	Industry. Photocopiers

Table 2. Sample of 53 companies that have been subject to an accounting scandal between 1980 and 2020

In order to determine the specific characteristics of the different accounting scandals identified, different aspects of each of the companies in the sample are analyzed below, such as:

- Country in which the company has its domicile
- Year in which the accounting deception was discovered and the accounting scandal is made public.
- Year(s) in which the accounting deception was carried out.
- Main activity of the company.
- Method of accounting fraud detection.
- Account auditor.
- Estimated fraud amount (in those cases in which it is not possible to find information on this amount, the amount of the penalties is provided).

Since the search criteria used the term “accounting scandal” in both Spanish and English, it is not surprising that the sample of companies obtained is predominated by Anglo-Saxon and Spanish companies (see Table 3).

Country	Number of companies	%
United States	22	41.51%
Spain	7	13.21%
United Kingdom	7	13.21%
China	3	5.66%
Japan	3	5.66%
Canada	2	3.77%
India	2	3.77%
Germany	1	1.89%
Belgium	1	1.89%
Holland	1	1.89%
Ireland	1	1.89%
Italy	1	1.89%
South Africa	1	1.89%
Switzerland	1	1.89%
Total	**53**	**100.00%**

Table 3. Countries of the companies in the analyzed sample

Information from the United States was used to identify the stock market crashes. This country was selected due to the relevance of the North American economy and its stock exchanges. From the United States, the New York Stock Exchange was selected as being the leading stock exchange worldwide. Prior to this, in order to find out more about the economic environment in which the stock market has operated over the last forty years analyzed, firstly, the evolution of the economy in the United States was analyzed in said period.

3.1. Evolution of the economy in the United States during the period 1980–2020

In order to determine the periods in which the North American economy experienced economic crises, the years in which the GDP (Gross Domestic Product) showed a negative growth were considered. To accomplish this, the growth of the GDP in the United States was consulted for the period between 1980 and 2020.

According to the data from the Federal Reserve (fred.stlouisfed.org) pertaining to the United States, between 1980 and 2020, the Gross Domestic Product experienced decreases in 1982, 2001, 2009 and 2020. During these years, the economy in the United States contracted by -1% in 1982; -0.9% in 2008, -9.1% in 2009 and as of July 1, 2020 the drop was by -33.7%.

3.2. Stock market crashes in the United States during the period 1980–2020

A crash is a rapid, important drop in stock market share prices. In this case, the New York Stock Exchange, more commonly known as Wall Street, was considered for having the most important stock exchange in the world. In order to identify the crashes that occurred, the moments when the New York Stock Exchange had a drop of approximately 30% or above were considered. According to the data from the New York Stock Exchange, over the last forty years, this stock market has experienced four important crashes:

- Starting on Monday, October 19, 1987, share prices fell by 29% on the New York Stock Exchange. This day went down in history as "Black Monday". The crash was not only registered on Wall Street, it was also evident in most of the stock exchanges around the world (Hong Kong experienced a drop of 45.5%; the United Kingdom: 26.4%; Australia: 41.8%, Canada: 22.5% and Spain: 31%).
- In 2000, the Internet (dot.com) bubble burst. The drop was by 49%; the market did not recover until three years later and the stock market crash was followed in 2001 by the September 11th terrorist attacks and two of the largest accounting scandals in history: Enron and WorldCom.
- The third great stock market crash was seen in 2008, as the result of the worldwide financial crisis caused by the bursting of the real estate bubble and garbage mortgages known as "sub-prime" loans. Wall Street dropped by 59%, which was the most important drop since the 1929 crisis.

- Finally, the 2020 pandemic had a very negative impact on the stock markets and the overall world economy. Specifically, in the United States between February and March 2020, the New York Stock Exchange fell by 34%. The crash was very similar in the remaining stock exchanges around the world.

