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POST- CREDIT ANNOUNCEMENT DRIFT

An Empirical Assessment of Credit Rating Announcements and Their Influence on the US Equity Market

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The aim of this study is twofold; (i) to investigate whether credit rating announcements result in a drift in stock prices on the US equity market and, if proven, (ii) how the drift is affected by firm size and the presence of extreme credit rating announcements. Using a sample of 2 922 credit rating announcements, this study examines the long-run stock performance subsequent to credit rating announcements, i.e. the post-credit announcement drift (PCAD), in the United States between 1992 and 2014. It is shown that abnormal stock returns remain up to 180 trading days and are asymmetrically distributed among downgrades and upgrades. In contrast to previous research, upgrades are followed by economically and statistically significant cumulative abnormal returns. The results are sensitive to market liquidity. Further, the magnitude and persistence of drift are, as expected, negatively correlated to firm size. However, extreme credit rating announcements cannot be confirmed to produce larger drift magnitude, contradictory to what is expected. Finally, our results indicate an overreaction following extreme credit rating announcements, contributing to the thinly research of extreme news drift persistence.

Key words: Post-Credit Announcement Drift, Market Efficiency, Abnormal Returns, Credit Rating Changes, Credit Rating Agencies

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1. INTRODUCTION

A credit rating is the relative ranking of probability to default (Kaplan, Urwitz 1979). When a credit rating agency (CRA) releases a credit rating announcement, characterised by an upgrade or a downgrade, it will signify an improvement or deterioration of a firm's financial condition. Arguably, credit rating announcements are common and well-disseminated information events, and empirically evidenced to impact financial markets (Dichev, Piotroski 2001).

Fundamental economic theory states that financial markets should be efficient (White, Sondhi et al. 2003). Accordingly, Fama (1970) claims three forms of market efficiency: the weak, the semi-strong, and the strong form of efficiency. The first claims that current stock prices fully reflect all *historical* stock information. The second means that all *public* information is incorporated in the current stock price. The third means that *all* information is fully absorbed, private and public. In this study, we will focus on the second, semi-strong-form efficient market where reaction to new public information is *immediate* and correct (Holthausen, Leftwich 1986). However, an extensive body of empirical research opposes the theorem of efficient markets as stock price returns tend to drift, succeeding public information announcements (Dichev, Piotroski 2001).

The first aim of this study is to investigate whether credit rating announcements result in a drift in stock prices on the US equity market. Previous studies within post-credit announcement drift, henceforth denoted PCAD, tend to focus on the initial reaction and the *magnitude* effect around announcements, but notably few have considered the *persistence* of drift. As previous PCAD studies lack long run focus, we find theories of post-earnings announcement drift (PEAD) applicable. More explicitly, PEAD is described as the delayed abnormal upward (downward) stock return response to announcements of good (bad) earnings news (Setterberg 2011). Asserting a clear association between earnings news and subsequent abnormal stock returns, the market is accused of failing to realise the implications of the news (Ball, Brown 1968). Equalising earnings bad news (good news) to credit rating downgrades (upgrades), PCAD studies find a similar reaction to the market, in which credit rating announcements generate a delayed stock price reaction.

We hypothesize a long run drift in PCAD to be present on the US equity market. Since the phenomenon of drift is observed in both PEAD and PCAD, we will be able to derive possible explanations from PEAD studies. The hypothesis is tested using an event-window of 180 trading days including credit rating announcements between 1992 and 2014, consisting of two portfolios; downgrades and upgrades.

The second aim of our study is to investigate how the drift is affected by firm size and the presence of extreme credit rating announcements. Acknowledged by previous research, these factors tend to influence the drift.

Our findings indicate that a drift is present in the US equity market. Historically, PCAD studies have been limited to only find significant cumulative abnormal returns (CARs) succeeding downgrades. Contributing to previous research, we find significant abnormal stock returns for both downgrades *and* upgrades. We believe that this improvement is achieved by our large and cleaner sample. Moreover, we can confirm that the drift is persistent up to 180 trading days by using a larger event window compared to previous research. Further, our findings confirm an asymmetric distribution among upgrades and downgrades, indicating that the impact of a CRA as information provider may differ depending on the characteristics of announcements. By controlling for firm size, we find that our significant CARs succeeding upgrades is largely contributed to market liquidity. Unexpectedly, when controlling for extreme credit rating announcements, results are followed by an overreaction. However, we are not able to confirm the expected higher drift magnitude from extreme credit rating announcements.

2. BACKGROUND, PREVIOUS RESEARCH AND HYPOTHESIS

2.1 Background

2.1.1 Credit Rating Agencies and Credit Ratings

A credit rating is a forward-looking opinion about a firm's ability and willingness to meet future financial obligations in full and on time, i.e. the creditworthiness of the firm (Standard & Poor's Rating Services 2015). Further, a credit rating is the relative ranking of a firm's creditworthiness; a high credit rating designation indicates a lower probability of default compared to a low credit rating designation. All credit ratings are assigned by credit rating agencies (CRAs), and the most influential CRAs are Standard and Poor's (S&P), Moody's and Fitch.

If a firm's probability to default has increased (decreased), the firm's credit rating will be downgraded (upgraded). Further, the CRAs designate credit ratings into different rating classes. S&P and Fitch assign 'AAA' as the rating class with lowest risk of default, down to 'D' when the firm is in payment default. The corresponding ratings are 'Aaa' and 'C' by Moody's. S&P and Fitch assign (+) and (-) within rating classes, and Moody assigns (1), (2) and (3). A credit rating change can move over one- or multiple notches (grades), across and within rating classes. At maximum, the total rating scale includes 22 notches (21 for Moodys), representing all possible rating levels. Further, a credit rating can be classified in investment attractiveness; investment grade or non-investment grade, separated between BBB- and BB+ (Baa3 and Ba1 for Moody's). Most institutional investors and banks are restricted to trade investments classified as investment grade, as the category represents a low risk of default (Adelson, Ravimohan et al. 2009). The CRAs credit rating designations are shown in Figure 1.

Figure 1: Credit Rating Designations

S&P/ Fitch	Moody's	Rating Description	
AAA	Aaa	Prime	
AA+	Aa1	High grade	
AA	Aa2		
AA-	Aa3		
A+	A1	Upper medium grade	Investment Grade
A	A2		
A-	A3		
BBB+	Baa1	Lower medium grade	
BBB	Baa2		
BBB-	Baa3		
BB+	Ba1	Speculative grade	
BB	Ba2		
BB-	Ba3		
B+	B1	Highly speculative grade	
B	B2		
B-	B3		
CCC+	Caa1	Substantial risk	Non- Investment Grade
CCC	Caa2		
CCC-	Caa3		
CC	Ca		
C			
D	C	Default	

Figure 1. Credit rating designations for the major CRAs; S&P, Fitch and Moody's. Investment grade and non-investment grade are separated between BBB- and BB+, Baa3 and Ba1 respectively (see the dotted line).

2.1.2 The Credit Rating Process and Credit Rating Announcements

The credit ratings are based upon qualitative and quantitative public and non-public information. The rating process is a multi-faceted factor approach and no standardised formula exists as the relative importance of several factors may vary between industries and during certain circumstances. The rating classes correspond to the same level of creditworthiness between widely disparate firms on a global basis (Adelson, Ravimohan et al. 2009).

Despite a multi-faceted approach, some factors are distinguished to have greater importance. The primary factor of the creditworthiness is the likelihood of default. This judgement is assessed by stress tests where each rating class reflects a level of stress that the credit rating should be able to withstand without defaulting. As the stress tests are highly dependent on external factors and economic cycles may be varying, exact 'default probabilities' cannot be ascribed. Secondary factors being important in the credit rating process are for example the projected recovery that an investor would expect to receive in case of default, and credit stability related to the firm's sensitivity to changing conditions (Adelson, Ravimohan et al. 2009).

2.1.3 The Relationship Between Credit Rating Announcements and Stock Prices

Evaluating firm probability of default (p-fail), credit ratings capture a significant aspect of bankruptcy risk (Kaplan, Urwitz 1979). Thus, attention to credit rating announcements will influence investors' evaluation of p-fail. Incorporated in several equity valuation models, such as the residual income valuation (RIV) model, p-fail is a contributing factor to valuation (White, Sondhi et al. 2003). Moreover, a firm's financial performance highly affects the outcome of a credit rating. Among several studies within PCAD, Chen et al. (2012) find that the determinants of a credit rating change are closely linked to financial metrics. Moreover, inputs essential in a credit rating process are partly derived from financial information that is also valuable for equity investors.

2.1.4 The Relationship Between Credit Rating Agencies

Empirically, no difference in the information content among the CRAs has been found and credit ratings changes tend to correlate in time and symbol between the major CRAs (Holthausen, Leftwich 1986). Referring to Moody's rating comparison update, over 80% of the ratings announced to S&P and Moody's coincide (Cantor, Harris et al. 2007). Norden (2004), uses data from S&P, Moody's and Fitch and tests for a stock price reaction in a 90-days window. He finds a strong correlation between S&P and Moody's, whereas results from Fitch are insignificant. The insignificance is caused by their main focus in assessing financial firms. Moreover, Dichev and Piotroski (2001) argue that when analysing a large sample, the necessity of including all agencies erodes. Summarising, the three CRAs are good substitutes for each other.

2.1.5 The Drift Explained

If the market is semi-strong efficient, a reaction to a credit rating announcement should be immediate and correct (Hand, Holthausen et al. 1992). This means that there should be a price response at announcement date caused by the change in the stock value when including the new information. If the market does not react immediately and correctly, the gradual adjustment to the correct stock price results in abnormal returns (AR), measured as the actual return less the normal (expected) return. The adjustment of ARs continues until the correct stock price is reached and ARs equals zero. The phenomenon of ARs converging towards zero is called mean reversion of abnormal returns. The gradual adjustment described above signifies a delayed reaction to information, resulting in a drift in stock prices. Furthermore, the drift is always characterised by an underreaction or an overreaction to the new information. The underreaction and overreaction can also be succeeded by each other. In PCAD studies, an underreaction is most common (Dichev, Piotroski 2001).

