ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
MSc Economics & Business
Master Specialisation Financial Economics

Corporate creditworthiness proxies: credit ratings and CDS spreads

A research on the behaviour of the CDS market towards credit rating events

Author: M. del Pozo de Andrés
Student number: 503616
Supervisor: Dr. Jan Lemmen
Second reader: Antti Yang
Finish date: April 2020

ACKNOWLEDGEMENTS

I would like to thank my thesis supervisor Jan Lemmen for the help and comments on this paper; he has made the process of writing the thesis more pleasant.

Most of all, I am thankful for the continuous support of my family during my entire academic development and life.

I would also like to thank my friends, the ones that lived this process by my side and the ones that supported and believed in me in the distance. Special mention to those friends who have invested the time to read this paper to help me improving it. I am also grateful to have found people who made this master year both so enriching and fun, where my roommate, my neighbour and my sisters played a special role.

I hope this paper can somehow contribute to its readers and incentivize other students to further research on this topic.

ABSTRACT

This thesis is addressed to determine which indicator of corporate creditworthiness reflects faster a change of the credit risk: credit ratings or credit default swap spreads. To analyse this issue, this paper conducts an event study that includes rating publications from S&P and Moody's and CDS spreads of U.S. corporates during the years 2004-2018. The findings reveal that the CDS market can anticipate rating events, however, CDS spreads still respond to rating announcements. Moreover, results exhibit that the level of response is higher after announcements that worsen the issuer's rating, compared to those publications that improve its rating, and after rating events that place the issuer in the other side of the investment/speculative grade. Also, this paper observes lack of response towards rating announcements that have been preceded by a negative review, suggesting full spread incorporation of the information contained in these announcements. In addition, this thesis examines the different response of the CDS market to rating events before, during and after the Great Recession to conclude that rating announcements' impact on the CDS spread has diminished considerably in the post-crisis period. Furthermore, by applying a logistic regression methodology this research discovers that the CDS market can also predict most of the rating announcements types.

JEL Classification: G01, G14, G20

Keywords: Credit risk pricing, credit ratings, credit default swap, information asymmetry, event study

Table of Contents

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 Introduction

1.1 Introduction

Pricing credit risk has become an important subject of study, especially after several recognised companies such as Enron and WorldCom defaulted at the beginning of the 2000s, as many researchers and economics have stated like Scholes (2010). According to Fabozzi (2013), credit risk has been understood as the lender's risk caused by the possibility that the borrower defaults in the payment of its contractual obligations. However, this author related this definition to only the default component of credit risk, while credit risk itself comprised two additional definitions. The second component is credit spread risk, defined as the possible value change of an obligation due to a variation of the creditworthiness of the issuer. Credit downgrade risk is considered the third component and is associated with the risk of a credit rating agency increasing the level of credit risk of the issuer of the obligation. Furthermore, Fabozzi (2013) highlights the interconnection between these types of credit risks, since a change in the creditworthiness of an issuer gauged in the market will make the credit spread to widen and credit rating agencies to reassess its rating. Therefore, the access to capital for this company would be hampered, further increasing its probability of default.

Duffie (1999) suggested that the credit default swap (CDS) spread is closely related to a par coupon bond credit spread of the same maturity. As credit spread risk is therefore associated with CDS spread risk, this paper intends to study the relationship between two of the three credit risks mentioned above, those being the credit default spread risk and the credit downgrade risk. In this relationship, Hull, Predescu and White (2004) suggested a time lag between both credit risk components in what regards to the incorporation of a credit risk change. On the one hand, CDS spread's changes are continuously appreciated while credit rating changes happen occasionally. This may lead to the conclusion that rating changes are expected to lag CDS spread changes. On the other hand, ratings are claimed to convey private information which may make them lead the CDS market in the discovery of credit quality variations. Following the rationale of Hull et al. (2004), this study aims to answer the following question: *do credit rating announcements lead the CDS market in the incorporation of changes in the creditworthiness of a company?*

This study is partially motivated by the fact that not all investors and market participants have adequate resources to access information or to conduct their own credit analysis. Hence, the existence of information asymmetry in the market according to Fabozzi (2013). The inception and surge of the so-called credit rating agencies in the United States in the early 1900s helped diminish this information asymmetry problem in what related to the creditworthiness of entities and securities, as Adelson (2012) stated. The Committee on the Global Financial System (2005) highlighted the relevant role of the rating agencies in the market, which eventually became so powerful and influential. Among them, they mention their role in setting standards and regulations, which we saw materialized in, for example, the incorporation of Basel II that defined the minimal capital requirements. Moreover, the Committee notes that ratings provide material information to institutional investors in their investment decision process and other stakeholders as, for instance, ratings can set interest rates calculations.

However, all that glitters is not gold. These agencies have been held responsible by many for contributing to the financial crisis that hit the U.S. during the years 2007 to 2009, termed as the Great Recession, together with credit default swap products. It all started in a scenario where the housing bubble bursted and there was a large number of investments in mortgage-backed securities and sophisticated derivatives, Foster and Magdoff (2009). In this period, as Mishkin (2011) related, the Federal Reverse had to bail out some of the major enterprises such as Bear Stearns and American Insurance Group due to the lack of funds to cover their debt. However, some other firms like as the investment bank Lehman Brothers could not be bailed out and consequently fell into bankruptcy.

On the one hand, and as Mathis, McAndrews and Rochet (2009) mentioned in their paper, during this recession the most influential agencies failed to anticipate major defaults and to adjust the risk of complex financial products that were commonly traded during this period. Consequently, rating agencies damaged their reputation and their capacity to impact investors, as they seemed to have lost trust on rating agencies. Such was the market discontent that it led to legal actions being taken against some of these agencies. For instance, Viswanatha and Freifeld (2015) informed of Standards & Poor's (S&P) being sanctioned for a total of $1.37 billion in 2015 and Moody's being under investigation by the U.S. Justice Department. Moreover, and as mentioned above, credit rating agencies served to set standards of capital requirement regulations; however, these agencies and their processes seemed to be poorly regulated, as Scholes (2010) explained on this topic. It was not until the end of the financial crisis that the government felt the need to impose major control and more severe regulation over these agencies motivated by their misrepresentation of the credit risk. The main objective of the regulations was to protect investors, guarantee a higher quality rating system and try to restore investor's trust on these agencies.

On the other hand, CDS products were criticized for allowing investors to get involved in riskier products such as synthetic mortgage-backed securities as they could enter in CDS contracts to hedge for their credit risk (Fung, Wen, and Zhang, 2012). Authors like Subrahmanyam, Tang and Wang (2014) demonstrated the worsening of the credit quality of reference entities of CDSs after the inception of these derivatives. Despite of that, the CDS market grew tremendously. Augustin, Subrahmanyam, Tang, and Wang (2014) among others illustrated the rise of these credit derivatives. They relate that the number of CDS trading started to grow considerably since the 2000s and it reached a peak in 2007 where the outstanding CDS notional value amounted to $62.2 trillion. However, the CDS market busted after the bankruptcy of Lehman Brothers in 2008 and dropped rapidly to $26.3 trillion by 2010 and $25.5 trillion in 2012 as the aftermath of the financial crisis, according to the International Swaps and Derivatives

Association. One of the main reasons behind this market disruption is claimed to be the absence of CDS regulations and the lack of transparency and standardisation of their legal documentation, Stulz (2010). By that time for instance, there was no institution in charge of verifying that the seller of the protection had the funds to reimburse the buyer if the bond defaulted.

Therefore, having both contributed to the financial distress experienced in the U.S. during the years 2007 to 2009, this paper studies the market perception of the CDS spread and credit ratings as measures of credit risk. The study analyses three types of credit rating announcements: credit rating changes, credit reviews and stable ratings after reviews, and their relationship with CDS spreads to answer the main research question of whether credit rating announcements lag or lead the CDS market in credit risk incorporation. To answer this question, an event study is conducted with credit rating data obtained from Bloomberg and CDS data from Datastream for U.S. corporates with CDS trading in the period 2004-2018.

Results of this research reveal that, overall, the CDS market leads rating agencies' publications in the incorporation of changes in corporate creditworthiness. Notwithstanding this, rating announcements still impact investors as spread changes occur also on the announcement day. In general, anticipation and reaction are found for both positive and negative events, which contradicts prior literature on the topic. In line with literature are the findings of negative reviews generating the greatest impact on spreads. The information contained on those events is fully incorporated in the premiums as announcements after a negative review do not generate CDS price changes. Moreover, the reaction to these events is larger when the announcement indicates a greater change in the credit quality, this is crossborder rating changes. Overall, this paper also finds a more pronounced response to ratings before and during the crisis period. Moreover, not only anticipation and response of the CDS market to ratings events is found, but also spreads can predict most of these rating announcements.

This paper adds to the existing literature in three ways. Firstly, it introduces a new type of credit event since it is the first study that analyses the impact of announcements that maintained their rating after being placed on a review. Secondly, the study counts with a comparably larger sample data which could increase the representativeness of the results. Thirdly, the research brings more information regarding the different market behaviour before, during and after the financial crisis and gives a current picture of the market reaction to credit rating changes.

The paper is structured as follows. Chapter 2 will provide a theoretical background of the main concepts discussed used: credit risk, credit rating agencies and credit default swaps, for the better understanding of the research topic. Following this, Chapter 3 will review the body of knowledge on the subject and related topics to set up the context of this study. In Chapter 4, the hypotheses are formulated and explained. Chapter 5 is dedicated to explaining how the data was collected and the variables constructed, as well as a descriptive analysis of the final data sample. Methodology is further elaborated in Chapter 6, followed by the results of the study in Chapter 7. The paper will conclude its finding and expose its limitations in Chapter 8.

CHAPTER 2 Background information

This chapter provides a brief explanation of the factors of interest for this research. Thus, the chapter will devote a section to elaborate on credit risk, credit rating agencies and credit default swaps.

2.1 Credit risk

As stated above, credit risk is generally understood as the risk involving a borrower not complying with its contractual obligations. This situation is, however, difficult to measure and debates are still ongoing about which credit risk pricing approach is more appropriate. To do so, certain models have been developed, out of which there are two primary candidates: the structural models and reduced form models. Black and Scholes (1973) created a model to price options and Merton (1974) expanded it and its applications to value credit risky securities as well, becoming the Black-Scholes-Merton (BSM) model. This structural model uses information from the equity market and value of a firm such as its balance sheet to analyse the assets and liabilities. A default here is considered when the asset level is below liabilities, and credit risk is priced according to these levels. Differently, reduced models rely on information of the fixed income market to define the probability of default, Fabozzi (2013).

2.2 Credit rating agencies

Credit rating agencies are companies that provide informational services about credit ratings of financial instruments issued to obtain funds and entities that seek to borrow money such as corporates or sovereign governments. According S&P Global Ratings Definitions (2016), credit ratings are forward looking opinions about the creditworthiness of the issuer on an obligation measured by the capacity and willingness of corporates to meet its financial commitments when they are due. In other words, credit ratings indicate a relative idea of the quality of a debt issue and the probability that the issue will default. However, as reported by Hull et al. (2004). since it is unlikely that issues from the same company will have different ratings, generally credit ratings reflect the creditworthiness of the issuer.

In the rating process the agencies conduct both a qualitative and quantitative analysis of public and private information, as stated in the S&P General Description of the Credit Rating Process (2019). Their assessment of public information involves the study of annual financial statements, analyst reports, published articles, industry analysis, and peer and competitor comparisons among others, as reported by Gonzalez et al. (2004). Private information is obtained from the entity and, according to Ederington and Yawitz (1985), it can be in, for instance, in the form of minutes of the board meetings, profit breakdowns or new product plans. In this credit analysis, agencies claim to follow a through-the-cycle approach which focuses on one-year default probabilities and is not affected by credit cycles, topic studied by Löffler (2004).

These agencies launch to the market different types of publications, as explained on Moody's Rating symbols and S&P Global Ratings Definitions. In general, both agencies have equivalent announcement types, which can be classified in terms of time horizon and likelihood of the change. Outlooks are the conservative announcements and encompass prospective rating changes of a medium-term. These publications send signals to the market of the likely direction of a credit risk change over a two-year horizon. A second type of announcements are the reviews which are short-term oriented opinions, of approximately 90-day prospects, and indicate a stronger perception of the credit risk change. Reviews are presented into the market as "CreditWatch" by S&P and "Watchlist" by Moody's. Agencies send a message that a current rating of a corporate is being assessed due to a possible change of its credit risk, as a significant event has taken place but the impact on the creditworthiness is not yet certain. The third release are the actual rating changes that are reported when there have been relevant changes in the issuer's creditworthiness and the impact on the credit risk is imminent.

As mentioned before, the ultimate goal of these agencies when publishing the ratings is to provide information that is not publicly available to investors, market participants and stakeholders. For this reason, agencies are perceived as having a powerful role and impact on the market, as they help reduce the cost to access information, which ultimately leads to an expansion of the group of potential investors, De Haan and Amtenbrink (2011). In this regard, the Bank of International Settlements' Joint Forum of 2009 defined the five main purposes of credit ratings. First, they create rules and guidelines to determine the capital requirements of financial institutions such as the Basel II. Second, ratings identify and classify assets for investors to further consider its investment decision and asset concentrations criteria. Third, to provide an evaluation of the credit risk associated with assets purchased as part of a securitisation offering or a covered bond offering. Fourth, ratings determine disclosure requirements and, fifth, they function to determine the prospectus eligibility.

Agencies receive compensation for their services either from the issuer that requests the rating or from stakeholders that subscribe to receive the rating publications and reports. Credit rating agencies that follow an issuer-paid business model have been widely criticised due to a possible conflict of interest, Bolton, Freixas and Shapiro (2012). On the one hand, they have financial incentive to seek the favour of the issuers as they would receive a fee if the rating determined is accepted by the issuer and therefore published. On the other hand, they need to provide an independent credit analysis. However, the subscription model is neither free of criticism as it is believed to increase the information asymmetry for two reasons, as discussed Deb and Murphy (2009). Firstly, not all investors may have resources to subscribe and secondly, under this model, the rating agencies will not receive private information from the entity under evaluation.

It is to be noted that the global industry of the credit rating business is highly concentrated and dominated by three agencies, Standard & Poor's, Moody's and Fitch. According to the Annual Report on Nationally Recognized Statistical Rating Organizations issued in 2018 by the U.S. Securities and Exchange Commission, in 2017 S&P issued the 49.2% of the outstanding credit ratings, a percentage that is closely followed by the 33.1% of Moody's and leaves Fitch with the third position and an ownership of the 13.5% of the rating publications.

In a legal context and under the US jurisdiction, the International Organization of Securities Commission (ISCO) published a Code of Conduct Fundamentals for Credit Rating Agencies aimed to set guidelines that help the rating agencies reduce this information asymmetry of the market. In 2006, the Credit Rating Agency Reform Act of 2006 entered to regulate the quality and transparency of the internal processes and practices to protect investors. After the financial crisis, legislators opted for stiffer regulations that materialized in 2010 in the Dodd-Frank Wall Street Reform and the Consumer Protection Act. Among others, these rulings made credit rating agencies liable for their reported ratings, increased the control exerted over the internal processes and protected investors by demanding more transparency over the processes.

2.3 Credit default swap market

A credit default swap is a type of credit derivative created by JP Morgan in the early 1990s, Tett (2006). These financial products are traded over the counter with non-standardized contracts, although guidance on their legal and institutional details is provided by the ISDA, as explained by Augustin et al. (2014). CDSs serve to transfer the default risk of an underlying security in case a certain credit event occurs before the maturity day of the contract, Fabozzi (2013).

As Fabozzi (2013) outlines, two parties are involved in these contracts: the seller and the buyer of the protection. They both agree to engage in protection over a reference obligation of a reference entity, where the reference entity is the issuer of the obligation and the reference obligation is the security protected by the CDS contract. In other words, the CDS seller sells protection against a certain credit event happening to the CDS buyer and, in return, the protection buyer agrees to pay a premium or CDS spread. Fabozzi (2013) explains that this spread CDS can be seen as the fixed annual price of the protection bought and it is measured by the probability of default observed by the market. The spread is denoted in basis points of the notional amount of the reference obligation, which is also the maximum amount to be paid by the protection seller in case of a credit event.

As an example of how a CDS spread is calculated, consider the case where the protection buyer contracts $10 million worth of protection and the spread is agreed to be 100 bp (equivalent to 1%). Under this scenario, the protection buyer has to pay the protection seller 100,000 USD per year, calculated by multiplying the notional amount by the CDS premium. Usually, the total yearly premium payment is settled quarterly and determined using the day count convention of actual/360. This entails that the actual number of days within a quarter is used and 360 days are assumed for the year. If we consider the period to have 92 days, the quarterly payment will equal to 25.277,78 USD.

In case of cash flows, there are two possible scenarios subject to the credit event happening. If the credit event does not take place, the protection buyer has to pay the protection seller the swap premium until the maturity of the contract, Augustin et al. (2014) informs. However, if the credit event occurs, the protection buyer ceases to pay the premium and is reimbursed with the termination value. Augustin et al. (2014) explain that this reimbursement can be either a physical or a cash settlement. In the physical settlement, the CDS buyer delivers the reference obligation to the protection seller in exchange of the par value of such obligation. If the cash settlement is agreed upon, the CDS seller transfers the buyer the notional amount reduced by the post-default market value of the reference obligation.

The maturity, type of debt insured, and the definition of the credit event are relevant components of the CDS contract. By default, CDS contracts are of a duration of 5-years and the type of debt secured is senior debt, Hull et al. (2004). However, credit events are not uniquely defined, as they can comprise different types of scenarios. In an attempt to unify the definition of credit event, the 2003 and 2014 ISDA Credit Derivative Definitions listed the following credit events: bankruptcy, obligation acceleration, obligation default, downgrade, failure to pay, repudiation and moratorium, and restructuring of an obligation (with is further explained in Appendix A).

Fabozzi (2013) explains that the model used to set the price of the CDS is based on the default probability and recovery rate. The CDS spread therefore acts as an indicator of the default risk: the higher the CDS spread is, the higher the estimation of the default risk is. However, pricing models are highly complex to implement due to the difficulty of computing default probabilities and default correlations.

Market participants can enter in credit default swaps agreement with the purpose of speculating, hedging risk or as an arbitrage strategy, Augustin et al. (2014). Investors enter CDS contracts to speculate about the likelihood of the credit event happening or when they believe a certain CDS is mispriced. Additionally, CDS can be bought to be simultaneously sold at a higher price in another market, as an arbitrage strategy. Moreover, and most commonly in practice, investors contract CDSs to reduce the risk of depreciation and to achieve credit risk diversification.

There are two types of CDS, the single-name CDS and index CDS, depending on the number of reference entities or obligations involved, according to Fabozzi (2013). In a single-name CDS, there is only one reference obligation while in an index CDS there is a pool of reference entities.

2.4 Chapter summary and conclusions

Credit risk is the degree of the exposure towards a borrower not meeting its obligations. Both the CDS market and credit rating agencies consider credit risk as a factor of interest. On the one hand, the CDS market observes the credit risk of a corporate in order to determine the premium to be paid over the notional. On the other hand, credit rating agencies analyse credit risk to establish the rating of an issuer or issue. However, while CDS are credit derivatives designed, among other purposes, to hedge the credit risk exposure of obligation; ratings are opinions addressed to stakeholders such as investors to assist them in making superior investment decisions.

CHAPTER 3 Literature review

A large number of studies have been addressed to shed light on the question whether credit rating announcements convey significant information to the markets. The study on the information content of credit rating announcements initially focused on the reaction of the bond and stock market to these announcements. It was at the beginning of the 2000s, when the trend changed and an interest in the effects on the credit default swap market aroused. This chapter contains an overview of existing literature regarding credit risk pricing, credit ratings agencies, and the relation between credit ratings and the CDS, stock and bond markets and sovereign CDSs. A summary of the literature can be found in Table 1.

3.1 Credit risk pricing

Authors such as Blanco, Brennan and Marsh (2005) tested the theoretical relationship between CDS spreads and credit spreads and the subsequent possible arbitrage relation. Using a Vector Error Correction Model (VECM) they found a parity relationship for all their U.S. sample and most of their E.U. sample, suggesting that the bond and the CDS market price credit risk equally. They also conclude that CDS convey useful information towards credit risk price discovery.