Based on the data related to the sample of companies that have been the subject of accounting scandals and the stock market crashes, an attempt was made to determine whether there was any relationship or pattern between the stock market crash and accounting fraud. To do this, we analyzed the year in which the stock market crash occurred, as well as the following three years, in order to observe whether there was a relationship between the time when the accounting scandals broke. We also analyzed whether there was any relationship between the moment when the company started to engage in accounting deception and the time the stock market crash occurred. In this case, we analyzed whether the moment when the company began to engage in deception coincides with the period which begins two years before and ends two years after the year in which the stock market crash occurs.

4. Results

As stated earlier, this work is intended to investigate whether there are any relationships between stock market crashes and accounting scandals. The utility of this objective was revealed by the literature review, as the relationship between the economic crisis and accounting fraud has been investigated on many occasions. On the other hand, the relationship between the stock market crash and the scandal has been researched to a lesser extent and the results are also contradictory. This work therefore intends to bridge this gap.

The information corresponding to the companies in the sample is analyzed below (see Table 2). First the relationship was analyzed between the time when the accounting scandals broke and the stock market crashes. Specifically, the period that was considered comprises the moment when the stock market crash occurs and the three following years. As can be seen in Table 4, 56.6% of the accounting scandals occurred in the 13 years in which a stock market crash occurred (or in the three following years). With regard to the last crash in 2020, only one year is considered, as the sample was selected in early 2021. Therefore, in 32.5% of the years (weight of the 13 years in the 40-year period considered), more than half of the scandals occurred. It can therefore be concluded that in the period between the time when a stock market crash occurs and the three years following it, a large number of accounting scandals occur. As can also be seen in Table 4, over the course of forty years, an average of 1.3 scandals per year have occurred. This average increases to 2.3 scandals per year in the periods with a stock market crash and during the three following years; on the other hand, this average decreases to 0.8 scandals per year during the remaining years. Therefore, when a stock market crash occurs and over the course of the next three years, the probability of accounting deception doubles.

<table>
<tr><th rowspan="2"></th><th colspan="5">Period consisting of the year in which the crash occurs and the following three years</th><th rowspan="2">No. of scandals in the remaining years</th><th rowspan="2">Total</th></tr>
<tr><th>1987-1990</th><th>2000-2003</th><th>2008-2011</th><th>2020-2021</th><th>Total</th></tr>
<tr><td>Number of companies whose accounting deceptions have been revealed when the crash occurs and in the following three years</td><td>3</td><td>15</td><td>7</td><td>5</td><td>30</td><td>23</td><td>53</td></tr>
<tr><td>% of all companies that present accounting fraud</td><td colspan="4" rowspan="3"></td><td>56.60%</td><td>43.40%</td><td>100%</td></tr>
<tr><td>No. of years in each period</td><td>13</td><td>27</td><td>40</td></tr>
<tr><td>% of total years</td><td>32.5%</td><td>67.5%</td><td>100%</td></tr>
<tr><td>No. of scandals per year</td><td colspan="4"></td><td>2.3</td><td>0.8</td><td>1.3</td></tr>
</table>

Table 4. Number of companies in which the accounting scandal was discovered during the period in which the crash occurred or in the next three years

Next, the duration of the period was analyzed in which the companies engaged in accounting deception before it was discovered (see Table 5). It is observed that the deception occurred for an average of 5.4 years, with the longest case being 20 years and the shortest being 1 year.

