The effect of changes in credit ratings on equity returns

-A study of Nordic companies rated by Moody's and Standard and Poor's

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ABSTRACT

The link between credit risk and return patterns on equity markets has increasingly become an area of interest. In this thesis we investigate the existence of a systematic relationship between credit ratings, as indicators of credit risks, and abnormal equity returns. In particular, we investigate the announcement effect on equity returns associated with credit rating changes. Furthermore, we contribute to the understanding of the observed announcement effects by relating them to various components of the rating process.

We base our study on a sample of credit rating changes from March 1990 to February 2006 by Moody's and Standard and Poor's for companies listed in the Nordic countries. We find that downgrade announcements on average are associated with negative abnormal share price reactions, whereas no systematic reaction is associated with upgrades.

Through sub sample and cross-sectional analyses we gain a deeper understanding of the driving forces behind the characteristics of the observed announcement effects. In general, we argue that variations in announcement effects are driven by various event and issuer specific characteristics and that these can be related to the relevance and implication of the information as well as the degree of market anticipation. Specifically, rating updates driven by changes in profitability and market position are more pricing relevant than those motivated by changes in capital structure. Also, rating events preceded by official opinions of the likely direction of the rating update have less pricing impact. Based on these two dimensions we identify several additional aspects of the credit rating process with implications for the impact on equity returns. These explanatory factors provide the foundation for a comprehensive analysis of the asymmetric reactions between upgrades and downgrades as well as for the cross-sectional variations for both rating events.

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1. INTRODUCTION

As capital has shifted from traditional bank lending to capital markets, the focus on credit rating agencies (CRAs) and their assessments of credit risk has increased. Apart from a growing number of rated issues the CRAs have also expanded the width of their coverage. In addition to the traditional long term debt issues the CRAs today offer ratings on a wide range of different debt instruments. Also, the link between bond and equity markets has increasingly attracted the attention of market participants. In the aftermath of spectacular default scandals such as Enron, WorldCom and Parmalat, default risk has become a concern of essential importance also for equity investors. Furthermore, the great investor losses associated with these scandals have spurred a discussion about the reliability and relevance of the information provided by credit ratings.

The aim of this thesis is to provide further insights to the link between credit risks and the corresponding impact on equity returns. In particular, our aim is to study the impact of credit rating changes on abnormal equity returns around the time of the announcement. For the purpose of identifying the factors of relevance for potential links between indicators of credit risks and return patterns on equity markets, various aspects of the credit rating process are analysed and interpreted with focus on the impact on equity investors. Based on this approach, the purpose of the thesis is i) to investigate whether there is a systematic and robust link between indicators of credit risk and return patterns on equity markets as well as ii) to explain the dynamics of a potential relationship based on observable characteristics. Hence, the purpose can be summarized by two research questions:

Is there a systematic link between credit ratings, as indicators of credit risk, and the return patterns on equity markets?

How can variations in issuer and event specific characteristics explain potential announcement effects on equity returns associated with credit rating changes?

The link between credit risk and bond returns is very intuitive, whereas the effect on equity returns is less clear. Several related studies have studied the existence of announcement effects on equity returns associated with credit rating transitions. The results, which are primarily based on US data, are rather inconclusive. Nevertheless, a majority of previous studies have concluded that the announcement reaction associated with downgrades is considerably larger than that found for upgrades. *Appendix B* provides a more comprehensive overview of related previous research.

The obvious rationale for using bond ratings is economies of scale in information gathering and solving problems of asymmetric information between investors and issuers. In addition to these functions the CRAs themselves claim to have access to non-public information which is ultimately

reflected in their ratings. Hence, the information associated with credit rating updates should not be entirely known by the market at the time of the announcement. Since equity investors, like bond investors, are affected by new information about the performance of the issuer, it seems reasonable to expect that the impact of credit rating changes is not limited to the return patterns on debt markets. Rather these events should be of relevance for a larger group of market participants including the residual claimants of the issuer's cash flows.

In order to understand the impact of credit rating changes on equity returns this thesis focuses on two main dimensions of the announcement effect. First, the market's anticipation of the event is intuitively a crucial component for the existence and magnitude of any announcement effect. Second, the relevance and implications of the underlying information of the rating change for shareholders is also suggested as an essential explanation for variations in announcement effects.

In addition to a unique sample, this thesis contributes to the understanding of the link between credit risks and equity returns by relating the findings to the dynamics of the credit rating process. This analytical approach enables us to describe a rather complex relationship by explaining the various aspects through two main dimensions. This provides more insights to the possible differential effects associated with upgrades and downgrades respectively as well as cross-sectional variations for each type of event. The study is based on a sample of credit rating updates by Standard and Poor's and Moody's for companies listed in the Nordic countries. To our knowledge there is to this date only one paper related to this topic based on Swedish data (Gabrielson et al, 2002).

1.1 Outline

Section 2 provides a description and analysis of various aspects of the rating process for the purpose of contributing to the interpretation of the obtained results. In *Section 3* the relevant theoretical foundation is outlined and discussed. The hypotheses are presented in *Section 4* along with explanations for the predicted effects. *Section 5* reports and discusses the characteristics of the data sample as well as its sources. Additionally, the methodological approach is described and motivated. In *Section 6* the results from the event study and the cross-sectional analysis are reported. The analysis and conclusions are presented in *Section 7*. Finally, in *Section 8* a set of suggested areas and approaches for further research related to the topic are discussed.

2. THE CREDIT RATING PROCESS

In order to fully understand the information content of credit rating changes and the implication for shareholders it is crucial to understand the dynamics of the rating process. There are several aspects of the credit rating process which potentially are related to the degree of market anticipation as well as the relevance of the underlying information. In this section we attempt to add alternative analytical tools for the analysis of the results as well as to provide the relevant background of the rating industry. This analytical framework focuses on the components of the rating process with relevance for the link between credit rating events and equity returns and thereby contributes to a better understanding of the information content associated with credit rating changes.

2.1 Credit rating agencies

Today the market for ratings of publicly traded bonds is dominated by the two US based CRAs; Standard and Poor's and Moody's Investors Service. As a percentage of total revenue Standard and Poor's and Moody's enjoy market shares of 41% and 38% respectively (Wall Street Journal, 6 January, 2003). In addition to the two giants a third ratings company, Fitch Investors Service, with a market share of about 14% may be regarded as a major market participant, but has in no respect a comparable market position.

Moody's is a subsidiary of Dun and Bradstreet, a commercial credit rating company and Standard and Poor's is owned by McGraw-Hill, a publishing and information processing company.

2.2 What is a credit rating?

Credit ratings are predictions of potential credit losses due to failures of making payments, delay in payments or partial payments. A credit loss is defined as the difference between what the issuer has promised to pay and what is actually received. Both Moody's and Standard and Poor's credit ratings measure total credit loss, including both the probability that an issuer will default as well as the expected severity of the loss if default occurs.

The rating assignments for Moody's and Standard and Poor's are shown in *Table A.1* in *Appendix A*. For Standard and Poor's the highest credit rating is AAA and the equivalent rating for Moody's is Aaa. Bonds with ratings lower than BBB- or Baa3 are said to have non-investment grade status, implying exposure to speculative elements and substantial credit risks.

The CRAs emphasize that credit ratings are fundamentally different from buy, hold or sell recommendations issued by equity and fixed income analysts. Rather than an investment advice, a credit rating should merely be viewed as the CRA's opinion about the creditworthiness of a particular issuer.

Also, the aim of a credit rating is to measure the long term default risk rather than short term fluctuations, which are primarily driven by cyclical developments in the economy. The ultimate goal is to provide a *through-the-cycle* rating. Hence, credit ratings are not expected to react instantaneously to changes in default risk, but rather to exhibit a large degree of rigidness.

2.3 The role of credit ratings for bond and equity markets

A common feature of publicly traded bond issues is the importance of limited information asymmetry between the issuer and the investors. In this respect the CRAs may play a pivotal role for the existence of public debt markets. By means of specialization in information gathering and access to non-public information CRAs facilitate the access of borrowers to debt markets. This function is generally referred to as *signaling*, which involves interpretation and provision of new information. One could argue that without this function markets for a number of debt securities would fail since it would not be efficient for individual investors to invest the required amount in reducing informational asymmetries. Rather than absorbing the costs of communicating directly to the market, potential issuers would instead find it more profitable to finance themselves with ordinary bank debt.

In addition to the signaling function, CRAs are generally assumed to have a *certification* role, which involves the formalization of a professional credit risk opinion. Many investors and regulators require credit rating coverage in order for issuers to achieve their confidence or approval.

It is likely that participants on equity markets also are concerned with the information associated with credit ratings. The functioning of equity markets is perhaps not as closely linked to the existence of credit ratings. Nevertheless, the potential incremental information provided by the CRAs through their signaling function may also contribute to reduce informational asymmetries on equity markets.

For the rating mechanism to work it is crucial that CRAs maintain their reputation as reliable and objective sources of information. Increasingly, this has become an issue of debate. For instance, the collapse of the American utilities giant Enron was followed by an especially turbulent period for the CRAs. As late as one month before the collapse both Moody's and Standard & Poor's assigned the company solid investment grade ratings. A credit analyst at the time of the collapse said "Investors have been burned by rating moves so many times I'm not sure why anyone still pays attention […] The worrying thing is that with changes to financial regulation, ratings agencies are getting more power" (Financial Times, 30 November, 2001).

The intensified criticism aimed towards CRAs may reflect the increased dependence on credit ratings due to the process of disintermediation on financial markets. Also, as the market for credit ratings has expanded, larger competition between the leading CRAs may lead to temptations of exploiting the business' inherent conflicts of interests. Nevertheless, the main impact on the announcement effect on equity returns should primarily relate to the amount of new information of relevance for shareholders that is released through the credit rating event.

2.4 The objectives

Both Standard and Poor's and Moody's have formulated specific objectives and limitations for their credit rating operations. Standard and Poor's defines a credit rating as an "opinion of the general creditworthiness of an obligor, or the creditworthiness of an obligor in respect to a particular debt security or other financial obligation" (Flink, 2005). Similarly, Moody's identifies the credit rating as an "opinion of future relative creditworthiness derived by fundamental credit analysis" (Moody's, 2002). In addition, the CRAs emphasise that a credit rating is not a recommendation to the investor of whether to sell, hold or buy the issuer's debt securities, but merely an opinion about the issuer's credit quality.

The officially stated objectives and limitations of credit ratings signal that the CRAs wish to limit their roles as information providers in financial markets. A possible reason for this is to reduce their responsibilities for implicit negative consequences associated with rating events. On the other hand, it makes the CRAs more vulnerable for criticism aimed towards failures of fulfilling these stated objectives.

Despite the clear objectives stated by the CRAs it is likely that the usage of credit ratings differ substantially between different market participants depending on their role in the financial system. According to a survey among issuers, investors, asset managers, regulators and other market participants performed by Moody's in 2002 the major conclusions were that market participants use credit ratings both for long term fundamental credit analysis as well as for portfolio management (Moody's, 2002). Hence, due to the multiple market applications there is a potential risk that the objectives, and therefore the information contents, of credit ratings are misunderstood.

In order for the CRAs to maintain and possibly strengthen their roles as information providers in financial markets it seems crucial to clearly communicate the intended objectives of the credit ratings. If the CRAs fail in this respect the information content of credit ratings is likely to be questioned and the market's confidence in CRAs may deteriorate. The ultimate consequence would potentially be reduced efficiency in capital markets.

For the purpose of understanding the link between the information associated with credit ratings and the return patterns on equity markets it is essential to understand the underlying incentives in the rating process. In this sub section we have argued that a potential abnormal share price reaction may be influenced by the perceived reliability of credit ratings by market participants. In particular, the CRAs appear to be concerned with implicit negative consequences of their rating actions. This may possibly contribute to the explanation of differential effects between upgrades and downgrades as well as cross-sectional variations for both rating events. If downgrades or rating changes of a particular sub category are expected to be more reliable, these should be associated with more pronounced announcement effects. Consequently, these arguments are primarily related to the relevance of the underlying information, rather than the degree of market anticipation.

2.5 Credit rating in practice

There are several aspects related to the process of assigning an issuer a credit rating that are relevant for the understanding of the impact of credit rating announcements on equity prices. The degree of anticipation and relevance of a rating event is potentially affected by the transparency of the process as well as the CRAs' and issuers' incentives and procedures for market communication.

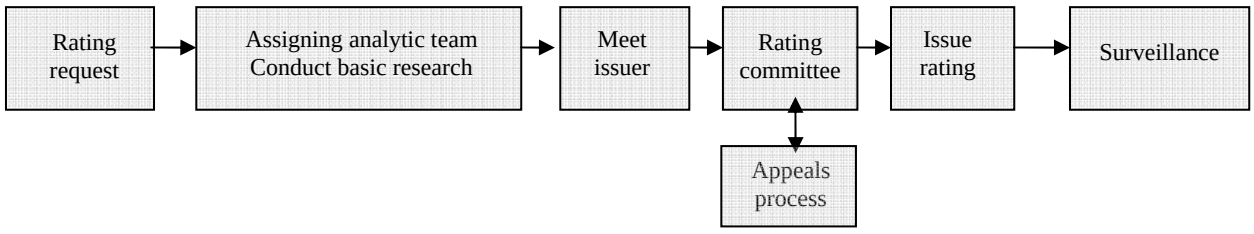
The rating process through which an issuer is assigned a credit rating follows a predetermined set of actions by the CRA as well as the issuer. *Figure 2.1* illustrates the key elements of the rating process as described by Standard and Poor's (Flink, 2005).