Similarly, Zhu (2006) aimed to discover the accuracy of credit risk pricing in the derivative and cash market by comparing the price of credit risk in the bond and the CDS market. In this paper, a panel data regression is first conducted with credit risk factors, rating events, macro-financial conditions, terms of contracts and liquidity as variables of interest to test the relationship between the two spreads. The findings confirm the theoretical relationship in the long run equilibrium also observed in previous studies. Nevertheless, there is a deviation from the parity in the short run caused by the higher response of CDS spreads to changes in the credit quality of reference entities. The author also investigates which market is more efficient in incorporating changes of the credit risk through a VECM and concludes that overall, the derivatives market leads in anticipating rating events and in price discovery.

Forte and Peña (2009) performed similar research than Blanco et al. (2005) and Zhu (2004,2006), however they included in their analysis the stock market in the search of market efficiency understanding. Under the rationale that the bond, CDS and stock markets are different but they all contain a credit risk component in the pricing of their assets, the authors research through a VECM and compare the moment which each market incorporates credit risk information. They found that, generally, the stock market leads the CDS and bond markets in most of the cases, being the CDS market ahead of the bond market in price discovery.

Similarly, Longstaff, Mithal and Neis (2005) studied the part of the spread change caused by default risk, using the CDS spread as a measure of default in reduced-form model approach. They first conducted a case study about the corporate Enron to latter expanded their model to the entire sample. Their findings suggest that a major part of the company's spread change is explained by the probability of default, however, other factors such as liquidity also play a role. With a similar research question, the study of Ericsson, Jacobs and Oviedo (2009) aimed to provide more information regarding the theoretical determinants of default risk and their influence on the definition of the spread. They regressed firm leverage, volatility, and risk-free interest rate and found evidence in favour of such factors being determinants of default risk. Consistent with Longstaff et al. (2005), there is still a large part of the spread determination that remains unexplained.

Galil, Shapir, Amiran and Ben-Zion (2014) also investigated the determinants of the CDS spread and its changes following a structural model. In their study, the authors perform time series regressions where they control for firm-specific factors and include among the explanatory variables stock return, stock return volatility change, and median CDS spread change in the rating class. The results contradict those from previous studies as market variables appear to explain a major part of the CDS spread. Moreover, ratings seem to explain CDS spread changes.

Subrahmanyam, Tang and Wang (2014) researched the effects on a company's fundamentals to have a CDS trading on its credit risk. By running multivariate analyses, they noticed that firms are more likely to be downgraded and have greater probability to go bankrupt after the inception of the CDS. More specifically, the rating decreases half a scale in the two first years after the inception and the likelihood of default doubles just after the start of the CDS. In their study, they also consider if the effects vary depending on the CDS restructuring conditions and conclude that the risk of bankruptcy is higher when restructuring CDS contracts are agreed. The authors go further and inspect which company's fundamentals are impacted and discover that leverage increases significantly after there are CDS trading on the firm. Therefore, the authors suggest that even though CDS's purpose is to provide protection against the borrower defaulting, CDS can increase the probability of this credit event happening.

3.2 Credit rating agencies

A more recent event study of Bedendo, Cathcart and El-Jahel (2018) investigates the reputation of the rating agencies and if the subsequent stricter regulations on their business affected investors' reaction to rating announcements. They pay attention to three events that episodes raised concerns about the credit rating business models and their rating quality: Enron and Worldcom scandals in 2001 and 2002, the crisis of 2007 and 2008 and the lawsuit against S&P in 2013. The authors find that the stock market reacts strongly to downgrades after these episodes, as investors noticed that agencies tend to overstate the ratings assigned. Moreover, their results indicate that new regulations like Dodd Frank improve the rating system's quality and decrease investors' response.

3.3 Credit rating events and CDS market

Micu, Remolona and Wooldridge (2004) studied the effects of negative credit rating announcements on the CDS market during the years 2001-2003 using an event study. In their research, they control for preceding rating events in the previous 60 days, although they did not find proof of the CDS spread being influenced by the existence of preceding events. While they supported the capacity of the CDS market to anticipate credit rating changes, they also considered that these rating changes still carry valuable information to market participants. This was probed as negative credit rating announcements impacted CDS spreads, even if these events had been already anticipated by an earlier widening of the spread. In a similar regard, another event study executed by Micu, Remolona and Wooldridge (2006), focused on explaining which type of rating announcements contains CDS pricing information and found that all types of rating publications, regardless of being positive or negative, significantly impact the CDS market. After this, the authors reached the conclusion that investors value both stable and timely frequent releases of information. It is noteworthy to mention that the highest impact is detected after a negative review. The authors brought novelty to this field, as their research is the first finding that outlooks have a significant CDS price impact. Moreover, they show that announcements have the largest impact when it changes the outstanding rating from speculative to investment grade or vice versa.

Norden (2008) uses an event study methodology to evaluate the relation between rating announcements and CDS spread. The author finds that the CDS market anticipates downgrades and that such rating announcements barely impact the CDS spreads. However, there is less anticipation to reviews and CDS spreads significantly react to negative reviews. Furthermore, this paper finds that the CDS market response is intensified in the presence of prior public information, measured as firm's media coverage of the underlying CDS. Similarly, private information is also proved to affect the CDS market before the rating is released, as market anticipation is higher the greater the number of major bank lenders the traded firm has. Similar to Norden (2008), Galil and Soffer (2011) aimed to discover whether CDS market response to rating announcements is solely explained by rating releases or public and/or private information also plays a role. Different from other studies, they build their analysis using a contaminated sample with clustered events and compare it to an uncontaminated data in an event study, indicating that removing the clustered events underestimates the market response. Consistent with studies that use an uncontaminated sample, the authors found that all types of rating announcements impact the CDS market, however, there is higher market response to negative than to positive rating events. Overall, the authors suggest that rating announcements do convey new information, however, they loss impact if they are published after another source of information or rating action.

Finnerty, Miller and Chen (2013) also contributed to the literature on the relationship between CDS and rating announcements by employing an event study. The authors analysed data from 2001-2009 and utilised an extensive sample. The authors find results that contradicted prior literature in some ways. Firstly, by finding that the CDS market can anticipate both positive and negative rating events, even though the anticipation of positive events is lower than for negative events. This was explained by the fact that investors have more incentives in monitoring events that may depreciate the value of their investments. Secondly, this paper shows that reviews and outlooks present abnormal returns on the announcement date as well, which contradicts prior studies that concluded the CDS market full anticipation of rating announcements. Furthermore, the authors investigated and confirmed the capacity of CDS spread to determine the probability of a negative credit rating event happening.

Using an event study, Bedendo, Cathcart, El-Jahel and Evans (2013) researched whether the financial crisis influenced rating agencies' capacity to impact the CDS market. They noted that the spread reaction to rating changes has significantly decreased since mid-2007, especially the reaction to negative reviews and to downgrades exerted the greatest impact before the crisis. They attributed this lower influence to reputational damage of the rating agencies during the crisis.

When Wengner, Burghof and Schneider (2015) conducted an event study to understand the impact of S&P ratings on CDS spreads and the subsequent effect on competitors during the years 2004-2011. They found that there is a significant impact on the event day of both positive and negative credit rating changes, which proved that rating announcements contain new information and that positive events also affect the CDS market. However, they noted that the impact on the market has increased since the beginning of the financial crisis.

3.4 Credit rating events and other markets

In a comparative event study, Norden and Webber (2004) investigate the potential existence of a market opportunity in investing in either the stock or the CDS market by analysing both markets' response to credit rating changes announcements. However, their findings showed evidence to prove that both stock and CDS markets are able to anticipate negative announcements, and therefore, there is no market opportunity. By employing regression analysis, the authors showed that reviews for downgrades provoked a much more substantial effect than actual downgrades across all agencies in the stock market. However, the effects of both rating events were more similar in the CDS market. Common in both markets was the CDS anticipation of reviews for downgrades.

Hull, Predescu and White (2004) conducted a similar study, however instead analysed bonds and CDS market reaction to credit rating changes. The authors examined both the theoretical relationship between CDS spread and bond yields, which they found proof in favour, and the relationship between CDS spread and credit rating changes for the period 1998-2002 with an event study approach. All negative rating events are anticipated in the CDS market; however, and similar to Micu et al. (2004), negative reviews still contain significant information on the event day. In parallel to studies of this time, when testing the impact of positive credit events, no significance was found. Moreover, in line with what Finnerty et al. (2013) revealed, they showed evidence of the CDS's spread capacity to provide information to estimate the probability of negative credit rating changes.

Moreover, Daniels and Jensen (2005) studied the relation between CDS spread and bond spread and their reaction to credit rating changes. Their results are consistent with those of Hull et al. (2004) as they also confirmed the relation between CDS spread and bond spread. Regarding the market reaction to credit announcements, they showed that both markets have the capacity to anticipate changes in credit ratings, detecting in the CDS market the earliest and strongest reaction. Furthermore, the authors noticed significant market reaction towards positive events, albeit negative events remained causing the greatest impact. Additionally, the authors revealed that the CDS market response is intensified if the rating changes are of low rated securities.

3.5 Other studies

To finish with, Ismailescu and Kazemi (2010) applied an event study methodology to analyse the effects of sovereign rating announcements on the CDS and its spillover effects on other emerging economies' CDS premium. Their findings showed that the CDS market can anticipate negative events while positive events have a greater impact the closer to the event day and they reveal the presence of a spillover effects. As Hull et al. (2004), they also investigated whether CDS spreads can estimate the probability of a rating event happening, which they confirmed.

3.6 Chapter summary and conclusions

Regarding credit risk, the literature agrees on the theoretical relationship between the credit spread and the credit default swap spread, which suggests that the bond and the CDS market price credit risk equally. Moreover, the above mentioned authors conclude that CDS market leads the bond market in anticipating rating events and price discovery. When testing for determinants of the CDS spread, the majority of researchers pointed the probability of default to be the main factor, although factors like liquidity, volatility or leverage also play a role together with some still unexplained determinants.

Among the literature, there is the collective notion that the CDS market can anticipate credit rating changes. This anticipation is, overall, more pronounced concerning negative events than positive events; nevertheless, there are studies that lead to different conclusions in this regard. However, there is still a material market reaction on the announcement day of rating changes, specially to negative reviews, implying that negative reviews still convey information to the market participants. In addition, there is the belief that the spread reaction to a rating change has significantly decreased since the crisis.

It is noteworthy to mention that we have evidence of the effects on CDS spread of upgrades, downgrades, reviews and outlooks, however research is yet to address the CDS spread reaction to neutral reviews and to announcements of stable ratings after they were placed under review. Consequently, this paper includes these types of announcements as events of interest to determine if the CDS market disregards the information contained in neutral reviews and in reviews that are not materialised. Furthermore, the majority of the samples analysed of the literature cited in this chapter have a limited number of observations, as a consequence of the deletion of overlapping events, which may affect the representativeness of the results. The sample employed in this research is comparably larger.

Table 1. Summary of the body of knowledge.

Study	Authors	Data and methodology	Findings
CDS and rating agencies	Micu, Remolona and Wooldridge (2004)	- US; 2001-2003 - S&P and Moody's: Rating changes, reviews and outlook. - Senior debt 5-year maturity CDS - 694 entities - Events study; [-60,20]	- CDS anticipation and reaction to downgrades and negative reviews, even if preceded by another announcement.
Rating agencies, Stock and CDS	Norden and Webber (2004)	- US, Europe and Asia; 2000-2002 - S&P, Moody's and Fitch: Rating changes and reviews - Senior debt 5-year maturity CDS - 1,000 entities - Event study [-90,90] and regression analysis	- Both markets anticipate and react downgrades and negative reviews, while no spread change after the rating announcement. - No CDS market reaction to positive events. - CDS market can anticipate negative review before the stock market. - S&P and Moody's have a higher impact.
Bonds, CDS and rating agencies	Hull, Predescu and White (2004)	- US, Europe, Asia and Australia; 1998-2002 - Moody's: Rating changes, reviews and outlooks - Senior debt 5-year maturity CDS - 1,599 entities - Equation demonstration and event study ; [-90,10]	- CDS spread are comparable to bond yield spreads. - CDS market anticipates negative rating announcements. - Negative reviews still convey material information on the event day. - Almost no significance of positive rating changes. - CDS spreads can predict negative ratings.
Bonds, and CDS and credit risk	Daniels and Jensen (2005)	- 2000-2002 - Changes, reviews and outlooks. - Equation demonstration and event study	- Both markets can anticipate rating changes. - The CDS market reacts faster and stronger. - No impact of positive events. - Dimension of change affects the spread change. - CDS pricing is derived from rating, short rate, slope and industry and time dummies.

Table 1. Summary of the body of knowledge. ***(Continued)***

Study	Authors	Data and methodology	Findings
CDS spread and bond spreads	Blanco, Brennan and Marsh (2005)	- US and Europe; 2001-2002 - Senior debt 5-year maturity CDS and 5-year bond yields - 33 entities - Equation demonstration	- Bond and CDS market price credit risk equally. - The CDS market leads the bond market in price discovery.
CDS spread and bond spreads	Longstaff, Mithal, and Neis (2005)	- 2001-2002 - 68 entities - Regresión reduced-form model.	- Spread is mainly explained by the probability of default. - Other factors such as liquidity also play a role.
CDS and rating agencies	Micu, Remolona and Wooldridge (2006)	- 2001-2005 - S&P, Moody's and Fitch: rating changes, reviews and outlooks. - 800 entities - 6,000 credit events - Event study; [-60,20]	- All types of rating announcements have a significant impact on CDS spreads. - Investors value both stable and frequent releases of information. - Rating changes have the largest impact when they move from speculative to investment grade or vice versa.
CDS spread and bond spreads	Zhu (2006)	- International sample; 1999-2002 - 1,400 reference - The panel data study and VECM analysis	- Parity relationship in the long run, while deviations in the short run. - CDS market lead in price discovery.
CDS and rating agencies	Norden (2008)	- US and Europe; 2000-2005 - S&P, Moody's and Fitch: rating changes and reviews - Event study - 95 entities	- CDS significantly reacts to downgrades but more to negative reviews. - Downgrades are more anticipated than negative reviews. - Public and private information impact the strength of announcement and anticipation effects.
Stocks, CDS and bonds	Forte and Peña (2009)	- US and Europe - 2001-2003 - 17 entities, 250 observations	- Stock market leads the CDS and bond market, but CDS leads the bond market.
CDS spread determinants	Ericsson, Jacobs, and Oviedo (2009)	- 1999–2002 - Structural form models - Univariate and multivariate time-series regressions	- Firm leverage, volatility, and risk-free interest rate are determinants of default risk. - Large part of the spread determination remains unexplained
Sovereign CDS and credit risk	Ismailescu and Kazemi (2010)	- 2001-2008 - S&P: rating changes and review - 161 credit events - 22 entities - Event study; [-90,1]	- Positive announcements convey information on announcement day while negative publications don't. - Capacity of CDS to estimate probability of a negative event happening, but not positive. - There are spillover effects, especially around positive events.
CDS and rating agencies	Galil and Soffer (2011)	- 2002-2006 - S&P and Moody's and: rating changes and reviews - 2152 entities - 2866 credit events - Event study; [-90,90]	- Higher market response to negative than to positive events. - Underestimation of market response when using an uncontaminated sample.

Table 1. Summary of the body of knowledge. ***(Continued)***

Study	Authors	Data and methodology	Findings
CDS and rating agencies	Finnerty, Miller and Chen (2013)	- International; 2001-2009 - S&P: rating changes, reviews and outlooks - Senior debt 5-year maturity CDS - Event study; [-90,30]	- The CDS market anticipates both negative and positive changes in ratings. - Better anticipation and reaction towards negative changes than towards positive. - Reviews and outlooks impact on announcement date. - CDS spreads influence the probability of a negative rating event happening.
CDS and rating agencies	Bedendo, Cathcart, El-Jahel and Evans (2013)	- US; 2004-2009 - Moody's: rating changes, reviews and outlooks - 542 credit events - 205 entities - Senior debt 5-year maturity CDS - Event study; [-40,15]	- Impact of rating announcements was much larger before the crisis. - Reviews have the largest impact on CDS spread before and after the crisis.
CDS spread determinants	Galil, Shapir, Amiram and Ben-Zion (2013)	- US - 2002-2013 - 718 entities	- Market variables explain part of the spread determination. - Firm-specific variables explain a material part of the CDS spread changes.
CDS and downgrades and bankruptcy	Subrahmanyam, Tang, and Wang, (2014).	- US - 1997-2009 - S&P - Event, logistic and regression studies	- Probability of downgrades and bankruptcy increases after the inception of CDS. - No restructuring CDS contracts increases probability of default . - Company fundamentals are impacted by having CDS trading.
CDS and rating agencies	Wengner, Burghof and Schneider (2015)	- International; 2004-2011 - S&P: rating changes - Senior debt 5-year maturity CDS - 168 entities - 635 rating events - Event study; [-30,1]	- Asymmetric reaction to negative and position events. - Different reactions across industries. - Existence of spillover effects on competitors, stronger reaction since the beginning of the crisis.
Stock and rating agencies	Bedendo, Cathcart, El-Jahel (2018)	- US - S&P, Moody's and Fitch: rating changes - Event study	- Stronger response of stock investors to downgrades after 3 market events. - Investors believe agencies overstates ratings. - New regulation has improved the rating quality and decrease investors response to rating announcements.

Source: Prepared by the author based on the exiting literature.

CHAPTER 4 Hypotheses Formulation

Considering the findings of the studies elaborated in the previous chapter, this chapter will formulate and explain four sets of hypotheses regarding the CDS market and the credit rating agencies.

4.1 Content information of rating announcements

The first set of hypotheses deals with the effects of changes in the credit quality of corporations, measured by credit ratings announcements, on the spread of the CDSs that trade over their debt instruments of such corporates. This aspect has been addressed by a large number of studies, being some of the ground breaking research the ones conducted by Norden et al. (2004), Hull et al. (2004) and Micu et al. (2004). Overall, these studies conclude that the CDS market can anticipate the change of the creditworthiness of an entity announced in a credit rating publication. At the same time, the results of the papers also confirm CDS market reaction to these publications. Furthermore, they also show that the effects of such publications on the spreads are higher when the announcement is a negative review. However, Hull et al. (2004) and Micu et al. (2004) add to the foregoing that negative reviews may still contain significant information on the event day as abnormal returns are observed on the publication day. Nevertheless, these papers date back to the years prior to the crisis where rating agencies exerted more influence on the markets, and they were less regulated. At the same time, the CDS market was growing and becoming more complex. Also, both the CDS market and the credit rating agencies' reputation suffered in the aftermath of the crisis as the market participants believed in their contribution to the financial recession. These are therefore reasons why it is interesting to conduct a more updated research on this topic. In addition, some recent research such as the ones from Finnerty, Miller and Chen (2013) and Wengner, Burghof and Schneider (2015) contradicted this prior literature by showing that the CDS market can also anticipate positive rating events. Moreover, these studies also cast doubt about whether the CDS market fully anticipates rating announcements as reviews and if outlooks still present significant abnormal returns on the announcement date.

Given the previous, the following hypotheses are defined, and the null and alternative hypotheses formulated:

Hypothesis 1: the CDS market reacts to rating changes.

$H_{0,1}$ *Downgrades (upgrades) announcements lead to positive (negative) CDS spread changes.*

$H_{a,1}$ *Downgrades (upgrades) announcements are anticipated by negative (positive) CDS spread changes.*

Hypothesis 2: the CDS market reacts to rating reviews.

$H_{0,2}$ *Negative reviews (positive reviews) announcements lead to positive (negative) CDS spread changes.*

$H_{a,2}$ *Negative reviews (positive reviews) announcements are anticipated by negative (positive) CDS spread changes.*

Hypothesis 3: the CDS market reacts to stable ratings after reviews.