Year in which the accounting deception was discovered	Year in which the company began to engage in accounting deception	Duration years since the company began to engage in accounting deception until it was discovered	Enterprise	Estimated fraud amount (in those cases in which it is not possible to quantify this amount, the amount of the penalties is provided
2011	1990-2011	20	Olympus	$1.7 billion USD
1987	1969-1987	19	Crazy Eddie	$120 million USD
2003	1989-2003	15	Parmalat	€15 billion EUR
2013	2001-2013	13	Caterpillar and Siwei	$580 million USD
2000	1988-2000	13	Lernout Hauspie	€553 million EUR
1990	1980-1990	11	Polly Peck	£29 million GBP
2013	2002-2012	11	Weattherford International	$140 million USD
2014	2004-2014	11	Gowex	€870 million EUR
2018	2009-2017	9	Stein Hoff International	$7.4 million USD
2009	2002-2009	8	Satyam	$2.25 million USD
2009	2002-2009	8	Taylor Bean Whitaker	$2.9 million USD
2015	2007-2014	8	Toshiba	€3.822 million
2003	1996-2002	7	Health South	$2.5 million USD
2004	1998-2004	7	Fannie Mae	$11 billion USD
2020	2014-2020	7	Wirecard	€1.99 billion EUR
1998	1992-1997	6	Waste Management	$1.7 billion USD
2001	1995-2000	6	Swissair	€3 billion EUR
2003	1997-2002	6	Freddie Mac	$7 billion USD
2020	2015-202	6	Under Armour	Undisclosed amount. The company paid a fine of $9 million USD to the SEC
2020	2013-2019	6	Ted Baker	£58 million GBP
2002	1997-2001	5	Xerox	$2 billion USD
2005	1999-2003	5	Kanebo	¥200 billion JPY
2015	2011-2015	5	Ricoh India	€1.123 billion EUR
1989	1986-1989	4	Mini Scribe	$200 million USD
2001	1997-2000	4	Enron	$74 billion USD
2002	1998-2001	4	Halliburton	$3.1 billion USD
2002	1999-2002	4	Merck	$14.4 billion USD
2003	1999-2002	4	Royal Ahold (USA division)	$500 million USD
2005	2002-2005	4	AIG American International	Group Undisclosed amount. The company paid a fine of $1.6 million USD to the SEC.
2014	2011-2014	4	Tesco	£598 million GBP
2018	2014-2017	4	Pastisserie Valerie	€45 million EUR
1998	1995-1997	3	Cendant	€2.45 million EUR
2000	1998-2000	3	Microstrategy	Undisclosed amount. The company, the directors and the auditors paid a fine of $64 million USD to the SEC.
2002	2000	3	Wordcom	$3.8 million USD
2002	1999-2001	3	Tyco International	$300 million USD
2002	2000-2002	3	Global Crossing	$750 million USD
2003	2001-2003	3	Biovail	$59 million USD
2011	2009-2011	3	Autonomy Corp.	$5 million USD
2014	2009-2011	3	Monsanto	Undisclosed amount. The company paid a fine of $80 million USD to the SEC.
2015	2014-2016	3	Abengoa	$194 million USD
2016	2015-2016	2	Valeant Pharmaceuticals (Bausch Health Companies, Inc.)	Undisclosed amount. The company paid a fine of $45 million USD to the SEC.
2018	2016-2017	2	DIA	€50 million EUR
2020	2019-2020	2	€266 million EUR	Luckin Coffee
2007	2006	1	€50.1 million EUR	Astroc

Year in which the accounting deception was discovered	Year in which the company began to engage in accounting deception	Duration years since the company began to engage in accounting deception until it was discovered	Enterprise	Estimated fraud amount (in those cases in which it is not possible to quantify this amount, the amount of the penalties is provided
2008	2008	1	Lehman Brothers	$613 billion USD
2008	2008	1	Anglo Irish Bank	€30 billion EUR
2011	2011	1	Bankia	€3.288 billion EUR
2013	2012	1	Pescanova	€3 billion EUR
2016	2014	1	BHS	Undisclosed amount. The company paid a fine of £10 million GBP.
2017	2016	1	Banco Popular	€2.5 billion EUR
2017	2016	1	Celadon Group	€60 million EUR
2018	2016	1	Constructora Carrillion	£845 million GBP
2020	2019	1	Tal Education China	$1.8 million USD
	MEAN	5.42		
	STANDARD DEVIATION	4.47		

Table 5. Mean in years that the companies have been engaged in accounting deception. Data in units (years)