The drift concerns two components: magnitude and persistence (Francis, Lafond et al. 2007). The first explains the information content (i.e. the effect on equity value) of an announcement, the latter concerns how long the drift (and consequently the ARs) remains over time (Norden, Weber 2004). When a drift has both larger magnitude and is more persistent, it is denoted as 'more pronounced'. Further, the drift is measured by aggregating the ARs. In this study we use cumulative abnormal returns (CAR) (See section 4.4 for further explanation of CAR). The mean reversion of abnormal returns results in a stabilised CAR (See Figure 2 and Appendix 8.3[1]).

Finally, if the normal return is calculated *excluding* the new information in an announcement and the market reacts correct, we expect an immediate abnormal return when the information is announced and zero ARs succeeding the announcement. This would result in a constant, and no drifting CAR at a magnitude equal to the information content of the announcement (Hand, Holthausen et al. 1992).

[1] Appendix 8.3 illustrates the drift caused by an overreaction.

Figure 2: The Drift Caused By an Underreaction

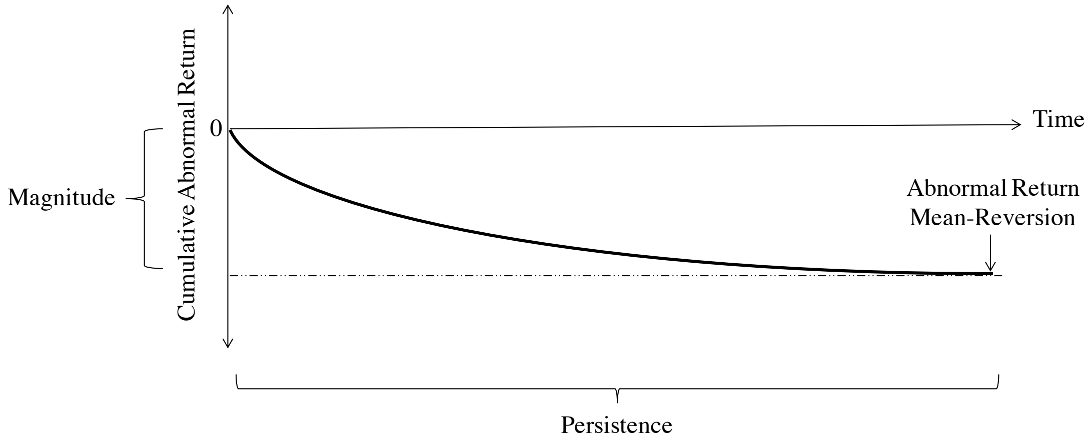

Figure 2. The drift consists of a magnitude resulted by the information content of the announcement, and persistence of ARs. For example, if the market reacts correctly to negative news (a downgrade in this study), no drift would occur and the price would drop immediately at announcement day. The figure shows a drift caused by an underreaction of negative news, i.e. a downward drift.

2.2 Previous Research Related to Post-Credit Announcement Drift

2.2.1 Insignificance for Upgrades

Pinches and Singleton (1978) are first to examine the PCAD effect on stock prices. They find no abnormal price effect; neither for downgrades, nor upgrades, proposing the market to be efficient in processing information. However, the method is performed in a simplistic manner, and no significance tests are performed. Griffin and Sanvicente (1982) observe an asymmetric distribution of ARs among downgrades and upgrades. The authors could only evidence significant negative ARs for downgrades, up to one month after announcement. Further, research is improved by using daily average stock returns, instead of monthly average returns. Daily stock returns provide more accurate data; distinguishing ARs, and facilitate the examination of drift. Glascock et al. (1987) find that stock prices react around credit rating announcements. The findings are statistically significant for downgrades at the announcement date. For upgrades, evidence is less clear; *initially* there is no statistical significant reaction at all, but a significant negative AR of -0.5% at trading day 20 is observed. However, the results are not statistically significant over the period. In general, ARs indicate to be asymmetrically distributed among downgrades and upgrades, and statistically significant results are limited to ARs succeeding downgrades.

2.2.2 Credit Rating Announcement Characteristics Examined

Previous research has tried to trace explanatory factors to the variation in ARs succeeding the announcement of new information. Hand et al. (1992) state that a "number of notches crossed" variable provides larger negative ARs (in magnitude) for downgrades, compared to upgrades. Norden and Weber (2004) examine the magnitude of CAR for downgrades when adjusting for number of notches changed. The authors find the ARs succeeding downgrades including two or more (multiple) notches to be statistically larger in magnitude than for downgrades including only one rating notch change.

Further, Hand et al. expect a larger magnitude in ARs when a credit rating announcement moves above or below investment grade. However, results are insignificant. On the other hand, the variable includes only 65 downgrades and 30 upgrades, and denotes some limitations. Barron, Clare and Thomas (1997) request an analysis of non-investment grades due to its institutional and regulatory impact on marketability and price. However, a variable is not created as their total sample only consists of 45 observations. PCAD research often fail to investigate the effects of different credit rating announcement factors as the studies lack the number of observations needed.

2.2.3 Other Influencing Factors

In order to observe a potential effect of market liquidity, Elayan et al. (2003) investigate the information content of a credit rating change in a smaller market, New Zeeland. To measure liquidity, the authors use variables of size and analyst coverage. Compared to stocks with higher exposure to other markets, i.e. the US equity market, stocks traded exclusively on the New Zeeland market experience larger ARs in the event of a credit rating announcement. Hence, the authors' findings suggest that a smaller market is less liquid, i.e. inefficient.

2.2.4 The Role of Credit Rating Agencies

Kliger and Sarig (2000) claim that there is a generally accepted rationale for why rating information is valuable, namely because issuers disclose private information to CRAs. Since the market reacts in occasion of credit rating announcement, the CRAs would enjoy superior information (Micu, Remolona et al. 2006). However, Wakeman (1981) is less confident to the proportion of private information that the CRAs base credit ratings on. Instead, he highlights the CRAs expertise in summarising public information, lowering the information asymmetry, as reflected in a stock price reaction. PCAD research evidence that a CRA play an important role to the equity market, assessing private information lowering an information asymmetry between informed and less informed investors.

2.2.5 Information Asymmetry Among Downgrades and Upgrades

Matolcsy and Lianto (1995) find that CRAs provide the market with new information. However, the information is more pronounced for downgrades. They hypothesise that "good news to travel faster than bad news, or that equity holders are more concerned about announcements of downgrades than upgrades" (p.901). Faster response to an upgrade is motivated by the presentation of information in disclosures where good news, associated with upgrades, are revealed quickly increasing the information asymmetry. Accordingly, Holthausen and Leftwich (1986) argue that "management's incentives to release information may not be symmetric" as documents covering 'good news' are released earlier than 'bad news'. Thus, the implications followed a firm trying to "hide" negative information, provides the CRAs with a larger price response in the event of a downgrade. Additionally, implications in assimilating information for downgrades are explained by an investor's irrational behaviour. Due to information-processing biases, the investor forms erroneous judgements of a downgrade's actual impact in relation to an upgrade of equal importance, resulting in asymmetry (Dichev, Piotroski 2001).

2.2.6 The Long Run Drift

Dichev and Piotroski (2001) focus on long run drift up to three years after a credit rating announcement. Having a considerably large sample of 4 727 observations, they find significant negative CARs following downgrades with magnitudes of; -4.0% after 60 trading days, and -7.2% after 180 trading days. Upgrades are insignificant but indicate CARs of 0.2% after 60 trading days. Moreover, the authors claim that drift effects should be stronger for small thinly followed firms. Conditioned on market value of equity separated by the median market value of equity, the sample is divided into two groups: large and small firms. Findings suggest that the drift magnitude succeeding downgrades is larger for small firms as they exhibit a CAR of -14.2% compared to large firms CAR of -4.3%[2].

Furthermore, the authors find underperformance of negative ARs in downgraded firms to be persistent over time as they compare cumulative ARs over three different time periods; (i) 1970-1978, (ii) 1979-1987, and (iii) 1988-1997. Overall, their findings indicate a drift, present over different time periods, causing market underreaction to credit rating announcements for downgrades.

[2] The CARs for the small respectively large firms are calculated by weighting CARs for investment grade and non-investment grade firms in the same size class

2.3 Possible Explanations for the Drift

2.3.1 Behavioural Biases

Additionally, the drift can be explained by investors' bias to individual expectations of the stock performance, hence they tend to weight private information too high and public information too low, being overconfident and self-attributed (Daniel, Hirshleifer et al. 1998). With investors' suspiciousness to new public information, they forgo the information released. Moreover, Barberis et al. (1998) mentions two possible biases to new information; if investors suffer from 'conservative bias' they underweight new information leading to an underreaction, if they suffer from 'representative bias' they overweight new information resulting in an overreaction. Further, Chan (2003) means that investors have different attitudes to good and bad news, leading to incorrect expectations about future performance and constantly underreacts to bad news.

2.3.2 Information Uncertainty

Francis et al. (2007) states that an underreaction to a value shift is caused by information uncertainty. Information uncertainty is defined as an investor's uncertainty about the new information's value implications resulting in an underrection. The information uncertainty is often more pronounced directly after the information announcement and diminishes over time resulting in a muted initial reaction from the investors. Extreme unexpected earnings news exhibit high information uncertainty and these earnings will produce a "more muted initial market reaction" (p.423). As uncertainty is resolved, the ARs diminish. Over time, extreme unexpected earnings news is hypothesised to produce larger ARs than unexpected earnings news (p.404).

2.3.3 Market Liquidity

Another explanation for the drift is directed to market liquidity. Previous research has demonstrated abnormal performance and possible market imperfections to be stronger for small firms (Fama 1998, Bernard, Thomas 1989). Bhushan et al.(1994) suggest that, for very liquid stocks, trade can be accomplished without any delay or abnormal price return impact. Further, such liquid stocks are most abundant on large markets. Conversely, research finds that *delayed* ARs are more pronounced on smaller markets (Elayan, Hsu et al. 2003). A reason for the asymmetry among markets is proposed to be due to lower analyst coverage and less frequent trading of stocks (Elayan, Hsu et al. 2003) Therefore, a potential explanation could be that a illiquid market is less efficient in processing information, resulting in delayed ARs.