$H_{0,3}$ *Stable ratings announcements after positive reviews (after negative reviews) lead to positive (negative) CDS spread changes.*

$H_{a,3}$ *Stable ratings announcements after positive reviews (after negative reviews) are anticipated by positive (negative) CDS spread changes.*

As credit rating agencies claim to count with confidential private information about the creditworthiness of an issuer that is not available to the general investors, they bring to the market brand new indications about the level of credit risk of an issue. Following that reasoning, credit rating announcements would suggest a change in the credit quality of an issuer and therefore a change in its probability of default. Consequently, this research expects negative ratings announcement to result in a widening of the CDS spread which will provoke positive abnormal change of these premiums. Whereas in the cases of positive announcements, which are associated with a lower default probability, this paper presumes that the CDS spreads will narrow and negative abnormal spread changes will be observed. It is noteworthy to mention that this paper will be the first one to conduct an analysis of the impact on the CDS market of stable ratings after they were placed on review. Reviews announce to the market a potential change on the rating of an issuer and its direction, unless the review is neutral. If the CDS market trusted the information contained on rating releases, we expect the CDS market to react after such announcements. Moreover, if an issuer with negative reviews outstanding is not finally being downgraded, this sends a relatively positive sign to the market, while stable ratings after a positive review might be seen as a relatively negative credit event. Spread reaction to this stable rating is expected to happen on the announcement day. In what regards neutral reviews and stable rating after a neutral review, this study will assume a widening of the spread as effects of the publication of such events on the basis of informational biases toward negative news. This information bias explanation is supported by authors like Dichev and Piotroski (2001) who believe that investors have more incentives to monitor only negative outcome events, and therefore investors are biased towards negative information. However, as is not common to find among the literature studies that address the effects of neutral events, this study will incorporate such events on the spotlight to monitor the CDS market reaction.

4.2 Price sensitivity of the CDS market to credit events

Credit rating announcements not only inform the market about the direction of a change in the rating, if the change is associated with an increase or a decrease of the credit risk of the entity. Furthermore, they also provide information regarding the magnitude of the change: how much the credit rating has improved or worsened based on the number of credit rating scale tranches that the issuer has placed up or down. Having tested whether there is CDS market reaction to credit rating announcements, this research aims to focus now on the magnitude of such reaction.

4.2.1 Positive and negative events

This part of the research will test whether the market response to positive events is symmetrical to the reaction towards negative events out of the same magnitude. Therefore, this test is a comparison of opposite direction event types where downgrades, negative reviews and stable ratings after positive reviews are considered negative events and upgrades, positive reviews and stable ratings negative reviews are positive events. Moreover, in order to be comparable, the magnitude of the change announced has to be the same, thus the rating should have scale up or down by the same number of tranches in the credit rating scale. The study of Norden and Weber (2004) expected an asymmetric market reaction to credit rating changes as they assumed that, contrary to downgrades, upgrades will not generate abnormal returns around the event date. This issue was also covered by plenty of other studies such as Wengner et al. (2015) and Galil et al. (2013), whose results also showed an asymmetric market reaction around upgrades and downgrades. Galil et al. (2013) believed the asymmetry was justified by the tendency of the negative rating events to cluster over a certain period of time. Differently, Vassalou and Xing (2003) explained that negative rating announcements have higher impact in markets as they are believed to serve as a disciplinary action against the management of the company. There are more alternative explanations of this asymmetry like information bias supported by Dichev and Piotroski (2001) mentioned before.

Hypothesis 4: There is an asymmetric CDS spread reaction to positive and to negative announcements.

$H_{0,4}$ *The CDS spread change reaction to credit negative rating announcements is equal to the CDS spread change reaction to positive announcements.*

$H_{a,4}$ *The CDS spread change reaction to credit negative rating announcements is larger than the CDS spread change reaction to positive announcements.*

In this regard, this study expects to confirm previous papers' results where negative events ended up in strong premium changes, while positive events will turn a lower impact on the CDS. Therefore, there are expectations that positive events will cause a lower decline in absolute terms in the CDS spread than the increase of the premium after a negative announcement.

4.2.2 Crossover in the investment/speculative grade category

The second hypothesis regarding the magnitude of a credit rating change considers the grade of the credit risk: investment or speculative. This study works with the belief that the level of the CDS market reaction will depend on the magnitude of the rating change. Consequently, this implies that a higher CDS market reaction is expected after a downgrade of two credit risk categories than after a downgrade of one risk category, for instance. However, there can be cases where two rating changes are of the same magnitude and yield very different levels of abnormal spread changes. These could be the cases of rising stars or fallen angels, defined by Marshall (2001). While rising stars are considered the issuers with an initial credit rating on the speculative grade that are upgraded to investment grade category, fallen angels are entities that were initially investment grade issuers and are now downgraded to speculative grade. Being placed on the investment grade or the speculative grade can yield very different implications, for example, investors may have selection criteria for only including in their portfolio assets graded as investment grade securities. Research such Finnerty et al. (2013) have also investigated these particular cases, concluding that there is a stronger CDS market reaction toward these crossborder events than to a same magnitude credit change within the same category. Between both types, these authors find that rising stars generate higher abnormal spread changes than fallen angels which they explained by the fact that upgrades come as a greater surprise to the market since it focuses on monitoring for downgrades.

In context, this paper will investigate whether a more pronounced market reaction to credit rating changes can be observed if such credit rating changes place the issuers in the other investment grade category. The hypotheses are defined as follows:

Hypothesis 5: The CDS market reaction is higher to fallen angels and rising stars than to downgrades and upgrades, respectively.

$H_{0,5}$ *The CDS spread change to downgrade (upgrade) announcements is equal to the CDS spread change reaction to fallen angel (rising stars) announcements.*

$H_{a,5}$ *The CDS spread reaction to downgrade (upgrade) announcements is lower than the CDS spread change reaction to fallen angel (rising stars) announcements.*

Hypothesis 6: There is an asymmetric CDS spread reaction to fallen angels and to rising stars announcements.

$H_{0,6}$ *The CDS spread change reaction to fallen angel announcements is equal to the reaction to rising stars announcements.*

$H_{a,6}$ *The CDS spread change reaction to fallen angel announcements is larger than the reaction to rising stars announcements.*

At this section, this research anticipates higher levels of abnormal CDS spread change towards fallen angels than to downgrades and towards rising stars than to upgrades. Furthermore, larger levels of CDS spread change are expected to happen after the rating announcement moves the issuer from an investment grade category to a speculative grade than vice versa.

4.2.3 Preceding events

As mentioned above, rating agencies publish credit reviews to inform the market of a potential change of the credit rating and its direction. It is therefore expected that the agency, within approximately 90 days, will make another announcement that will confirm the credit rating change or will maintain the rating outstanding before the review. Micu, Remolona and Wooldridge (2004) investigated the effects on the CDS market caused by a rating announcement that have been preceded by another announcement in the previous 60 days. The authors stated that the CDS spread change is not influenced by the existence of preceding events; however, they believed that events clustering may exacerbate the price information. This part of the paper is addressed to discover if the information contained first announcement is fully incorporated on the spread or subsequent rating releases are considered. The hypothesis definition results in the following:

Hypothesis 7: There is asymmetric CDS spread reaction to rating announcements that have not been preceded by reviews than to rating announcements that have been preceded by reviews.

$H_{0,7}$ *The CDS spread reaction to rating announcements that have not been preceded by a review is equal to the CDS spread reaction to rating announcements that have been preceded by credit reviews.*

$H_{a,7}$ *The CDS spread reaction to rating announcements that have not been preceded by a review is larger than the CDS spread reaction to rating announcements that have been preceded by credit reviews.*

This paper expects the market reaction to announcements preceded by a review to be weaker than to announcements that have not been anticipated by a review, since markets are awaiting an update on the review status of the issuer's rating.

4.3 The role of credit ratings before, during and after the crisis

As previously discussed, the crisis of the years 2007-2009 hindered investors' trust in credit rating agencies due to a series of underestimations of the credit risk of the issuers rated. Hence, this paper is interested in investigating whether investors cease to follow credit rating publications after the crisis regardless of the higher regulations or if ratings still convey material information that is not accessible to the public. If investors do not base their investment decision on credit rating released anymore, the CDS market reaction to rating announcement after the crisis is presumed to be weaker than the period before the Great Recession or during. Some papers have already incorporated the effects of the crisis on their studies. For instance, Bedendo, Cathcart, El-Jahel and Evans (2013, 2018) found a significant decrease in the CDS spread response to a rating change since the beginning of the crisis in mid- 2007. These authors attribute this decline in the impact of credit rating changes to the reputational damage experienced by the rating agencies. Consequently, the hypothesis of this research is defined:

Hypothesis 8: The perception of rating announcements was harmed after the crisis.

$H_{0,8}$ *Credit rating announcements lead to lower CDS spread changes after the crisis.*

$H_{a,8}$ *Credit rating announcements did not lead to lower CDS spread changes after the crisis.*

In this part of the study, a weaker CDS market reaction to credit events after the crisis period is expected, as a consequence of investor's loss of trust in these rating agencies.

4.4 CDS influence in forecasting rating events

Credit rating agencies consider many different factors to determine the rating imparted to an entity, such as country and industry risk or competitive position, according to S&P Guide to Credit Rating Essentials (2014). This paper includes a study to investigate whether among these factors the spread of a CDS trading on the obligations of such corporate could influence the rating category entitled to that corporate. A spread change could therefore be an indicator of the probability of a credit event happening. Hull et al. (2004), Ismailescu and Kazemi (2010) and Finnerty et al. (2013) also performed this study on their papers to demonstrate the capacity of the CDS to estimate the probability of negative rating events occurring. This paper intends to bring additional information on this field and defines the following hypothesis:

Hypothesis 9: CDS spread changes can predict rating announcements.

$H_{0,9}$ *CDS spreads can estimate the probability of a credit event taking place.*

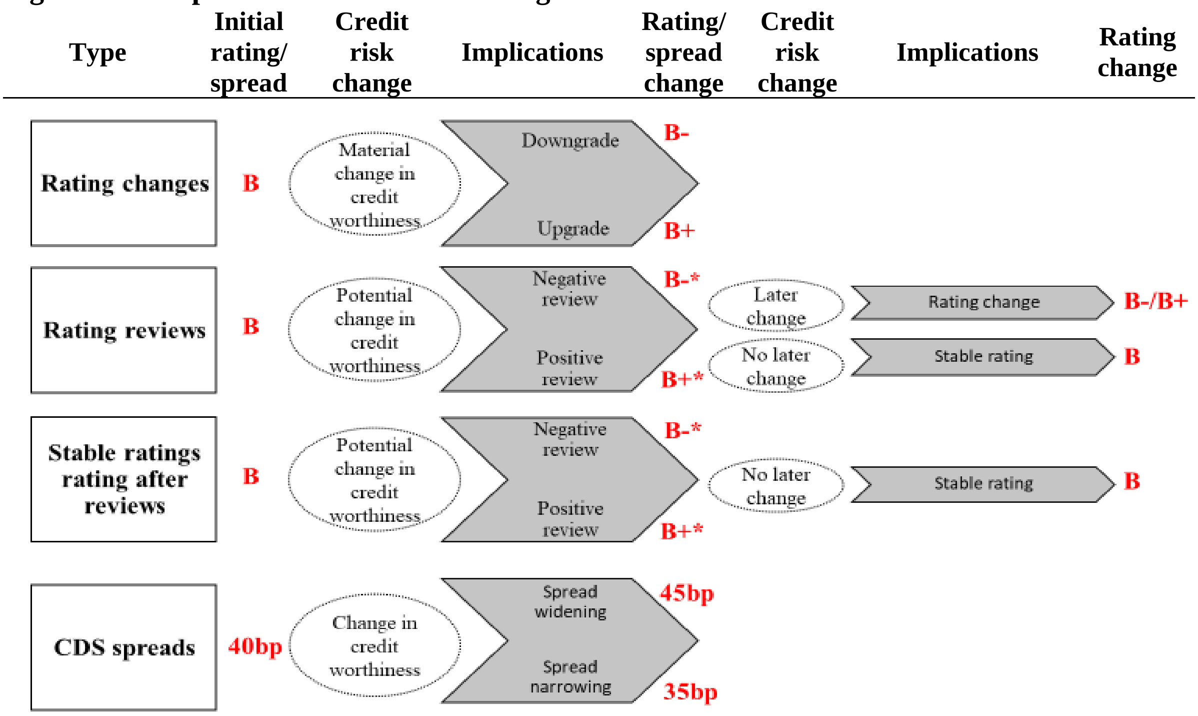
$H_{a,9}$ *CDS spreads can not estimate the probability of a credit event taking place.*

This paper expects to find that CDS spreads can be used to predict rating announcements, especially if the CDS market anticipation to rating announcements is evidenced in the previous parts of this research.

4.5 Chapter summary and conclusions

An explanation of the incorporation of credit risk changes in the rating assessment process and in the CDS spreads can be found in Figure 1.

Figure 1. Incorporation of credit risk changes.



Source: Prepared by the author based on the hypothesis's rationale.

CHAPTER 5 Data and descriptive statistics

This chapter is dedicated to explaining the data collection process as well as how the variables were constructed. Furthermore, this chapter will provide an overview of the merging of both datasets and a descriptive analysis of the survival sample.

5.1 The data sets

To conduct this study, two types of data were used: data on credit rating announcements and CDS spreads. The data obtained regards to the US market and corresponds to the period between January 2004 and December 2018 so as to reflect the pre-crisis, crisis and post crisis periods.

5.1.1 Credit rating data

A collection of the long-term issuer credit rating publications of the two major rating agencies S&P and Moody's for United States' corporates between the years 2004 and 2018 was obtained from Bloomberg. The study narrows the data set to these two agencies as they are in charge of the evaluation of the majority of the US rating market and for comparability purposes with results of existing literature on the topic.

From the types of ratings that Bloomberg terminal provides, Issuer Rating and Long Term Foreign Currency Issuer Credit are included from to Moody's and S&P respectively. This selection criteria was based on Norden and Weber (2004) scale of creditworthiness for the rating types of both agencies. An example of the credit rating data information provided by Bloomberg can be seen in Figure 2. In this case, PepsiCo Inc experienced on the 26th of April 2017 a credit rating upgrade on its S&P rating and Microsoft Corp received a negative review by Moody's on the 13th of June 2016. From the data available, this paper did not consider outlooks since a few number of observations could be obtained.

Figure 2. Bloomberg credit rating announcement examples.

	Company Name	Date↑	Rating Type	Agency	Curr Rtg	Last Rtg	Ctry	Industry Type
	pepsi	MM/DD/YYYY						
101)	PepsiCo Inc	04/26/2017	LT Foreign Issuer …	S&P	A+	A	US	Food and Bever…

	Company Name	Date↑	Rating Type	Agency	Curr Rtg	Last Rtg	Ctry	Industry Type
	microsoft	MM/DD/YYYY						
101)	Microsoft Corp	06/13/2016	Issuer Rating	Moody's	Aaa *-	Aaa	US	Technology

Source: Bloomberg terminal data.

After downloading the data of interest, variables were constructed to account for the type of credit event following the previous reasoning. First, in order to be able to identify an equivalency between the different scale systems of the agencies, a numeric system was constructed. The results for the mapping of these agencies on a 21-grade scale are shown in Table 2.

Table 2. Rating systems explanation and numerical scale equivalence.

S&P	Moody's	Level of credit risk	Numerical scale	Grade
AAA	Aaa	Minimal	1	
AA+	Aa1	Very low	2	
AA	Aa2	Very low	3	
AA-	Aa3	Very low	4	
A+	A1	Low	5	
A	A2	Low	6	Investment grade
A-	A3	Low	7	
BBB+	Baa1	Moderate	8	
BBB	Baa2	Moderate	9	
BBB-	Baa3	Moderate	10	
BB+	Ba1	Substantial	11	
BB	Ba2	Substantial	12	
BB-	Ba3	Substantial	13	
B+	B1	High	14	
B	B2	High	15	
B-	B3	High	16	
CCC+	Caa1	Very high	17	Speculative grade
CCC	Caa2	Very high	18	
CC-	Caa3	Very high	19	
CC	Ca	Near default	20	
C		Near default	20	
SD	C	In default	21	
D		In default	21	

Source: Prepared by the author based on data provided by S&P and Moody's.

Subsequently, the data was set up to construct the variables that will indicate the type of announcement and its direction.

Three types of rating announcements were created and are defined in Appendix B. The first rating announcement type is denominated as credit rating change and occurs when there has been an actual change on the credit rating of the issuer, and it is now classified in a lower or higher notch of the numeric scale. Credit rating changes can be downgrades, if the rating agency places the issuer in a lower scale on the rating system, or upgrades, if the issuer now has been related with less credit risk. The second type of rating event is the review, and it takes place when the agency has placed an issuer under evaluation to decide whether there will be a credit rating change in the near future. Reviews can be positive, negative or neutral when the expected direction of the credit rating change is upgrade, downgrade or not defined yet, respectively. Last, this paper considers stable ratings after reviews as the situation where the last rating announcement placed the issuer in a review scenario and the current publication states whether the potential change has materialized. These types of events can be stable ratings after positive, negative, or neutral reviews. Issuers having a rating denoted by Bloomberg as withdraw rating ("WR") or no rating ("NR").

After having determined the type of rating announcement of each observation, a variable was created to indicate the direction of the announcement, whether is positive, negative or neutral, if applicable.

Lastly, a variable that expresses the magnitude of the change in terms of the number of notches shifted in the numeric scale as a consequence of a rating change.

When observing the data, it was noticeable that the rating publications tended to cluster, certain companies have multiple credit rating events announcements over a certain period. This could be explained by the fact that credit changes are preceded by reviews in many of the cases. In order to avoid contamination and control for clustering of events, in case a company has experienced rating events that overlaps in a 90 days period, only the first event is included from the sample. Additionally, for the cases where both agencies have released an announcement for the same company on the same day and the announcement is of the same nature, the event will be considered once. It is to be noted that this study does not control for cross-agency contamination.

5.1.2 CDS spread data

With regards to CDS information, due to timely availability of information, daily CDS spreads are obtained from two sources within Datastream: CMA Datavision for the period from 2004 to 2007 and Thomson Reuters DataStream for the observations of 2008-2018. Only daily quotes corresponding to trading days were considered for study.

To gather this data, a portfolio in Bloomberg was created to obtain the ISIN of the US companies that experienced a credit announcement over the years studied. However, ISIN data could not be obtained from all the companies of interest and therefore, their corresponding credit rating observations were dismissed.

With the ISINs, Thomson Reuters tickers could be identified and further used to construct the CDS codes, consisting of the company's ticker, the maturity, the currency and an indicator or the type of restructuring that constitutes a credit event. For this study, CDS codes for 5-year corporate credit default swaps spreads quoted in bp over a USD notional with no restructuring credit event considered were formulated. CDS contracts with 5-year maturity were preferred as they are the benchmark maturity in the CDS market and are the most liquid contracts, according to the body of knowledge. Moreover, CMAs Datavision codes could be converted into the Thomson Reuters equivalent codes using the guidelines provided by DataStream. The restructuring term considered for the dataset was AX, which indicates that no restructuring event is considered, following Thomson Reuters statement that restructuring term choice should be based on a regional preference and AX is preferred for the US market (Appendix A). This preference can also be explained by the fact that a routine modification of obligations or soft changes would cause a credit event situation leading to an opportunistic behaviour of the protection buyer which will receive a payout, Fabozzi (2013).

5.2 Merged dataset and descriptive analysis

5.2.1 Merged Dataset

The merging of data sets required to transpose the CDS dataset from wide to long data. Next, a variable was created in both the CDS and the credit rating datasets which concatenated the ISIN and the date, the rating publication in the rating dataset and the day of the daily spread for the CDS data. This variable was used to merge the datasets one to many, leading to a final sample of 504,654 observations equal to 2,094 different credit events announcements of corporates with trading CDSs.

5.2.2 Descriptive analysis

As stated above, the sample used for this study comprises a total of 2,094 credit announcements. The vast majority, 88.35% (1,850 announcements) are reported by S&P while only 10.50% (212 announcements) are published by Moody's. The remaining 1.15% (24) of announcements have the particularity that both agencies released the same type and dimension of change in the same day. Since the study focuses on discovering the impact of the credit rating changes overall regardless of the agency who published it, one of the two announcements was deleted from the sample to avoid duplicates, as explained before.