The rating process starts when the CRA obtains a mandate from the issuer. A rating team is thereafter formed with a lead analyst responsible for managing the process. The team meets with the issuer's management to review key parameters. Following the fundamental analysis, a rating committee discusses the rating recommendation by the lead analyst. The rating committee is composed by 5 to 10 credit analysts who decide with a majority vote whether to support the proposed rating opinion. The issuer can appeal the assigned rating and must in such cases also provide support for that. The committee decides with a majority vote whether to sustain or reject the appeal.

In most markets outside the US the issuer has the choice of whether to publish the rating. If the issuer decides to do so, a press release with the rationale for the rating is sent to the media. Ratings of public debt issues are monitored for a minimum of one year and thereafter the issuer can request additional surveillance. A rating change is a consequence of the surveillance process and the rating decision follows the same procedure as for the initial rating.

Rating outlooks and Watchlist inclusions are also important components of the rating process. A rating outlook, expressed as positive, stable or negative, is an opinion issued by the CRA about the likely direction of any medium-term rating action. The outlook opinion is based on an 18 month horizon. The decision to change an outlook is taken by the rating committee or by the lead analyst with support from a managing director. An issue is placed on the Watchlist if the current rating is contradicted by changes in circumstances. The announcement of a Watchlist inclusion contains information about whether the issuer is on review for a possible upgrade, downgrade or uncertain direction. A conclusion whether to change the rating is generally reached within 90 days.

Figure 2.1 **The rating process**



Source: Company presentation by Standard and Poor's, Stockholm School of Economics, 18 November, 2005

The design of the credit rating process has potential implications for the interpretation of the information content in credit ratings. Of particular importance for the relevance of a rating opinion is the CRA's independence from the issuer. To strengthen the market's confidence in the process, the composition of the rating committee is held confidential to eliminate the possibility that the issuer could exert pressure on individual members. The fact that the issuer has discretion over whether to disclose the rating may, however, potentially be of larger concern. If issuers systematically use this option to avoid negative rating disclosures, investors will anticipate that disclosed rating events are biased towards positive news about the issuers. The consequence could be that disclosed downgrades are interpreted as signals of high management integrity and the pricing impact may be less severe than if public disclosure was mandatory. For upgrades, no similar effect should be found since disclosure would not signal any information about the management's quality.

Also, the timing of the rating announcement, and hence the probability that it will contain new information, is affected by the amount of time required to process the information and follow the required steps in the rating process. On the other hand, there is likely to be a trade-off between the timing and amount of time spent on the credit analysis and thereby the quality of the final rating opinion.

Outlook opinions and Watchlist additions should primarily affect the interpretation of the rating change through the effect on the market's anticipation. A rating change in the direction opposite of that indicated by the outlook opinion is potentially more informative. Also, a longer time between the issue of the outlook statement and the rating change should imply that the market's anticipation of the event is lower, even though the rating change confirms the indicated direction. Finally, rating changes preceded by Watchlist additions should be less informative as the market is more likely to anticipate the change.

In summary, the design of the rating process has several potential impacts on the announcement effect of updated credit ratings for equity investors. In particular, the procedures and principles for the credit rating process aim to establish the independence of the CRAs. However, a contradicting aspect is the disclosure procedure, which potentially provides the issuer with an option and hence incentives to avoid unfavourable events. In addition to these aspects, which primarily should affect the relevance of the information, the degree of anticipation could also be better understood by recognizing the impact of outlook opinions and Watchlist additions as well as the trade-off with respect to research effort and timing.

2.6 The performance of credit ratings

An important component of the credit rating process with relevance for the market's confidence in the rating process as well as the incentives for CRAs to provide timely information is the possibility to evaluate the ex post performance of credit ratings.

Historical data supports the conclusion that CRAs are reasonably successful in measuring relative credit risk. One way of evaluating the performance with respect to the measurement of credit risk is to compare the consistency of credit ratings with the pricing or credit risk in financial markets.

It is found that the market systematically demands higher spreads on debt securities with lower credit ratings (Sarig and Warga, 1989). *Table 2.1* reports monthly average spreads above the US Treasury rate for US corporate zero coupon bonds of various maturities for different rating classes. The numbers correspond to the period from February 1985 to September 1987. However, as the CRAs do not primarily attempt to measure absolute credit risk, the implied default probabilities associated with the different credit ratings could vary over time (Cantor et al, 1994). Nevertheless, during the longer term perspective the credit risk measures should exhibit a large degree of stability within each credit rating cohort and credit ratings could therefore also be used as measures of long term absolute credit risk.

Table 2.1 **Yield spreads for US corporate zero coupon bonds, February 1985 – September 1987 (%)**

Maturity (yrs)	AAA	AA	A	BBB	BB	B/C
0.5-2.5	0.401	0.621	0.775	1.326	1.670	4.996
2.5-4.5	0.232	0.562	0.736	1.275	1.495	4.650
4.5-6.5	na	0.620	0.778	1.405	2.730	3.365
6.5-8.5	na	0.620	0.660	na	1.878	2.959
8.5-10.5	0.626	0.575	0.816	na	0.989	2.912
10.5-12.5	na	0.566	0.854	na	na	na
12.5 Plus	0.544	0.544	0.740	na	na	na

Source: Sarig and Warga, 1989

Even though the CRAs primarily are concerned with measuring relative credit risk, for the reason stated above, it is also interesting to evaluate the performance of credit ratings as predictors of absolute default and loss rates. One obvious evaluation method is to compare the implied default risks associated with the assigned credit ratings with actual default and loss rates. By comparing actual loss rates for different credit ratings, historical data show that on average CRAs are also capable of separating issuers on the basis of absolute credit risk. *Table 2.2* presents the average cumulative loss rates over different horizons for various rating cohorts rated by Moody's from 1985 to 2005. However, since the default rates are likely to vary considerably over business cycles, credit ratings are better predictors or relative than absolute credit risk.

Table 2.2 **Average cumulative credit loss rates, 1982-2005 (%)**

Cohort Rating	Year 1	Year 2	Year 3	Year 4	Year 5
Aaa	0	0	0	0	0.004
Aa	0	0.001	0.018	0.038	0.08
A	0.007	0.033	0.090	0.159	0.227
Baa	0.108	0.313	0.572	0.902	1.241
Ba	0.767	2.173	3.925	5.623	7.042
B	3.605	8.059	12.119	15.590	18.612
Caa-C	14.427	22.966	29.530	34.112	37.701
Investment Grade	0.041	0.111	0.257	0.470	0.766
Speculative Grade	3.246	6.709	13.019	18.903	26.965
All Corporates	1.078	0.445	2.475	4.358	6.974

Source: Moody's, 2005

The dispersion of default rates are generally believed to be greater for the lower rating categories. There are two major reasons for this. Economic events have greater impact on lower rated firms and the CRAs adjust credit ratings only slightly over the business cycle. As issuers with low credit quality are likely to be more affected by business cycle swings, the less than perfect timing of credit rating adjustments to changes in credit risk has a larger impact on issuers with lower ratings. *Table 2.3* reports data on the cumulative annual default rates for issues rated by Moody´s from 1970 to 1997.

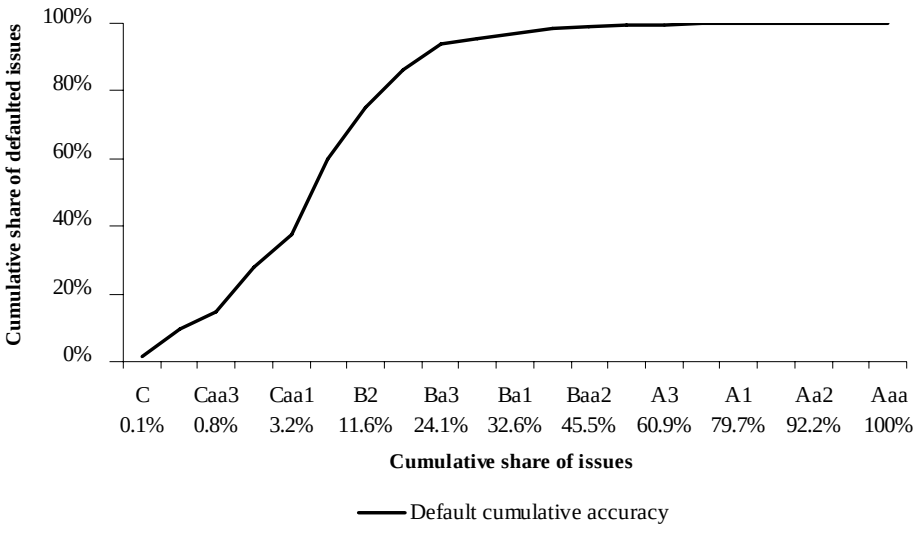
Table 2.3 **Moody's five-year cumulative default rates, 1970-1997 (%)**

	Mean	Std. dev.	Minimum	Maximum
Aaa	0.1	0.6	0.0	2.5
Aa	0.3	0.5	0.0	1.9
A	0.5	0.7	0.0	2.6
Baa	1.9	1.4	0.0	5.4
Ba	11.5	7.4	2.5	24.0
B	30.8	12.2	3.6	44.6
Caa-C	56.6	25.1	0.0	100.0

Source: Moody's, 2002

The power of the CRAs to separate defaulters from non-defaulters is illustrated in *Figure 2.2*. It can be found that 90% of the issuers that have defaulted since 1983 were rated Ba3 or lower by Moody's at the beginning of the default year.

Figure 2.2 **Moody's default cumulative accuracy profile 1983-2005**



Source: Moody's Annual Global Default Statistics 2005

It can be concluded that the market's pricing of credit risk is largely consistent with the CRAs' classifications. Hence, the information content associated with credit rating changes should be larger if the credit spread on the rated issue deviates from the spread consistent with the rating in the direction opposite to that implied by the rating change. In this scenario the rating change is unexpected by the market and hence the amount of information released through the rating change is relatively large. However, there are several limitations of this measure of market anticipation. For instance, market prices do not only reflect credit risk but also the security's liquidity as well as temporary market sentiments. Also, pricing of issues with the same rating will differ with respect to the duration and other issue specific characteristics.

Furthermore, since the power of credit ratings to predict default rates are likely to vary over time, the market may recognize this and react differently in various stages of the business cycles. If the market is concerned with absolute credit risks the relevance of the CRAs opinions may hence be related to the timing of the rating event with respect to overall market movements. When ratings are believed to provide more accurate measures of default risk, the market reaction should be larger.

The possibility to evaluate credit ratings provides a strong incentive for CRAs to provide systematic and reliable credit rating opinions with respect to realised measures of both absolute and relative credit risks. If CRAs fail to provide consistent and objective credit risk opinions the relevance of the information will be questioned by market participants, including equity investors. Hence, the incentives for CRAs to update a credit rating is larger for issuers that deviate from the general levels of credit risk within their respective credit rating cohort. Consequently, any questioning of the reliability of credit ratings based on potential conflicts of interests and other inefficiencies in the rating process must consider this inherent mitigating effect. However, a possible confusion of the difference between absolute and relative credit risks may potentially create short run incentives for CRAs to deviate from a systematic risk classification for individual issuers.

2.7 The credit rating methodology

A fundamental aspect of the credit rating process with relevance for the link between bond and equity markets is the credit rating methodology. Based on knowledge about input parameters and their relative weighting in the rating models, we should be able to gain a deeper understanding about the relevance of information associated with credit ratings and consequently the effect on equity returns.

For corporate bonds default rates have followed relatively stable patterns, whereas the loss-severity rates have been less predictable. Consequently, the ratings have historically primarily reflected the relative default probability, and severity has played a secondary role for the rating opinion. However, due to the increased sophistication of market participants, the weight given to expected *loss-given-default* has increased since the 1980s. Also, for bonds of speculative grade, for which losses are

more likely to be of material importance, a larger emphasis is placed on the expected loss-given-default (Moody's, 1999).

The creditworthiness is derived through fundamental credit analysis. The analysis is partly based on somewhat subjective indicators of financial behaviour, such as management quality. Additionally, more objective financial measures such as leverage, liquidity, coverage and profitability are given various weights depending on the expected default and loss probability. The final ratings are based on the most likely scenario among a set of potential future scenarios, which are given weights according to their likely outcomes as well as the potential credit consequences (Flink, 2005).

Standard and Poor's applies a credit rating methodology that distinguishes between business risk and financial risk. *Table 2.4* shows an illustrative relationship between the credit rating and the business and financial profile of the issuer. For issues of investment grade quality financial and business risks are given relatively equal weights, whereas for issues of speculative grades indicators of financial risk are weighted more heavily.

Table 2.4 **Business risk/Financial risk**

	Financial risk profile				
Business risk profile	**Minimal**	**Modest**	**Intermediate**	**Aggressive**	**Highly Leveraged**
Excellent	AAA	AA	A	BBB	BB
Strong	AA	A	A-	BBB-	BB-
Satisfactory	A	BBB+	BBB	BB+	B+
Weak	BBB	BBB-	BB+	BB-	B
Vulnerable	BB	B+	B+	B	B-

Source: Standard and Poor's, Corporate Ratings Criteria 2006

The assessments of business and credit risks are based on several categories of information, which are categorized and listed in *Table 2.5*. The classification of financial risk follows a set of indicative ratios, which are outlined in *Table 2.6*. The distributions of key financial ratios for firms rated within a particular rating class may differ substantially with respect to the issuer's industry. The distribution of key financial ratios for industrials rated by Standard and Poor's are displayed in *Table 2.7* (Standard and Poor's, 2006).