2.3.4 Market Frictions

According to Bernard and Thomas (1989), the drift could be explained by market frictions (eg. transaction costs). Investors who seek to take opportunity of an abnormal gain are not willing to invest unless they perceive the gain to exceed the cost of transacting (Ball, Brown 1968). The behaviour will result in delayed response, recognised as a drift. However, Bernard and Thomas (1989) argue that if market frictions cause the drift, it would be constrained by an upper bound, representative of transaction costs depending on small or large stocks. When the drift has reached the upper bound, the drift will diminish and the return will be constant.

2.3.5 An Omitted Risk Variable

Among several explanations, previous research argue that the observed drift is due to a compensation for risk not taken into consideration in the choice of method; hence the returns are just seemingly abnormal. However, PEAD research states two possible explanations for why an 'omitted risk variable' is not plausible. First, investors are assumed to be risk-averse in general; expecting an omitted risk variable to be systematic and resolve over time. Accordingly, ARs will be skewed and drift upwards (Setterberg 2011). Second, a systematic risk factor is unlikely to be concentrated to announcements and change around such events (Bernard, Thomas 1989). If a downgrade firm hedge against some systematic risk, the hedge would have resulted in positive ARs in at least some periods.

2.4 Hypothesis Development

This first aim of this study is to investigate whether credit rating announcements result in a drift on the equity market or not. Regarding the existence drift, theory suggests several potential explanations of drift succeeding information announcements. As mentioned in the previous section, following factors are considered to fully or partially explain the drift: behavioural biases, information uncertainty, market liquidity, market frictions and an omitted risk variable. Interestingly, the discussion of each factor's impact has previously been focused to the phenomenon of PEAD. However, the theories are also applicable on PCAD (Dichev, Piotroski 2001).

Further, previous research has repeatedly proven the existence of a drift following a downgrade within an event window up to 90 trading days (Griffin, Sanvicente 1982, Glascock, Davidson III et al. 1987, Norden, Weber 2004). However, statistically significant results regarding drift succeeding upgrades are only randomly spotted in some studies; hence the drift is just indicated but not evidenced in previous research (Dichev, Piotroski 2001). As this study includes (i) a larger sample than the majority of the previous studies and (e.g

Holthausen, Lewitch 1986) and (ii) a more filtered sample by excluding overlapping credit rating announcements (e.g. Dichev, Piotroski 2001), the likelihood to achieve significant results for the drift succeeding upgrades is improved. Moreover, the theories of potential explanations of a drift succeeding information announcement do not separate between bad and good news (i.e. downgrades and upgrades). Therefore we hypothesize that:

H1: A drift exists succeeding both downgrade and upgrade credit rating announcements.

Since previous research is limited to shorter event windows up to 90 trading days, except for Dichev and Piotroski, results lack inferences about the persistence of drift. By employing an event window of 180 trading days, we will hopefully contribute to the thinly examined persistence of PCAD.

Previous research consistently indicates asymmetric drift among downgrades and upgrades, where downgrades are succeeded by larger and more persistent ARs. Dichev and Piotroski (2001) mean that the asymmetry is due to information process biases. However, as previous research fail to evidence statistically significant ARs succeeding upgrades, the drift asymmetry has not been proven. Consequently, due to our improved sample, we hypothesize:

H2: The drift succeeding downgrade and upgrade credit rating announcements is asymmetric, being larger and more persistent for downgrades.

The second aim of our study is to investigate how the drift is affected by firm size and extreme credit rating announcements. The reason for the second aim is twofold; (i) to deepen our understanding and analysis of our expected findings related to the first aim of this study and (ii) to contribute to the PCAD research by rejecting or supporting previous findings. As previous research has evidenced, specific firm and credit rating announcement characteristics have major effects on the drift. However the research is limited since they use the characteristics only as explanatory variables in regression analyses to draw inferences of drift(Hand, Holthausen et al. 1992, Norden, Weber 2004).

In order to fully investigate the variables impact on the PCAD, we improve method by creating portfolios of credit rating announcements conditioned on the firm size and extreme credit rating announcements. As the drift is implicitly expected to change but remain in all portfolios regardless of characteristic, this part of the study will also function as a robustness test for our findings regarding the existence of PCAD.

Firm size is defined as the market capitalisation at the credit rating announcement date. Previous research shows a more pronounced drift for smaller firms, explained as they in general exhibit lower analyst coverage (e.g. Elayan, Hsu et al. 2003). Following, we hypothesize:

H3: The drift magnitude and persistence, succeeding a credit rating announcement, is negatively correlated to firm size.

Extreme credit rating announcements are proxied by multiple notches crossed. As extreme news is defined as extreme unexpected earnings news in a PEAD setting, multiple notches crossed is a valid proxy in the PCAD research since the majority of credit ratings announcements include only one notch crossed. Extreme news in a PCAD setting is denoted as extreme credit rating announcements. According to theory, extreme news includes higher information uncertainty and therefore increases the magnitude of the drift (Francis, Lafond et al. 2007). This is confirmed in previous research. Therefore we hypothesize:

H4: The drift magnitude, succeeding a credit rating announcement, is positively correlated to the presence of extreme credit rating announcements.

Finally, we have decided not to include a discussion about an omitted risk variable. Setterberg (2011) disregards a risk-based explanation, as one has to assume that a risk factor is both systematic, and that it resolves over time. If a risk factor exists, it would cause ARs on both upgrades and downgrades to drift in the same direction. Further, Setterberg means, “it is not trivial to explain the classic PEAD results with an omitted risk variable” (2011, p. 123). Moreover, the intention of that the drift could be fully explained by flawed methodologies is disregarded as no methodological approaches have been able to explain the drift.

3. DATA

3.1 Data Needed for Documenting the Post-Credit Announcement Drift

3.1.1 Credit Rating Announcement Data

In this study, we will concentrate on ratings provided by S&P. A comprehensive list of all S&P credit rating announcements regarding non-financial listed firms in the US between 1992 and 2014 is retrieved form the S&P Capital IQ database. The advantage of using US data is to maintain the study comparable to previous research. Excluding financial firms is due to deviating firm characteristics and financial structure, being incoherent to other non-financial firms. Further, in order to avoid survivorship biases, the data includes delisted and liquidated firms during the sample period. Initially, we have 8 317 observations.

In order to ensure a higher quality of the data compared to previous research, two eliminations are performed. We eliminate (i) credit rating announcements occurring the same date as quarterly earnings announcements and (ii) credit rating announcements regarding a firm that have another credit rating announcement 180 trading days preceding or 180 trading days subsequent the observed announcement. The first elimination minimises the impact from other events that could affect the outcome of the AR. The second elimination reduces overlapping since the returns from a credit rating announcement might be influenced by adjacent rating events from the same firm. Considering these two eliminations, the first sample is reduced to a sample of 4 539 observations. Further, we eliminate credit rating announcements for firms missing stock prices for 750 trading days preceding the credit rating announcement and 181 trading days including and after the credit announcement, resulting in a sample of 3 875 observations. After eliminating credit rating announcements missing information, such as number notches crossed, our total sample used in this study includes 2 922 observations. Consequently, the total sample is divided into downgrades and upgrades, 1 350 and 1 572 observations. The data is specified in Figure 3.

Figure 3: Specification of Data

Initial sample of S&P credit rating announcements (excluding financial firms)

8 317

Succeeding eliminations due to concurring earnings announcements and overlapping credit rating announcements

4 539

Succeeding matching with available stock prices

3 875

Succeeding eliminations due to other missing information

2 922

Downgrades	Upgrades
1 350	**1 572**

Figure 3. The total sample consists of 2 922 credit rating changes, divided into 1 350 downgrades and 1 572 upgrades. The data is collected from S&P Capital IQ, and reflects the US market during 1992-2014.

3.1.2 Abnormal Return Data

In order to calculate the coefficients for the normal return model, being used to estimate abnormal returns (ARs), adjusted stock prices for 750 trading days (approximately three calendar years) preceding each credit rating announcement are downloaded from S&P Capital IQ database. The daily Fama French factors for USA are downloaded from Kenneth R. French's database (French 2015). Moreover, we have downloaded 180 trading days' stock prices succeeding each credit rating announcement from the S&P Capital IQ database. Thereafter, daily returns are calculated. The daily returns will correspond to the actual stock returns during the event period.

3.2 Data Needed for Firm and Extreme Credit Rating Announcements

For firm size, we download market capitalisation data for each stock at the actual credit rating announcement date from the S&P Capital IQ database. The sample includes 2 749 credit rating announcements with corresponding market capitalisation figures. Compared to the total sample, the loss is small (less than 10%), and no further efforts are made to gather complementary data. Based on relative market capitalisation sizes, four portfolios are created. The first portfolio (small) contains all observations up to the 25th percentile, the second (small-medium) contain observations up to the median, the third (medium-large) contains observations up to the 75th percentile, and the fourth (large) contains observations over the 75th percentile. Approximately, each size portfolio contains 687 observations.

In order to estimate extreme credit rating announcements, we need to document how many notch crossings each rating change include. Screening for number of notches crossed, accepting (+) and (-) grades, we find crossings from one to twelve, as the twelfth crossing is the most extreme. In total, we find 461 multiple notch crossings; 275 downgrades and 186 upgrades, and 2 461 one notch crossings; 1 075 downgrades and 1 386 upgrades.[3]

[3] In Appendix 8.5.1, we have included a test on investment attractiveness, meaning that we have divided the total sample into two categories: investment grade and non-investment grade. The test functions as a robustness test.