During the studied period, 589 (28.13%) upgrades were announced and 614 (29.32%) downgrades. When analysing the frequency of the reviews, we can observe a great number of negative reviews, 492 (23.50%), compared to 233 (11.13%) positive reviews and only 29 (1.38%) cases where neutral reviews were announced. Moreover, there were 111 (5.30%) stable ratings after negative reviews, 16 (0.76%) observations of stable ratings after positive reviews and 10 (0.48%) stable ratings after neutral reviews. All types of events considered, 1,122 were negative events and 933 positive events, and neutral events were 39. The average level of credit risk of the entire sample is moderate, being the average rating BBB- in S&P scale and Baa3 in Moody's. Overall, the mean dimension or magnitude of the credit ratings changes amounts to 1.32 for downgrades and -1.17 for upgrades, indicating that by average the credit rating changes did not change by more than 1 tranche in the numeric credit risk scale. When the mean dimension is observed on a yearly basis, the dimension of change is moderately higher for the crisis period.

When observing the distribution of these announcements among the studied period, we can appreciate a considerably higher number of announcements in the years 2008 and 2009. This surpassing number of credit releases is explained when placing it in the context of the US financial crisis years, where over those years corporates suffered continuous changes on their credit risk. A more detailed breakdown of the distribution over the years of the announcements can be seen in Table 3.

Table 3. Credit rating announcements distribution over the years of interest.

	Type of event								
Year	Downgrades	Upgrades	Negative reviews	Positive reviews	Neutral reviews	Stable ratings after negative reviews	Stable ratings after positive reviews	Stable ratings after neutral reviews	Total
2004	6	4	4	2	0	2	0	0	18
2005	23	39	32	13	1	7	1	0	116
2006	35	37	43	21	3	13	1	0	153
2007	57	35	45	20	4	14	1	1	177
2008	79	32	69	11	0	13	1	2	207
2009	86	22	55	23	0	11	0	0	197
2010	34	62	23	24	4	7	0	1	155
2011	42	55	41	24	2	8	0	2	174
2012	38	40	30	8	1	11	0	1	129
2013	22	49	25	33	4	2	0	1	136
2014	24	53	26	11	1	4	1	0	120
2015	43	43	35	14	5	3	1	2	146
2016	57	44	21	10	1	6	1	2	142
2017	32	40	25	9	1	4	3	2	116
2018	36	34	18	10	2	6	0	2	108
Total	614	589	492	233	29	111	10	16	2,094

Source: Prepared by the author based on data provided by Bloomberg.

Similarly, in Table 4, we can see a distribution of the credit rating announcements over the period of interest. From this table we can infer the proportionally higher amount of the credit rating announcements over the crisis period. Moreover, the dimension of the credit rating change was also considerably higher during the crisis period as displayed in Table 5. In this table is also noticeable downgrade dominance over upgrade only during the crisis period.

Table 4. Credit rating announcements distribution over the periods of interest.

	Period			
Type of event	Pre-crisis	Crisis	Post-crisis	Total
Downgrades	64	222	328	614
Upgrades	80	89	420	589
Negative reviews	79	169	244	492
Positive reviews	36	54	143	233
Neutral reviews	4	4	21	29
Stable ratings after negative reviews	22	38	51	111
Stable ratings after positive reviews	0	3	13	16
Stable ratings after neutral reviews	2	2	6	10
Total	287	581	1,226	2,094

Source: Prepared by the author based on data provided by Bloomberg.

Table 5. Dimension of rating changes per period.

Period	Mean	Standard deviation	Minimum	Maximum
Pre-crisis	-0.0592	0.9106	-5	2
Crisis	0.3425	1.1607	-8	5
Post-crisis	-0.0464	1.0695	-8	5

Source: Prepared by the author based on data provided by Bloomberg.

Regarding CDS data, the sample contains information of 589 CDS trading over the period studied which lead to 504,654 observations.

Table 6 presents the number of CDS trading and number of daily spreads per year. It can be observed that the higher number of CDS trading and observations happened during the crisis years and in 2010. In addition, the average CDS spread reaches its maximum quotes also during the financial recession years. For two of the years, there are reference entities with a maximum CDS spread larger than 10,000 bp, which entails a premium of the 100% of the notional value. CDS spread above 10,000 bp are considered to occur when the risk of default is imminent or when a company is in financial distress, according to Hull et al. (2004). All the above reflects the impact on the CDS market of the financial recession. In table 6, what is also noticeable is the high volatility of the CDS spreads, measured as the standard deviation, during the crisis years.

Table 6. Credit default swap data distribution and summary statistics over the years of interest.

Year	Number of observations	Number of credit announcements	Mean	Standard deviation	Minimum	Maximum
2004	4,338	18	100.6067	96.4227	16.80	460.90
2005	27,956	116	124.1333	214.2389	1.00	2,541.80
2006	36,873	153	117.3088	158.5367	3.00	1,010.00
2007	42,657	177	120.0661	161.6107	3.20	2,038.80
2008	49,887	207	440.8538	731.0973	9.80	23,645.20
2009	47,477	197	915.7419	1,405.293	1.20	23,645.20
2010	37,355	155	449.7381	689.7812	21.18	1,0695.59
2011	41,934	174	308.0011	417.9498	16.28	6,825.45
2012	31,089	129	445.3064	1,007.4480	22.17	14,845.46
2013	32,776	136	253.617	299.7443	16.98	2,401.54
2014	28,920	120	251.2536	596.4070	18.31	8,992.36
2015	35,186	146	295.3150	969.4038	13.10	14,565.25
2016	34,222	142	417.3503	1,090.3630	14.22	10,099.17
2017	27,956	116	263.2308	406.3606	17.89	2,999.00
2018	26,028	108	241.5410	400.7182	14.70	4,573.81
Total	504,654	2,094	349.3112	770.8379		

Source: Prepared by the author based on data provided by Thomson Reuters.

When observing the CDS data in terms of period of interest in Table 7, it can be noticed the proportionally higher number of CDS trading during the crisis and its higher CDS spreads.

Table 7. Credit default swap data summary statistics over the periods of interest.

Period	CDS trading	Number of observations	Mean	Standard deviation	Minimum	Maximum
Pre-crisis	287	69,167	119.0196	180.4604	1.00	2541.80
Crisis	581	140,021	504.1473	985.8007	1.20	23,645.20
Post-crisis	1,226	295,466	329.8446	722.8847	13.10	14,845.46

Source: Prepared by the author based on data provided by Thomson Reuters.

Table 8 displays the number of CDS trading over each rating type issuer and the average CDS spread per credit risk category. The table gives signs that the average CDS spread increases as the credit risk level increases, however, it can be seen that the majority of the CDS contracted is concentrated on the centre of the credit risk rating system, suggesting that the markets tend to enter in more CDS contracts when there is moderate to substantial risk. Moreover, the average CDS spread over the CDS observations sample is 349.26 basis points.

Table 8. Credit default swap data distribution and summary statistics over the credit risk categories.

Rating Scale	N	Mean	Standard deviation	Minimum	Maximum
1	14	64.4900	114.042	3.87	446.65
2	9	144.368	216.712	7.80	702.93
3	24	83.1680	109.604	7.50	353.37
4	58	107.6460	164.777	7.00	902.50
5	90	71.7410	72	11.50	366.60
6	162	91.6130	113.11	9.40	590.09
7	205	132.2960	187.255	1.20	1,048.00
8	300	104.7010	111.858	10.90	901.48
9	401	171.3230	277.977	14.75	3,331.50
10	275	224.2	296.91	23.80	2,911.32
11	200	278.815	354.094	9.00	3,677.30
12	176	351.686	491.93	32.78	4,473.89
13	205	502.467	486.912	32.78	4,381.78
14	170	573.097	626.208	55.00	5,456.22
15	153	986.315	1159.901	117.34	9,640.25
16	125	1339.557	1509.689	2.30	9,640.25
17	50	2134.908	2254.743	235.93	13,050.17
18	43	2757.264	2882.97	3.50	13,050.17
19	8	3292.232	2934.91	756.91	8,261.19
20	27	2691.97	3054.06	235.93	12,930.86
21	26	4042.292	3881.226	863.16	14,565.25

Source: Prepared by the author based on data provided by Thomson Reuters.

5.3 Chapter summary and conclusions

From the sample data, concerning the credit rating observations, the vast majority of the announcements are published by the S&P. As to the type of announcements in the sample, the predominance are downgrades, upgrades and negative reviews, which together represent almost three quarters of the whole sample. Also, the sample is close to having an equal number of positive and negative events. Lastly, the average level of credit risk of the entire sample is moderate and on average the credit rating changes did not change by more than 1 tranche. In terms of the timing of these credit announcements, a higher number of rating publications happened in 2008 and 2009, which coincide with the US financial crisis years.

In regard to the CDS observations, there is a cluster of CDS trading during the crisis years where the average CDS spread also reaches its maximum quotes and a higher volatility of the spreads is observed. Additionally, the majority of the CDS are agreed over entities with a moderate and to substantial credit risk rating.

CHAPTER 6 Methodology

In chapter 6, the methodology employed to conduct the research is described. In the first section the event study methodology can be found, followed by the logistic regression model and the description of the robustness test.

6.1 Event study

An event study is performed to determine cumulative abnormal spreads changes for US CDS corporates following a rating event occurred between 2004-2018.

6.1.1 Event and event day

The event day is defined as the date when any agency publishes a credit rating announcement and it is considered as day zero, Brown and Warner (1985). Different types of events are included in this study, being all credit rating announcements. In this research, announcements can be in the following forms: downgrades, upgrades, positive reviews, negative reviews, neutral reviews, stable ratings after negative reviews, stable ratings after positive reviews and stable ratings after neutral reviews. These announcements are further clarified in Appendix A.

6.1.2 Event window

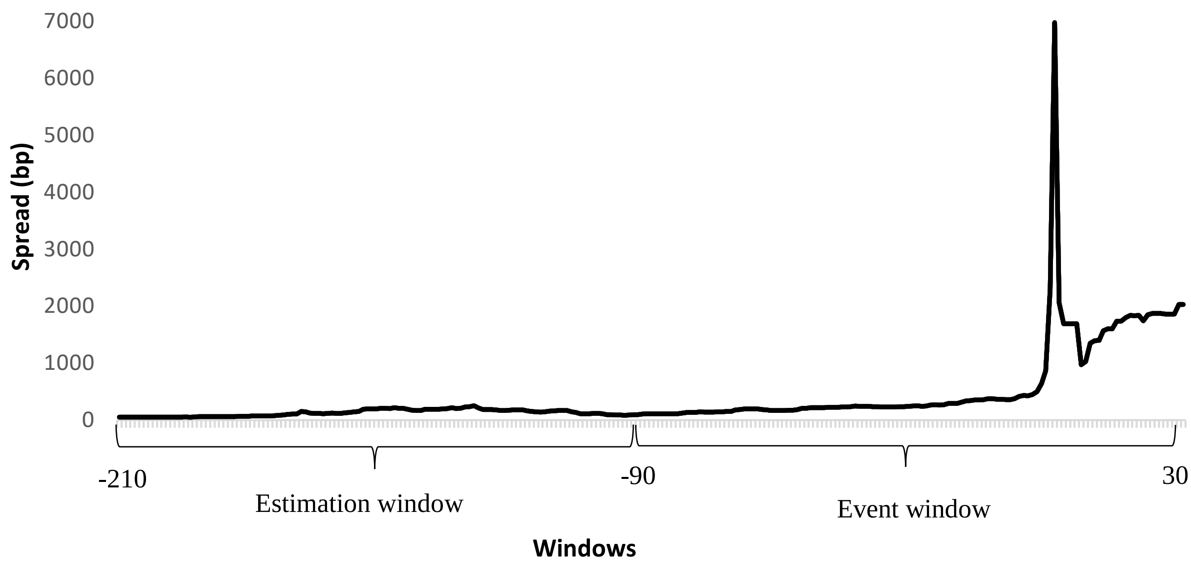
The event window is defined as the number of days around the event date, as stated by Brown and Warner (1985). They also explained that during those days the abnormal returns are calculated. When the event day is a certain day a narrow event window is preferred to capture these abnormal returns; however, in case of the possibility of leakage, the event window should be wider before the event date, according to Weil, Wagner, and Frank (2001). Both agencies have stated that if they consider having all the information available to assure a change in the credit rating of an entity, the rating change will be immediate. Nevertheless, when it gets to their notice that a certain event might affect a credit rating, the agencies will react towards this information within 90 days, according to S&P Guide to Credit Rating Essentials (2014). Moreover, in case the CDS market obtains credit information prior to the rating announcement day, abnormal spread reaction will occur before day zero. Following these ideas, an event window of starting on the 90 day before the event day seems adequate for this study.

Furthermore, in order to better capture a potential anticipation capacity of the CDS market or a leakage in the market before the event, the event window is further fractionated into narrower time intervals: [-90,-61], [-60,-31] [-30,-11] [-10,-2] [-1,1] [2,10] [11,30]. A common pattern within the literature is the division of the event window in subintervals of one-month length. In a similar way than Galil and Soffer (2011), this paper specifies narrower windows the closer to the event day. Each subinterval will be studied to investigate if there is a particular moment of the event window where the reaction in the CDS market is stronger.

6.1.3 Estimation window

The period during which no event is occurred is defined as the estimation period, MacKinlay (1997). Over this period, it is possible to calculate the normal returns: how the returns should behave in absence of an event. This study follows literature on event studies where MacKinlay (1997) suggests the use of an estimation window of the 120 days prior to the event window. An illustration of the estimation and event windows can be found in Figure 3.

Figure 3. CDS change of a corporate over the estimation and event window.



Source: Prepared by the author based on data provided by Thomson Reuters.

6.1.4 Selection of sample events

As mentioned before, events that have been preceded by other events in the prior 90 days have been excluded from the sample in order to avoid contamination due to clustered events.

6.1.5 Calculation of normal spread change, abnormal spread change and cumulative abnormal spread change

According to the event study's methodology, the value of the information contained in the event is measured by the abnormal returns, Brown and Warner (1980).This paper looks towards the potential abnormal CDS spread changes caused by a credit event, being these events rating announcements.

To test so, abnormal CDS spread change is defined as the difference between the actual CDS spread change and the normal CDS spread change, where normal CDS spread change is the expected change in absence of the event, MacKinlay (1997). This means, for this research topic an abnormal CDS spread change is the deviation between the actual observed spread change and the expected CDS spread change if there has not been a credit event. In the literature, there are two common approaches to obtain these abnormal CDS spread changes: though the market-adjusted model and calculating normal returns to later compare them to the actual spread change and obtain abnormal spread change.

On the one hand, the market-adjusted method adapts the CDS spreads changes to control for market wide factors. According to papers like the one of Norden et al. (2004), this implies to adjust CDS spreads with a CDS spread index. This index could be calculated as the equally weighted average of all CDS spreads within the same rating category of each company. This way, the spread change is related to the spread change of a portfolio.

On the other hand, the other approaches need the calculation of the normal CDS spread change. Within the literature, different models have been used to calculate these normal changes such as constant mean return model or market-adjusted model, MacKinlay (1997). The former assumes a constant mean return over the window while the later predicts the normal change of the asset performing an Ordinary least squares (OLS) regression for each company over the estimation window.

Many researchers, such as Norden et al. (2004) and Hull et al. (2004) used a market-adjusted model to calculate abnormal returns or abnormal spread change. However, according to other sources this method is considered to be less reliable and it seems less adequate for this event study for several reasons. First, given that there are several credit rating categories, this research does not count with enough observations to construct meaningful indices for all rating categories per day. Moreover, and as Micu et al. (2006) advocate, CDS spreads changes vary widely even within the same rating class, which questions the adequacy of the market-adjusted model. Second, market model is claimed to be more appropriate for periods where high spread volatility existed, such as the crisis period is. Consequently, this research employs a model similar to the one of Micu et al. (2006) and Cathcart et al. (2013) as it performs a market model for the calculation of normal returns which will be further used as a benchmark to estimate the abnormal returns. Like these authors, a market index is built with the median spread to control for outliers common in high volatile data and in periods of study when there was a crisis.

As mentioned above, this event study is intended to capture abnormal spread changes that might happen due to rating announcements. To do so, first, normal returns are calculated over the estimation window of the 120 days prior to the event window, this is [-210,-90].

Moreover, the spread changes are calculated as the percentual change of the daily spread per CDS and of the daily CDS-index. The Eq. (1) displays these calculations:

$$SC_{it=} \frac{S_{it}}{S_{it-1}} \; ; \; ISC_{mt=} \frac{IS_{mt}}{IS_{mt-1}} \quad (1)$$

where SCit is the normal spread change of CDS i between day *t* and *t-1*, Sit and Sit-1 are the premium of CDS i for day t and t-1, respectively. ISCmt is the median spread change of the CDS market index of CDS i on day t and median spread of the CDS index of day t and t-1 are IS_{mt} IS_{mt-1}.

After this, an estimation of the market model parameters αi or intercept and βi or slope is computed using the Eq. (2):

$$SC_{it} = \propto_i + \beta_i ISC_{mt} + \epsilon_{it} \quad (2)$$

where ϵ_{it} is the part of the change explained by firm-specific events. Afterwards, abnormal spread change (ASC) is calculated as follows:

$$ASC_{it} = SC_{it} - (\propto_i + \beta_i ISC_{mt}) \quad (3)$$

The following step is the calculation of the cumulative abnormal spread change (CASC) for each CDS in the sample by adding the abnormal spread changes within the event window as Eq. (4) shows:

$$CASC_{i[t1,t2]} = \sum_{t1}^{t2} ASC_{it} \quad (4)$$

Different events studies are conducted following this methodology to capture the cumulative abnormal spread change under different scenarios to give response to the hypotheses developed.

6.1.6 Test for significance of abnormal spread change

Once abnormal spread changes are computed, it is necessary to study their statistical significance running a significance test. There are several ways of testing significance, the preference falls upon the assumptions to be made about the distribution of the abnormal returns, MacKinlay (1997). Overall, these tests can be divided into parametric and non-parametric tests. The former tests make assumptions of abnormal returns being normally distributed, unlike non-parametric tests. This paper studies the significance of the CASC using both parametric and non-parametric tests.

This research uses a t-statistic, which is the most common parametric significance test over the literature. However, three assumptions have to be checked over the dependent variable to corroborate the validity of a t-test, Brown and Warner (1980). First, the sample needs to be a random sample which is verified by the fact that the sample data has been selected randomly from the population and it is equally likely to be included in the analysis. Second, the dependent variable is continuous, which can be confirmed. And third, the observations follow a normal distribution. However, some papers such as Ismailescu and Kazemi (2010) or Hull et al. (2004) stated that CDS spread differences are mostly positive skewed and thus non-normally distributed. In order to check the former, this study considers the large sample size (504,654 observations) and assumes that it follows an approximately normal distribution. In addition, to further investigate the normal distribution of the data a histogram is plotted and a summary statistic of the CASC is presented Appendix C. A considerable number of observations lay within the same range of values; however, certain outliers observations make this distribution initially non normal. After analyzing the substantial standard deviation, this study removed the outliers by winsorizing at the 1% and 99% level. The histogram of the CASC after the winsorization shows a normal distributed observation sample and therefore, a normal distribution of the data is concluded.

Normal distribution can be also tested using the Shapiro-Wilk statistic. When conducting this test (Appendix C), conversely, the outcomes suggests that the data still does not follow a normal distribution. Under the assumption that spread changes do not follow a normal distribution, t-test will turn out to be less reliable and non-parametric tests are needed. Therefore, and in order to yield robust results, this study also searches for significance using non-parametric test likewise Norden and Weber (2004), but conducting in this case the Wilcoxon Mann–Whitney sign rank test to control for the possible non-normality of the CDS spread changes, according to what Harris and Hardin (2013) described.

Therefore, in the search for significance, the study will assess if the CASC are significantly different from zero. As for the t-test the null hypothesis examines the mean of CASC being equal to zero, unlike the non-parametric tests, where the null hypothesis is defined as the median of the CASC to be equal to zero.