Table 2.5 **Corporate credit analysis factors**

Business risk	**Financial risk**
Country risk	Accounting
Industry characteristics	Corporate governance/Financial policies
Company position	Cash flow adequacy
Product portfolio/Marketing	Capital structure/Asset protection
Technology	Liquidity/Short term factors
Cost efficiency	
Strategic and operational management competence	
Profitability/Peer group comparisons	

Source: Standard and Poor's, Corporate Ratings Criteria 2006

Table 2.6 **Financial risk indicative ratios**

	Cash flow (Funds from operations/Debt) (%)	Debt leverage (Total debt/Capital) (%)
Minimal	Over 60	Below 25
Modest	45-60	25-35
Intermediate	30-45	35-45
Aggressive	15-30	45-55
Highly leveraged	Below 15	Over 55

Source: Standard and Poor's, Corporate Ratings Criteria 2006

Table 2.7 **Key industrial financial ratios, Long term debt**

	AAA	AA	A	BBB	BB	B	CCC
EBIT Interest coverage (x)	23.8	19.5	8.0	4.7	2.5	1.2	0.4
EBITDA Interest coverage (x)	25.5	24.6	10.2	6.5	3.5	1.9	0.9
FFO/total debt (%)	203.3	79.9	48.0	35.9	22.4	11.5	5.0
Free operating cash flow/total debt (%)	127.6	44.5	25.0	17.3	8.3	2.8	(2.1)
Total debt/EBITDA (x)	0.4	0.9	1.6	2.2	3.5	5.3	7.9
Return on capital (%)	27.6	27.0	17.5	13.4	11.3	8.7	3.2
Total debt/total debt + equity (%)	12.4	28.3	37.5	42.5	53.7	75.9	113.5

Source: Standard and Poor's, Corporate Ratings Criteria 2006

Despite the fact that both CRAs disclose formal definitions of their respective ratings and detailed descriptions of the relative weighting of input variables, this information provides little explanation to the frequent occurrence of divergence in the final rating decisions. Based on the disclosed rating methodologies there are no obvious reasons to believe that the CRAs employ fundamentally different methodologies in their credit risk assessments. However, the subjective characteristics of some input variables are clearly a potential source of divergence in the rating opinions between the CRAs.

The fact that credit ratings attempt to aggregate large amounts of data into a single rating symbol has several potential implications for the understanding of the informational content of credit ratings. One consequence is that issuers with comparable overall credit risks may differ substantially with respect to specific characteristics. Consequently, the informational content associated with a credit rating event may have a different impact depending on the triggering factors. This is of particular importance when analysing the implicit consequences of credit risk for equity investors. For instance, if the triggering factor of a rating downgrade is a deterioration in leverage or coverage ratios it may have less impact on equity returns than if it is triggered by decreased profitability or cash flow generation. Also, due to the fact that input factors are weighted differently with respect to the issuer's credit quality, rating events are likely to contain different information depending on the level of the rating prior to the update.

Based on the analysis of the rating methodologies it is likely that the relevance of the information associated with credit rating updates for equity investors should be related to the triggering factor of the rating change. Hence, the effect on equity returns should be larger for rating updates that are motivated by changes in factors with larger relevance for shareholders. Additionally, the relative weighting of

input variables for issues with different credit ratings suggests that for a given input parameter, the relevance of the information associated with a credit rating change may deviate for issuers of different overall credit risks. However, the analysis of the rating methodology by itself does not suggest an asymmetric effect between upgrades and downgrades. Also, the rating methodology provides no evidence that the degree of anticipation should differ systematically between different issuers or events.

2.8 Sources of information

Another crucial aspect of the rating process is the CRAs' possible access to non-public information. Under the assumption that markets are at least semi-strong efficient, an abnormal announcement effect on equity returns should indicate that at least some information is not available to the market prior to the rating change. Hence, it is reasonable to assume that rating events which are based on a larger degree of non-public information should experience larger adjustments in abnormal returns. Additionally, this should also be true for events where the CRAs have a larger comparative advantage in processing and interpreting public information.

Both Moody's and Standard and Poor's declare that they rely primarily on public information provided by the issuer. However, as a part of the ongoing surveillance during the rating process, companies provide the CRAs with non-public information such as budgets and forecasts as well as information related to new financings, acquisitions, dispositions and restructurings (SEC, 2002), (Moody's, 2002). Additionally, meeting with the management is normally a part of the credit rating process. According to Standard and Poor's, the purpose of such meetings is to review the company's key financial plans, management policies and other factors of relevance (Standard and Poor's, 2006).

In order for the CRAs to obtain access to non-public information they need to commit themselves to strict policies not to disclose any confidential contents. However, the published rating opinions are based on the total amount of information available to the CRAs. Hence, credit rating changes are potential sources of new information to the market, even if the CRAs do not directly disclose the input relevant parameters. Also, this feature of the credit rating process may be of particular importance since issuers may not be willing to communicate all pricing relevant information to the market directly. The option to disclose this information to the CRAs, and thereby reducing the information asymmetries between issuers and investors, without revealing sensitive information may play a pivotal role for the existence of public debt markets.

With respect to the information content of credit ratings, it is both the relative advantage of CRAs to gather and interpret large amounts of data from public sources as well as their access to non-public information that suggest that CRAs provide new and pricing relevant information to the market. Consequently, indicators of access to non-public information as well superior skills by the CRAs and economies of scale in information processing should be associated with a lower degree of anticipation and thereby a higher abnormal share price reaction. If these factors systematically differ between

upgrades and downgrades, the different degrees of market anticipation may also explain differential announcement effects for these rating events.

2.9 The timing of credit ratings

The timing of the announcement of a credit rating update could affect both the anticipation of the event as well as the relevance of the information for equity investors. The incentives for CRAs to provide timely information may differ between different rating events and the relevance of the information associated with a credit rating update could also potentially differ with respect to the timing of the rating announcement.

The CRAs aim to provide through-the-cycle ratings, which should reflect the issuers' credit quality regardless of the stage in the business cycle. This limits the credit ratings' usefulness as real-time indicators or credit risk. It is reasonable to assume that the actual default probabilities exhibit cyclical patterns, rising in economic upturns and falling in recessions.

The through-the-cycle principle requires that the CRAs can predict the cyclicality with reasonable accuracy. However, the CRAs are not always able to forecast all parameters necessary to separate the factors with direct impact on the issuer's long term credit quality from those associated with the business cycle. *Figure 2.3* illustrates the rating in an ideal world and *Figure 2.4* illustrates the rating pattern expected in the real world.

Figure 2.3 **Rating in an ideal world**

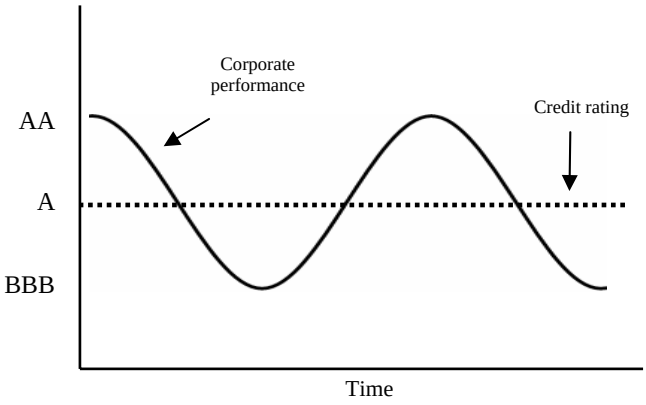
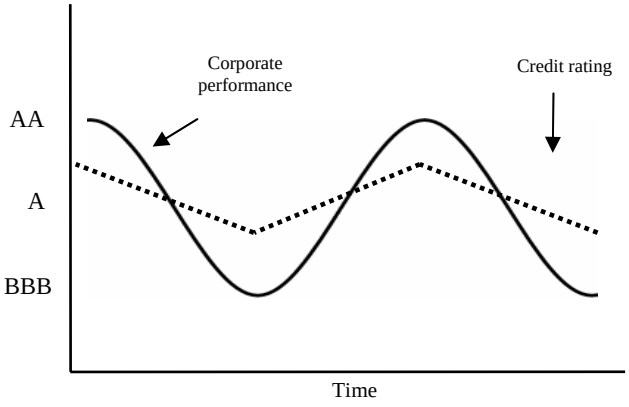


Figure 2.4 **Rating in the real world**



Due to the through-the-cycle rating approach credit ratings exhibit a rigidness with respect to changes in the issuer's credit quality. The primary reason for this rating approach is that rating reversions are particularly costly for some investor clienteles. Since many investors link their investment strategies to credit ratings, an excessive volatility would imply large transaction costs associated with portfolio rebalancing. This has implications for the reliability of credit ratings as indicators of credit risk. Consequently, the CRAs face a trade-off between the timing of rating updates and the practical consequences for market participants. According to Moody's, giving only modest weight to economic cycles best serves the interest of the majority of investors (Moody's, 1999).

Watchlists and rating outlooks are, however, ways to provide investors with additional information about the credit risk development of the issuer.

It is possible that the timing of the rating varies between different rating events. There is evidence that the pricing implication of a credit rating may be linked to the supply-effects on the market (Karam and Midander, 2005). Institutional investors are generally restricted from investing in non-investment grade securities. Hence, a downgrade from an investment to a non-investment grade rating would potentially be less timely since CRAs may recognize that a rating reversion would result in substantial costs for large investor groups. It is also possible that ratings are self-fulfilling. Therefore, CRAs may be reluctant to respond quickly to indicators of changed credit quality since a "false" negative prediction would have adverse effects on the issuer's financing costs.

Also, the amount of information associated with a rating change may potentially explain the different responses associated with upgrades and downgrades respectively. Investors are likely to be more vulnerable to deteriorations than improvements in credit quality. Hence, CRAs have incentives to provide more timely ratings for downgrades than for upgrades. Consequently, downgrades should provide more new information to the market.

Since credit ratings are not expected to reflect immediate changes in the issuers' credit risks, the information content associated with rating changes may already be available to the market. Once the rating change occurs, the market already has obtained the underlying information and priced securities accordingly. This is consistent with several studies that have found that credit ratings generally lag changes in credit risks and adjustments in credit spreads (Löffler, 2002), (Odders-White and Ready, 2005).

Based on the timing aspect of the credit rating process we can identify two effects with potential impact on the announcement effect on equity returns. First, the rigidness of credit ratings with respect to changes in credit risk suggests that much of the information related to the credit rating update should be known by the market prior to the announcement, implying that the event is anticipated. However, it is possible that the timing may differ between rating events, which could explain the existence of differential share price reactions. Second, also the relevance of information should depend on the timing. During times of pronounced business cycles equity investors should potentially place less emphasis on credit ratings since they are expected to be worse indicators of absolute default rates. Ultimately, these effects are affected by the incentives for the CRAs to provide timely information, which in turn are affected by the trade-off between providing timely and accurate information as well as avoiding excessive rating volatility.

2.10 Conflicts of interest

The relevance of the information associated with credit rating changes are affected by the CRAs perceived independence as information providers. To understand the impact of the CRAs' business models on the information content of rating announcements, it is essential to consider the inherent conflicts of interests associated with the credit rating industry.

One important feature of a credit rating is its public good characteristic. Once released, there is no way for the CRA to prevent access to non-paying users. This has clear implications for the business concepts of CRAs. Initially the CRAs did not charge anything for providing public ratings of major issuers. Their primary source of revenue was therefore the sale of various publications. This concept made CRAs vulnerable to the customers' sharing of information and prevented public releases of rating information. Eventually the CRAs changed their business models and today the major CRAs earn the bulk of their revenue by charging a fee directly to the issuer. This cost is ultimately shared with investors in the form of adjusted yields. Issuers are willing to pay for ratings as they are rewarded through lower spreads and access to larger investor pools.

It can be concluded that credit ratings generate significant positive externalities, which cannot be entirely internalised by the CRAs. Hence, by relying on charging fees to the issuers, there are a number of inherent conflicts of interests in the rating process. In order for the CRAs to maintain their independence and reliability it is crucial to handle any suspicion of conflicting interests. This could possibly explain the public disclosing of the CRAs' rating methodologies as well as the existence of numerous internal procedures related to the relationship between the issuer and the CRA. One should also recognize that reputational considerations as well as the temptations to exploit conflicts of interest are potentially more serious when informational asymmetries are large (Smith and Walter, 2001).

The existence of potential conflicts of interests may be relevant for the interpretation of the information associated with rating changes. Despite numerous attempts to mitigate suspicions that the CRAs' loyalty primarily lies with the issuer rather than the users of the information, the structure of the fee system imposes an inherent incentive for the CRAs to at least consider the potential implications of a rating action on its future business opportunities. To the extent that equity investors believe that this consideration play a role in the rating process, they may place less relevance on the information provided by the CRAs, and hence we would expect lower announcement effects. Additionally we should also be able to explain potential differential effects between rating events by studying indicators of conflicting interests. The potential effect associated with this incentive problem, however, is likely to be mitigated by the incentive for the CRAs to maintain ratings with consistent default probabilities in ex post evaluations.

2.11 Summary

We have identified a number of aspects of the credit rating process which potentially affect the announcement effects on equity returns associated with credit rating updates. The summary in *Table 2.8* below illustrates whether the aspects are related to the degree of market anticipation or the information relevance for equity investors.

There are several different aspects related to both dimension. However, some aspects are more easily testable and quantifiable as well as of larger importance for the analysis. For the effect related to the anticipation of the rating event, outlook opinions and Watchlist additions as well as the rigidness of the credit ratings are observable aspects with clear theoretical implications. The aspects with largest and most intuitive impact on the information relevance for shareholders are related to the triggering factors of the rating update as well as the incentives for CRAs to provide timely and reliable information. The remaining aspects within both dimensions may still be important but are harder to empirically support.