Next, the years that have passed for each company between the time that they begin to engage in accounting fraud and the year in which the scandal breaks were analyzed (see Table 6). This table shows that in the period between two years before the crash and two years afterward, i.e., a 5-year period (see the area in grey in the figure), 30 cases of accounting deception began, representing 56.6% of all cases. As in the forty-year period studied, four crashes have occurred (although in the last one, in 2020, it was only possible to analyze what happened in the two previous years and in 2020). We see that 56.6% of the cases (30 scandals) have begun in an 18-year period, while the rest of the cases (23) began in the 22 remaining years. Therefore, in the five-year period between the two years before the year of the crash and the two years afterwards, 1.6 accounting scandals have occurred per year. On the other hand, in the rest of the years, 1.04 scandals per year have occurred. As a result, during the five-year period between the two years before the year of a crash and the two years afterward, there is a 53% greater chance that a company starts to engage in account deception that will eventually erupt into an accounting scandal.

No. of years of difference between the start of the accounting deception and the year of the crash	Number of companies	% of companies out of the total number of companies
13 years before the crash	1	1.89%
5 years before the crash	4	7.55%
4 years before the crash	5	9.43%
3 years before the crash	4	7.55%
2 years before the crash	5	9.43%
1 year before the crash	9	16.98%
The year the crash occurs	5	9.43%
1 year after the crash	3	5.66%
2 years after the crash	8	15.09%
3 years after the crash	2	3.77%
4 years after the crash	2	3.77%
5 years after the crash	5	9.43%
Total	**53**	**100.00%**

56.6% of the cases

Table 6. Number of years of difference between the start of the accounting deception and the year of the stock market crash

5. Discussion

This section compares the results obtained from the literature review and describes the main contributions of the study carried out.

First of all, evidence has been found for the relationship between a stock market crash and an accounting scandal. This is a topic on which there is little research and moreover, the previous research is inconclusive. On the other hand, in agreement with the academic literature, the stock market crashes usually anticipate periods of economic crisis (Callao & Jarne, 2011), as evidenced in this research.

This research reveals that in the years in which a stock market crash occurs (and in the three following years), the large majority of the accounting scandals are revealed. One possible explanation for this result, as indicated by Papadaki and Tsobas (2017), is that when a stock market crash occurs, the economy begins to deteriorate and the margins and profits of companies decrease. As a result, the deceptions can be detected more easily, given that the impact of the practices of accounting manipulation is more visible.

Another aspect that could be determined through the research carried out is the duration of the period (an average of 5.4 years) between the time a company begins to engage in accounting manipulation and the time when it is discovered and the scandal breaks. This is an aspect that has not been previously researched.

Finally, evidence has also been obtained regarding the start of the accounting deception and its relationship to the stock market crash. This is a topic that has not been previously studied, and it has been found that in the years in which the stock market crashes occur and in the years shortly before and after them, the great majority of accounting deception begins. As commented for the first result obtained (the relationship between the scandal and the stock market crash), when a stock market crash occurs, the economy begins to deteriorate, which has a negative effect on many companies, which may encourage them to engage in accounting deception (Fatima et al., 2020).

6. Conclusions

The aim of this work has been to investigate the relationships between economic crises, stock market crashes and accounting scandals. To accomplish this, the main accounting scandals of the last forty years were analyzed, along with the economic crises and stock market crashes that also occurred in this same period.

The evidence obtained allows us to reach the following conclusions in relation to the three research questions that have been posed:

- Question 1: Regarding the relationship between accounting scandals and stock market crashes, we have detected that in the years in which a stock market crash occurs (and in the three following years, whichis usually a crisis period), the large majority of the accounting scandals are revealed. In this sense, we have verified that each year an average of 1.3 scandals occurs. This average increases to 2.3 scandals per year in the periods with a stock market crash and the three following years; on the other hand, this average decreases to 0.8 scandals per year in the rest of the years. Therefore, when a stock market crash occurs and over the next three years, there is twice the probability of discovering an accounting deception that triggers an accounting scandal.

- Question 2: Regarding the duration of the period in which the companies engaged in accounting deception until they were discovered, we have found that an average of 5.4 years go by, with the longest case being 20 years and the shortest being 1 year.