4. METHOD

4.1 Downgrades and Upgrades

In accordance to previous research and inspired by PEAD research, a credit rating announcement will be considered news (i.e. a surprise) for the investors; downgrades (upgrades) being equivalent to "bad news" ("good news") (Goh, Ederington 1993). The general reason for distinguishing between downgrades and upgrades is because they are expected to have opposite effects on the stock returns, a downward and upward drift respectively (see Appendix 8.2). However, in PEAD studies an earnings announcement is only considered news if it deviates from estimated normal (expected) earnings, being unexpected earnings news. In PCAD studies this process is simplified since it is much harder to estimate the normal (expected) rating. Hence, PCAD credit rating announcements are put in relation to PEAD unexpected earnings news, and PCAD extreme credit rating announcements are put in relation to PEAD extreme unexpected earnings news.

4.2 The Event Study Design

We will to document credit rating announcements effect on stock returns, up to 180 trading days, approximately nine calendar months. In order capture the full effect, we have set up an event study. According to MacKinaly (1997), an event study's purpose is to "measure the impact of a specific event on the value of a firm" (p.13). The method is applied by both PEAD and previous PCAD studies.[4]

In an event study, it is necessary to specify three time periods; an *estimation window*, an *announcement window* and an *event window*. The estimation window will provide data for the estimation of normal returns in the event window, the announcement window is the period where the credit announcement occurs, and the event window is the period in which the actual stock return is compared to an estimated normal return, i.e. calculating the AR per trading day. We have chosen an estimation window of 750 trading days and event window time interval of 180 trading days. As mentioned by MacKinlay (1997), some announcements may be released at trading day zero, but after the close of the equity market. Therefore, we have chosen to measure the ARs from trading day one. Hence, our announcement window consists of the actual announcement day, plus one trading day. See the event study set up in Figure 4 below.

[4] Overall, the statistical testing section based on MacKinlay's (1997) research paper. For a detailed assessment, please read the article "Event Studies in Economics and Finance".

Figure 4: The Event Study Design

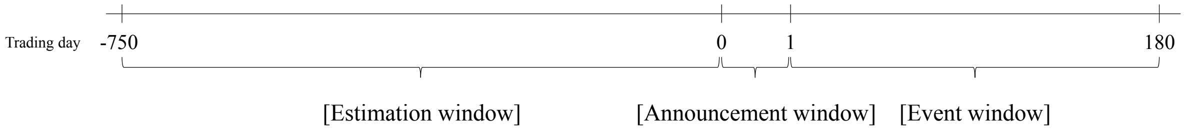

Figure 4. The estimation window consists of 750 trading days, and the event window covers 180 trading days. The day a credit rating announcement is released is set as trading day zero.

4.3 Abnormal Return

According to MacKinlay (1997), the AR is defined as the actual ex post return of a stock, minus the normal return of the stock. Contrasting previous studies measuring long run PCAD, our study uses daily data. Using daily data is advantageous as a clearer development and more precise reaction in event of an announcement will be defined.

The AR for stock *i* at trading day *t* is defined as:

$$AR_{it} = R_{it} - E(R_{it}) \tag{1}$$

Where $E(R_{i\tau})$ is the normal return conditioned on the normal return model, and $R_{i\tau}$ is the actual stock return.

The magnitude of the abnormal reaction estimates how the market reacts to a credit rating announcement. If the AR is constant zero during the event window, meaning that actual stock return and normal return is equal, the drift has ceased. If are ARs are drifting, positive or negative deviations are produced causing the market to underreact or overreact to the announcement over time.

4.4 Normal Return

A number of approaches are available when estimating the normal return, as previous research is not consistent in method when calculating normal returns. Some argue that existence of ARs depend on the model that is used for estimating normal returns (Jewell, Livingston 1998). Other claim that existence of ARs is not produced by the choice of method as research in PEAD and PCAD find no major differences when comparing results from different normal return models (Dichev, Piotroski 2001). Accordingly, we disregard the idea that PCAD could be fully explained by the choice of different methods when calculating normal return.

The most common approach when determining a model for normal return is the use of a statistical model where return follows statistical assumptions conditioned on stock return behaviour. In the simplest setting, the normal return is assumed to be zero. More careful approaches compare actual returns against a market index, known as the market model (MacKinlay 1997). However, the approach of comparing against a market index is not optimal when the sample stretches over several financial markets and the characteristics of a firm is varying.

Instead, estimating the normal return by using the Fama French three-factor model is argued to have high explanatory power (MacKinlay 1997). Adding one factor, the momentum (MOM) factor, the explanatory power is improved. Further, the model is called *the Carhart model* and will represent the model used in our study. The model is expressed as:

$$E(R_{it}) = R_{ft} + \beta_1(R_{mt} - R_{ft}) + b_2 \cdot SMB_t + b_3 \cdot HML_t + b_4 \cdot MOM_t + \varepsilon_{it} \quad (2)$$

where R_{ft} is the risk free return, $(R_{mt} - R_{ft})$ is the excess market return, SMB stands for small minus big (market capitalisation), HML stands for high minus low (book-to-market ratio), MOM is the momentum factor, and ε is the error term. β_1 is the beta of a stock's in relation to the market premium, and b_2, b_3 and b_4 are coefficients for the other factors mentioned above. The beta and coefficient values are determined by linear regressions. Mentioned by Fama and French (1993), the portfolios are formed on size and book-equity to market equity to capture common factors in stock returns, as the factors will absorb most of the variation in stock return making intercepts quite precise. The MOM factor is controlling for the trend of a stock to continue rising (declining) if it is increasing (deteriorate) in value (Carhart 1997).

4.5 Aggregation of Abnormal Returns

The AR measure is used for measuring the performance of a stock over a single time period. In this study, we want to assess the performance over a longer time period, and therefore ARs need to be aggregated. There are two central methods in aggregating ARs; (i) the buy-and-hold abnormal return (BHAR) and (ii) cumulative abnormal return (CAR). The BHAR measures the buy-and-hold return of an investment in the sample firm *less* the buy-and hold return in a matched portfolio firm (Barber, Lyon 1997). The CAR sums all daily abnormal stock returns over the event window (Fama 1998).

Further, the two methods in aggregating abnormal returns have their own strengths and are considered as complementary rather than competing approaches (Dichev, Piotroski 2001). Though, the distinction between the two approaches relies on the effect of compounding, as the CAR measure sums ARs (Barber, Lyon 1997). Thus, CAR imposes that returns are balanced to the original investment and do not consider effects of reinvestment. In contrast, BHAR assumes periodical rebalancing. However, Fama (1998) means that the BHAR measure complicates in the long run because of a rebalancing bias. Maintaining an equally weighted portfolio, the best performing stocks are sold and the worst performing are purchased resulting in inflated returns that skew results. Thus, and with confidence to the fact above, we have chosen to use CAR as a measure of aggregated return drawing the drift for downgrades and upgrades.

The CAR is defined as:

$$CAR_i(t_1 t_2) = \sum_{t=t_1}^{t_2} AR_{it} \quad (3)$$

Where AR_{it} represents the ARs summed over $t_1 \leq t_2$ resulting in a CAR. The CAR for a stock *i* t_1 to t_2 calculated by summing the one period AR over the same time period. Assuming ARs to be independent across individual stocks, with no overlapping of stocks over the event window, ARs are averaged up to 180 trading days after the announcement. The portfolio CARs in this paper are calculated as the average n-trading day CAR for all stocks, exhibiting downgrades or upgrades.

4.6 Statistical Testing

Consistent with the null hypothesis related to efficient markets, the AR over time is expected to be zero. If the AR is statistically different from zero, and remains after the announcement date, a drift will be noted. Referring to MacKinlay (1997), the AR will be jointly normally distributed with a zero conditional mean and conditional variance of:

$$\sigma^2(AR_{it}) = \sigma_{\varepsilon_i}^2 + \frac{1}{L_1}\left[1 + \frac{(R_{m_\tau} - \overline{\hat{\mu}_m})^2}{\hat{\sigma}_m^2}\right] \quad (4)$$

The formula consists of two components, one component $\sigma_{\varepsilon_i}^2$ that describes the disturbance variance, and a second component examining the sampling error in the AR model. Even though we assume independence across stocks, the sampling error due to the use of a relative sample instead on an entire population may lead to serial correlation of the ARs. As the length of the estimation window (L_1) increases, the second component approaches zero (MacKinlay 1997). In our study, the extended estimation window of 750 trading days will reduce the impact of the second component. Thus, the variance of the AR will be close to $\sigma_{\varepsilon_i}^2$ and independent over time.

Further, distributional properties of the AR to a given observation under H_0 follows:

$$AR_{i\tau} \sim N(0, \sigma^2(AR_{it})) \quad (5)$$

$$CAR_i(t_1, t_2) \sim N(0, \sigma_i^2(t_1, t_2)) \quad (6)$$

Given the null distribution of the AR and the CAR, the null hypothesis assuming the mean CAR equal to zero can now be tested:

$$\theta_1 = \frac{\overline{CAR}(t_1,t_2)}{var(\overline{CAR}(t_1,t_2))^{1/2}} \sim N(0,1) \quad (7)$$

According to formula (7), the significance for a defined time interval is derived by dividing the mean CAR with the standard deviation. Hence, the significance test utilises the ARs in the stock over the event window, relative to the standard deviation of the stock return over the estimation window. The test statistics is in accordance with the central limit theorem, assuming that the more commonly non-normal mean of ARs, variance distributions converge to zero as the sample size increases (Barber, Lyon 1997). Therefore, we can apply a student's t-distribution, with (n-1) degrees of freedom, where n denotes number of observations (Micu, Remolona et al. 2006). Since the degrees of freedom exceed 200, the distribution is assumed to be normal (Brown, Warner 1985). If the null hypothesis is rejected, this will indicate ARs to exist and provide evidence of PCAD.

4.7 Sample Portfolios

The data will be analysed under different portfolios. The portfolios included in our study are; the total sample (TOTAL), size portfolios (SIZE), and extreme credit rating announcements portfolios (1_NOTCH and 2-12_NOTCH). Each portfolio is divided into downgrades (D) and upgrades (U). For a specification of the portfolios and all shortenings, see Appendix, 8.1 Acronyms.[5]

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[5] Functioning as a robustness test we have included a portfolio of investment attractiveness (INV_GRADE and NON_INV_GRADE). See Appendix. 8.5.1.