Table 2.8 **Summary table: Implications for announcement effects on equity returns due to credit rating changes**

	Anticipation	Information Relevance
The role of CRA		The signalling function by CRAs reduces informational asymmetries on equity markets.
Objectives		CRAs wish to avoid responsibility for negative consequences of rating actions by communicating and limiting their objectives.
Credit rating in practice	Outlook opinions and Watchlist additions increase anticipation of rating events and the amount of credit research affects the timing of the announcement.	Non-mandatory disclosure requirements reduce the relevance of credit rating information.
Performance of CRAs	If the performance of the issuer deviates from the general level of its rating cohort the event should be more anticipated.	Ex post evaluations provide incentives for the CRAs to provide timely and consistent rating information.
Rating methodology		The relevance of credit rating information for equity investors is related to the triggering factor of the rating update. The relevance may also differ depending on relative weighting of input variable for issuers of different credit qualities.
Sources of information	Access to non-public information and comparative advantage in information processing suggest that CRAs add new information.	
Timing	The rigidness of credit ratings suggests that information reaches the market prior to the announcement.	Credit ratings are worse indicators of default risk during times of pronounced business cycles.
Conflicts of interests		The public good characteristic of credit ratings imposes conflicts of interests, which may reduce the reliability of the information.

3. THEORETICAL FOUNDATION

In addition to the theoretical insights based on the description and analysis of the rating process, several additional theories can be used as broad explanations for the existence, or absence, of share price reactions in connection to rating changes. In this section we attempt to provide a comprehensive overview of the main theoretical arguments that provide the basis for our analysis.

The ultimate objective for a theoretical framework is to establish a robust link between variation in the credit risk of the issuer's bonds and the characteristics of the share price returns, which also takes into account the dynamics of the rating process. Neither finance nor contracting theory can support the existence of such relationships. Instead, the analysis of the information content of credit ratings is generally evaluated using capital market theory. This approach assumes market efficiency and focuses on the information content associated with credit rating updates. Hence, this theoretical framework may be of limited relevance if abnormal returns are driven by unexpected investor reactions that do not fully correspond to the information released.

3.1 Market prices and information availability

The strong form of market efficiency requires that all public and private information about the value of an asset is reflected in the current price. Several observations provide evidence against this form of efficiency. For instance, the observed excess returns achieved by insider traders support the conclusion that some information about the value of a firm is not always incorporated in the price. In a similar fashion, rating agencies may have access to non-public information and hence an abnormal share price reaction associated with an update of the credit rating could be evidence that new and relevant information about the value of the company is brought to the market. If market prices adjust to reflect the new information once it is revealed, markets are said to be semi-strong efficient.

Based on the assumption of semi-strong market efficiency, the existence of announcement effects can broadly be explained by three hypotheses: i) the information content hypothesis, ii) the wealth redistribution hypothesis and iii) the signaling hypothesis.

3.2 Information content hypothesis

As outlined by Zaima and McCarthy (1988) the information content hypothesis suggests that there is information asymmetry between the CRA and the market. This implies that announcements of credit rating changes potentially supply additional information relevant for the valuation of the firm. There are two main views related to this hypothesis.

According to one view, CRAs have only access to public information and there is generally a lag between the announcement and when it becomes available to the market due to the time required to

process the information. Hence, if markets are semi-strong efficient, a changed credit rating should not affect security prices. This argument is supported by the view, outlined by Holthausen and Leftwich (1986), that rating agencies do not monitor companies closely and that changes in credit ratings tend to be related to issuance of new debt. Also, Kaplan and Urwitz (1979) as well as Wakeman (1984) argue that rating agencies have a certification function rather than a research function and therefore they are likely to reflect merely public information.

Another view suggests that CRAs have access to inside information which is not available to other investors. It can be argued that if information gathering is costly, the CRAs are the lowest cost providers of such information. They are information specialists who obtain information about specific conditions that are not available to the public. According to Ederington et al (1984) there are two reasons why this is the case. First, there are economies of scale in collection and evaluation of the relevant information. Second, due to a potential agency problem, managers may not release inside information to the public which they provide to the rating agencies. According to this view, one would therefore expect that a revision of a credit rating should affect security prices.

An underlying assumption of this view is that shareholders, like bondholders, are affected negatively by a downgrade and positively by an upgrade. The information content hypothesis does, however, not consider the underlying reasons for the credit rating revision or the rationale for the predicted effect on shareholder wealth. Rather, it merely recognizes that there is information asymmetry between the CRA and the market.

3.3 Wealth redistribution hypothesis

The wealth redistribution hypothesis suggests that there is a conflict of interest between bond and equity investors. Given that a downgrade provides information about a deterioration of the issuer's credit quality, the value of the outstanding bonds should decrease. This does, however, not necessarily imply that the value of the firm as a whole decreases with an equivalent amount. Instead, according to the wealth redistribution hypothesis, at least some value is transferred from the bondholders to the shareholders.

It has been argued that a shareholder holds a security with a pay-off pattern that can be characterised as a call option on the firm's assets (with a strike price equal to the value of the firm's debt). Hence, according to option pricing theory (Merton, 1998), shareholders may benefit if the lower credit quality implied by the rating downgrade is motivated by higher volatility in the issuer's cash flow patterns, but not necessarily lower expected returns. Over the short term shareholders will benefit since as long as the firm does not need to raise new capital on debt markets, they avoid paying the higher cost of capital associated with these new levels of risk.

Consequently, this hypothesis suggests that a credit rating downgrade (upgrade) should be followed by a positive (negative) share price reaction. According to Mollemans (2004) it is reasonable

to assume that any wealth redistribution from bondholders to shareholders is unanticipated since managers are expected to act in the interest of the shareholders and therefore do not release information about changed risk levels prior to the CRAs.

3.4 Signaling hypothesis

The signaling hypothesis is based on the view that a credit rating change represents a signal about future earnings and cash flows of the company as well as for the competitors within the industry.

According to this hypothesis, rivalling firms can gain information about the competitive situation in a particular market. A downgrade can, for instance, signal that a competitor may be weakened and hence potentially vulnerable to attacks. Consequently, a downgrade of one firm may cause an increase in the valuation of competing firms. Also, a downgrade can signal negative information about the whole industry, reflecting adjustments in the general operational conditions. Therefore, announcements of downgrades may cause negative share price reactions for companies operating within the same operational environment. Hence, depending on whether the changed credit rating refers to firm specific or to industry wide information, we would expect different impacts on the valuation of competing firms.

The general implication of this hypothesis is that different intra-industry effects are caused by credit rating changes, which are driven by the impact on the issuers' positioning in their respective industries. Apart from these additional effects, a downgrade (upgrade) would be expected to be followed by a negative (positive) share price reaction for the issuing firm, which again implies that asymmetric distribution of information is a necessary condition.

3.5 Combined announcement effects

The information content hypothesis and the signaling hypothesis both suggest that credit rating downgrades should be followed by negative share price reactions and that upgrades should be followed by positive share price reactions.

Most previous studies have found evidence in favour of these predications for downgrades, whereas for upgrades the results have been considerably less consistent. Consequently, one possible explanation could be that the wealth redistribution effect, which predicts opposite share price reactions, offsets the information content and signaling effects. On the other hand, for downgrades the wealth redistribution effect is dominated by the information content and the signaling effects. The predicted impact on the announcement effect on equity returns are summarized in *Table 3.1*.

Figure 3.1 **Prediction of share price reactions following credit rating changes**

	Rating change	Information Content Hypothesis	Wealth Redistribution Hypothesis	Signaling Hypothesis
Share price Effect	***Upgrade***	*Increase*	*Decrease*	*Increase*
	Downgrade	*Decrease*	*Increase*	*Decrease*

It is, however, important to notice that the wealth redistribution hypothesis focuses directly on the relationship between the information implied by the rating update and the effect on equity returns, whereas the other two hypotheses merely acknowledge the fact that under certain conditions rating changes should cause adjustments in equity prices in the same direction as for bondholders. Following the arguments for each of the effects outlined above, wealth redistribution is primarily related to the information relevance of the underlying information of the rating event, whereas the information content relates primarily to the degree of market anticipation and signaling to both dimensions. *Figure 3.2* illustrates the relationships between the different theories and the two main dimensions.

Figure 3.2 **Theories related to anticipation and information relevance**

	Information Content Hypothesis	Wealth Redistribution Hypothesis	Signaling Hypothesis
Dimension	*Anticipation*	*Information relevance*	*Information relevance /Anticipation*

Since the effects associated with the theoretical arguments provided this far could be understood within the framework of anticipation and information relevance it could be argued that they do not add additional insights. However, in the absence of a single theory that predicts homogenous reactions for rating changes in both directions respectively, we believe that it provides as reasonable starting point for the analysis. In order to fully understand the dynamics of the potential announcement effects we believe that the findings should also be related directly to these two dimensions. For this reason the main arguments and aspects related to these are outlined below.

3.6 Market anticipation

A crucial explanatory component of the equity market's reaction to announcements of credit rating changes is the degree of market anticipation. Anticipation depends both on factors affecting the availability of information about the issuer as well as the uncertainty in the market as a whole. Obviously, rating changes that confirm the market's anticipated view are less likely to reveal new information. The degree of anticipation is closely related to the information content hypothesis since a low degree of market anticipation is associated with releasing of larger quantities of pricing relevant information.

The importance of anticipation is confirmed by a number of studies (Hsueh and Liu, 1992), (Chandy et al, 1993), (Purda, 2005). Market anticipation can also potentially explain the different reactions associated with upgrades and downgrades respectively. According to Matolscy and Lianto (1995), the management has incentive to release positive information about the firm's performance, whereas the release of negative news is generally less timely. Hence, downgrades are less anticipated than upgrades. This explanation is also highlighted by Mirco Bianchi, Global Head of Ratings Advisory at UBS Investment Bank, as the primary reason for the asymmetric reaction between upgrades and downgrades.

An alternative explanation for the larger reaction associated with downgrades is the implications of the through-the-cycle rating approach. Rating changes are rigid with respect to changes in credit risk. Hence, the inaccurate timing of information may imply that the market turns to alternative sources of information, implying that rating changes are anticipated (Odders-White and Ready, 2005). If investors are more concerned about deteriorations in credit risks than improvements, CRAs have incentives to provide more timely rating updates for downgrades, which explain the larger reactions associated with such events (Altman and Rijken, 2005).

The degree of market anticipation can be related to a number of factors. For instance, ownership dispersion can be assumed to be positively related to the uncertainty about the issuer since larger owners have incentives to invest more resources in monitoring and obtaining information about the issuer (Hsueh and Liu, 1992). Similarly, according to the search theory, the amount of analyst coverage should be positively related to the amount of information available about the issuer, and hence the anticipation of a rating event (Chandy et al, 1993). Other factors of importance for the degree of market anticipation could potentially be Watchlist additions (Gropp and Richards, 2001), outlook opinions, disclosure requirement, the amount of intangible assets (Cornell et al, 1989) or characteristics of previous rating events (Cantor, 2004).

In summary, the degree of market anticipation is an essential component for the explanation of announcement effects on equity returns associated with credit rating changes. However, an unanticipated rating event does not by itself imply an abnormal share price reaction. It is merely a necessary condition for the announcement to have a significant effect on shareholder wealth.

3.7 Relevance and impact of information

In line with the conclusion by Holthausen and Leftwich (1986), announcement effects associated with rating updates can, in addition to the degree of anticipation, be expected to depend on the underlying reason for the rating change. A rating update that is triggered by a change in the firm's financial performance, such as profitability and cash flow generation, is potentially of different relevance for shareholders than changes in liquidity or solidity (Ederington and Goh, 1993). This is consistent with the implications of the wealth redistribution hypothesis that a change in the credit risk that is motivated

by increased cash flow volatility may have different implications for bondholders than for shareholders. However, depending on the nature of the underlying information, the effect on equity prices could also be similar to that on bond prices.

Also consistent with the wealth redistribution hypothesis, there is an inherent conflict of interests between bond and equity investors. Due to the shareholders' residual cash flow claim, they are generally believed to benefit if the payments to bondholders are reduced. Consequently, the relative power of shareholders to negotiate with bondholders in case of default should affect the impact on equity returns due to credit rating changes (Garlappi et al, 2005).

It may also be the case that information relevance of rating changes differ between various issuers. It is found that more heavily regulated issuers generally react more strongly to rating changes (Gropp and Richards, 2001), which may suggest that information relevance implied by rating revisions is larger for such companies.

Based on the fact that different types of information is weighted differently depending on the level of credit risk, the relevance of the information may vary between rating changes in various levels on the rating scale. In addition to the supply-based explanations (Midander and Karam, 2005), this could potentially explain the larger price reaction found for non-investment graded bonds compared to that associated with bonds with investment grade ratings.

In order to understand the potential systematic link between credit risk and equity returns the relevance and implication of the underlying information are crucial factors. From a shareholder perspective, several theoretical arguments suggest that the relevance of the information associated with a credit rating may differ substantially with respect to various issuer and event specific factors.

3.8 Inefficient markets

We have already addressed the limitations of the assumptions of market efficiency. According to this view, the poor returns following downgrades could potentially be explained by market inefficiencies rather than real economic implications for shareholders.

This explanation suggests that even though shareholders are fully aware of the information content of the downgrade, share prices may not reflect this information due to different information-processing, behavioural and/or institutional biases. For instance, Bernard and Thomas (1990) show that investors systematically underreact to earnings surprises. Also, according the theory of moderated confidence outlined by Bloomfield et al (2000) investors tend to overreact to unreliable information whereas they generally underreact to highly reliable information.

If the assumption of semi-strong equity markets does not hold, we cannot draw conclusions regarding systematic links between credit risks and equity returns by studying announcement effects of credit rating changes. Rather, we would have to rely on alternative methodologies that do not depend on this assumption.