- Question 3: With regard to the year the accounting deception begins, we have found that during the period starting two years before the crash and ending two years after it, i.e., in 5 years, most of the accounting deception begins. During these years, there is a 53% greater chance that a company will start to engage in accounting deception that will lead to an accounting scandal.

In short, we have found evidence of the relationship between accounting deception (and its discovery) and stock market crashes. These are relevant conclusions for the present day, since an important stock market crash has occurred as the result of the coronavirus. For this reason, if the pattern of recent decades repeats itself, it would be expected that more accounting scandals would be revealed following the stock market crash of 2020. For the moment, at the start of 2023, there is already evidence of different accounting and financial scandals in companies that have come to light in 2021 and 2022 (Celsius, FTX, Weber Shandwick, Henan Bank, Granite Construction, etc.). Auditing and consulting firms could bear this in mind in their control procedures and users of accounting information should take precautions.

This exploratory work has various limitations. First of all, only those scandals reported on English or Spanish-language websites have been analyzed. Therefore, the sample may be biased, giving more weight to companies in English and Spanish-speaking countries. Secondly, the sample consisted of a small number of companies (53), which are those that met the search criteria used.

Thirdly, another limitation to stress is the nature of the 2020 crisis, which is different from previous crises considered in this study, since its origin is the emergence of a new virus that was unknown to science and medicine, and not the bursting of a financial bubble, as in the previous crises. Therefore, given that the 2020 crisis had a different trigger, specifically, the pandemic caused by the emergence of COVID-19 (Carlsson-Szlezak, Reeves & Swarts 2020), it would be interesting to analyze the similarities or differences among the possible cases of accounting scandal that might appear over the short and medium term. Given the exploratory nature of the work, we intend to continue to analyze the cause-and-effect relationships among the different concurrent variables in the companies analyzed in order to obtain evidence that would make it possible to expand the knowledge of the factors that cause accounting deception, the deceptive practices used, the indications that allow them to be discovered and the economic and other types of consequences that they have. Another line of future research would be when a stock market crash occurs and the economy deteriorates, whether there is more interest in engaging in accounting deception and whether these cases are easier to detect.

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Appendix 1

Composition of the sample of companies that have been the subject of accounting scandals during the period 1980-2020

Country	Year the accounting deception was discovered	Period of years in which the company engaged in the accounting deception	Company	How the deception was detected	Audit	Auditing firm
United States	1987	1969-1987	Crazy Eddie	Company acquisition	Yes	Penn & Horowitz
United States	1989	1986-1989	Mini Scribe	Internal audit	Yes	Coopers Lybrand
United Kingdom	1990	1980-1990	Polly Peck	Regulatory authority	Yes	Stoy Hayward
United States	1998	1995-1996-1997	Cendant	Internal audit	Yes	EY
United States	1998	1992-1997	Waste Management	Change in management team	Yes	Arthur Andersen
Belgium	2000	1988	Lernout Hauspie	Mass media	Yes	Arthur Andersen
United States	2000	1998-2000	Microstrategy	Regulatory authority	Yes	PWC
United States	2001	1997-2000	Enron	Employee whistleblower	Yes	Arthur Andersen
Switzerland	2001	1995-2000	Swissair	Third-party whistleblower	Yes	PWC
United States	2002	2000-2002	Global Crossing	Employee whistleblower	Yes	Arthur Andersen
United States	2002	1998-2001	Halliburton	Employee whistleblower	Yes	KPMG
United States	2002	1999-2002	Merck	Mass media	Yes	Arthur Andersen
United States	2002	1999-2001	Tyco International	Regulatory authority	Yes	PWC