Significance tests are adapted to each hypothesis. For the first set of hypotheses (H1, H2 and H3) and hypothesis 8, an independent one-sample t-test is performed, and two tailed p-values are observed. Differently, an independent two-sample t-test is conducted in the research of significance of the results of the second set of hypotheses (H4, H5, H6 and H7). The two-sample t-test have different variations, depending on the relationship between the samples (independent or paired), the sizes of the samples (equal or unequal) and the variances of the observation in the sample (equal or unequal). For all the hypotheses, an independent test is performed with unequal samples sizes. However, any differences in variances had to be investigated. To do so, a F-test was performed in the following manner, Snedecor and Cochran (1983):

$$F = \frac{S_1}{S_2} \quad (5)$$

where S_1 and S_2 represent the sample variances. Ratio outcomes different from zero indicate unequal population variances. After performing the F-test, this study observes unequal variances.

6.2 Logistic regression study

If the CDS market is found to be able to anticipate credit announcements, this paper will research the forecasting power of this market, its capacity to predict credit events. Though a logistic analysis this paper will model the probability of a credit announcement happening attributed to CDS spread changes. This methodology is adequate for this purpose, as it is used to predict the relation between a binary dependent variable and certain independent variables which are called predictors, Menard (2010). Similar to an OLS regression, a logistic regression determines whether the predictive power of a variable is statistically significant. This test relies on three main assumptions: large sample size, no multicollinearity between predictors, and extreme values or outliers, which can be all verified.

To set up the data for this analysis, this paper follows the methodology of Hull et al. (2004) where the data of each CDS trading is sectioned in non-overlapping 30-days intervals. Out of the intervals formed, those where a rating event took place were disregarded. After constructing the intervals, a dummy variable denoted by P is created that yields a value of 1 when in the following interval a rating announcement occurs, and zero otherwise. The logistic model is established as:

$$P = \frac{1}{1-e^{-(b0+b1x)}} \quad (6)$$

where P is the probability of a rating announcement being published within the coming 30-days interval; x is the predictor measured by the spread change in basic points in each interval defined as the difference between the last spread and the first spread observed in the interval; and b_0 and b_1 are constants. To perform this study, this paper assumes that the probability of a rating announcements over the next period follows a logistic distribution with parametersb_0 and b_1 and time-varying covariates x.

The coefficients obtained in the logistic model give indication of the variables having predicting power over a rating announcement occurring. However, in order to reveal the measure of the impact of spread changes on the probability of a rating announcement being published, the studies of Hull et al. (2004) and Finnerty et al. (2013) calculated what they both called probability sensitivity measure. This value measures the increase/decrease in the probability P of a rating event associated with a one basis point increase/decrease in the spread change x. Similarly, this paper reflects the magnitude of the impact on the probability by means of marginal effects. In these regressions, the significance of the coefficients is investigated according to the Wald test value, denoted by z.

6.3 Robustness check

Similar than the event study of section 6.1, this paper conducts a second event study to obtain the cumulative abnormal spread changes attributed to the events using the market-adjusted model to calculate the abnormal cumulative CDS changes as a robustness check. The market-adjusted model is performed in a similar way as Norden et al. (2006) did. This is, the CDS spread changes until the event day are adjusted by the changes of a CDS spread index formed by entities of the same rating class of the company's last rating. From the day of the event, the adjustment over the CDS spread will be done with a CDS spread index formed with the current rating category. As a result, abnormal spread changes are calculated as follows:

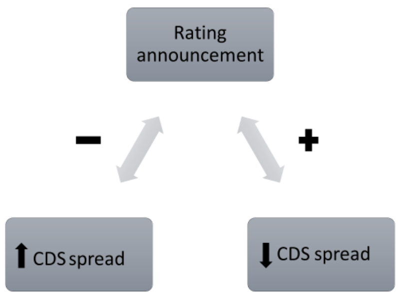
$$CDS\ index\ adjustment = ASC_{it} = \begin{cases} (S_{it} - S_{it-1}) - (I_{lt} - I_{lt-1}) & if\ t < 0 \\ (S_{it} - S_{it-1}) - (I_{ct} - I_{ct-1}) & if\ t \geq 0 \end{cases} \quad (7)$$

where ASC_{it} accounts for the abnormal spread change for CDS i on day t, S_{it} represents the CDS spread for CDS i on day t and I_{lt} and I_{ct} are CDS spread index for same as CDS i last rating class on day t and same as CDS i current rating class on day t, respectively. Daily CDS spread index levels correspond to the equally weighted cross-sectional mean of all CDS spreads for a certain rating class in the sample. Similarly, the significance of the results is tested with a t-test.

6.4 Chapter summary and conclusions

This section displays the associated predictive validity framework with the purpose of providing an overview of the conceptual relationship and the methodology design. This framework contains boxes which illustrate the relation between variables. The research question is whether a rating announcement lag or lead the CDS market on the understanding of a change in the creditworthiness of an entity. In this model, a positive announcement on the credit risk of a company is associated with a narrowing of the CDS spread which is materialized on negative CASC, while negative events are related to widening of the CDS spreads and positive CASC. A visualization of the conceptual model can be found in Figure 4.

Figure 4. Conceptual framework.



Source: Prepared by the author based on the methodology's rationale.

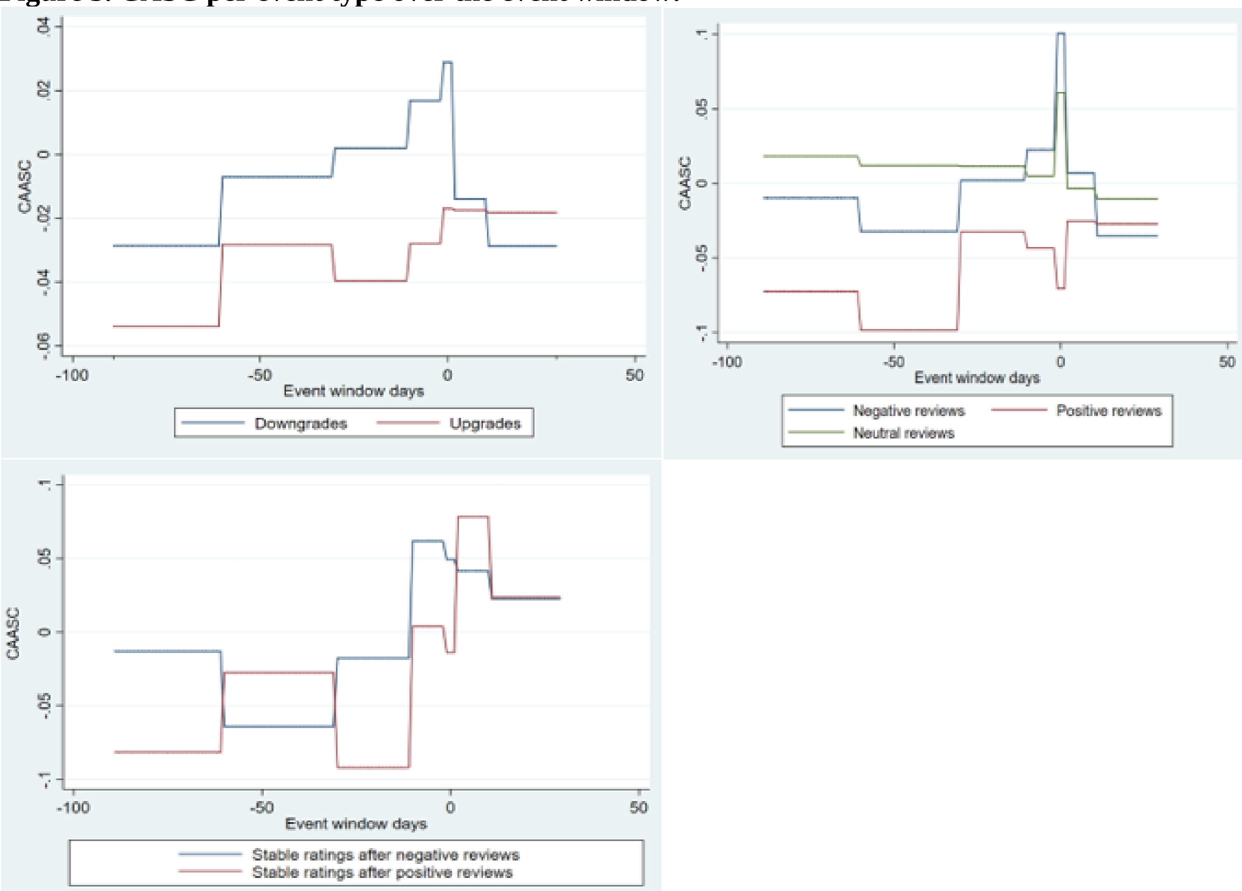
CHAPTER 7 Empirical results and analysis

In this chapter the results obtained after following the methodology elaborated in chapter 6 for the CDS market response to rating announcements are presented and explained.

7.1 Content information of rating events

In this first section, the results obtained on the research on the CDS market response to each type of credit rating announcement are displayed in Table 9. This paper was expecting to find evidence of rating events containing valuable information to the CDS market by noting significant CASC on and from the day of the event. The evolution of the spread changes over the windows can be found in Figure 5. This study finds evidence to partially confirm the hypotheses 1, 2 and 3, as overall market reaction is found as well as certain levels of anticipation to these events. In general, more support of the previous is obtained through the signed rank test than through the t-test.

Figure 5. CASC per event type over the event window.



Source: Prepared by the author based on results from Stata.

With regards to negative events, the expectation was to observe positive CASC on and after the announcement day. In the cases of downgrade announcements, on the one hand, significant positive abnormal spread changes could be already noticed prior to the event day from the window [-30,-11], providing evidence in favour of the alternative hypothesis that indicates anticipation of the CDS market to credit downgrades. On the other hand, the highest level of CASC, which is significant at a 1% level, can be seen in the window [-1,1]. This can be interpreted as a sign of market reaction towards downgrades, as such window contain the announcement day. The days after the announcement display a significant narrowing of the spread at a 10% level, which may reveal price adjustment. In general, there is more evidence to reject the null hypotheses using the signed-rank test, as CASC are significant in almost every time interval. Overall, it can be stated that downgrades are anticipated by the CDS market with a widening of the spread, however, there is still market reaction on the announcement day and price adjustment of such reaction afterwards, similar to prior studies such as the one of Norden et al. (2004)

A similar scenario is observed when negative reviews are published, where significant positive CASC from day -10 are observed. This implies, as some prior literature like Norden et al. (2004) has confirmed that negative reviews can be anticipated by the CDS market while they still convey new and material information appreciated by the investors on their announcement. This is consistent with finding the highest level of CASC (0.10%), on the event day interval [-1,1]. As downgrades, significant negative CASC are noticed after the announcement, in this case only on the [11,30] window. Also, the signed rank test exhibits significant CASC in every sub-interval.

A greater reaction towards negative reviews than to downgrades is to be noted, in line with results from Norden et al. (2004). The previous can be explained by the fact that reviews do not disclose the magnitude of the potential credit risk change, but only the direction of such possible change. Consistent with Steiner et al. (2001), negative CASC are observed after the downgrades and negative reviews which could be an attempt to adjust the market response on the event announcement from a possible overreaction.

In regard to stable ratings after positive reviews, these events yield positive CASC from the time interval [-1,1] until the end of the event window. Although these results are in line with expectations of being perceived by the market as a relatively negative sign, they are not significant in any of the tests. However, a spread widening in windows [-90,-61], [-60,-31] [-30,-11] and [11,30], can be confirmed using the signed-rank test.

This paper can conclude to partially support hypotheses 1 and 2 with regards to downgrades and negative reviews. Significant increase of the spreads already occurs before the announcement, suggesting anticipation power of the CDS market. Additionally, significant spread changes are found in the [-1,1] interval which evidences market reaction; however, this reaction is adjusted in the subsequent days as spreads narrow afterwards. The above is in line with the results of Norden et al. (2004) and Hull et al. (2004) regarding downgrades and negative reviews. However, these studies found anticipation up to 90 to

60 days before the event. Regarding hypothesis 3, this paper does not find enough evidence to confirm or reject CDS response to stable ratings after negative reviews under the t-test.

Regarding positive events, the expectation was to detect negative spread changes on and after the release of the rating changes. The results of the three types of positive events are very similar as they all display negative CASC through every time interval, where the highest levels of changes are also caused by reviews. Significance on upgrades and positive reviews is found in almost the entire event window using both tests and, once again, higher significance levels through the signed rank test. For stable ratings after negative reviews, the outcomes are only significant using the sign rank test. All this considered, there is evidence to partially support the alternative hypothesis about CDS market anticipation, although reaction at the announcement and subsequent days is also found. This paper finds significance results towards positive events, contrary to the majority of the prior studies like Norden et al. (2004). In line with the results of Micu et al. (2006) and Finnerty et al. (2013), which advocate for the upgrades impact on the CDS market as well as for some level of CDS anticipation toward these events, although to a lower extend that downgrades. Consequently, this paper partially confirms H1, H2 and H3 regarding market reaction, however, it must add the CDS market anticipation.

In the cases of neutral events, conclusions are hard to be drawn for several reasons. Firstly, the CASC obtained follow an almost opposite trend and secondly, no significance could be found in any time interval. Moreover, the number of events collected is not sufficient to conclude representative facts.

Table 9. Cumulative abnormal spread changes per event type per sub-window.

		Window						
Type of event		[-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Downgrades	N	614	614	614	614	614	614	614
	CASC	-0.0285	-0.0068	0.0019	0.0169	0.0291	-0.0143	-0.0294
	T-Value	-1.35	-0.35	0.10	1.75	3.40	-1.72	-1.70
	T-test P-Value	0.1835	0.7445	0.9085	0.0805*	0.001***	0.0895*	0.0935*
	Z-Value	4.47	4.50	3.68	2.24	2.20	2.46	3.68
	Sign rank P-value	0.0000 ***	0.0000 ***	0.0002 ***	0.0125 **	0.0138 **	0.0135 **	0.0002 **
Upgrades	N	589	589	589	589	589	589	589
	CASC	-0.054	-0.0285	-0.0395	-0.0286	-0.0167	-0.0175	-0.0185
	T-Value	-2.60	-1.35	-2.55	-3.25	-2.50	-2.00	-1.10
	T-test P-Value	0.0100 ***	0.1755	0.0115 **	0.0015 ***	0.0120**	0.0480**	0.2805
	Z-Value	-6.32	-6.22	-5.08	-3.41	-1.97	-3.41	-5.08
	Sign rank P-value	0.0000 ***	0.0000 ***	0.0000 ***	0.0006 ***	0.0489 **	0.0006 ***	0.0000 ***

Table 9. Cumulative abnormal spread changes per event type per sub-window. ***(Continued)***

Type of event		Window [-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Negative reviews	N	492	492	492	492	492	492	492
	CASC	-0.0095	-0.0318	0.0185	0.0225	0.1005	0.0066	-0.035
	T-Value	-0.40	-1.30	0.10	2.00	7.60	0.60	-1.80
	T-test P-Value	0.6940	0.1950	0.9030	0.04750 **	0.0000 ***	0.5430	0.0700*
	Z-Value	23.79	23.79	19.42	13.03	7.52	13.03	19.42
	Sign rank P-value	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***
Positive reviews	N	233	233	233	233	233	233	233
	CASC	-0.0725	-0.0985	-0.0325	-0.0435	-0.0705	-0.0255	-0.02700
	T-Value	-2.05	-3.40	-1.60	-30	-4.70	-1.70	-1.10
	T-test P-Value	0.0415**	0.0010**	0.1140	0.0030 ***	0.0000 ***	0.0910*	0.2700
	Z-Value	-21.50	-21.50	-17.55	-11.77	-6.79	-11.77	-17.55
	Sign rank P-value	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***	0.0000 ***
Neutral reviews	N	29	29	29	29	29	29	29
	CASC	0.0185	0.0118	0.0115	0.0046	0.0607	-0.0035	-0.0105
	T-Value	0.30	0.30	0.55	0.25	0.80	-0.15	-0.40
	T-test P-Value	0.7540	0.7585	0.5770	0.8130	0.4295	0.8905	0.6810
	Z-Value	1.47	1.48	1.21	0.81	0.47	0.81	1.21
	Sign rank P-value	0.1367	0.1367	0.2244	0.4152	0.6385	0.4152	0.2244
Stable ratings after negative reviews	N	111	111	111	111	111	111	111
	CASC	-0.1087	-0.1016	-0.0718	-0.0125	-0.0267	-0.0445	-0.0355
	T-Value	-3.15	-3.35	-2.80	-1.00	-3.60	-4.05	-1.50
	T-test P-Value	0.002***	0.001***	0.006***	0.3175	0.0005 ***	0.0000**	0.1310
	Z-Value	-23.67	-23.67	-19.33	-12.96	-7.48	-12.96	-19.33
	Sign rank P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stable ratings after positive reviews	N	16	16	16	16	16	16	16
	CASC	-0.0123	-0.0637	-0.0184	-0.0109	0.0487	0.0415	0.0225
	T-Value	-0.15	-0.80	-0.45	-00.42	1.15	1.45	0.45
	T-test P-Value	0.8675	0.4225	0.6760	0.7300	0.2775	0.1670	0.668
	Z-Value	2.22	2.22	1.81	1.22	0.70	1.22	1.81
	Sign rank P-value	0.0260**	0.0260**	0.0690*	0.2220	0.4789	0.2220	0.0690*
Stable ratings after neutral reviews	N	10	10	10	10	10	10	10
	CASC	-0.0815	-0.0275	-0.0923	0.0044	0.8795	0.0785	0.0235
	T-Value	-1.40	-0.40	-1.25	0.15	-0.75	1.20	0.75
	T-test P-Value	0.1905	0.6820	0.2500	0.8795	0.4825	0.2600	0.4780
	Z-Value	-5.71	-5.71	-4.66	-3.13	-1.82	-3.13	-4.66
	Sign rank P-value	0.0000 ***	0.0000 ***	0.0000 ***	0.0017 ***	0.0684	0.0017	0.0000

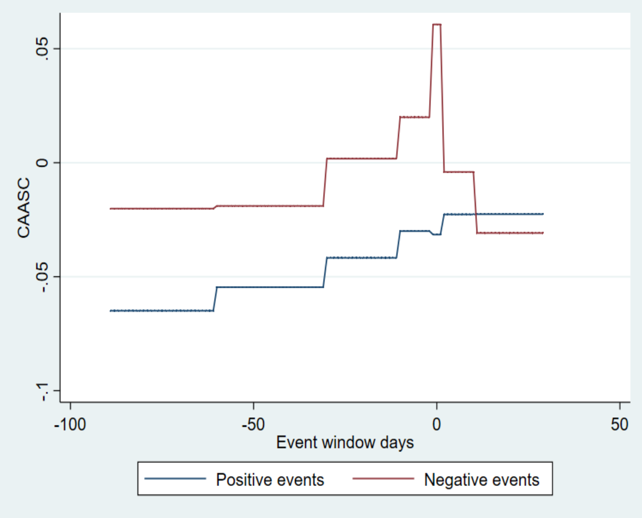
The table represents cumulative abnormal spread changes as a % of the change in each time interval caused by each event type using the market model, where N denotes the number of observations. The null hypothesis is mean-CASC=0 under the t-test and median CASC=0 under the Wilcoxon Mann–Whitney sign rank test. Statistical significance is calculated using one-sample t-test and Wilcoxon sign-rank test. Significances at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

7.2 Price sensitivity of the CDS market to credit events

7.2.1 Positive and negative events

Table 10 reports the CASC for both positive and negative events studied in a two-sample test. For this part of the study, there were expectations that negative events cause a greater response of the CDS market than positive events. The CDS market reaction over the event window can be found in Figure 6. Overall, there is evidence in favour of the previous idea and hypothesis 4 is confirmed.

Figure 6. CASC of negative and positive events over the event window.



Source: Prepared by the author based on results from Stata

All positive events considered follow the same trend as displayed in the previous section individually, this is negative CASC during the whole event window. Whereas, CASC of negative events show positive values from day -30 to day 1, and negative values in the rest of time intervals. At first glance, this suggests that both types of events can be anticipated by the CDS market but still respond on the day zero. Additionally, negative events are followed by a price adjustment the days after the announcement. This is all consistent with what was mentioned in section 7.1. Moreover, it can be proved that the differences of the means are negative for all pre-event intervals and the interval containing the announcement, which suggests that negative events generate greater spread changes than positive events. These results are overall significant at a 1% level using both the parametric and non-parametric test, leading to the rejection of the null hypotheses of both means being equal. However, during the post- event windows a positive difference in both CASCs can be noticed, although these results are partially significant.