4. HYPOTHESES

Based on previous research, the analysis of the rating process and the theoretical foundation we have identified two major factors of relevance for the characteristics of announcement effects on equity returns associated with credit rating updates. The factors are the relevance and implication of the rating information as well as the degree of market anticipation. Both factors relate to the magnitude of the announcement effects as well as the potential asymmetry between the effects associated with upgrades and downgrades respectively.

The aim of this thesis is to study the existence and characteristics of the potential link between credit risk and share price returns by investigating the impact of credit rating updates on share prices around the time of the announcement. Our two major research questions as outlined in the introduction are:

> *Is there a systematic link between credit ratings, as indicators of credit risk, and the return patterns on equity markets?*
>
> *How can variations in issuer and event specific characteristics explain potential announcement effects on equity returns associated with credit rating changes?*

In addition to answering these research questions, we also hope to identify the factors that are most relevant for the explanation of the potential announcement effects. For the purpose of fully understanding the dynamics of the link between credit risk and stock prices, we have formulated six hypotheses. These are outlined in *Table 4.1*.

The first three hypotheses are related to the existence and magnitude of announcement effects of credit rating updates on share prices. A majority of previous findings have confirmed that credit rating updates are associated with abnormal effects on share price returns. However, only downgrades are generally associated with significant (negative) reactions. Hypothesises 2 and 3 aim to examine how and why share prices react to credit rating announcements by relating them to the two main explanatory factor; relevance and anticipation. Hypothesis 4 addresses the potential asymmetric effects between upgrades and downgrades. In hypotheses 5 and 6 we try to explain the potential existence of such asymmetric effects once again by relating them to the main explanatory factors; relevance and anticipation. All hypothesises are based on the description and analysis of the credit rating process in *Section 2* as well as the main theoretical arguments outlined in *Section 3*.

Table 4.1 **Hypotheses**

Existence and magnitude of announcement effect	
H1:	*Changes in credit ratings are associated with abnormal share price returns.*
H2:	*The magnitude of the reaction is greater if the relevance and implication of the information associated with the rating announcement is larger for equity investors.*
H3:	*The magnitude of the reaction is larger if the market's anticipation of the event is lower.*
Differential effects between upgrades and downgrades	
H4:	*The announcement effect due to credit rating changes differ between downgrades and upgrades.*
H5:	*The potential differential effect is affected by the relevance and implication of the rating information.*
H6:	*The potential differential effect is affected by the degree of market anticipation.*

4.1 Existence and magnitude of announcement effect

Hypothesis 1: *Changes in credit ratings are associated with abnormal share price returns.*

Based on our knowledge about the rating process and the general theoretical background we expect that announcements of credit rating changes add new and relevant information to the market either by their specialisation in information processing or their access to non-public information. Since the CRAs' assessments of credit risks are based on input variables which, on average, should be relevant for shareholders we expect that these events are associated with abnormal share price reactions.

Under the assumption that markets are semi-strong efficient and without separating the effects associated with the underlying rating information, an overall prediction for both upgrades and downgrades is that the potential effect of credit rating changes on shareholders will be similar to that on bondholders. Hence, effects related to wealth redistribution should not dominate the observed reactions. This is primarily based on the assumption that changes in credit risks are primarily driven by factors with similar impact on shareholders as on bondholders.

Hypothesis 2*: The magnitude of the reaction is greater if the relevance and implication of the information associated with the rating announcement is larger for equity investors.*

Ceteris paribus, rating changes that provide more pricing relevant information for shareholders should experience larger abnormal share price returns around the time of the announcement. Consequently, rating updates that are triggered by changes in factors which are expected to be of lower shareholder concern as well as factors indicating redistribution of wealth from the bondholders to shareholders should experience smaller abnormal announcement effects for both upgrades and downgrades.

In addition to the triggering factor of the rating change, the analysis of the rating process as well as the theoretical foundation suggest that the relevance of the underlying information for shareholders should be affected by the perceived independence of the CRA, the timing of the announcement with respect to macroeconomic fluctuations as well as the credit quality of the issuer.

***Hypothesis 3**: The magnitude of the reaction is larger if the market's anticipation of the event is lower.*

The magnitude of any potential abnormal share price reaction associated with announcements of changes in credit ratings should be lower if the event is anticipated for both upgrades and downgrades. Hence, based on the analysis of the rating process we expect that outlook opinions, Watchlist additions and other indicators market anticipation should affect the magnitude of announcement effects due to credit rating changes. Specifically, announcement effects should be of lower magnitude for rating events when the predicted directions are confirmed.

Of particular concern for the degree of market anticipation is the timing of the announcement. Incentives for the CRAs to provide timely information should affect market anticipation negatively and hence increase the share price reaction. In addition to the issuer specific anticipation, a higher uncertainty in the economy should also indicate a lower degree of anticipation and hence a larger share price reaction.

4.2 Differential effects between upgrades and downgrades

***Hypothesis 4**: The announcement effect due to credit rating changes differ between downgrades and upgrades.*

Most previous studies have found an asymmetric announcement effect between upgrades and downgrades. According to these findings the announcement effect is expected to be of larger magnitude as well as more systematic for downgrades than for upgrades. Also, based on the theoretical foundation, the potential differential effect could be explained by a larger impact of wealth redistribution for upgrades than for downgrades. However, the insights from the rating process also suggest that the relevance and implications as well as the degree of market anticipation could be factors of importance for the possible differential effects between these rating events.

Hypothesis 5: *The potential differential effect is affected by the relevance and implication of the rating information.*

If either upgrades or downgrades are associated with more relevant information for shareholders, announcement effects for these events should be of larger magnitude than the other.

Based on arguments in previous sections it is possible that there is a systematic difference between the rating methodologies and procedures for downgrades and upgrades, which suggests that announcement effects should be of larger magnitude for downgrades. More information of relevance for shareholders is expected to be released through downgrade announcements. This is primarily based on the prediction that downgrades generally are of larger concern for shareholders than upgrades and that CRAs therefore have incentives to provide more relevant information through these events.

Hypothesis 6*: The potential differential effect is affected by the degree of market anticipation.*

A differential effect between upgrades and downgrades could potentially be explained by differences in the degree of market anticipation between the events. According to the design of the rating process as well as several theoretical predictions, announcements of upgraded credit ratings are expected to be anticipated to a larger extent than announcements of downgrades. Hence, the magnitude of potential abnormal announcement effects for upgrades should be lower than for downgrades.

With respect to the degree of market anticipation, there are two offsetting effects associated with the timing of the rating announcement. First, it is likely that shareholders are more concerned about deteriorations in credit qualities than improvements, which implies that CRAs have incentives to provide more timely rating changes for downgrades. Second, there are indications that credit ratings are self-fulfilling and that the CRAs, due to the adverse effects on the issuers' financing costs, are more concerned with assigning a "wrong" rating for downgrades than for upgrades. Consequently, downgrades should be less timely as CRAs spend more effort and time on the credit rating analysis in order to ensure a correct rating decision.

Despite the indistinguishable effect on anticipation associated with the timing of the rating event, there are still arguments that support the existence of a larger announcement effect for downgrades. An explanation with strong support in previous research as well as among professionals in the rating industry is that the incentives for the management to communicate with the market are larger for positive than for negative information. Downgrade announcements should therefore be less anticipated suggesting that these credit rating events are more pricing relevant for equity investors.

5. DATA AND METHODOLOGY

In this section we provide an overview of the characteristics of our data sample. Also, the chosen sample criteria and information sources are described and discussed. Additionally we describe and motivate the methodological approach chosen for the study.

5.1 Data

Our original sample consists of 254 rating changes corresponding to 50 different issuers rated by Moody's and Standard and Poor's over the period from March 1990 to February 2006 of whom 150 are downgrades and 104 are upgrades. The ratings correspond to issuers listed on the Swedish, Finnish, Danish and Norwegian stock exchanges. The observations are obtained from Moody's *Rating Interactive* and Standard & Poor's *RatingsDirect* which are restricted access databases containing ratings and related information. In addition to historical rating updates, data on outlook opinions as well as potential Watchlist additions were collected. The dates of the rating updates were crosschecked against the *Factiva* news search database to confirm the publication dates reported by Moody's and Standard and Poor's. The dates matched in almost all cases except for a few events that were not published in the media at all.

Based on the information in the articles on the publication dates we also categorized observations according to the underlying motivation for the rating change. All rating updates were classified based on three categories: *financial performance*, *change in leverage* or *other*. An observation was classified as financial performance if the rating was changed due to revised expectations about the issuer's operating performance such as profit, cash flows, market share or business opportunities. Alternatively, a rating change was classified as a due to a change in leverage if it was motivated by updated information about the issuer's capital structure or financing options. 138 observations where associated with motives related to financial performance, 37 were due to changes in leverage and 79 did not fall into either of the other categories.

All observations correspond to ratings of long term straight and unsecured debt. Hence we exclude ratings of short term and convertible debt. The main reason is that the major part of the corporate debt markets consists of long term bond issues. Also, the results of previous research is almost exclusively concerned with long term ratings.

Each rating change corresponds to one observation even if the issuer has several debt contracts outstanding that are affected. It is possible that different issues have different ratings and that the rating may deviate depending on whether it is denoted in foreign or domestic currency. For this reason we have, whenever possible, used the *issuer rating* for long term debt which in almost all cases is the rating for individual long term issues as well. When the issuer rating was not accessible, we used the

domestic currency rating of the individual issues, corresponding to the largest issue in case of several issues. However, it is very rare that ratings deviate between different issues or with respect to currency.

Table A.2 and *Table A.3* in *Appendix A* report the distribution of rating changes within and across rating classes as well as over CRAs and issuer domicile. In addition, *Table A.4* in *Appendix A* provides a transition matrix, which reports the number of rating changes between each pair of rating classes, where rating classes are translated to Standard and Poor's rating scale.

The number of observations is relatively equally distributed between the two CRAs and the proportion of downgrades, corresponding to approximately 60 percent, is slightly larger than that of upgrades. Furthermore, some clustering over time for both upgrades and downgrades can be observed. Approximately 39 percent of the downgrades occurred between 1999 and 2002. Likewise, about 48 percent of the upgrades occurred during the period between 2003 and 2006. Approximately 50 percent of the rating changes correspond to Swedish issuers, 22 percent to Finnish, 16 percent to Norwegian and 12 percent to Danish. Also, there are no substantial differences between the agencies with respect the number of rating changes for each geographical market.

Roughly the same portion for both downgrades and upgrades correspond to changes across class (42-44 percent) and within class (56-58 percent) respectively. Within rating class changes are defined as changes between two sub ratings within a rating class as defined by the CRAs (see *Table A.1*), for instance a downgrade from BB+ to BB. Most rating changes are single-class jumps. Multi-class jumps for credit ratings are very infrequent.

Daily share price and index data was collected from *DataStream*. Share prices are adjusted for dividends, share repurchases and share issues. If the issuer had more than one class of exchange traded shares, we selected the most liquid share class. Market index data is adjusted to correspond to the adjustments of the share price data. We use all-share market indices corresponding to the four stock exchanges. The indices are OMXS for Sweden, OMXC for Denmark, OMXH for Finland and the Oslo all-share index for Norway.

From the original sample of 254 observations abnormal return estimation was only possible for 188 observations. The primary reason for removal was lack of data. Some of the observations were removed due to missing share price or index data. Also, several recent observations were removed due limited post-event data for the parameter estimation of the market model (see *Methodology*). In addition, abnormal return estimates of extreme magnitude for individual days during the event period were removed if they were contaminated by unrelated events. This did, however, not reduce the number of observations since the uncontaminated estimates over the remaining event days were kept (see *Methodology*).

5.2 Methodology

5.2.1 Event study

Our main approach to test the abnormal share price reaction associated with credit rating changes is to perform an event study over relevant event windows and test for significance using regular parametric tests. For the purpose of estimating the parameters for the calculation of normal returns we have selected an estimation window involving 180 trading days from $t = +60$ to $t = +240$, where the day of the rating announcement, the event day, is denoted $t = 0$. The choice of a post-event estimation period is based on the general finding that the period prior to the announcement generally is associated with a downward (upward) share price drift for downgrades (upgrades).

To study the timing of potential share price reactions we have defined several event windows. The event window used to study the announcement effect is defined from t = 0 to t = +1. The following trading day is included since the announcement of an updated credit rating may not affect the closing price until the following day if the trading on the event day had stopped at the time of the announcement. In order to test whether the choice of event window affects the results we also used an alternative definition of the event window including the announcement only (t = 0).

The pre-event window covers the period from t = -10 to t = -1. By studying the abnormal returns during this period we are able to draw conclusions about the development of the company's abnormal share price prior to the announcement. Finally, we define the post event window as the period between the trading days t = +2 and t = +10. The choice of post-event period is consistent with several previous studies. Also, studying a relatively short post-event window increases the ability of the test to isolate the effect associated with the announcement of the rating update.

In addition to studying the entire sample, we also perform sub sample analyses for both downgrades and upgrades to separate the effects of the underlying rationale for the rating update (see Data) as well as outlook opinion. The calculations associated with the event study are outlined in *Appendix C*.

5.2.2 Cross-sectional analysis

For the purpose of testing for potential cross-sectional variations and thereby enable a better understanding of the dynamics of the link between credit risk and equity returns, we perform a multivariate regression analysis of the obtained results from the event study. We use the aggregated abnormal return during the event window (t = 0 to t = +1) as the dependent variable. Based on the arguments in previous sections, the multivariate regression model is formulated as follows, where the explanatory variables are defined and motivated below:

$$AR_i = \alpha + \beta_1 Financial_i + \beta_2 Leverage_i + \beta_3 GradeChanges_i + \beta_4 InterestVolatilty_i$$
$$+ \beta_5 LOGmarket_i + \beta_6 GradeNumber_i + \beta_7 Drift30_i + \beta_8 FinInst_i + \beta_9 Opinion_i + \varepsilon_i$$

Financial: This is a dummy variable used to separate any potential effect associated with rating updates motivated by changed financial performance such as profitability, cash flow generation and/or market share (see *Data*). The dummy is equal to *1* if the change is due to financial performance and *0* otherwise. In general it is believed that the coefficient should be negative (positive) for downgrades (upgrades) since the implication on shareholders should be similar to that on bondholders. Consequently, it can be regarded as a measure of the information relevance for shareholders and should therefore be associated with larger announcement effects.