Country	Year the accounting deception was discovered	Period of years in which the company engaged in the accounting deception	Company	How the deception was detected	Audit	Auditing firm
United States	2002	2000	Wordcom	Internal audit	Yes	Arthur Andersen
United States	2002	1997-2001	Xeroc	Regulatory authority	Yes	KPMG
Canada	2003	2001-2003	Biovail	Accident	Yes	PWC
United States	2003	1997-2002	Freddie Mac	Regulatory authority	Yes	Arthur Andersen
United States	2003	1996-2002	Health South	Employee whistleblower	Yes	Independent auditor
Italy	2003	1989-2003	Parmalat	Change in management team	Yes	Grant Thornton (audited the instrumental companies) Deloitte & Touche
Holland	2003	1999-2002	Royal Ahold	External audit	Yes	Arthur Andersen
United States	2004	1998-2994	Fannie Mae	Regulatory authority	Yes	KPMG
United States	2005	2002-2005	AIG (American International Group)	Employee whistleblower	Yes	PWC
Japan	2005	1999-2003	Kanebo	Internal controls	Yes	Chuo Aoyama (subsidiary of PWC)
Spain	2007	2006	Astroc	Drop in share prices	Yes	Gassó MRI
Ireland	2008	2008	Anglo Irish Bank	Regulatory authority	Yes	EY
United States	2008	2008	Lehman Brothers	Company bankruptcy	Yes	EY
India	2009	2002-2009	Satyam	Third-party whistleblower	Yes	PWC
United States	2009	Since 2002	Taylor Bean Whitaker	Regulatory authority	Yes	PWC audited the Colonial Bank
United Kingdom	2011	2009-2011	Autonomy Corp.	Entered into losses	Yes	Deloitte
Spain	2011	2011	Bankia	Drop in share prices	Yes	Deloitte
Japan	2011	During 20 years	Olympus	Employee whistleblower	Yes	In the 1990s: the Japanese subsidiary of Arthur Andersen.
China	2013	2001-2013	Caterpillar and Siwei	Company acquisition	Yes	EY and Deloitte
Spain	2013	2012 ?	Pescanova	Company bankruptcy	Yes	BDO
United States	2013	2002-2012	Weattherford International	Regulatory authority	Yes	EY
Spain	2014	Since 2004	Gowex	Mass media	Yes	M&A Auditores
United States	2014	2009-2010-2011	Monsanto	Employee whistleblower	Yes	Deloitte
United Kingdom	2014	2011-2014	Tesco	Employee whistleblower	Yes	PWC
Spain	2015	2014-2016	Abengoa	Company bankruptcy	Yes	Deloitte
India	2015	2011-2015	Ricoh India	External audit	Yes	Sahni Natarajan & Bahl

Country	Year the accounting deception was discovered	Period of years in which the company engaged in the accounting deception	Company	How the deception was detected	Audit	Auditing firm
Japan	2015	2007-2014	Toshiba	Regulatory authority	Yes	EY
United Kingdom	2016	2014	BHS	Regulatory authority	Yes	PWC
Canada	2016	2015-2016	Valeant Pharmaceuticals (Bausch Health Companies, Inc.)	Mass media	Yes	Signalife
Spain	2017	2016	Banco Popular	External audit	Yes	KPMG
United States	2017	2016	Celadon Group	Internal audit	Yes	Independent auditor
United Kingdom	2018	2016	Constructora Carrillion	Company bankruptcy	Yes	KPMG
Spain	2018	2016-2017	DIA	External audit	Yes	KPMG
United Kingdom	2018	2014-2017	Pastisserie Valerie	Employee whistleblower	Yes	Grant Thornton
South Africa	2018	2009-2017	Stein Hoff International	External audit	Yes	Deloitte
China	2020	2019-2020	Luckin Coffee	External audit	Yes	EY
China	2020	2019	Tal Education China	Internal audit	Yes	EY
United Kingdom	2020	2013-2019	Ted Baker	Internal control	Yes	KPMG
United States	2020	2015-2020	Under Armour	Regulatory authority	Yes	PWC
Germany	2020	2014	Wirecard	Mass media	Yes	EY

Table A. Composition of the sample of companies that have been the subject of accounting scandals during the period 1980-2020