Prior literature found mixed results regarding this topic. Some authors concluded asymmetric reactions in the absence of significant results of positive events (Norden et al. (2004), Hull et al. (2004) and Daniels and Jensen (2005)). Others found that both rating types impact the CDS market (Micu, Remolona and Wooldridge (2006), Galil and Soffer (2011) and Wengner et al. (2015)). The results of this research are therefore in line with the latter group of papers, as they evidenced asymmetric CDS market reaction to upgrades than to downgrades for the total sample. Possible explanations for this asymmetric reaction have been discussed among the researchers. Dichev and Piotroski (2001) sustained the existence of a bias in the processing of negative and positive information, while others such as Vassalou and Xing (2003) advocated the higher marker reaction to negative events as a management disciplinary method. Ederington and Goh (1998), instead, suggested that this asymmetry is due to the fact that positive announcements only confirm information that has been already provided by the firm while negative announcements disclose new information to the market.

Table 10. Cumulative abnormal spread changes of positive and negative events per sub-window.

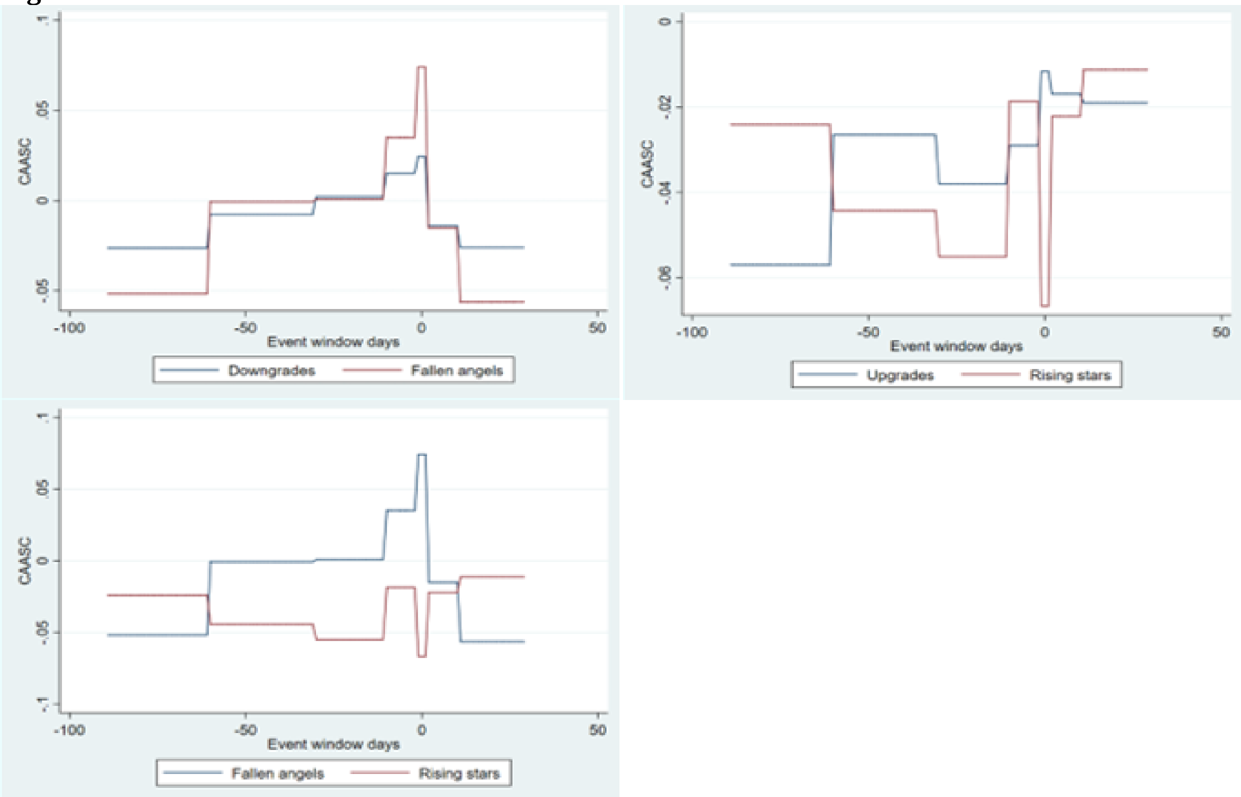
		Window						
Type of event		[-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Positive events	N	933	933	933	933	933	933	933
	CASC	-0.0652	-0.0553	-0.0413	-0.0300	-0.0321	-0.0220	-0.0225
	SD	0.50	0.47	0.35	0.20	0.17	0.20	0.38
Negative events	N	1,122	1,122	1,122	1,122	1,122	1,122	1,122
	CASC	-0.0200	-0.0191	0.0023	0.0203	0.0626	-0.0044	-0.0313
	SD	0.53	0.54	0.40	0.24	0.25	0.22	0.42
	Mean Difference	-0.0448	-0.0356	-0.0434	-0.0499	-0.0921	0.5520	0.0150
	T-test T-Value	-1.95	-1.56	-2.56	-4.96	-9.39	-0.01	0.45
	T-test P-Value	0.0251**	0.0563*	0.0052***	0.0000***	0.0000***	0.0274**	0.6764
	Z-Value	-1.33	-1.92	-2.65	-3.65	-10.83	-0.52	2.43
	Sign rank P-value	0.1819	0.0543*	0.0078***	0.0003***	0.0000***	0.6010	0.0148**

The table represents cumulative abnormal spread changes as a % of the change in each time interval caused by positive and negative events using the market model, where N denotes the number of observations and SD standard deviation. The null hypothesis is mean-CASC=0 under the t-test and median CASC=0 under the Wilcoxon Mann–Whitney sign rank test. Statistical significance is calculated using an independent two-sample t-test and Wilcoxon sign-rank test. Significance at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

7.2.2 Crossover in the investment/speculative grade category

This section elaborates the results of the effects of the events that make an entity cross to the other side of the rating scale category. Table 11 presents the outcomes of the study where Panel A exhibits the results for both downgrades and fallen angels and upgrades and rising stars studied in two-sample tests, and panel B contains the effects of both fallen angels and rising stars events studied together in a two-sample test. Moreover, the evolution of the CAASC over the window of the previous three studies is displayed in Figure 7. From these studies, this paper recovered enough evidence to confirm hypothesis 5 and 6.

Figure 7. CASC of crossborder and non-crossborder events over the event window.



Source: Prepared by the author based on results from Stata

The first of the tests contains the results of the cases where the credit risk worsens. In both regular downgrades and fallen angels, positive CASC can be observed from the day -30 and until day 1 event, while negative CASC afterwards. The effects of the fallen angels are considerably higher than those of the regular downgrades, to the point that the CASC in the [-1,1] window of a fallen angel almost triples the ones of a regular downgrade, which is also the only significant window using the t-test. For that reason, in this study it can only be concluded the different effects of fallen angels and downgrades in days -1 to 1, rejecting the null hypothesis. Regarding upgrades and rising stars, negative CASC can be observed during the entire windows of both types of events. The differences in the mean suggest that the effects caused by the rising stars are, in general, also higher than upgrades. However, also in this study the null hypothesis can only be rejected in the window [-1,1]. Both tests are in line with what Daniels and Jensen (2005) stated, as dimension of change affects the levels of spread change.

When assessing the spread changes caused by rising stars and fallen angels, overall, higher reaction can be noticed in case of fallen angels during the event windows. Also, in this study, the only interval where significance CASC are found is over the [-1,1] period at a 1% level, using both tests. This leads to support hypothesis 6 and state that the CDS markets responses to fallen angels are more pronounced than to rising stars. A possible explanation is grounded in regulatory restrictions and portfolio investment criteria, as Steiner et al. (2001) suggested. This means, an issuer rated now as speculative forces investors to make selling decisions while a change towards the investment grade does not necessarily end up with an investment in such corporate. These results, however, contradict those of Finnerty et al. (2013) as they found that the spread's response to rising stars is more pronounced than to fallen angels, mainly due to lower monitoring of upgrades than downgrades.

Table 11. Cumulative abnormal spread changes of crossborder and non-crossborder events per sub-window.

Panel A								
		Window						
Type of event		[-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Fallen angels	N	55	55	55	55	55	55	55
	CASC	-0.0521	-0.0005	0.0005	0.0353	0.0748	-0.0151	-0.0565
	SD	0.37	0.37	0.40	0.26	0.27	0.16	0.36
No fallen angels downgrades	N	559	559	559	559	559	559	559
	CASC	-0.0263	-0.0080	0.0022	0.0154	0.0252	-0.0143	-0.0266
	SD	0.55	0.55	0.41	0.23	0.20	0.20	0.42
	Mean Difference	-0.0254	-0.0439	-0.0013	0.01987	0.0497	-0.0012	-0.0303
	T-test T-Value	-0.45	-0.79	-0.02	0.53	1.29	-0.05	-0.58
	T-test P-Value	0.3239	0.2157	0.4906	0.2983	0.0994*	0.4783	0.2812
	Z-Value	-0.00	0.43	-0.03	0.34	-0.45	0.14	1.37
	Sign rank P-value	0.9946	0.6650	0.9762	0.7292	0.6506	0.8838	0.1686
Rising stars	N	57	57	57	57	57	57	57
	CASC	-0.0241	-0.0440	-0.0553	-0.0179	-0.0668	-0.0217	-0.0123
	SD	0.59	0.54	0.44	0.27	0.23	0.26	0.51
No rising stars upgrades	N	532	532	532	532	532	532	532
	CASC	-0.0570	-0.0259	-0.0377	-0.0289	-0.0122	-0.0173	-0.0190
	SD	0.50	0.50	0.37	0.20	0.15	0.20	0.40
	Mean Difference	0.0328	-0.0177	-0.0171	0.0103	-0.0550	-0.0051	0.0077
	T-test T-Value	0.40	-0.23	-0.28	0.28	-1.74	-0.14	0.10
	T-test P-Value	0.3433	0.4078	0.3901	0.3896	0.0433**	0.4436	0.4565
	Z-Value	-0.54	0.20	1.83	0.67	4.96	2.21	0.72
	Sign rank P-value	0.5891	0.8362	0.0664*	0.4972	0.0000***	0.0271**	0.4666

The table represents cumulative abnormal spread changes as a % of the change in each time interval caused by fallen angels and downgrades in Panel A and rising stars and upgrades in Panel B, using the market model. N denotes the number of observations and SD the standard deviation. The null hypothesis is mean-CASC=0 under the t-test and median CASC=0 under the Wilcoxon Mann–Whitney sign rank test. Statistical significance is calculated using independent two-sample t-test and Wilcoxon sign-rank test. Significance at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

Table 11. Cumulative abnormal spread changes of crossborder and non-crossborder events per sub-window. (*Continued)*

Panel B

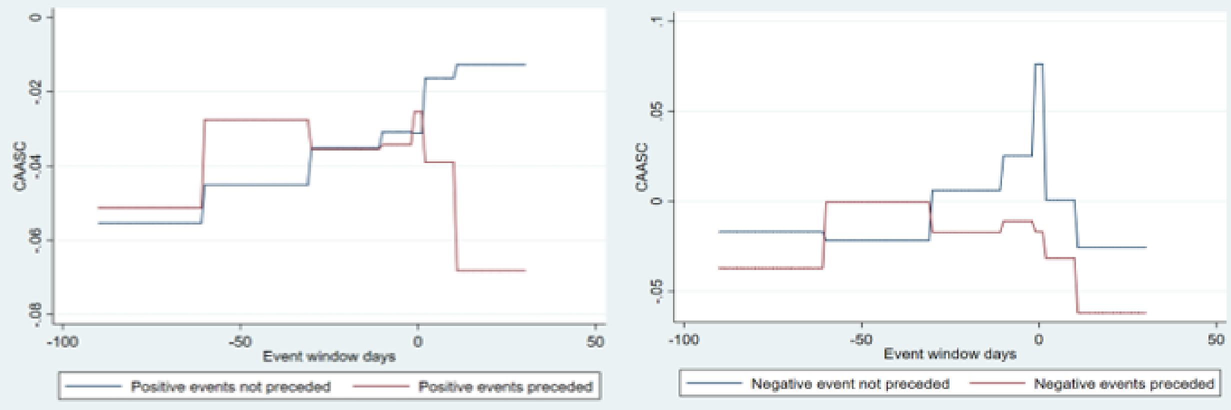
Type of event		Window [-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Rising stars	N	57	57	57	57	57	57	57
	CASC	-0.0241	-0.0443	-0.0550	-0.0181	-0.0668	-0.0218	-0.0122
	SD	0.59	0.54	0.44	0.27	0.23	0.27	0.51
Fallen angels	N	55	55	55	55	55	55	55
	CASC	-0.0522	-0.0005	0.0005	0.0348	0.0743	-0.0152	-0.0565
	SD	0.37	0.37	0.40	0.27	0.28	0.16	0.36
	Mean Difference	0.0276	-0.0438	-0.0557	-0.0536	-0.1408	-0.0069	0.0450
	T-test T-Value	0.29	0.08	-0.69	-1.05	-2.90	-0.16	0.53
	T-test P-Value	0.3836	0.4664	0.2449	0.1460	0.0022***	0.4339	0.2964
	Sign rank Z-Value	-0.36	-0.16	1.20	0.71	4.23	0.63	-1.17
	Sign rank P-value	0.7160	0.8728	0.2272	0.4759	0.0000***	0.5239	0.2409

The table represents cumulative abnormal spread changes as a % of the change in each time interval caused by rising stars and fallen angels using the market model, where N denotes the number of observations and SD standard deviation. The null hypothesis is mean-CASC=0 under the t-test and median CASC=0 under the Wilcoxon Mann–Whitney sign rank test. Statistical significance is calculated using independent two-sample t-test and Wilcoxon sign-rank test. Significance at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

7.2.3 Preceding events

The last study of this set of hypotheses tests the different effects on the CDS market caused by credit events that have been preceded by a review and those that were not preceded by a review. Here, it was expected that events that have not been placed on a review in the previous days will generate greater reaction on the CDS market than those that were being under review, as they imply a higher surprise. The results of the CAASC found over the event windows days are displayed in Figure 8. These results are exhibit in Table 12, where Panel A shows the positive events and Panel B the negative events. There is evidence to only support the hypothesis 7 with regards to negative events.

Figure 8. CASC of events preceded and not preceded by a review over the event window.



Source: Prepared by the author based on results from Stata.

In Panel A, both types of positive events display negative CASC over the event window and with a similar magnitude of spread change in the pre-event windows. However, moderately higher CASC are noted on the event window [-1,1] in not preceded positive events. After, higher spread changes are noticed on the events that were preceded by a positive review. Nevertheless, these results are only partially supported by the signed-rank test higher, thus this study can only validate higher CASC of preceded events after the announcement and partially reject hypothesis 7. In the case of negative events, it is noteworthy to mention that, while negative events unpreceded by reviews display positive CASC from day -30 to day 10, negative events preceded by a negative review do not generate positive CASC in any of the sub-windows. This might be a consequence of full incorporation of the review information as investors might trust the potential change on the credit risk. Significance is found using the t-test in windows [-10,-2] [-1,1] and [2,10], suggesting a higher reaction towards not preceded negative events, similar to the results using signed-rank test.

Norden et al. (2004) and Micu et al. (2006) agreed that both preceded and not preceded events generate spread changes on the announcement date. Based on this, it could be understood that investors appreciate both announcement of potential changes and actual changes similarly. The results of this paper, however, can not confirm the previous in what regards to the reaction of negative events preceded by a review. In line with the findings of this section are the results of Norden et al. (2004) regarding the more pronounced market reaction when the event has not been preceded by another announcement. However, Micu et al. (2006) found evidence to support a higher level of CDS anticipation to events that were not preceded by another announcement, which we can not confirm due to insignificant results.

Table 12. Cumulative abnormal spread changes of events preceded and not preceded by a review per sub-window.

Panel A

Type of event		[-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Positive events not preceded	N	739	739	739	739	739	739	739
	CASC	-0.0553	-0.0450	-0.0347	-0.0308	-0.0311	-0.0163	-0.0126
	SD	0.51	0.48	0.35	0.21	0.18	0.21	0.38
Positive events preceded	N	77	77	77	77	77	77	77
	CASC	-0.0512	-0.0275	-0.0354	-0.0342	-0.0253	-0.0389	-0.0681
	SD	0.43	0.42	0.37	0.17	0.17	0.23	0.45
	Mean Differences	-0.0040	-0.0175	0.0003	0.0033	-0.0058	0.0226	0.0554
	T-test T-Value	-0.07	-0.34	0.01	0.15	-0.27	0.79	1.03
	T-test P-Value	0.4699	0.3666	0.4965	0.4373	0.3930	0.2136	0.1509
	Z-Value	1.76	0.58	0.29	1.21	0.24	2.03	1.85
	Sign rank P-value	0.0777*	0.5568	0.7719	0.2246	0.8067	0.0423**	0.0632*

Table 12. Cumulative abnormal spread changes of events preceded and not preceded by a review per sub-window. ***(Continued)***

Panel B

Type of event		Window [-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[11,30]
Negative events not preceded	N	924	924	924	924	924	924	924
	CASC	-0.0168	-0.0219	0.0058	0.0253	0.0762	0.0006	-0.0256
	SD	0.54	0.55	0.40	0.25	0.27	0.23	0.44
Negative events preceded	N	181	181	181	181	181	181	181
	CASC	-0.0372	-0.0003	-0.0173	-0.0110	-0.0168	-0.0317	-0.0620
	SD	0.52	0.51	0.40	0.20	0.11	0.17	0.34
	Mean Differences	0.0203	-0.0215	0.0232	0.0363	0.0931	0.0323	0.0363
	T-test T-Value	0.47	-0.50	0.69	2.07	7.62	2.17	1.23
	T-test P-Value	0.3174	0.3056	0.2426	0.0194**	0.0000***	0.0151**	0.1093
	Z-Value	1.55	0.23	2.36	2.36	4.95	1.62	0.35
	Sign rank P-value	0.1187	0.8160	0.0179**	0.0181**	0.0000***	0.1045	0.7254

The table represents cumulative abnormal spread changes as a % of the change in each time interval caused by events that were not preceded by reviews and events preceded by reviews using the market model. N denotes the number of observations and SD standard deviation. The null hypothesis is mean-CASC=0 under the t-test and median CASC=0 under the Wilcoxon Mann–Whitney sign rank test. Statistical significance is calculated using independent two-sample t-test and Wilcoxon sign-rank test. Significance at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

7.3 The role of credit ratings before, during and after the crisis

Table 13 shows the results of the spread changes related to each type of event per period of interest. In this study, it was expected to find a higher market response on the periods before and during the crisis, while lower levels of market reaction in the post-crisis. This decrease in the response could be attributed to the loss of reputation of the rating agencies as a consequence of their misrepresentation of the credit risk during the financial crisis. Results support hypothesis 8, as lower CDS market reaction is appreciated in the aftermaths of the crisis.

Downgrades in the pre-crisis period generate mostly negative CASC, except for the sub-windows [-10,-2] and [-1,1]. This could suggest anticipation up to 10 days before the event and market reaction, however, this paper can only validate the CASC being different from zero on the windows [-90,-61] and [11,30] and these judgements being based on moderate number of observations. In the period during the crisis, a widening of the spread is observed in almost the entire event window and this paper can reject null hypothesis in the [-1,1] to confirm market response to the event. It is noteworthy to mention that the highest level of market response on day zero is found in the pre-crisis and crisis period. Lastly, in the post-crisis period, similar to the pre-crisis, negative CASC are observed except for day -10 to day 1. In this case, significant widening of spread confirms anticipation to downgrades up to 10 days before the event and still certain market reaction on the announcement day.

Regarding upgrades events, narrowing of the CDS spreads are noted during the entire event window in each period. Significant results are found to confirm CDS market reaction before and during the crisis, as well as certain anticipation in the post-crisis. The results are characterized by the notably lower reaction on the post-crisis period.