Leverage: This is a dummy variable equal to *1* if the rating update is motivated by a change in the issuer's capital structure or financing options (see *Data*) and zero otherwise. There is no consistent expectation of the sign of the coefficient. If the change in leverage benefits the shareholders on the expense of bondholders through wealth redistribution, it should be positive (negative) for downgrades (upgrades). However, a change in leverage does not necessarily imply wealth redistribution. Despite the difficulty of establishing consistent expectations regarding the sign, it should be expected that the significance should be lower than for *Financial* since the information should be of lower relevance for shareholders.

GradeChanges: This variable measures the number of grades that the rating is changed. Each grade is assigned a number from 1 to 28, where AAA (using the standard and Poor's rating scale) corresponds to 1 and D to 28. The number of grades changed is calculated as *old grade - new grade*. We predict that the coefficient will be negative (positive) for downgrades (upgrades). Given the abnormal share price reaction measured over the event window for both upgrades and downgrades, a rating change between a larger number of grades should be associated with a stronger abnormal reaction. Relatively more information about the issuer is theoretically released through the announcement.

InterestVolatility: This measure is designed to indicate the uncertainty in the market as a whole. It is defined as the standard deviation of the long term Treasury rate for the country of the issuer's domicile over a period of one calendar year prior to the announcement. The coefficient is expected to be positive (negative) for downgrades (upgrades). A larger variability in the reference rate should indicate that there is a larger degree of uncertainty in the economy. The importance of the rating updates should be larger in more uncertain time periods. However, the information relevance of rating updates may be lower in times of higher uncertainty due to the through-the-cycle rating approach. Credit ratings are less likely to reflect the absolute level of default risk in economic recession and booms. Hence, under the assumption that interest volatility is larger during extreme economic conditions, is should be expected that the coefficient of this variable is of the opposite sign compared to the prediction of the anticipation argument. Consequently, the primary purpose of this variable is to control for any potential impact of the timing of the rating update with respect variability in macroeconomic conditions.

LOGmarket: This variable is an alternative/complementary measures of market anticipation. It is defined as the logarithm of the market capitalisation of the issuer at the time of the announcement denominated in SEK. We expect the coefficient to be positive (negative) for downgrades (upgrades). Due to a larger investor base, the information asymmetry is likely to be smaller for larger issuers. Also, larger companies have often more liquid shares and broader analyst coverage. Hence, shareholders of smaller issuers should be more affected by announcements of updated credit ratings.

GradeNumber: Each grade class is assigned a number from 1 to 10, where AAA rated issues are assigned 1 (using Standard and Poor's rating scale) and D rated issues 10. A larger number corresponds to a lower rating. It is expected that for downgrades (upgrades) the coefficient of this variable should be negative (positive). This is based on the assumption that rating changes between lower ratings are potentially of greater importance for shareholders. This is explained by the CRAs' heavier weighing of information related to the issuer's financial risk or larger implicit consequences on the issuer's financing opportunities.

Drift30: This variable measures the drift in abnormal returns 30 days prior to the announcement. It is defined as the aggregated abnormal return over the 30 day pre-event period. There are two views related to the expected sign associated with this variable. According to the *surprise hypothesis*, the coefficient should be positive (negative) for downgrades (upgrades) since a drift prior to the announcement could be seen as a measure of the degree of anticipation.

The second hypothesis predicts the opposite relationship, namely that the coefficient should be negative (positive) for downgrades (upgrades). This so called *importance hypothesis* states that some companies are more sensitive to credit rating changes than others. They are therefore monitored more closely and rating changes should consequently be more anticipated. However, since the importance of the rating change is larger, the announcement will have a larger effect on share prices.

FinInst: This is a dummy variable equal to *1* if the issuer is a financial institution and *0* otherwise. Hence, it is designed to measure any differential effect associated with this industry. Since the business models of financial institutions are largely related to the structure of the balance sheet and available financing options, it is likely that the effect is larger. On the other hand, the distribution of credit ratings for financial institutions is more concentrated towards the higher end of the rating scale and rating changes for these issuers are generally more frequent. Consequently, the effect associated with this variable is unclear. Therefore, the variable is primarily included for the purpose of controlling for potential industry driven effects rather than contributing to the understanding of the obtained results.

Opinion: This variable indicates market anticipation. It is a dummy variable with the value *1* if the rating change confirms the outlook opinion assigned to the issuer prior to the rating change and *0* if the change contradicts the opinion or if no direction is indicated. The coefficient is expected to be positive

(negative) for downgrades (upgrades). Provided that investors are affected by outlook opinions, anticipated announcements should be associated with lower abnormal returns.

Overall predictions: *Table 5.1* summarises the overall predictions of the variables included in the regression models and relates them to the hypotheses for which the estimated coefficients may provide answers. Additionally, the variables are constructed to in various ways measure the impact of the two main dimensions; anticipation and information relevance, which is also illustrated in the table. Since we run separate regressions for upgrades and downgrades, the results are primarily related to hypotheses 2 and 3, which are associated with the cross-sectional variations for each rating event respectively. However, by comparing the significance and relative magnitude of the different variables we can also potentially draw conclusions related to hypotheses 5 and 6, about possible differential effects for upgrades and downgrades.

Table 5.1 **Summary overview of predicted sign, related hypothesis and explanatory dimension**

Variable	Predicted sign		Hypothesis	Dimension
	Upgrades	Downgrades		
Financial	+	-	H2	Information relevance
Leverage	-	+	H2	Information relevance
GradeChanges	+	-	H2	Information relevance
InterestVolatility	+/-	+/-	H2/H3	Information relevance/Anticipation
LOGmarket	-	+	H3	Anticipation
GradeNumber	+	-	H2	Information relevance
Drift30	+/-	+/-	H3	Anticipation
FinInst	+/-	+/-	na	na
Opinion	-	+	H3	Anticipation

5.2.3 Elimination of contaminated observations

Based on the estimation of abnormal returns it is clear that several measures of abnormal returns for individual days during the event period are contaminated by other unrelated events. In order to eliminate/reduce this contamination effect we removed observations of extreme magnitude corresponding to individual days during the event period (day -10 to +10) that are likely to be driven by unrelated information. Critical values for the elimination of observations for individual days were determined by multiplying the values corresponding to the 10th and 90th percentiles with five for each day in the event period. *Table A.5* in *Appendix A* reports the critical values for the individual days for downgrades and upgrades respectively. Additionally, the omitted observations and the rationale for assuming contamination are summarized in *Table A.6* in *Appendix A.*

The choice of method for determining critical values may be questioned on the ground that it is arbitrary in its design. However, due to the limited sample size, we believe that removal of the entire observation in case of contamination would be too costly. Also, it is a systematic approach that considers the variation in the distribution of abnormal returns during the individual days in the event period.

6. RESULTS

The main results of our study are based on the event study approach described in previous section. In this section we report the obtained results for various sub periods and sub samples for upgrades and downgrades respectively. Additionally, the findings based on the cross-sectional analysis of the obtained estimates of abnormal returns are presented.

6.1 Development of abnormal returns

Figures 6.1 and *6.2* illustrate the development of average abnormal returns for upgrades and downgrades respectively over the 21 day period (t = -10 to t = +10) surrounding the announcement of the rating update. The pattern for downgrades is more volatile and the aggregated reaction over the entire period exhibits a clear negative drift. For upgrades the pattern is less volatile and there is no clear drift over the period. *Table A.7* in *Appendix A* reports the cumulative abnormal return over the period from t = -200 to t = +60 for downgrades and upgrades.

Figure 6.1 **Development of abnormal returns**

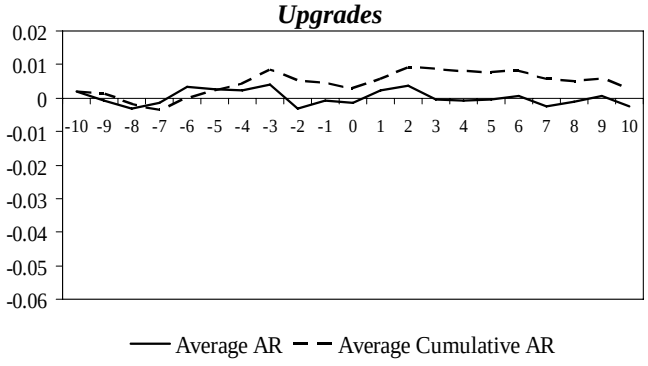
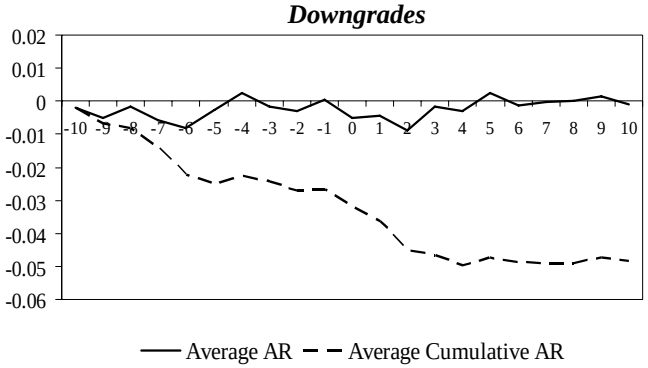


Figure 6.2 **Development of abnormal returns**



6.2 Event study results for all observations

Table 6.1 reports the results for the calculations of the abnormal returns for the various event windows based on the entire sample for upgrades and downgrades respectively. Over the announcement window (t = 0 to t = +1) downgrades experience a negative abnormal share price reaction of 0.9% which is significant at the ten percent level, with a p-value of 0.053. However, the negative reaction of 0.5% experienced on the announcement day only (t = 0) falls outside the ten percent threshold level, with a p-value of 0.113. Upgrades during the two alternative announcement windows experience virtually no abnormal reactions, implying that the results are insignificant.

During the pre-announcement window downgrades experience a negative aggregated abnormal reaction of 2.7%, which is statistically significant at the five percent level (p-value = 0.021). Upgrades do not experience any significant abnormal reaction during the corresponding period.

Finally, downgrades are associated with a statistically significant negative reaction of 1.7% (p-value = 0.083) during the post-event period whereas no significant reaction is associated with upgrades during the same period.

It can be concluded that downgrades are associated with more pronounced reactions for all studied sub periods. Also, the most significant reactions are found for the pre-event and announcement periods for downgrades.

Furthermore, *Figures A.1* to *A.4* in *Appendix A* illustrate the distribution of abnormal returns for downgrades and upgrades respectively and validates the underlying assumption of normality.

Table 6.1 **Abnormal return measures for all observations**

	Upgrades*			**Downgrades†**		
Window	**SACAR**	**t-dist**	**p-value**	**SACAR**	**t-dist**	**p-value**
-10 to -1	0.000	-0.030	0.488	-0.027	-2.060	0.021
0 to +1	0.001	0.279	0.391	-0.009	-1.631	0.053
0	-0.001	-0.518	0.303	-0.005	-1.215	0.113
2 to 10	-0.003	-0.322	0.374	-0.017	-1.394	0.083

* 73 observations, † 115 observations

6.3 Event study results for sub sample analysis based on rating rationale

When separating the sample based on the underlying reasons for the rating updates (see section *Data and Methodology*), the results deviate in several respects from those obtained from the original sample. *Tables 6.2, 6.3* and *6.4* report the results for rating changes due to changes in *financial performance*, *leverage* and *other reasons* respectively. *Figures 6.3* and *6.4* show the development of abnormal returns for rating changes motivated by changes in financial performance.

The development of abnormal returns for downgrades is consistent with the results found in the original sample but of larger magnitude, implying a more pronounced negative drift, as well as a larger reaction on the announcement day. For upgrades no major difference is noticeable.

Downgrades due to financial performance are associated with highly significant share price reactions of larger magnitude than in the original sample. During the announcement window ($t = 0$ to $t = 1$) downgrades in this category experience a negative reaction of 1.6%, which is significant at the five percent level (p-value = 0.033). Also, during the pre-announcement period downgrades are found to experience a negative reaction of 4.9% which is highly significant (p-value = 0.006). Upgrades within the same category are not found to be associated with any statistically significant abnormal share price reaction for any of the sub periods.

The results corresponding to the sub sample of rating changes motivated by a change in leverage show that neither upgrades nor downgrades experience any statistically significant abnormal share price reaction during any of the defined sub periods. This is true for the sub sample containing rating changes due to other reasons as well.

It is clear that when separating the sample based on the underlying rating rationale, only downgrades due to changed financial performance are found to be associated with abnormal share price returns. The negative reaction for this sub category is substantially stronger than in the original sample, both during the announcement and the pre-announcement periods. Also during the post-announcement period the magnitude of the negative reaction is somewhat larger, but with less significance. For upgrades the magnitudes of the reactions for each sub category are somewhat larger, and in some cases of opposite sign, but the significance remains low.