5. RESULTS

5.1 Total Sample

Table 1: Summary Statistics of the Total Sample

DOWNGRADES

D:TOTAL portfolio

Variable	Obs.	Mean	Std. dev.
CAR1	1 350	-0,005 ***	0,001
CAR30	1 350	-0,018 ***	0,004
CAR60	1 350	-0,047 ***	0,006
CAR90	1 350	-0,059 ***	0,007
CAR120	1 350	-0,068 ***	0,009
CAR150	1 350	-0,066 ***	0,010
CAR180	1 350	-0,066 ***	0,011

UPGRADES

U:TOTAL portfolio

Variable	Obs.	Mean	Std. dev.
CAR1	1 572	0,001	0,001
CAR30	1 572	0,009 **	0,004
CAR60	1 572	0,013 **	0,006
CAR90	1 572	0,015 **	0,007
CAR120	1 572	0,014 *	0,008
CAR150	1 572	0,013	0,009
CAR180	1 572	0,023 **	0,010

Table 1. The statistics for the sample used to measure the stock performance subsequent to credit rating announcements. The first panel shows the performance of a portfolio consisting of stocks subsequent a downgrade. The second panel show the performance of a portfolio consisting of stocks subsequent an upgrade. The stars *, ** and *** denote the statistical significance at the 10%, 5% and 1% significance levels, respectively.

Table 1 presents descriptive data for our total sample, divided into two portfolios consisting of downgrades and upgrades, respectively. The downgrade portfolio is labelled D:TOTAL, and the upgrade portfolio is labelled U:TOTAL, consisting of 1350 and 1572 observations respectively.

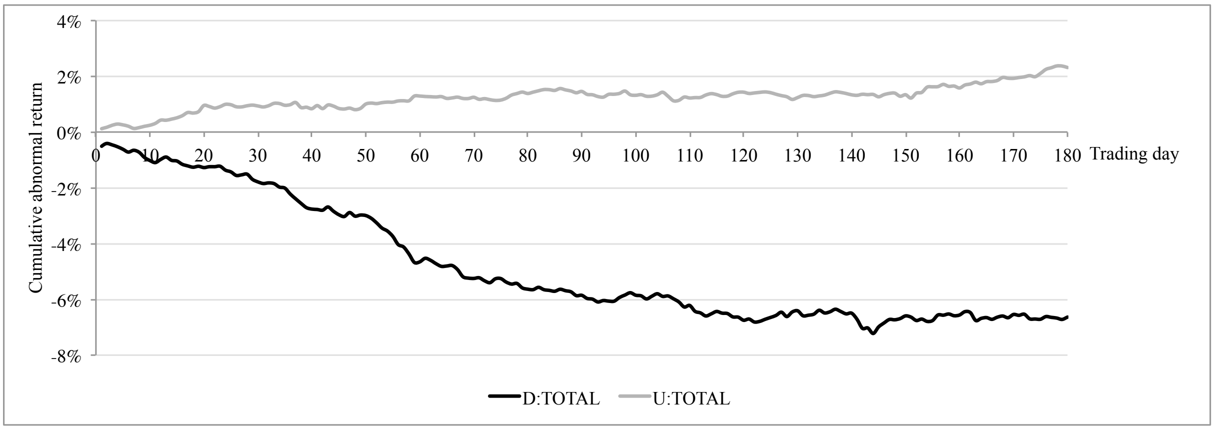
Further, the sample is separated into seven time intervals; CAR1, CAR30, CAR60, CAR90, CAR120, CAR150, and CAR180 respectively. For example, CAR180 corresponds to the accumulated ARs for 180 trading days after the announcement date.

As described by Table 1, the mean values for CAR180 are statistically and economically significant for downgrades -6.6%, and for upgrades 2.3% differ. As you can notice the magnitude is about three times larger for downgrades. In D:TOTAL extreme values affects the values more compared to U:TOTAL (See Appendix 8.4). However, we do not find any objective reasons for removing the extreme values.

CARs for D:TOTAL are significant at the 1% level over all time intervals. For U:TOTAL the CARs vary being significant at the 5% level at CAR30, CAR60, CAR90 and CAR180. The first day AR, CAR1, is significant for D:TOTAL performing -0.5%, and insignificant for U:TOTAL performing 0.1%.

Graph 1 illustrates the drift of the total sample's downgrades and upgrades, where you can see that the CAR for D:TOTAL drifts downwards and U:TOTAL drifts upwards. The results from these two portfolios were expected.

Graph 1: 180- Trading Days CAR of the Total Sample



Graph 1. The cumulative abnormal return (CAR) over a 180-trading day event window, in which the total sample is separated on downgrades and upgrades.

5.2 Firm Size Portfolios

Table 2: Summary Statistics of the Four Size Portfolios

DOWNGRADES				*UPGRADES*			
D:SMALL portfolio				**U:SMALL portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	430	-0.012 ***	0.002	CAR1	257	0.004	0.003
CAR30	430	-0.022 **	0.010	CAR30	257	0.032 **	0.016
CAR60	430	-0.081 ***	0.014	CAR60	257	0.040 *	0.023
CAR90	430	-0.108 ***	0.018	CAR90	257	0.053 *	0.028
CAR120	430	-0.120 ***	0.020	CAR120	257	0.068 **	0.032
CAR150	430	-0.122 ***	0.023	CAR150	257	0.065 *	0.036
CAR180	430	-0.134 ***	0.025	CAR180	257	0.083 **	0.040

Panel A: Summary statistics for observations representing the first quartile size firms

D:MEDIUM-SMALL portfolio				**U:MEDIUM-SMALL portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	294	-0.004 ***	0.001	CAR1	393	0.002	0.001
CAR30	294	-0.023 ***	0.008	CAR30	393	0.004	0.008
CAR60	294	-0.052 ***	0.011	CAR60	393	0.004	0.011
CAR90	294	-0.068 ***	0.014	CAR90	393	-0.005	0.014
CAR120	294	-0.082 ***	0.016	CAR120	393	-0.005	0.016
CAR150	294	-0.081 ***	0.018	CAR150	393	-0.020	0.018
CAR180	294	-0.095 ***	0.019	CAR180	393	-0.006	0.020

Panel B: Summary statistics for observations representing the second quartile size firms

D:MEDIUM-LARGE portfolio				**U:MEDIUM-LARGE portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	282	-0.003 **	0.001	CAR1	405	0.000	0.001
CAR30	282	-0.007	0.007	CAR30	405	0.007	0.006
CAR60	282	-0.024 **	0.010	CAR60	405	0.012	0.009
CAR90	282	-0.021 *	0.012	CAR90	405	0.018 *	0.011
CAR120	282	-0.024 *	0.014	CAR120	405	0.014	0.013
CAR150	282	-0.035 **	0.015	CAR150	405	0.023	0.014
CAR180	282	-0.027 *	0.017	CAR180	405	0.034 **	0.016

Panel C: Summary statistics for observations representing the third quartile size firms

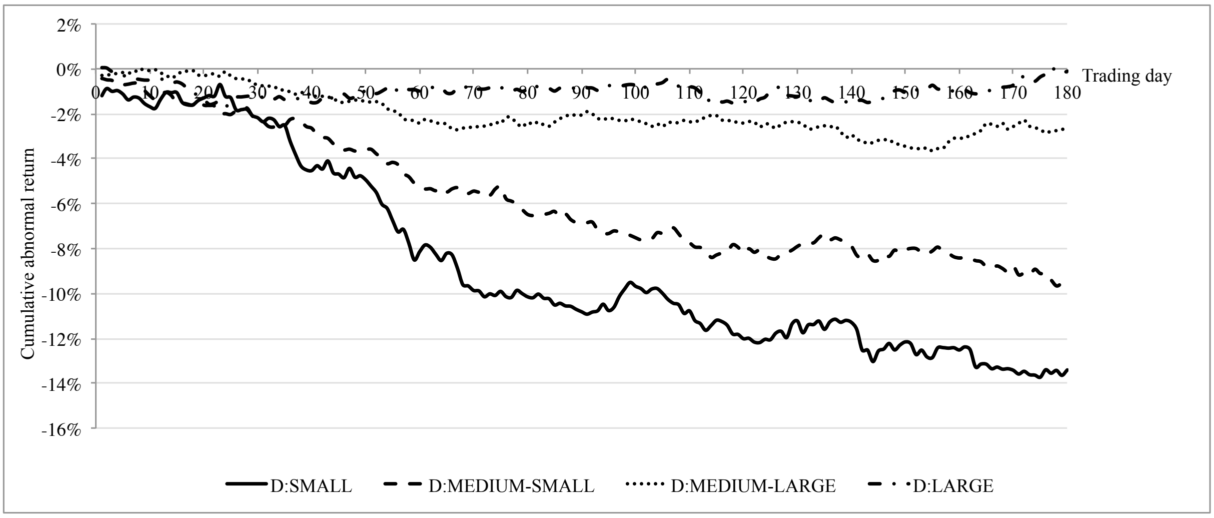
D:LARGE portfolio				**U:LARGE portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	245	0.000	0.001	CAR1	443	0.001	0.001
CAR30	245	-0.012 **	0.006	CAR30	443	0.005	0.005
CAR60	245	-0.010	0.009	CAR60	443	0.008	0.007
CAR90	245	-0.008	0.011	CAR90	443	0.007	0.009
CAR120	245	-0.015	0.013	CAR120	443	0.002	0.011
CAR150	245	-0.011	0.014	CAR150	443	0.009	0.012
CAR180	245	-0.001	0.015	CAR180	443	0.010	0.013

Panel C: Summary statistics for observations representing the fourth quartile size firms