Before the crisis, negative reviews only widened the spread in the time interval [-1,1] as a sign of market reaction, results significant at a 1% level. During the crisis, a longer widening of the spread is noted although these results can not be validated. Later, on the post-crisis, an increase on the CDS spread can be confirmed only in the event window containing the announcement day. Similar to the two previous cases, greater market reaction towards the announcement is noticed before and during the crisis.

Positive reviews, similar to upgrades, narrow CDS spreads in all windows of the three periods, except in the crisis period where negative CASC are observed after the announcement. In the pre-crisis period, significance is found in almost every window, suggesting market anticipation and reaction, however, this conclusion is drawn based on a limited number of observations. Also, few observations are collected on the crisis period and fewer spread changes could be evidenced. However, on the post-crisis significant negative CASC are observed from day -90 to day 1, confirming market anticipation and reaction up to the event day, although lower levels of spread reaction in the post-crisis period apply also for positive reviews.

Due to the limited number of observations collected and the lack of significance, this paper does not elaborate on the results of neutral reviews and stable ratings after reviews. Nevertheless, they can be found on Table 13.

Overall, a larger widening of spread before and during the crisis period is common for downgrades and negative reviews, where reviews have the largest impact on CDS spread before and after crisis. The premium related to positive events for each event type, also higher spread changes are also noted before and during the crisis periods. Overall, the fact that for any of the events types the spread changes levels are lower on the post-crisis period entails that after the crisis investors did not consider as much the information contained in rating changes as they used to. Results are similar to those of Bedendo et al. (2013) who investigated the reputation of the rating agencies after the financial recession to conclude a higher impact of credit rating changes on investors before the crisis; especially in case of negative reviews.

Table 13. Cumulative abnormal spread changes per event type per sub-window over the periods of interest.

		Pre-crisis			Crisis			Post-crisis		
Type of event	Window	N	CASC	T and P-Value	N	CASC	T and P-Value	N	CASC	T and P-Value
Downgrades	[-90,-61]	64	-0.1705	-1.88 0.0634*	222	-0.0081	-0.17 0.8598	328	-0.0147	-0.82 0.4112
	[-60,-31]	64	-0.0708	-0.69 0.4907	222	0.0029	0.06 0.9471	328	-0.0015	-0.08 0.9354
	[-30,-11]	64	-0.1073	-1.52 0.1321	222	0.0414	1.14 0.2546	328	-0.0035	-0.27 0.7872
	[-10,-2]	64	0.0149	0.35 0.7254	222	0.0136	0.70 0.4827	328	0.0194	2.08 0.0375 **
	[-1,1]	64	0.0587	1.54 0.1265	222	0.0440	2.52 0.0124 **	328	0.0127	1.65 0.0997*
	[2,10]	64	-0.0461	-1.41 0.1613	222	-0.0137	-0.83 0.4059	328	-0.0079	-0.92 0.3548
	[11,30]	64	-0.1695	-2.26 0.0269**	222	0.0212	0.64 0.5183	328	-0.0351	-2.01 0.0449 **
Upgrades	[-90,-61]	80	-0.0921	-1.19 0.2358	89	-0.0990	-1.53 0.1292	420	-0.0369	-1.74 0.0820*
	[-60,-31]	80	-0.0368	-0.56 0.5769	89	-0.1233	-1.82 0.0712*	420	-0.0065	-0.29 0.7686
	[-30,-11]	80	-0.0552	-1.19 0.2371	89	-0.0847	-1.60 0.1122	420	-0.0271	-1.62 0.1045
	[-10,-2]	80	-0.0738	-2.41 0.0178**	89	-0.0191	-0.64 0.5183	420	-0.0211	-2.45 0.0145 **
	[-1,1]	80	-0.0499	-1.94 0.0552*	89	-0.0504	-3.16 0.0021**	420	-0.0035	-0.49 0.6241
	[2,10]	80	-0.0280	-0.87 0.3859	89	-0.0203	-0.68 0.4983	420	-0.0148	-1.70 0.0894*
	[11,30]	80	-0.0539	-0.90 0.3691	89	-0.0392	-0.65 0.5170	420	-0.0070	-0.42 0.6696

Table 13. Cumulative abnormal spread changes per event type per sub-window over the periods of interest. ***(Continued)***

		Pre-crisis			Crisis			Post-crisis		
Type of event	Window	N	CASC	T and P-Value	N	CASC	T and P-Value	N	CASC	T and P-Value
Negative reviews	[-90,-61]	79	-0.0687	-0.98 0.3275	169	0.0683	1.47 0.1418	244	-0.044	-1.47 0.1406
	[-60,-31]	79	-0.0475	-0.60 0.5487	169	-0.0154	-0.32 0.7462	244	-0.0387	-1.39 0.1634
	[-30,-11]	79	-0.0110	-0.20 0.8388	169	0.0238	0.67 0.5018	244	-0.0084	-0.39 0.6947
	[-10,-2]	79	-0.0146	-0.44 0.6575	169	0.0509	2.17 0.0309 **	244	0.0147	1.23 0.2184
	[-1,1]	79	0.1422	2.99 0.0037 ***	169	0.1177	5.14 0.00	244	0.0754	5.04 0.0000 ***
	[2,10]	79	-0.0047	-0.14 0.8863	169	0.0082	0.34 0.7322	244	0.0099	0.82 0.4100
	[11,30]	79	-0.0058	-0.08 0.9290	169	-0.0163	-0.45 0.6529	244	-0.0576	-2.72 0.0068 ***
Positive reviews	[-90,-61]	36	-0.1615	-1.32 0.1949	54	0.0645	0.92 0.3576	143	-0.1017	-2.50 0.0133**
	[-60,-31]	36	-0.1463	-2.18 0.0360**	54	-0.0352	-0.55 0.5831	143	-0.1102	-2.97 0.0034 ***
	[-30,-11]	36	-0.0772	-1.12 0.2690	54	-0.0744	-2.07 0.0432 **	143	-0.0442	-1.78 0.0762*
	[-10,-2]	36	-0.0886	-1.88 0.0681*	54	-0.0126	-0.44 0.6603	143	-0.0436	-2.49 0.0138
	[-1,1]	36	-0.1229	-4.45 0.0001 ***	54	-0.1219	-3.96 0.0002 ***	143	-0.0377	-1.89 0.0600*
	[2,10]	36	-0.1031	-2.81 0.0079 ***	54	0.0217	0.60 0.5459	143	-0.0235	-1.33 0.1854
	[11,30]	36	-0.1007	-2.23 0.0321**	54	0.0168	0.32 0.7491	143	0.0253	-0.76 0.4428
Neutral reviews	[-90,-61]	4	-0.1194	-0.76 0.4428	4	0.4307	-1.77 0.1740	21	-0.0340	1.92 0.1497
	[-60,-31]	4	0.0196	-0.62 0.539	4	0.1462	0.31 0.7724	21	-0.0148	1.46 0.2385
	[-30,-11]	4	-0.0116	-0.30 0.7628	4	0.0210	-0.27 0.8006	21	0.0140	0.32 0.7677
	[-10,-2]	4	0.0044	0.56 0.5798	4	0.0417	0.05 0.9604	21	-0.0019	1.25 0.2975
	[-1,1]	4	-0.0063	-0.07 0.9391	4	0.7034	-0.05 0.9595	21	-0.0487	1.85 0.1601
	[2,10]	4	-0.0221	-1.07 0.2967	4	0.0174	-0.25 0.8128	21	-0.0039	0.34 0.7515
	[11,30]	4	0.0016	-0.12 0.8986	4	0.0298	0.04 0.9700	21	-0.0204	0.44 0.6833

Table 13. Cumulative abnormal spread changes per event type per sub-window over the periods of interest. ***(Continued)***

		Pre-crisis			Crisis			Post-crisis		
Type of event	Window	N	CASC	T and P-Value	N	CASC	T and P-Value	N	CASC	T and P-Value
Stable ratings after negative reviews	[-90,-61]	22	-0.0294	-0.40 0.6875	38	-0.2134	-3.01 0.0047***	51	-0.0628	-1.50 0.1265
	[-60,-31]	22	-0.0984	-1.13 0.2704	38	-0.2175	-3.73 0.0006***	51	-0.0175	-0.57 0.5669
	[-30,-11]	22	-0.0137	-0.28 0.7769	38	-0.1352	-3.25 0.0024***	51	-0.0500	-1.21 0.2288
	[-10,-2]	22	-0.0418	-1.87 0.0748*	38	0.0033	0.10 0.9142	51	-0.0111	-1.21 0.2316
	[-1,1]	22	-0.0362	-2.50 0.0207**	38	-0.0339	-2.11 0.0412**	51	-0.01803	-1.96 0.0551**
	[2,10]	22	-0.0427	-2.03 0.0551*	38	-0.0880	-3.60 0.0009***	51	-0.0133	-1.16 0.2484
	[11,30]	22	0.0692	1.22 0.2327	38	-0.1228	-3.17 0.0030***	51	-0.0157	-0.49 0.6216
Stable ratings after positive reviews	[-90,-61]	0	-	-	3	0.0542	0.15 0.8944	13	-0.0285	-0.45 0.6586
	[-60,-31]	0	-	-	3	0.0750	0.23 0.8338	13	-0.0963	-1.35 0.2003
	[-30,-11]	0	-	-	3	-0.0352	-0.41 0.720	13	-0.0137	-0.28 0.7836
	[-10,-2]	0	-	-	3	0.0990	1.28 0.3269	13	0.0529	1.04 0.3160
	[-1,1]	0	-	-	3	0.0664	2.24 0.1537	13	0.0452	0.84 0.4170
	[2,10]	0	-	-	3	0.0441	0.48 0.6741	13	0.0408	1.33 0.2069
	[11,30]	0	-	-	3	0.0301	0.20 0.8598	13	0.0206	0.36 0.7200
Stable ratings after neutral reviews	[-90,-61]	2	-0.1313	-2.08 0.2852	2	-0.2943	-2.70 0.2252	6	0.0058	0.08 0.9319
	[-60,-31]	2	0.1320	0.49 0.7065	2	-0.0863	-1.06 0.4809	6	-0.0611	-0.83 0.4428
	[-30,-11]	2	0.0440	1.59 0.3558	2	-0.4567	-2.21 0.2695	6	-0.0155	-0.30 0.7731
	[-10,-2]	2	0.0171	0.50 0.7023	2	-0.0568	-0.76 0.5852	6	0.0198	0.57 0.5879
	[-1,1]	2	-0.0380	-2.24 0.2673	2	-0.0006	-0.00 0.9963	6	-0.0099	-0.88 0.4158
	[2,10]	2	0.028	1.90 0.3082	2	0.1454	0.52 0.6934	6	0.0724	0.86 0.4286
	[11,30]	2	-0.0354	-0.64 0.6335	2	0.0269	0.15 0.8998	6	0.0422	1.66 0.1563

The table represents cumulative abnormal spread changes as a % of the change in each time interval caused by each event type during the three periods studied. The results are based on the market model. N denotes the number of observations. The null hypothesis is mean-CASC=0 under the t-test. Statistical significance is calculated using one-sample t-test, where significance at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

7.4 CDS influence forecasting rating events

In this section, results from logistic regression are displayed in Table 14. Panel A exhibits the outcomes regarding credit rating changes within investment grade (IG), within speculative grade (SG), fallen angels and rising stars. Panel B shows the results of the logistic test for both positive and negative reviews and those events preceded by a review. Overall, the majority of the events tested can be forecasted if noticing the spread change of the 30 days before the coming announcement and therefore hypothesis 9 can be confirmed.

First, this paper considers that the study obtained a significant high value of LR-chi-squared for each regression and therefore a good fit of the model where spread changes predict the probability of a rating announcement can be validated.

Results of Panel A indicate that CDS premiums are good predictors of downgrades within both sides of the rating scale, of fallen angels and of rising stars, as significance is found for those coefficients. However, insignificant coefficients for the probability of investment and speculative grade upgrades is observed, and therefore CDS spreads are not adequate predictors of such events. It should be also noted that for all cases the coefficient $\beta 0$ is significant.

In order to determine the magnitude of the forecasting effect this research includes marginal effect values which, overall, are low for all types of events. The marginal effect of both downgrades in the investment and the speculative grade indicate that one basis point increase of the spread increases the probability of a downgrade by 0.01 percent points. This probability is higher in cases of crossborder events, as the probability increases to 0.04 and 0.05 percent points for fallen angels and rising stars respectively.

The outcomes of Panel B reveal significant coefficients of spread changes for the probabilities of positive reviews and events that have been preceded by reviews, both positive and negative. Conversely, there is no evidence to affirm that negative reviews can be forecasted by observing CDS spread changes. Also, in these cases the coefficient $\beta 0$ is significant.

When observing the magnitude of the forecast impacts however, some surprising results are found. To start with, the marginal increase in the probability of an event happening after a negative review was placed is close to zero. What is more, there is a positive relationship between positive reviews and spread changes suggesting that a decrease of a basis point of the spreads leads to a decrease of the probability of a positive review happening.

Among the prior literature on this topic, Hull et al. (2004) found that the adjusted spread levels could predict downgrades and review for downgrades, results that are partially in line with the ones obtained in this research. These outcomes are consistent with the results of Finnerty et al. (2013) who discovered that the CDS market can not predict neither upgrades nor negative reviews.

Table 14. Spread changes predictive power of rating events.

Panel A

		Type of event					
		Downgrades between IG	Downgrades between SG	Upgrades between IG	Upgrades between SG	Fallen angels	Rising stars
CDS Spread Change	Coefficient	0.0009	0.0008	-0.0009	0.0001	0.0034	-0.0044
	SE	0.0003	0.0001	0.0007	0.0001	0.0004	0.0010
	Z-Value	0.0026***	0.0000***	0.228	0.686	0.0057***	0.0023 ***
Constant	Coefficient	-1.7925	-1.7960	-1.7919	-1.7919	-1.8159	-1.7986
	SE	0.01162	0.0120	0.01129	0.01309	0.02704	0.0262
	Z-Value	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.000***
	N	60,480	56,910	64,050	47,670	11,550	11,970
	Marginal Effects	0.0001	0.0001	-0.0001	0.0000	0.0004	-0.0005

Panel B

		Type of event			
		Negative reviews	Positive reviews	Announcements after negative reviews	Announcements after positive reviews
CDS Spread Change	Coefficient	-0.00003	0.0009	-0.0006	0.0010
	SE	0.0001	0.0002	0.0001	0.0005
	Z-Value	0.8480	0.0005***	0.0000***	0.0597*
Constant	Coefficient	-1.7917	-1.7912	-1.7921	-1.7911
	SE	0.0088	0.0174	0.01154	0.0204
	Z-Value	0.0000***	0.0000***	0.0000***	0.0000***
	N	103,320	48,930	61,320	19,530
	Marginal Effects	-0.0000	0.0001	0.0000	0.0001

The table represents the coefficients of the logistic regressions, where CDS spread change in is the predictor variable and SE denotes standard errors. Statistical significance is calculated using Wald test where significance at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

7.5 Robustness check

For robustness purposes, this paper also carried out the analysis of hypothesis 1. 2 and 3 under the market-adjusted model. However, the results obtained are not in line with those from the market model in terms of the direction of the spread change under each event type and the significance over these spread changes. Market-adjusted model results can be found in Table 15.

Both downgrades and negative reviews generate a widening in the spread from the day -10 to day 30, which suggest some symptoms on anticipation, however the magnitude of the spread changes on the event day and after is more pronounced than those obtained using the market model. Notwithstanding the previous, only significant market reaction to negative reviews can be confirmed. Stable ratings after positive reviews although widen considerably the CDS spread from day -30 until the day after the event are not significant.

Regarding positive events, both upgrades and stable ratings after negative reviews display changing directions of the spread changes, from which a trend is difficult to define. Besides that, positive reviews narrow CDS spread in almost every window, results that resemble those of the market model.

In what respects to neutral events, while neutral reviews present mixed CASC directions, stable ratings after neutral reviews caused a narrowing of the spread in almost every event window.

Besides all the above, it is also noticeable that significance of the market reaction is considerably lower than in the market model, as there is barely evidence to reject the null hypotheses over the entire robustness study.

Table 15. Cumulative abnormal spread changes per event type per sub-window using the market-adjusted model.

Type of event		Window [-90,-61]	[-60,-31]	[-30,-11]	[-10,-2]	[-1,1]	[2,10]	[10,30]
Downgrades	N	614	614	614	614	614	614	614
	ASC	-0.321	-20.353	-1.400	1.501	3.156	2.979	4.123
	T- Value	-0.25	-1.45	-0.85	0.80	1.60	1.55	2.50
	P- Value	0.789	0.154	0.402	0.414	0.108	0.122	0.013**
Upgrades	N	589	589	589	589	589	589	589
	ASC	0.254	-1.161	-0.168	0.736	0.875	-0.380	0.303
	T- Value	0.35	-1.30	-0.20	0.90	0.95	-0.65	0.50
	P- Value	0.739	0.199	0.844	0.360	0.331	0.503	0.610
Negative reviews	N	492	492	492	492	492	492	492
	ASC	-0.332	1.271	-0.902	1.807	3.913	0.136	1.266
	T- Value	-0.40	10.20	-0.75	1.60	2.70	0.10	0.90
	P- Value	0.700	0.236	0.442	0.110	0.007***	0.929	0.364
Positive reviews	N	233	233	233	233	233	233	233
	ASC	-1.077	-5.957	-2.023	0.005	-2.751	-1.85	2.122
	T- Value	-0.65	-2.40	-1.10	0.00	-1.850	-1.10	1.40
	P- Value	0.532	0.018**	0.266	0.998	0.067*	0.273	0.156
Neutral reviews	N	29	29	29	29	29	29	29
	ASC	-1.497	1.065	-4.134	2.172	-2.531	1.478	2.675
	T- Value	-0.85	0.35	-0.60	1.75	-0.65	1.80	1.25
	P- Value	0.407	0.719	0.540	0.095*	0.535	0.084*	0.222
Stable ratings after negative reviews	N	111	111	111	111	111	111	111
	ASC	-4.428	2.698	0.814	-1.973	-1.531	-3.289	3.901
	T- Value	-1.55	0.90	0.25	-0.60	-0.75	-1.45	1.35
	P- Value	0.120	0.372	0.800	0.562	0.455	0.149	0.180
Stable ratings after positive reviews	N	16	16	16	16	16	16	16
	ASC	-2.769	-0.369	1.763	10.392	9.656	-10.154	-3.385
	T- Value	-1.42	-0.23	0.55	0.89	1.68	-1.26	-0.53
	P- Value	0.175	0.816	0.586	0.385	0.113	0.224	0.600
Stable ratings after neutral reviews	N	10	10	10	10	10	10	10
	ASC	-0.899	-0.822	-3.388	1.058	-4.587	-8.082	-0.295
	T- Value	-0.96	-0.32	-3.22	0.63	-0.84	-1.84	-0.16
	P- Value	0.361	0.753	0.010	0.542	0.420	0.097*	0.8717

The table represents abnormal spread changes in basic points in each time interval caused by each event type using the market-adjusted model, where N denotes the number of observations. The null hypothesis is mean-ASC=0 under the t-test. Statistical significance is calculated using one-sample t-test, where significances at a 1% level is indicated with ***, at a 5% level with ** and at a 10% level with *.

CHAPTER 8 Conclusions

This chapter draws conclusions out of the findings of the previous chapter and determines the contribution to the body of knowledge, its limitations and suggests avenues for future research on this topic.

8.1 Conclusions

This paper studies the relation between two indicators of credit risk, credit ratings announcements and CDS premiums, in order to answer the main research question: *do credit rating announcements lead the CDS market measuring the credit quality of an issuer?* To answer this question, an event study is performed over eight types of rating announcements of S&P and Moody's agencies and the 5-year CDS spread changes of U.S. corporates. As both rating agencies and CDS derivatives are held responsible for contributing to the financial crisis, this analysed the relation of both credit risk measures over the years 2004 to 2018; where 2004-2006 is considered pre-crisis, 2007-2009 crisis and 2010- 2018 post-crisis period.