Figure 6.3 **Development of abnormal returns**

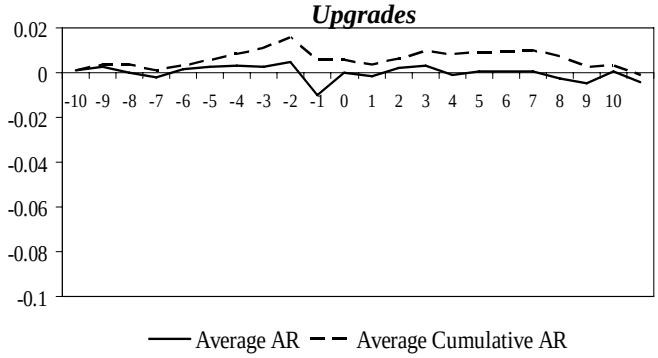


Figure 6.4 **Development of abnormal returns**

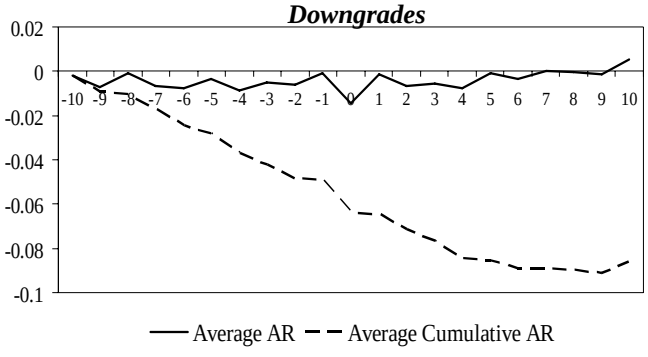


Table 6.2 **Abnormal return measures for rating changes motivated by changed financial performance**

	Upgrades*			Downgrades†		
Window	**SACAR**	**t-dist**	**p-value**	**SACAR**	**t-dist**	**p-value**
-10 to -1	0.005	0.477	0.318	-0.049	-2.623	0.006
0 to +1	0.001	0.120	0.453	-0.016	-1.876	0.033
0	-0.002	-0.559	0.289	-0.014	-2.441	0.009
2 to 10	-0.007	-0.779	0.220	-0.021	-1.210	0.116

* 47 observations, † 55 observations

Table 6.3 **Abnormal return measures for rating changes motivated by changed leverage**

	Upgrades*			Downgrades†		
Window	**SACAR**	**t-dist**	**p-value**	**SACAR**	**t-dist**	**p-value**
-10 to -1	-0.016	-0.035	0.486	-0.019	-0.517	0.306
0 to +1	-0.019	-0.091	0.465	-0.013	-0.778	0.223
0	-0.021	-0.146	0.444	0.002	0.181	0.429
2 to 10	0.022	0.052	0.480	-0.009	-0.268	0.396

* 8 observations, † 19 observations

Table 6.4 **Abnormal return measures for rating changes motivated by reasons other than leverage or financial performance**

	Upgrades*			Downgrades†		
Window	**SACAR**	**t-dist**	**p-value**	**SACAR**	**t-dist**	**p-value**
-10 to -1	-0.006	-0.340	0.369	0.000	-0.022	0.491
0 to +1	0.010	1.138	0.135	0.000	0.054	0.479
0	0.007	1.185	0.126	0.005	0.713	0.240
2 to 10	0.001	0.031	0.488	-0.015	-0.786	0.218

* 18 observations, † 41 observations

6.4 Event study results for sub sample analysis based on market anticipation

Based on the assumption that outlook opinions of the issuers' credit ratings are relevant for determining the market's anticipation of rating changes, we divide the sample into two groups: *anticipated* and *unanticipated* (see *Data and Methodology* section). *Table 6.5* reports the abnormal returns associated with anticipated rating changes and *Table 6.6* shows the results corresponding the unanticipated rating changes.

For downgrades only unanticipated rating changes experience a significant negative abnormal share price reaction over the announcement window ($t = 0$ to $t = 1$) and anticipated upgrades are found to be associated with a slight negative reaction during the announcement day ($t = 0$). Unanticipated downgrades are associated with a negative reaction of 2.3%, which is significant at the ten percent level (p-value = 0.058). Also, anticipated downgrades are associated with a significant pre-announcement reaction of 2.7% (p-value = 0.030). Additionally, both anticipated upgrades and downgrades experience negative abnormal reactions during the post-event periods which are significant at the ten percent level. None of the remaining sub periods are associated with any significant reactions for either upgrades or downgrades within either of the two sub samples.

The results of this sub sample analysis appear to follow a less systematic pattern than in the previous sub sample. However, for downgrades the reaction during the announcement window is substantially larger and of higher significance for unanticipated rating changes. For upgrades the reactions in both sub samples are of low magnitude and in opposite directions. Also, it seems that anticipated rating changes for upgrades are of higher significance.

Table 6.5 **Abnormal return measures for anticipated rating changes**

	Upgrades*			**Downgrades†**		
Window	**SACAR**	**t-dist**	**p-value**	**SACAR**	**t-dist**	**p-value**
-10 to -1	0.013	0.899	0.188	-0.027	-1.900	0.030
0 to +1	-0.004	-0.562	0.289	-0.005	-0.840	0.202
0	-0.007	-1.481	0.074	-0.004	-0.871	0.193
2 to 10	-0.018	-1.343	0.094	-0.024	-1.815	0.037

* 33 observations, † 86 observations

Table 6.6 **Abnormal return measures for unanticipated rating changes**

	Upgrades*			**Downgrades†**		
Window	**SACAR**	**t-dist**	**p-value**	**SACAR**	**t-dist**	**p-value**
-10 to -1	-0.011	-1.196	0.116	-0.026	-0.812	0.212
0 to +1	0.003	0.676	0.251	-0.023	-1.622	0.058
0	0.001	0.177	0.430	-0.009	-0.873	0.195
2 to 10	0.010	1.112	0.137	0.002	0.080	0.468

* 40 observations, † 29 observations

6.5 Cross-sectional analysis

Tables 6.7 and *6.8* report the results of the regression models used for the cross-sectional analysis of the obtained event study results for downgrades and upgrades respectively. The dependent variables used for the model estimations are the abnormal return estimates corresponding to the announcement day and the following trading day. The primary purpose of the regression analysis is to study the relative importance and the consistency with respect to ex ante predictions of the obtained coefficients. Hence, we are not necessarily interested in constructing the model with the best explanatory power.

In order to validate the results obtained through this analysis, we perform a series of tests related to the OLS assumptions underlying the methodological approach. These tests are reported and explained in *Appendix D*.

6.5.1 Regression results for downgrades

For downgrades the regression model is highly significant with a p-value of 0.5%. The R^2 measure of 13.7% is low and indicates a weak ability of the model to explain the variability in the dependent variable. However, this is consistent with the results in regression analyses in previous studies (Holthausen, 1986), (Cornell et al, 1989).

The only variables with statistically significant coefficients (on the five and ten percent levels respectively) are the 30 day pre-announcement drift in abnormal returns (p-value = 0.031) and the logarithm of the market value (p-value = 0.053). In addition, all coefficient signs are consistent with ex ante expectations.

The effect attributable to market anticipation, as indicated by outlook opinion, is of substantially lower significance (p-value = 0.321) than the alternative/complementary measure defined as the logarithm of the market value.

Despite the low significance of the coefficients corresponding to the two dummy variables indicating rating changes due to revised expectations about financial performance or leverage, both the magnitude and significance of the latter is substantially lower (p-value = 0.490 and 0.955). This is consistent with the ex ante prediction.

Also, it is found that the level of the credit rating in the rating scale, as indicated by the grade number variable, is of larger significance than the effect associated with the number of ratings changed (p-value = 0.192 and 0.527).

Finally, the variable designed to measure the macroeconomic uncertainty is highly insignificant, indicating that the timing of the rating change with respect to changes in macro economic conditions is unimportant for the explanation of abnormal share price reactions in our sample.

6.5.2 Regression results for upgrades

Despite the finding that upgrades in general do not experience significant abnormal share price reactions due to credit rating changes, we perform a cross-sectional analysis based on the same regression model as used for downgrades. The purpose of this analysis is to test whether the effects due to cross-sectional variations have equivalent implications as those indicated for downgrades.

For upgrades the regression model in itself is insignificant, which is indicated by a p-value of 28.8%. The R^2 measure of 3.8% is also very low. Nevertheless, the results still provide evidence for the existence of some systematic effects associated with cross-sectional variations related to the nature of the issuers as well as the rating events.

The variable with the highest significance and magnitude is the dummy variable designed to measure potential effects related to financial institutions. Contrary to the finding for downgrades, the coefficient associated with this variable is significant, which indicates that announcement effects for upgrades of financial institutions are of lower magnitudes than for upgrades of non-financial issuers.

The significance and magnitude of the coefficient for the variable indicating rating updates due to changes in leverage is, contrary to the expectations, larger than that of the variable indicating changes in financial performance. The coefficient sign for the latter variable is also contradicting expectations. Hence, the results indicate that announcement effects are lower for upgrades motivated both by changes in financial performance as well in leverage. Consequently, the results show that there is no similar differential effect due to underlying rating rationale for upgrades as was the one found for downgrades.

The variable designed to measure the effect associated with the number of grades changed generates a coefficient sign consistent with predictions, but the coefficient in itself is of low significance (p-value = 0.822). Also, the variable indicating differential effects due to the level in the rating scale is of high significance (p-value = 0.067) but with the “wrong” sign.

On the contrary, variables associated with the degree of market anticipation generate results which are more in line with the theory based predictions. In particular, the coefficient of the logarithm of the market value has the predicted sign and is of larger significance (p-value = 0.182) than both the coefficient associated with rating opinion (p-value = 0.243) as well as with the 30 day pre-announcement drift in abnormal returns (p-value = 0.841), which both also have signs consistent with predictions.

Finally, consistent with the finding for downgrades, the volatility in the Treasury rate is found to be an unimportant explanatory variable for the abnormal share price reactions associated with upgraded credit ratings.

In general, the results of the cross-sectional analysis for upgrades appear less systematic and to have a larger degree of inconsistency with ex ante predictions than the results obtained for downgrades. Also, the low significance of the model in itself confirms the lower degree of robustness of the results.

Table 6.7 **Regression results cross-sectional model, downgrades**

	Explanatory variables										Adj. R^2 (%)	# obs	F-stat	Sign (%)
	Intercept	**Financial**	**Leverage**	**Grade-Changes**	**Interest-Volatility**	**LOG-market**	**Grade-Number**	**Drift30**	**FinInst**	**Opinion**				
						Downgrades								
Predicted sign		(-)	(+)	(-)	(+/-)	(+)	(-)	(+/-)	(+/-)	(+)				
Estimated coefficient	-0.054	-0.008	0.001	-0.004	-0.002	0.017	-0.007	-0.065	0.010	0.011	13.7	107	2.857	0.5
Std.Error	0.056	0.012	0.015	0.007	0.026	0.009	0.005	0.03	0.013	0.011				
t-stat	-0.955	-0.692	0.057	-0.635	-0.096	1.955	-1.315	-2.185	0.775	0.997				
Sign	0.342	0.490	0.955	0.527	0.923	0.053	0.192	0.031	0.440	0.321				

Table 6.8 **Regression results cross-sectional model, upgrades**

	Explanatory variables										Adj. R^2 (%)	# obs	F-stat	Sign (%)
	Intercept	**Financial**	**Leverage**	**Grade-Changes**	**Interest-Volatility**	**LOG-market**	**Grade-Number**	**Drift30**	**FinInst**	**Opinion**				
						Upgrades								
Predicted sign		(+)	(-)	(+)	(+/-)	(-)	(+)	(+/-)	(+/-)	(-)				
Estimated coefficient	0.120	-0.013	-0.037	0.001	0.002	-0.011	-0.011	0.011	-0.027	-0.009	3.8	69	1.298	28.8
Std.Error	0.047	0.009	0.017	0.007	0.014	0.008	0.006	0.053	0.011	0.008				
t-stat	2.563	-1.416	-2.207	0.226	0.124	-1.350	-1.864	0.202	-2.368	-1.180				
Sign	0.013	0.162	0.031	0.822	0.902	0.182	0.067	0.841	0.021	0.243				

6.6 Summary of results

In this sub section the general results presented above are summarised.

All observations: Downgrades are associated with significant negative abnormal share price reactions during the event window defined as the announcement day and the following trading day. No significant reaction is found for upgrades during the same period.

Sub sample based on rating rationale: The magnitude of the negative abnormal share price reaction is substantially larger for downgrades due to changes in financial performance than in the original sample. On the other hand, downgrades motivated by changes in leverage or other factors do not experience any significant similar effects. For upgrades a significant share price reaction is still not found for any of these sub samples.

Sub sample based on market anticipation: Anticipated downgrade announcements, defined as events where the outlook opinion is confirmed, experience smaller abnormal share price reactions than downgrades defined as unanticipated. Confirming the absence of a significant announcement effect for upgrades, the importance of anticipation is found to be less systematic for these events.

Cross-sectional analysis: The signs of the coefficients on the explanatory variables confirm the ex ante predictions for downgrades, whereas for upgrades there is less consistency with economic intuition. For downgrades the separation of the sample based on the underlying rating rationale is confirmed by the relative magnitude and significance of the variables associated with these factors. The coefficients associated with other variables designed to measure the relevance of the underlying information suggest that downgrades for lower rated issuers and rating transitions between a larger number of credit ratings are more pricing relevant. Additionally, the alternative measures of market anticipation confirm the predicted impact on the announcement effect for both upgrades and downgrades.

Overall empirical findings: In general, the results confirm the importance of information relevance and anticipation as overall explanations for variations in announcement effects. The significant reaction found for downgrades is hence partly due to lower anticipation. However, this is not a sufficient condition for the significant abnormal reaction. Rather, the larger significance of the abnormal reaction found for rating events that are assumed to be associated with greater implications for shareholders confirms the importance of information relevance. In order to fully understand these results and to be able to answer our research questions, which are based on the predictions by the hypotheses, we must however, relate these findings to the dynamics of the credit rating process as well other relevant theories.