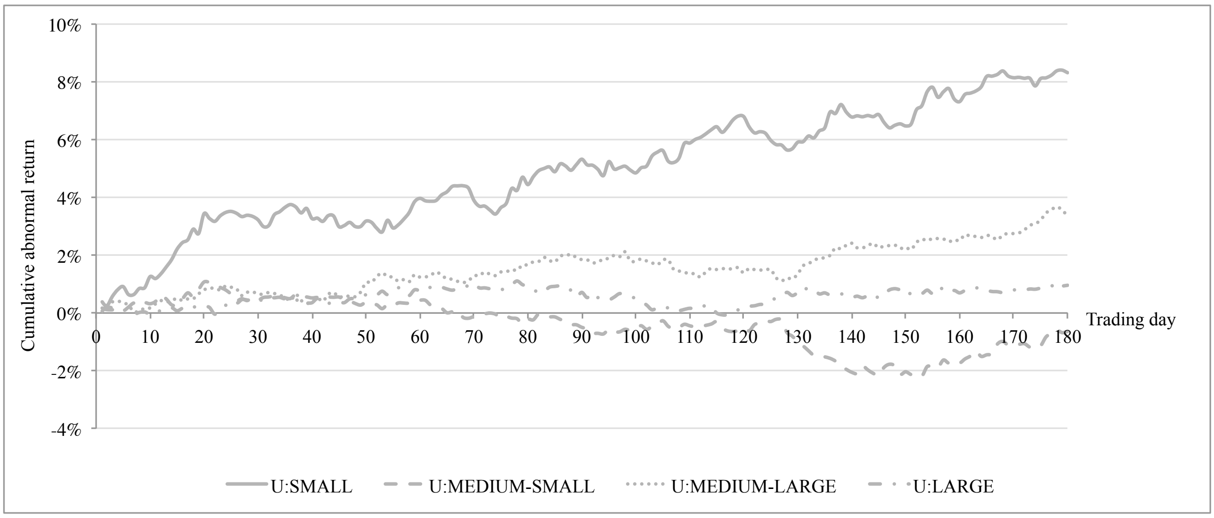
Table 2. The statistics for the sample used to measure the stock performance subsequent to credit rating announcements, separated to different size portfolios. The four market capitalisation based size portfolios represent firms within the first-, second-, third-, and fourth quartile. Portfolios are separated on downgrades and upgrades. The stars *, ** and *** denote the statistical significance at the 10%, 5% and 1% significance levels, respectively.

Table 2, showing the SIZE portfolios, evidences the difference in magnitude of ARs when separating for size. You can notice that a small firm's CAR is larger in magnitude compared to large firm's CAR. For example, D:SMALL CAR180 is -13.4% and D:LARGE is -0.1%. However, the difference is in not statistically evidenced as D:LARGE is insignificant. On the other hand, you can see a gradual decline from D:SMALL to D:MEDIUM-SMALL, where CAR180 is reduced from -13.4% to -9.5% over the two portfolios. For D:LARGE the CAR is small in magnitude and only significant for CAR30 of -1.2%. Regarding upgrades, U:SMALL is significant presenting a positive CAR180 of 8.3%. For the larger size portfolios, ARs following upgrades are statistically insignificant. Further, the distribution of observations between downgrades and upgrades differs among the portfolios.

Graph 2: 180- Trading Days CAR of the Four Sizes Portfolios



Graph 2A. *DOWNGRADES*. The cumulative abnormal return (CAR) over a 180-trading day event window, presenting the four different size portfolios; Small, Small-Medium, Medium-Large, and Large.



Graph 2B. *UPGRADES*. The cumulative abnormal return (CAR) over a 180-trading day event window, presenting the four different size portfolios; Small, Small-Medium, Medium-Large, and Large.

5.3 Extreme Credit Rating Announcements Portfolios

Table 3: Summary Statistics of the Credit Rating Announcement Characteristics Portfolios

DOWNGRADES				*UPGRADES*			
D:2-12_NOTCHES portfolio				**U:2-12_NOTCHES portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	275	-0.006 ***	0.002	CAR1	186	0.000	0.002
CAR30	275	-0.041 ***	0.011	CAR30	186	0.016	0.013
CAR60	275	-0.060 ***	0.015	CAR60	186	0.014	0.018
CAR90	275	-0.084 ***	0.018	CAR90	186	0.023	0.022
CAR120	275	-0.103 ***	0.021	CAR120	186	0.040	0.026
CAR150	275	-0.088 ***	0.024	CAR150	186	0.038	0.029
CAR180	275	-0.068 ***	0.026	CAR180	186	0.049	0.032

Panel A: Summary statistics for observations representing "multiple notches crossed" firms

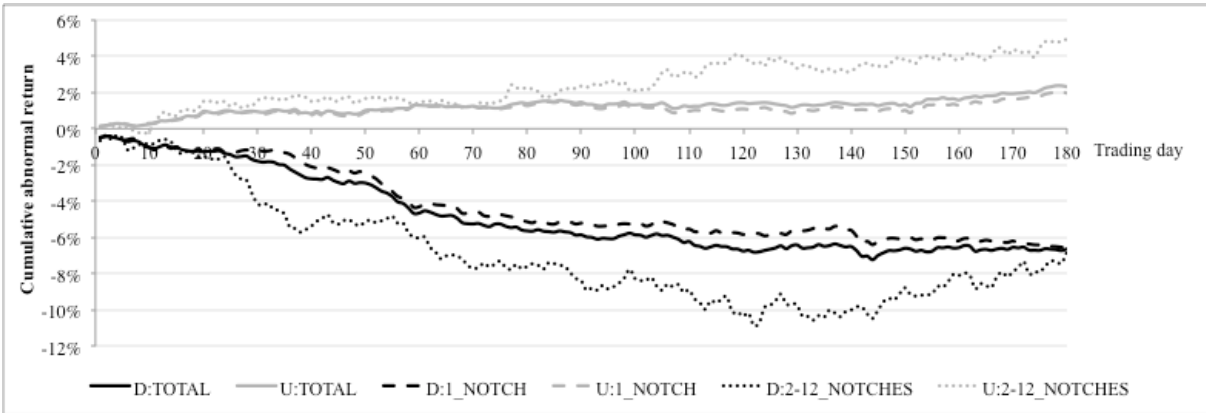
D:1_NOTCH portfolio				**U:1_NOTCH portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	1075	-0.005 ***	0.001	CAR1	1386	0.001 *	0.001
CAR30	1075	-0.012 **	0.005	CAR30	1386	0.009 **	0.004
CAR60	1075	-0.043 ***	0.007	CAR60	1386	0.013 **	0.006
CAR90	1075	-0.052 ***	0.008	CAR90	1386	0.013 *	0.007
CAR120	1075	-0.058 ***	0.009	CAR120	1386	0.011	0.009
CAR150	1075	-0.060 ***	0.011	CAR150	1386	0.010	0.010
CAR180	1075	-0.066 ***	0.012	CAR180	1386	0.020 *	0.010

Panel B: Summary statistics for observations representing "one notch crossed" firms

Table 3. The statistics for the sample used to measure the stock performance subsequent to credit rating announcements, separated on number of notches crossed. The notch crossings represent an immediate credit rating change, across or within different rating classes. A one notch crossing represent for example, BB+ to BB, and a multiple notch crossing could be BB+ to CCC+ (six notches). Panel A shows the performance of a multiple notch crossings. Panel B show the performance of one notch crossings. Portfolios are separated on downgrades and upgrades. The stars *, ** and *** denote the statistical significance at the 10%, 5% and 1% significance levels, respectively.

Table 3 shows the statistics for the NOTCHES portfolio, our proxy for extreme credit rating announcements. The magnitude is larger for the D:2-12_NOTCHES than D:1_NOTCH. For example, CAR90 is -8.4% for D:2-12_NOTCHES, while -5.2% for D:1_NOTCH. However, the difference diminishes notably over the event window, leaving D:2-12_NOTCHES at CAR180 of -6.8%, compared to D:1_NOTCH of -6.6%. In Graph 3, you can see a clear reversion of D:2-12_NOTCHES. The strong reversion is more prominent and seems to occur earlier than for D:1_NOTCH.

Graph 3: 180- Trading Days CAR of the Credit Rating Announcement Characteristics Portfolios



Graph 3. The cumulative abnormal return (CAR) over a 180-trading day event window, presenting the "number of notches crossed" portfolios; one notch crossings, and multiple notch crossings. Portfolios are separated on downgrades and upgrades.

6. DISCUSSION

6.1 Total Sample

The first aim of this study is to investigate whether credit rating announcements result in a drift in stock prices on the US equity market. More specifically, we examine a 180 trading days event window between 1992 and 2014. Our findings show a statistically and economically significant drift succeeding *both* downgrades and upgrades. Consequently, we are able to confirm our hypothesis about existence of the drift succeeding both downgrades and upgrades (H1). The existence of a PCAD suggests that equity investors do not react directly and correctly to credit rating announcements, resulting in a delayed market response.

Possible explanations for the observed drift pattern could be found in theories of behavioural biases. Being overconfident about private information, the investor tends to underweight public information (i.e. credit rating announcements), leading to a delayed response (Daniel, Hirshleifer et al. 1998).

Our statistically significant drift succeeding an upgrade is a major contribution to the research of PCAD since previous studies have not been able to document statistically significant ARs following an upgrade (Glascock, Davidson III et al. 1987). We argue that our outcome is a result of two central factors improving the relevance of the data; (i) a larger and (ii) cleaner sample as we have eliminated overlapping credit rating announcements during the event period. The absences of these factors are recognised as major flaws in previous research. Our documentation of the existence of PCAD between 1992 and 2014 challenges the semi-strong efficient market hypothesis in the US equity market.

We observe the CAR *magnitude* to be asymmetric succeeding downgrades and upgrades. Our findings indicate the magnitude to be approximately three times larger in a CAR for downgrades than upgrades. Due to the substantial magnitude and asymmetry succeeding both downgrades and upgrades, the transaction cost-based explanation for the drift is not plausible. Previous research has not been able to document the asymmetry of drift magnitude as with statistically significant results. Comparing our downgrade CAR180 of -6.6% to the magnitude of Dichev and Piotoriski (2001) CAR180 at -7.2%, we observe a decrease of 0.6 percentage points between the two studies' time period.