The first hypothesis designed was the response of the CDS market to rating announcements. On this note, however, this paper finds evidence of the CDS market anticipating downgrades and negative reviews. In addition, this market still reacts on the announcement day suggesting ratings publications still convey useful information to investors, while this reaction is greater towards negative reviews than downgrades. However, widening of spreads is found after the announcement as a sign of possible price adjusted. Although the results of the impact of stable ratings after positive reviews are in line with the expectations, no significant spread change can be seen. This research also reveals both anticipation and reaction to upgrades, positive reviews and stable ratings after negative reviews. These findings concerning positive events are relatively novel among the literature as not many researchers found prove of market reaction to positive events. It is to be noted that the anticipation and reaction to positive events is lower than to negative events, which confirms the hypothesis formulated regarding the existence of market information asymmetry. Conversely, no conclusion can be drawn regarding the information conveyed in neutral events.

Furthermore, on the hypothesis of the asymmetric reaction of non-crossborder and crossborder announcements, this paper finds that fallen angels and rising stars generate considerably greater spread reaction on announcement day compared to downgrades and upgrades, respectively. This is to the point that fallen angels provoke three times more spread variation than downgrades. When observing the different reaction to events preceded by reviews and to events unpreceded, this paper only finds sufficient evidence to confirm that there was no widening of the spread observed in case of downgrades preceded by negative reviews. The previous suggests that the market includes in the CDS premiums the possibility of downgrades when negative reviews are placed, novel finding among the literature.

In regard to the consequences of the crisis in investors' consideration of the information contained in credit announcements, this paper contributed with proof to confirm a lower CDS response to rating agencies publications after the crisis. The former suggests the relative loss of trust of investors in the rating information system.

Besides finding anticipation in the CDS market of rating announcements, this paper also finds predictive power of most of these events, as negative reviews and upgrades can not be forecasted.

Possible implications of this research for investors and stakeholders could be to increase attention in signs of the CDS market, as they seem to convey reliable information regarding the credit risk of a firm. Although ratings will still play a significant role in decisions such as investing in investment grade securities or fixing interest rates, certain weight of the premiums could be taken as well into account.

This study makes several contributions to the existing body of knowledge. Firstly, it considers the effects of a new rating event type, since it is the first paper that analyses the impact of stable rating announcements after being placed on a review. In this regard, this study also includes neutral events that were commonly disregarded in prior studies. Secondly, the research adds information regarding the different market behaviour by the time of the financial crisis and its aftermath which additionally served to provide a current picture of the market reaction to credit rating changes, as there is lack of contemporary studies in this topic. Thirdly, the findings provided evidence of the importance of negative reviews as these events generated the greater response and the information contained in them was fully incorporated in the CDS prices. Fourthly, this paper employed an innovative methodology which included combining different models used in the prior studies, at the same time that it counts with a wider sample that allows to obtain greater representativeness of the results.

8.2 Limitations and avenues for future research

While conducting this study, several choices and drawbacks were identified as possible limitations of this research.

First, and in a more theoretical note, the fact that rating changes are mostly released under request of the issuer might condition the sample selection. Furthermore, unequal observations are obtained for each agency and therefore, results might only be representative to ratings of S&P agency as it provides the greater number of announcements.

In terms of selection criteria, the exclusion criteria of events that were preceded by other events by 90 days might be stringent and affect the results. Although the majority of the literature applies this criteria, it causes a considerable drop on the sample size and therefore significantly reduces its representativeness. Moreover, Galil and Soffer (2011) on their study showed results that proved that the practice of using uncontaminated samples where clustered announcements are omitted causes underestimation of market response to credit events. In the same contamination line, this study does not consider cross-agency contamination, it analyses the nature of the event regardless of the agency which released it. Also, the inclusion of only U.S. agencies and corporates affects the extrapolation effect as the U.S. agencies have a more stringent regulation on their business than non- US agencies, especially after the crisis period.

A possible limitation of the methodology is the creation of the index used to adjust the CDS spread changes could misrepresent the market. In addition, the number of observations that composes the index is scarce and it does not control for specifics as the industry each corporate belongs to. Moreover, in several scenarios the significance of the results obtained differs depending on the test performed, thus results might be biased. Another limitation found in the research is that the robustness check performed using the market-adjusted model differed from the baseline results.

On another note, during the performance of this research, certain extensions or improvements were identified.

Among those, it could be an avenue of future research to study the effects on credit risk perception under different situations. After the financial recession of the years 2007-2009, the world has experienced certain scenarios where the credit risk of a certain region was in the spotlight. For instance, the attempts of independence of Scotland and Catalonia sent to the markets a sign of uncertainty which was materialized in changes in the stock, bond and CDS markets. Another scenario to study could be the so-called Brexit as it marks a before and after in the European Union history.

Furthermore, the Coronavirus that hit China in December 2019 and quickly expanded globally is leaving behind dire economic consequences. This outbreak is bringing unprecedented reactions of the markets and therefore we might be seeing in the coming months numerous companies facing serious difficulties or even filling bankruptcy. If so, it will not come as a surprise to see a raise in the number of CDS trading as an attempt from investors to hedge for this risk. Therefore, another possible future research could focus on the consequences of this independence events and a worldwide health crisis on the markets.

Additionally, in an attempt to extend the research performed, suggestions to control for company specifics such as debt ratios or industry belonging could enhance the understanding on the topic. Furthermore, a deeper study of the effects of neutral events could be considered for future papers, as there is no evidence for the time being.

Lastly, alternative measures of corporate creditworthiness could be searched for.

APPENDIX A Restructuring terms

The types of restructuring contracts are listed and explained in Table 16.

Table 16. Restructuring type explanation.

Restructuring Type	CDS Code Symbol	Definition
Full restructuring	AC	Any restructuring event is considered credit. It was the default restructuring clause on the standards first contracts.
Modified restructuring	AR	Only those restructuring events considered by the Modified restructuring clause that the ISDA introduced in 2001 are credit events.
Modified-modified restructuring	AM	Only those restructuring events defined by the Modified-modified restructuring clause introduced by the ISDA in 2003 are credit events.
No restructuring	AX	Any restructuring events constitutes credit events.

The restructuring type choice is based on regional preference: fully restructured for Asia, Modified Modified restructuring for Europe and No restructuring for the US.

Source: Prepared by the author based on information provided by Thomson Reuters

APPENDIX B Credit rating announcements definition

This research studies the effects of credit rating announcements on the CDS market. As credit rating announcements, this paper understands and defines 3 types of credit events:

1) Credit rating changes: when a change in the credit risk of a corporate has been identified and therefore, the rating agency publishes a change over the current rating of such corporate. These cases involve both upgrades and downgrades.
2) Reviews: when the agency has noted a potential change in the credit risk of the corporate and published a review to indicate a possible future credit rating change. Reviews can be negative if they send signs that there could be a coming downgrade, positive if they believe an upgrade could happen in the near future or neutral when the direction of the change is not yet defined.
3) Stable ratings after a review: in these cases, the company does not change the rating being under review. This is if previously the agency has placed an issuer under a negative review, but the downgrade is not materialised, and the company stays stable in the latest rating assigned before it was being reviewed. Here we can find stable ratings after a negative review, stable ratings after a positive review or stable ratings after a neutral review.

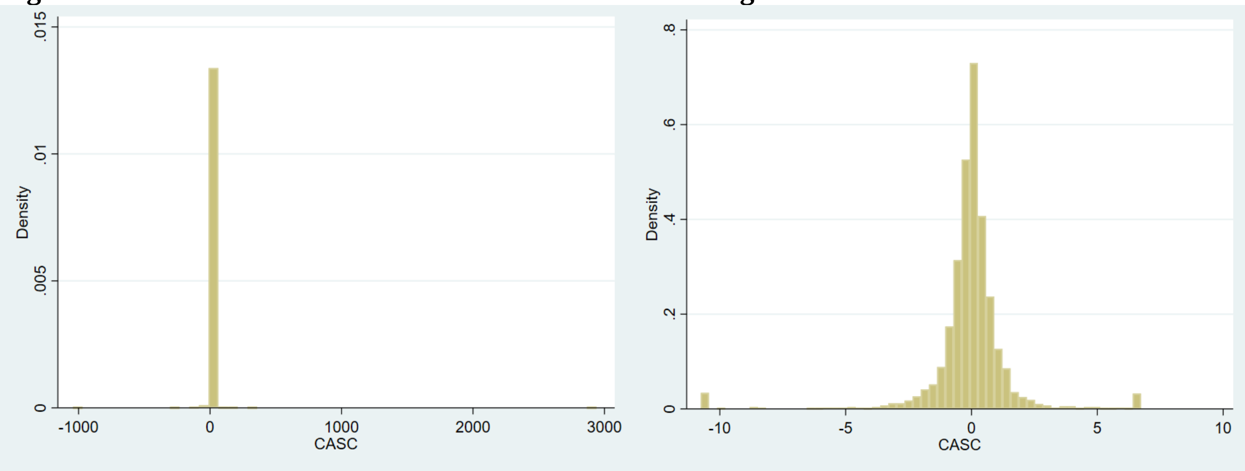
Moreover, this paper considers:

1) Negative events: downgrades, negative reviews and stable ratings after positive reviews.
2) Positive events: upgrades, positive reviews and stable ratings after negative reviews.
3) Neutral events: neutral reviews and stable ratings after neutral reviews.

APPENDIX C Normal distribution test

This appendix is devoted to show the search for normalization distribution of the CASC. Figure 9 displays at the left side the distribution the results before the data was winsorized and Table 17 the summary statistics of the CASCs. After observing the previous, the existence of outliers is concluded and data is wonsorized, which distribution can be observed in the right side of Figure 9.

Figure 9. Distribution of CASC before and after winsorizing.



Source: Prepared by the author based on results from Stata

Table 17. Summary statistics of CASC.

	Mean	SD	Min	Max
CASC	0.9443	69.3414	-1043.2430	2939.4221

Another check for the normality distribution of the CASC is performed conducting a Shapiro-Wilk Test. The result of Table 18 where the value W represents the deviation from normality. According to this test, there CASC do not follow a normal distribution.

Table 18. Shapiro-Wilk test.

Shapiro-Wilk W test for normal data					
	N	W	V	Z	Prob>z
CASC	2,094	0.6613	418.806	15.384	0.0000

Note: The normal approximation to the sampling distribution of W' is valid for 4<=n<=2000.

REFERENCES

Adelson, M. H. (2012). The Role of credit ratings in the financial system. Standard & Poor's.

Augustin, P., Subrahmanyam, M. G., Tang, D. Y., & Wang, S. Q. (2014). Credit Default Swaps: A Survey. *Foundations and Trends in Finance*, 1-188.

Aruna Viswanatha, Karen Freifeld (2015). S&P reaches $1.5 billion deal with U.S., states over crisis-era ratings. Retrieved September 29, 2019 from: https://www.reuters.com/article/us-s-p-settlement/sp-reaches-1-5-billion-deal-with-u-s-states-over-crisis-era-ratings-idUSKBN0L71C120150203

Bank for International Settlements. Committee on the Global Financial System. (2005). The Role of Ratings in Structured Finance: Issues and Implications.

Bank of International Settlements' Joint Forum. (2009). Stocktaking on the Use of Credit Ratings.

Basel Committee on Banking Supervision (n.d.) Basel II: Revised international capital framework. About Basel II, Place unknown: Bank for International Settlements. Retrieved November 15, 2019 from: https://www.bis.org/publ/bcbsca.htm

Bedendo, M., Cathcart, L., El-Jahel, L., & Evans, L. (2013). The credit rating crisis and the informational content of corporate credit ratings. *Unpublished working paper. Bocconi University, Imperial College Business School, and University of Auckland.*

Bedendo, M., Cathcart, L., & El-Jahel, L. (2018). Reputational shocks and the information content of credit ratings. *Journal of Financial Stability,* 34, 44-60.

Blanco, R., Brennan, S., & Marsh, I. W. (2005). An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps. *The journal of Finance,* 60(5), 2255-2281.

Bolton, P., Freixas, X., & Shapiro, J. (2012). The credit ratings game. *The Journal of Finance*, 67(1), 85-111.

Brown, S. J., & Warner, J. B. (1980). Measuring security price performance. *Journal of financial economics*, 8(3), 205-258.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies. *Journal of financial economics*, 14(1), 3-31.

Daniels, K. N., & Jensen, M. S. (2005). The effect of credit ratings on credit default swap spreads and credit spreads. *The Journal of Fixed Income*, 15(3), 16-33.

De Haan, J., & Amtenbrink, F. (2011). Credit rating agencies. *DNB Working Paper, 2011 (278),*1-37.

Deb, P., & Murphy, G. (2009). Credit rating agencies: An alternative model. *London School of Economics working pape*r. 1-27.

Dichev, I. D., & Piotroski, J. D. (2001). The long-run stock returns following bond ratings changes. *The Journal of Finance*, 56(1), 173-203.

Duffie, D. (1999). Credit swap valuation. *Financial Analysts Journal*, 55(1), 73-87.

Ederington, L. H., & Yawitz, J. B. (1985). The bond rating process. Washington University. Institute of Banking and Financial Markets.

Ederington, L. H., & Goh, J. C. (1998). Bond rating agencies and stock analysts: who knows what when?. *Journal of Financial and Quantitative Analysis*, 33(4), 569-585.

Ericsson, J., Jacobs, K., & Oviedo, R. (2009). The determinants of credit default swap premia. *Journal of financial and quantitative analysis*, 44(1), 109-132.

Fabozzi, F. J. (2013). Bond markets, analysis and strategies. 8-th ed.

Finnerty, J. D., Miller, C. D., & Chen, R. R. (2013). The impact of credit rating announcements on credit default swap spreads. *Journal of Banking & Finance*, *37*(6), 2011-2030.

Fischer Black and Myron Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81 (1973), pp. 637–654.

Forte, S., & Pena, J. I. (2009). Credit spreads: An empirical analysis on the informational content of stocks, bonds, and CDS. *Journal of Banking & Finance, 33*(11), 2013-2025.

Foster, J. B., & Magdoff, F. (2009). The great financial crisis: Causes and consequences. NYU Press.

Fung, H. G., Wen, M. M., & Zhang, G. (2012). How does the use of credit default swaps affect firm risk and value? Evidence from US life and property/casualty insurance companies. *Financial Management*, 41(4), 979-1007.

Galil, K., & Soffer, G. (2011). Good news, bad news and rating announcements: An empirical investigation. *Journal of Banking & Finance*, 35(11), 3101-3119.

Galil, K., Shapir, O. M., Amiram, D., & Ben-Zion, U. (2014). The determinants of CDS spreads. *Journal of Banking & Finance*, 41, 271-282.

Gonzalez, F., Haas, F., Persson, M., Toledo, L., Violi, R., Wieland, M., & Zins, C. (2004). Market dynamics associated with credit ratings: a literature review. *ECB Occasional Paper*, (16).

Harris, T., & Hardin, J. W. (2013). Exact Wilcoxon signed-rank and Wilcoxon Mann–Whitney ranksum tests. *The Stata Journal*, 13(2), 337-343.

Hull, J., Predescu, M., & White, A. (2004). The relationship between credit default swap spreads, bond yields, and credit rating announcements. *Journal of Banking & Finance*, 28(11), 2789-2811.

International Swaps and Derivatives Association (ISDA). ISDA Market Survey: Notional amounts outstanding at year-end, all surveyed contracts, 1987–present. Retrieved October 10, 2019 from https://web.archive.org/web/20120307124122/http://www.isda.org/statistics/pdf/ISDA-Market-Survey- annual-data.pdf.

International Swaps and Derivatives Association (ISDA). ISDA Market Survey: Summaries of market survey results. Retrieved October 10, 2019 from https://web.archive.org/web/20110913153054/http://www.isda.org/statistics/recent.html

Ismailescu, I., & Kazemi, H. (2010). The reaction of emerging market credit default swap spreads to sovereign credit rating changes. *Journal of Banking & Finance*, 34(12), 2861-2873.

Löffler, G. (2004). An anatomy of rating through the cycle. *Journal of Banking & Finance*, 28(3), 695-720.

Longstaff, F. A., Mithal, S., & Neis, E. (2005). Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market. *The Journal of Finance*, 60(5), 2213-2253.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of economic literature*, 35(1), 13-39.

Marshall, J. F. (2001). Dictionary of Financial Engineering (Vol. 74). John Wiley & Sons.

Mathis, J., McAndrews, J., & Rochet, J. C. (2009). Rating the raters: are reputation concerns powerful enough to discipline rating agencies?. *Journal of monetary economics*, 56(5), 657-674.

Menard, S. (2010). Logistic regression: From introductory to advanced concepts and applications. Sage.

Micu, M., Remolona, E., & Wooldrigde, P. (2004). The price impact of rating announcements: evidence from the credit default swap market. Bank for International settlements. Quarterly Review , pp. 55-64.

Micu, M., Remolona, E. M., & Wooldridge, P. D. (2006). The price impact of rating announcements: which announcements matter?. Bank for International settlements. No 207.

Mishkin, F. S. (2011). Over the cliff: From the subprime to the global financial crisis. *Journal of Economic Perspective*s, 25(1), 49-70.

Moody's. (2014). Rating symbols and definitions. Retrieved October 1, 2019 from https://www.moodys.com/sites/products/AboutMoodysRatingsAttachments/MoodysRatingSymbolsandDefinitions.pdf

Norden, L., & Weber, M. (2004). Informational efficiency of credit default swap and stock markets: The impact of credit rating announcements. *Journal of Banking & Finance*, 28(11), 2813-2843.

Norden, L. (2008). Credit derivatives, corporate news, and credit ratings. Mannheim, Department of Banking and Finance, University of Mannheim.

Ratings, S.P.G. (2014). Guide to Credit Rating Essentials. Retrieved December 15, 2019 from: https://www.spratings.com/documents/20184/774196/Guide_to_Credit_Rating_Essentials_Digital.pdf

Ratings, S.P.G. (2016). S&P Global Ratings Definitions. Retrieved October 1, 2019 from: https://-www. standardandpoors. com/en_US/web/guest/article/-/view/sourceId/504352

Ratings, S.P.G (2019). General description of the Credit Rating Process (as of March 1, 2019). Retrieved October 1, 2019 from: https://www.standardandpoors.com/en_US/delegate/getPDF;jsessionid=B5E9618648A6CA49B12C0C332C68E2A3?articleId=2194024&type=COMMENTS&subType=REGULATORY.

Robert Merton, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*,29 (1974), pp. 449–470.

Scholes, M. (2010). Regulating Wall Street: The Dodd-Frank Act and the new architecture of global finance (Vol. 608). John Wiley & Sons.

Securities and Exchange Commission. (2018). Annual Report on Nationally Recognized Statistical Rating Organizations. *As Required by Section*, 6.

Snedecor, George W. and Cochran, William G. (1989), Statistical Methods, Eighth Edition, Iowa State University Press.

Steiner, M. & Heinke, V. (2001). Event study concerning international bond price effect of credit rating actions. *International Journal of Finance and Economics*, Vol. 6 (2001), p.139-157.

Stulz, R. M. (2010). Credit default swaps and the credit crisis. *Journal of Economic Perspectives*, 24(1), 73-92.

Subrahmanyam, M. G., Tang, Y. D., & Wang, Q. S. (2014). Does the Tail Wag the Dog?: The Effect of Credit Default Swaps on Credit Risk. *The Review of Financial Studies*, 27(10), 2927-2960.

Tett, G. (2006). Financial times: The dream machine: invention of credit derivatives. Retrieved on October 12, 2019 from: https://www.ft.com/content/7886e2a8-b967-11da-9d02-0000779e2340

United States. Congress. (2010). Dodd-Frank Wall Street Reform and Consumer Protection Act: Conference Report (to Accompany HR 4173) (Vol. 111, No. 517). US Government Printing Office.

Vassalou, M., & Xing, Y. (2003). Equity returns following changes in default risk: New insights into the informational content of credit ratings. *In EFA 2003 Annual Conference Paper* (No. 326).

Weil, R. L., Wagner, M. J., & Frank, P.B. (2001). Litigation services handbook: The role of the financial expert. John Wiley & Sons. Third Edition.

Wengner, A., Burghof, H. P., & Schneider, J. (2015). The impact of credit rating announcements on corporate CDS markets—Are intra-industry effects observable?. *Journal of Economics and Business*, 78, 79-91.

Zhu, H. (2006). An empirical comparison of credit spreads between the bond market and the credit default swap market. *Journal of Financial Services Research*, 29(3), 211-235.