Our findings indicate that the information content differs among the two types of announcements, downgrades and upgrades, where a downgrade seems to have higher information content. Further, the information content for downgrades seems to become lower over years. The reason for the difference in information content, as reflected in different magnitudes among downgrades and upgrades, can be explained by Holthausen and Lewitch (1986) who suggest that management's incentives to release information is not symmetric. As management try to hide negative information as long as possible, the information content for downgrade is larger in the event of an announcement. Proposed by Dichev and Piotorski (2001), another explanation could be investors suffering from information-biases, acting irrational and forming erroneous judgements of a downgrades actual impact compared to an upgrade.

Analysing the *persistence* of the drift, we observe a mean-reversion of ARs after 130 trading days for downgrades, and 60 trading days for upgrades. Consequently, we are able to confim the hypothesis regarding credit rating announcement asymmetry (H2). In both cases, the stabilisation of CARs indicates a market underreaction. Comparable results from Dichev and Piotorski (2001) state persistence over 180 trading days for downgrades. In other research, the persistence of drift is seldom observed due to short event windows. Our results indicate investors' inability to fully understand the implications of a downgrade, compared to an upgrade. A potential explanation for the divergent persistence of drift among downgrades and upgrades is suggested by Matolscy (1995). He explains that the asymmetric drift pattern is a result of good news travelling faster than bad news. If his statement holds, good news is always communicated earlier to the market, and partly absorbed at the announcement date resulting in a seemingly less persistent drift.

Confirming previous indications of drift, the documentation of an asymmetric drift magnitude and persistence provides a unique finding to research of PCAD. Further implications of our findings are; (i) the role of the CRA as information provider seems to be more important for downgrades than upgrades, (ii) the importance of the CRA as information provider is indicated to diminish over time, and (iii) information included in upgrades has possibly already leaked out to the market before a credit rating announcement.

6.2 Firm Size and Extreme Credit Rating Announcements

The second aim is to investigate how the drift is affected by firm size and the presence of extreme credit rating announcements.

6.2.1 Firm Size

The separation of credit rating announcements based on firm size shows a major effect on the drift. Our findings indicate a more pronounced drift to credit rating announcements for smaller firms. Hence, we are able to confirm our hypothesis about the magnitude and persistence is negatively correlated to firm size (H3).

Firstly, there is a larger CAR magnitude for smaller firms, regardless of a downgrade or an upgrade. An explanation could be that there is less accessible information about smaller firms; hence the information content in the credit rating announcement is higher (Elayan, Hsu et al. 2003). Comparing our drift magnitudes to the results from Dichev and Piotroski (2001), we observe a more substantial reduction over time for the 180 trading day CAR succeeding downgrades for smaller firms compared to downgrades in the total sample. The decrease is -2.5 percentage points compared to -0.8 percentage points.

Secondly, the earlier AR mean-reversion of D:MEDIUM-LARGE compared to D:SMALL indicate that larger firms have less persistent drift. These findings could be a result of the higher analyst coverage of larger firms ((Elayan, Hsu et al. 2003). Further, above observations indicate that the role of the CRA as information provider for equity investors is more important regarding small firms compared to large firms.

As size is correlated to analyst coverage, market liquidity seems to be one of the most important factors explaining the pattern of the PCAD. When combining the results from Section 6.1 with the observations in this section, we cannot claim that our findings challenge the semi-strong efficient market hypothesis for the *largest* firms in our sample. The extended implications of our results in this study is rather that the market is not semi-strong efficient for *smaller* firms.[6] Moreover, as most of the significant CARs succeeding upgrades are attributed to the U:SMALL portfolio, the results regarding upgrades in our total sample seem to be sensitive to the firm size and consequently market liquidity.

6.2.2 Extreme Credit Rating Announcements

When creating portfolios based on extreme credit rating announcements, proxied by multiple-notch crossed, the results indicate an effect on the drift pattern. However, we are not able to confirm the hypothesis about extreme credit rating announcements producing higher magnitudes (H4).

Our findings imply that a multiple-notch crossing is aligned with the one-notch pattern until trading day 20. These findings support an explanation of drift in terms of information

[6] Regarding the results from portfolios based on investment attractiveness, another proxy for liquidity, the same conclusions are made; the drift is higher in magnitude and more persistent for non-investment grade firms, which in general have lower analyst coverage. (See Appendix 8.5.1)

uncertainty, as the initial reaction from an extreme credit rating announcement is expected to be muted (Francis, Lafond et al. 2007). Initially, an investor might perceive the implications of a one-notch change equal to a multiple-notch change. After 20 trading days, a multiple-notch crossing produces larger ARs. However, the drift for downgrades does not stabilise at a larger magnitude, but changes drift direction after approximately 120 trading days, indicating investors overreacting to the extreme credit rating announcement. This has not been evidence in earlier research. Due to upward drift at the end of the event window, we are not able to confirm if extreme credit rating announcements produce larger drift magnitudes, as the drift seems to continue. An extension of the event window is needed.

Concluding, our results indicate that in a PCAD setting, extreme credit rating announcements could lead to investors' overreacting. This finding contributes to the empirical research of extreme news, as it has only focused on the magnitude and not the persistence.

6.3 General Remarks

In order to obtain consistency, the data in this study is gathered from one source, S&P Capital IQ. Data available from other sources have been crosschecked in order to ensure validity. The data does not seem to suffer from any major problems. The lack of statistical significance imposes some problems when attempting to draw conclusion for the drift explanation factors. The insignificance for the sub portfolios could possibly be explained by smaller sample sizes.

The results from the PCAD documentation and the variables explaining PCAD are most likely reliable since a researcher should be able to follow the approach used in this paper and obtain the same results. The replication of the results should be fairly easy if access to the S&P Capital IQ database is obtained. The results are also generalizable since they are in line with previous research, which possibly makes them relevant for a similar setting to the US market.

7. CONCLUSION AND FUTURE RESEARCH

7.1 Conclusion

This first aim of this study is to investigate whether credit rating announcements result in a drift in stock prices. We examine a sample of 2 922 credit rating announcements from S&P in the US market between 1992 and 2014. Our main findings show statistical significant drift succeeding both downgrades and upgrades, up to 130 and 60 trading days respectively. This challenges the semi-strong efficient market hypothesis, as the drift notions a delayed reaction from investors. In accordance to previous research, we find asymmetry in the drift patterns, indicating different information content and investor attitudes towards downgrades and upgrades.

The second aim is to investigate how the drift is affected by firm size and the presence of extreme credit rating announcements. The chosen characteristics have shown a significant impact on the drift succeeding downgrades. Due to lack of significant evidence for ARs succeeding neither upgrades nor downgrades for the largest companies in the sample, the implications from our main findings are further developed; the findings regarding PCAD in this study do not challenge the semi-efficient market hypothesis for the largest companies.

This paper contributes to the research on PCAD by showing statistical significant ARs succeeding upgrades, thus providing unique evidence of the existence of drift succeeding *both* types of credit rating announcements. The reason for the improved results is argued to be a larger and cleaner sample, excluding overlapping credit rating announcement windows. Our findings also contributes to research by the notion of a drift persistent up to 180 trading days, compared to most of the studies focusing on shorter event windows. Moreover, due to the statistical significance of drift succeeding upgrades, this paper provides evidence for asymmetry between downgrades and upgrades regarding magnitude and persistence of drift, which has only been indicated by earlier studies. Comparing to the findings of Dichev and Piotroski (2001), this paper proves a reduction of the drift succeeding downgrades over time, indicating lower information content of credit rating announcements for the equity investors.

The results from creating portfolios conditioned on firm size support earlier research as the drift magnitude and persistence is proved negatively correlated to the firm size. As the majority of significant ARs succeeding upgrades is contributed to the smallest firms, our findings in the total sample seems to be sensitive to market liquidity.

We are not able to confirm earlier research about the drifts magnitude succeeding extreme credit rating announcements, as the drift seems to continue beyond the event window. Finally, to the best of the authors' knowledge, the indicated overreaction succeeding extreme news has not been documented earlier in either PCAD or PEAD research, hence contributing to both fields.

7.2 Future Research

We recommend future researchers to include a *pre*-event window. As we study the magnitude and persistence of drift, focusing on a longer *post*-announcement period, we have prioritised post-announcement effects. However, some behaviour of the drift might be explained by including a pre-event window.

Moreover, evidencing information asymmetry among downgrades and upgrades, we suggest future research to extend the theory and empirical results regarding drivers behind this asymmetry. Elaborating on influencing factors and include investor behavioural aspects, further explanations for the asymmetry might be revealed.

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8. APPENDIX

8.1 Acronyms

General

AR	Abnormal Return
CAR	Cumulative Abnormal Return
CRA	Credit Rating Agency
Credit Rating Announcement	Credit Rating Change (downgrade or upgrade)
Notch	A credit rating change on the rating scale
PCAD	Post-Credit Announcement Drift
PEAD	Post-Earnings Announcement Drift

TOTAL portfolio

D:TOTAL	- All downgrades
U:TOTAL	- All upgrades

SIZE portfolio*

D:SMALL	- Downgrades representing the first quartile size firms
U:SMALL	- Upgrades representing the first quartile size firms
D:MEDIUM_SMALL	- Downgrades representing the second quartile size firms
U:MEDIUM_SMALL	- Upgrades representing the second quartile size firms
D:MEDIUM_LARGE	- Downgrades representing the third quartile size firms
U:MEDIUM_LARGE	- Upgrades representing the third quartile size firms
D:LARGE	- Downgrades representing the fourth quartile size firms
U:LARGE	- Upgrades representing the fourth quartile size firms

NOTCHES portfolio

D:1_NOTCH	- All downgrades that include a one notch rating change
U:1_NOTCH	- All upgrades that include a one notch rating change
D:2-12_NOTCHES	- All downgrades that include a multiple notch rating change
U:2-12_NOTCHES	- All upgrades that include a multiple notch rating change

INVESTMENT ATRACTIVENESS portfolio

D:INV_GRADE	- Companies classified as investment grade after downgrade
U:INV_GRADE	- Companies classified as investment grade after upgrade
D:NON_INV_GRADE	- Companies classified as non-investment grade after downgrade
U:NON_INV_GRADE	- Companies classified as non-investment grade after upgrade

* Firm size is based on market capitalisation att credit rating announcement date

8.2 Comparing Post-Earnings Announcement Drift and Post-Credit Announcement Drift

Drift Phenomenon	Type of Announcement	Signal	Expected Drift
		Good News	Upward
PEAD (Post-Earnings Announcement Drift)	Earnings News	No News	No Drift
		Bad News	Downward
		Upgrade	Upward
PCAD (Post-Credit Announcement Drift)	Credit Rating Announcement	No Change	No Drift
		Downgrade	Downward

8.3 The Drift: Overreaction

Figure A8.3: The Drift Caused By an Overreaction

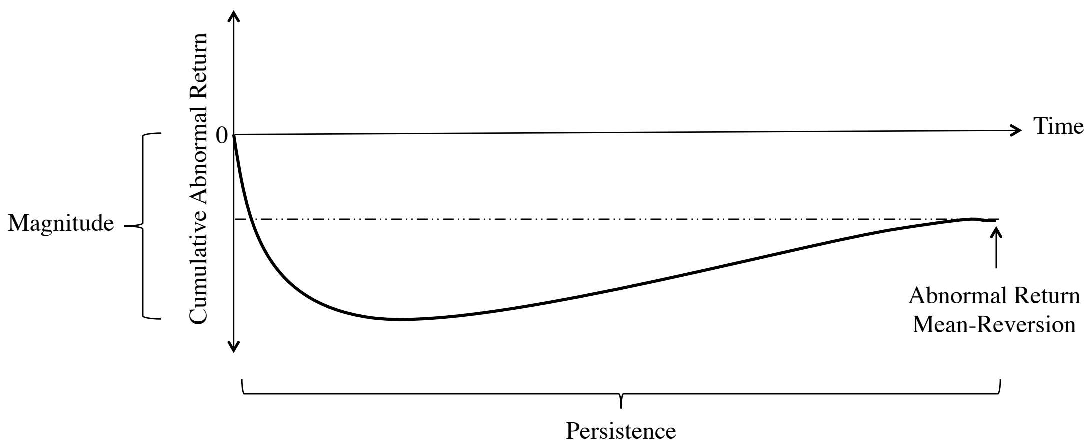


Figure A8,3. The drift consists of a magnitude resulted by the information content of the news, and persistence of abnormal returns. For example, if the market reacts correctly to negative news (a downgrade in this study), no drift would occur and the price would drop immediately at announcement day (0). The figure shows a drift due to overreaction of negative news, i.e. a upward drift.

8.4 Descriptive Table for Total Sample

Table A8.4: Summary Descriptives of the Total Sample

DOWNGRADES

D:TOTAL portfolio

Variable	Obs.	Mean		Std. dev.	Minimum	25th perc.	Median	75th perc.	Maximum
CAR1	1 350	-0.005	***	0.001	-0.443	-0.018	-0.002	0.011	0.459
CAR30	1 350	-0.018	***	0.004	-2.013	-0.085	-0.012	0.061	1.899
CAR60	1 350	-0.047	***	0.006	-3.297	-0.135	-0.026	0.078	1.265
CAR90	1 350	-0.059	***	0.007	-3.180	-0.172	-0.025	0.093	1.239
CAR120	1 350	-0.068	***	0.009	-3.292	-0.195	-0.039	0.095	1.614
CAR150	1 350	-0.066	***	0.010	-2.968	-0.217	-0.046	0.113	2.467
CAR180	1 350	-0.066	***	0.011	-3.495	-0.235	-0.050	0.132	3.959

Panel A: Descriptive statistics for the total sample's downgrades

UPGRADES

U:TOTAL portfolio

Variable	Obs.	Mean		Std. dev.	Minimum	25th perc.	Median	75th perc.	Maximum
CAR1	1572	0.001		0.001	-0.118	-0.009	0.000	0.011	0.155
CAR30	1572	0.009	**	0.004	-0.517	-0.055	0.003	0.067	0.618
CAR60	1572	0.013	**	0.006	-1.393	-0.076	0.006	0.091	1.209
CAR90	1572	0.015	**	0.007	-1.475	-0.090	0.007	0.112	1.294
CAR120	1572	0.014	*	0.008	-1.473	-0.103	0.009	0.131	1.713
CAR150	1572	0.013		0.009	-1.987	-0.129	0.013	0.147	1.808
CAR180	1572	0.023	**	0.010	-1.895	-0.129	0.013	0.168	1.847

Panel B: Descriptive statistics for the total sample's upgrades

Table A8.4. The statistics for the sample used to measure the stock performance subsequent to credit rating announcements. Panel A shows the performance of a portfolio consisting of stocks subsequent a downgrade. Panel B show the performance of a portfolio consisting of stocks subsequent an upgrade. The stars *, ** and *** denote the statistical significance at the 10%, 5% and 1% significance levels, respectively.

8.5 Additional Statistics

8.5.1 Investment Attractiveness Portfolios

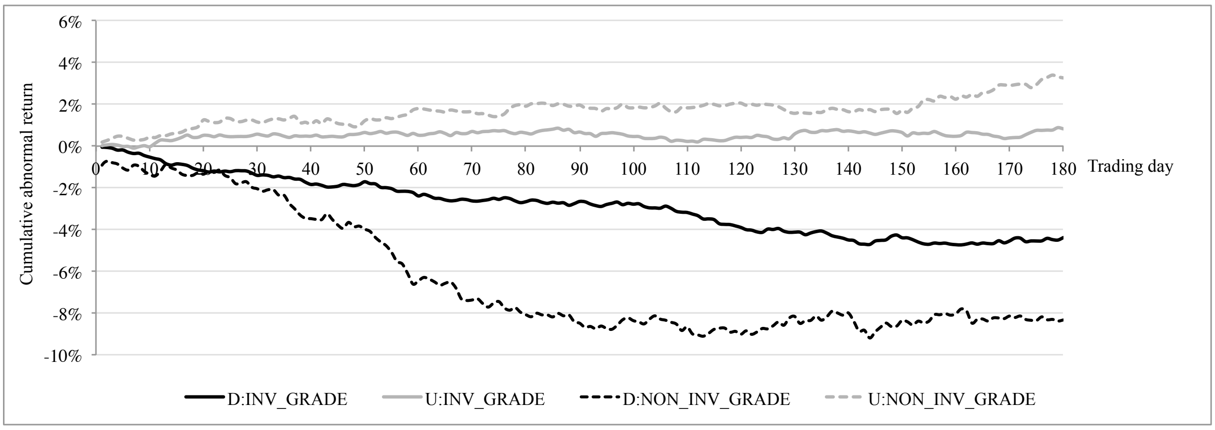
Table A8.5: Summary Statistics of the Investment Attractiveness Portfolios

DOWNGRADES				*UPGRADES*			
D:INV_GRADE portfolio				**U:INV_GRADE portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	608	0.000	0.001	CAR1	659	0.000	0.001
CAR30	608	-0.014 ***	0.004	CAR30	659	0.006	0.004
CAR60	608	-0.024 ***	0.006	CAR60	659	0.005	0.006
CAR90	608	-0.026 ***	0.007	CAR90	659	0.007	0.007
CAR120	608	-0.039 ***	0.009	CAR120	659	0.004	0.008
CAR150	608	-0.044 ***	0.010	CAR150	659	0.007	0.009
CAR180	608	-0.044 ***	0.010	CAR180	659	0.008	0.010
Panel A: Summary statistics for observations representing investment grade firms							
D:NON_INV_GRADE portfolio				**U:NON_INV_GRADE portfolio**			
Variable	Obs.	Mean	Std. dev.	Variable	Obs.	Mean	Std. dev.
CAR1	733	-0.009 ***	0.001	CAR1	896	0.002	0.001
CAR30	733	-0.020 ***	0.007	CAR30	896	0.012 *	0.006
CAR60	733	-0.065 ***	0.010	CAR60	896	0.018 **	0.009
CAR90	733	-0.085 ***	0.012	CAR90	896	0.020 *	0.011
CAR120	733	-0.090 ***	0.014	CAR120	896	0.021	0.013
CAR150	733	-0.083 ***	0.016	CAR150	896	0.017	0.015
CAR180	733	-0.083 ***	0.017	CAR180	896	0.033 **	0.016
Panel B: Summary statistics for observations representing non-investment grade firms							

Table A8.5. The statistics for the sample used to measure the stock performance subsequent to credit rating announcements, separated for investment attractiveness. Panel A shows the performance of investment grade firms. Panel B show the performance non-investment grade firms. Portfolios are separated on downgrades and upgrades. The stars *, ** and *** denote the statistical significance at the 10%, 5% and 1% significance levels, respectively.

In Table A8.5, the INVESTMENT ATRACTIVENESS portfolio presents higher CAR magnitude for the NO_INV_GRADE portfolios compared to INV_GRADE. Comparing the downgrade and upgrade portfolios, the credit rating announcements succeeding the downgrades result in a CAR that is approximately three to four times higher for the same trading day. The D:NON_INV_GRADE show an earlier AR mean reversion around trading day 100 compared to the D:INV_GRADE mean reversion around trading day 140. The U:NON_INV_GRADE indicate a mean reversion around trading day 60 while the U:INV_GRADE show no ARs.

Graph A8.5: 180- Trading Days CAR of the Investment Attractiveness Portfolios



Graph A8.5. The cumulative abnormal return (CAR) over a 180-trading day event window, presenting the investment attractiveness portfolios; investment grade, and non-investment grade. Portfolios are separated on downgrades and upgrades.