7. ANALYSIS AND CONCLUSIONS

In this section we analyse and interpret the results reported in the previous section and relate them to the hypotheses stated in *Section 4*. First, we focus on the occurrence and magnitude of announcement effects in the original sample based on a basic theoretical foundation (outlined in *Sections 3.1-3.5*). Second, we identify potential explanations for the obtained results for the purpose of describing the dynamics of the link between credit risk and equity returns. These arguments are related to the dynamics of the rating process as well as previous findings and additional theoretical explanations. Finally, in *Tables 7.1* and *7.2* we illustrate whether the hypotheses are supported by the arguments in the different sections of the analysis and summarise the conclusions related to the prediction of the hypotheses.

7.1 Announcement effects

The results of the event study for the original sample indicate that there is a negative abnormal announcement effect for downgrades during the event day and the following trading day. For upgrades we did not find evidence of a significant abnormal reaction during the same period. Accordingly, the results only partly support *hypothesis 1* that credit rating updates are associated with abnormal share price reactions. Due to the differential effect between upgrades and downgrades we can also confirm the prediction by *hypothesis 4* that these rating events are associated with an asymmetric share price reaction. Despite the significant reaction for downgrades, the conclusion could be questioned on the basis that the measured effect on the announcement day falls outside any reasonable level of significance. Also, the magnitude of the reaction is relatively small.

Based on the assumption of market efficiency, it appears that the announcement of a credit rating downgrade provides pricing relevant information to equity markets. This is consistent with the prediction of the information content hypothesis. However, the significant abnormal pre-announcement effect for these events indicates that not all relevant information becomes available to the market at the time of the announcement, but rather during a longer period leading up to the announcement. Hence, the results indicate that not all information provided by the CRAs is private. Prior to the rating change, the market appears to be able to incorporate some, but not all, of the pricing relevant information, which indicates that the downgrade decision is not based entirely on non-public information. Some of the information released through the rating change may also relate to the relative advantage of CRAs to gather, process and interpret public information.

The existence of an abnormal announcement effect for downgrades is also supported by the lower significance and magnitude of the effect for the post-announcement period compared to the period prior to the announcement. This indicates that the pricing relevant information is associated with the rating event in itself.

The insignificant abnormal reaction found for upgrades may be explained by the offsetting effect associated with *wealth redistribution*. However, based on the results of the whole sample we are not able to separate this effect from potential *information content* and *signaling* effects. On the other hand, it is possible to conclude that any wealth redistribution effect is of low relevance for the impact on shareholders in the downgrade sample.

The results based on the original sample provide a crude indication of a negative abnormal announcement reaction for rating downgrades. However, in order to better understand the underlying dynamics of the announcement effects, it is necessary to perform a more sophisticated analysis of the results as well as to base the interpretation on a broader theoretical foundation.

7.2 Information relevance and impact

When separating the sample based on the underlying rationale for the rating change, the existence of a negative announcement effect for downgrades is strongly confirmed. The magnitude of the reaction during the announcement day and the following trading day is of substantially higher significance and increases from -0.9% to -1.6%. Also, the sub sample corresponding to rating changes motivated by deteriorations in financial performance support the conclusion that the information is released through the rating event. This is based on the finding that the significance of the reaction during the post-announcement period is substantially lower than in the original sample, which implies that that the market reaction is limited to the period prior and during the announcement. The separation of the sample based on underlying rating rationale is also supported by the finding that downgrades due to other reasons than changed financial performance do not experience abnormal share price reactions, which is true for all studied sub periods. In addition, the insignificant reaction found for upgrades is confirmed by the finding that none of the studied sub periods are associated with significant abnormal share price reactions. This is true for all of the identified underlying reasons for the rating changes.

The evidence of the impact of the underlying rating rationale provide strong support for the prediction by *hypothesis 2* that the larger the relevance and implication of the underlying information of the rating change for shareholders the greater the magnitude of the announcement effect. However, despite this factor, the study find little support for the prediction of *hypothesis 5* that it is a driving factor behind the asymmetric effect between upgrades and downgrades. Also, the analysis of the rating methodology does not provide support for the conclusion that the relevance of the information for shareholders is systematically different for upgrades compared to downgrades. Below we analyse various aspects of the findings based on arguments related to the relevance and implication of information released through rating change announcements for equity investors.

7.2.1 Wealth redistribution and information relevance

The result of this analysis provide strong support for the conclusion that the existence of abnormal announcement effects for equity investors is conditioned on the implied relevance of the underlying reason for the rating update. In addition to strong empirical evidence, this conclusion is also supported by a number of theoretical arguments. First, changes in the issuer's profitability or market position is more likely to be associated with revised expectations about the firm's future cash flow generation than a change in the capital structure. Hence, the increased risk for bondholders is less likely to lead to wealth redistribution effects and the effect on shareholders should therefore be similar to that on bondholders. This is consistent with the insignificant announcement effect for the sub sample based on credit ratings due to changed leverage. In this case an increase in credit risk may not be associated with a decrease in the expected future cash flows, which implies a potential wealth redistribution effect. This in turn may offset potential negative reactions, which explains the insignificant reaction for these observations.

The larger reaction is, however, not necessarily contingent on the existence of wealth redistribution effects. Rather, due to more information regarding profitability, it is also likely that the information about revised expectations about financial performance is of higher relevance for shareholders than information regarding changes in capital structure. Consequently, for several reasons, the insignificant reaction for downgrades could be explained by a lack of relevance for shareholders.

The differential effects associated with the underlying rating rationales are also confirmed by the results of the regression analysis for downgrades. The significance and magnitude of the variable designed to measure changes in financial performance is substantially larger than of the variable associated with changes in leverage. In addition, the negative sign of the coefficient for financial performance is consistent with the relevance arguments.

7.2.2 Differential relevance due to rating class and transition

The designs of the CRAs' rating models implicitly affect the relevance of the information associated with rating changes. Since the weighting of input parameters varies for issuers of different credit qualities, the relevance for shareholders should vary depending on the level of the credit rating. This is consistent with the finding of the cross-sectional analysis, where the announcement effect for downgrades is larger for lower rated issuers. Based on the design of the rating models, this suggests that changes in financial risks have larger impact on shareholders than changes in business related risks. These definitions are, however, relatively crude and contingent on the discretion by the CRAs. Therefore, we can merely conclude that rating changes between lower ratings are of larger relevance for shareholders, and that this is potentially explained by the relative weighting of input parameters by the CRAs.

Based on the assumption that the distribution of the implied input parameters is consistent with the assigned ratings, changes between multiple ratings should be of larger relevance for shareholders. The coefficient sign of the variable measuring the number of grades changed, in the regression for downgrades, is consistent with this intuitive explanation. However, in our sample the relative importance of this effect is substantially lower than that related to the level in the rating scale. This may be explained by the low frequency of multiple rating transitions in the sample.

7.2.3 Relevance related to confidence in the rating process

The significant abnormal share price reaction for downgrades supports the conclusion that CRAs are regarded as reliable sources of information by shareholders. Hence, CRAs are successful in mitigating potential suspicions of loyalty with its clients. However, our tests provide no evidence implying that the absence of a significant abnormal share price reaction for upgrades is explained by lack of confidence in the rating process.

7.2.4 Differential relevance due to timing

Based on the assumption that shareholders are concerned with information related to the absolute credit risk of the issuer, the timing of the rating change could affect the reliability of the information provided by the CRAs. Since credit ratings generally are worse indicators of absolute credit risk during periods of pronounced business cycle movements, shareholders will obtain less relevant information than in other periods. However, the results from the cross-sectional regression analyses for both upgrades and downgrades indicate that market timing with respect to variability in macroeconomic variables, as measured by the volatility of the Treasury rate, does not affect the abnormal share price reaction. The insignificant effect may, on the other hand, be explained by the expected mitigating effect due to lower market anticipation during the corresponding periods.

7.2.5 Differential relevance due to industry

In our sample the most obvious separation based on potential differential announcement effects associated with industry specific differences is between financial and non-financial institutions. A differential effect can be observed in the cross-sectional analysis for both upgrades and downgrades. It is found that shareholders of financial institutions on average are less affected by changes in credit ratings. Given that financial institutions generally are dependent on the availability of financing options as well as more legally restricted, the impact should theoretically be larger. On the other hand, the relatively higher frequency in rating changes for financial institutions may indicate a higher degree of anticipation. However, based on our results we cannot separate these offsetting effects. Rather, we can merely conclude that financial institutions in our sample experience lower announcement effects.

7.3 Market anticipation

Based on the analysis of the CRAs' consistency in the usage of input parameters as well as actual default probabilities, the distributions of relevant measures appear to be systematic with respect to the assigned ratings. Hence, in order to sustain these rating consistent distributions, issuers cannot deviate systematically from the general levels of the input measures or actual default frequencies for their specific credit ratings. This supports the underlying assumption for the analysis of market anticipation that the information used to establish the rating opinion is of relevance for shareholders. Since the information is assumed to be relevant, the effect of anticipation should also be related to the degree of private information released through the credit rating change, which is suggested by *hypothesis 3*.

The results of the sub sample analysis based on market anticipation, as indicated by outlook opinion, indicate that unanticipated rating changes are associated with larger announcement effects, and higher significance, than the anticipated rating changes during the announcement day and the following trading day. This is true for both upgrades and downgrades.

Additionally, the results for the pre-announcement period for downgrades support the conclusion that anticipation affects the abnormal share price reactions associated with credit rating changes. When downgrades are anticipated, there is a larger reaction during the period leading up to the announcement day, indicating that more information related to the rating update is public prior to the announcement.

The results corresponding to the post-event periods are less interesting from a market anticipation perspective, since anticipation per definition relates to the period prior to the announcement.

In addition, the division of the sample based on rating opinion provides less insight to the importance of market anticipation for upgrades than for downgrades. In general, the measure of anticipation, as indicated by outlook opinion, does not provide a systematic criteria for the sample division for upgrades. This, in turn, may be explained by the lack of systematic relationships between rating upgrades and abnormal market reactions for upgrades.

Finally, a potential reason for the larger reaction for downgrades could also be that unanticipated rating changes to a larger degree than anticipated are motivated by changed financial performance, and therefore are of larger relevance for shareholders. However, the importance of anticipation, as an independent explanation, is confirmed by the signs of the coefficients associated with the variable indicating anticipation based on outlook opinion in the regression analyses for both upgrades and downgrades.

Based on the analysis of market anticipation, we can conclude that both the magnitude of the announcement effect as well as the differential effects between upgrades and downgrades are related to the degree of market anticipation. Hence, both the predictions by *hypothesis 3* and *hypothesis 6* are confirmed. Below we analyse the different aspects related to the degree of market anticipation with the focus on the impact of announcement effect on equity returns.

7.3.1 Issuer specific anticipation

In addition to the anticipation effect associated with the outlook opinions, the results of the cross-sectional analyses provide further insight to the importance of issuer specific conditions related to the degree of market anticipation and hence the effect on potential abnormal share price reactions. Specifically, the coefficients on the variables corresponding to the logarithm of the market values are of relatively high significance for both upgrades and downgrades. This indicates that shareholders of larger issuers are less affected by changes in credit ratings. This is consistent with the expectation that larger issuers are more closely monitored due to the larger demand for information by investors. Hence, it is likely that anticipation, and thereby the magnitude of the announcement effect, is directly related to the size of the issuer.

Also, the signs of coefficients on the variables measuring the 30 day pre-announcement drifts in abnormal returns for both upgrades and downgrades support the relevance of market anticipation. Under the assumption that the drift in abnormal returns prior to the rating change is a reliable measure of market anticipation, a larger pre-announcement drift in the direction indicated by the rating change should result in a lower abnormal effect at the announcement. However, compared to the logarithm of the market value, the results also indicate that the importance of this measure of anticipation is lower for upgrades than for downgrades. Consequently, for downgrades the results indicate that issuers who experience a larger negative drift in abnormal returns prior to the rating change are likely to generate a lower surprise effect at the time of the announcement.

7.3.2 Market uncertainty

Besides the issuer specific variation in anticipation, it might also be expected that the relative uncertainty about the economic development in the economy should affect the anticipation of credit rating changes. The results of the regression models, however, indicate that the market wide uncertainty, as indicated by the volatility in the Treasury rate, does not affect the abnormal share price reaction for either upgrades or downgrades. Hence, based on these results the value of the information provided by CRAs for shareholders is not likely to be higher in periods of larger economic uncertainty.

7.3.3 Anticipation effect due to timing

Based on the results that unanticipated rating changes are associated with more pronounced announcement effects, it is natural to assume that the timing of the rating change is of relevance when studying share price reactions associated with credit rating updates.

Timing may also provide insight to the differential effect found for upgrades and downgrades. One suggested reason for the more accurate timing of downgrades is that investors in general are more concerned with information related to downgrades than to upgrades, and that the CRAs therefore have

incentive to provide more timely rating opinions for downgrades. This explanation is supported by the characteristics of the rating process. Specifically, the through-the-cycle rating approach implies that CRAs do not provide timely rating revisions reflecting changes in absolute credit risk. It is also likely that the level of the absolute credit risk is of larger relevance for investors of issues with a deteriorating credit quality. Therefore, CRAs should be more responsive to cyclical information for downgrades, and consequently provide more timely information with a lower degree of anticipation. However, the trade-off between the amount of time and resources spent on credit analysis and the timing of the release suggests the opposite effect. Downgrades generally result in larger implications for the issuers due rating based investment strategies and restrictions for issuers with low ratings to expand its business, which implies that CRAs would be more concerned with avoiding an "incorrect" downgrade than an upgrade. Hence, this creates incentives for a more thorough analysis and consequently less accurate timing. Nevertheless, our results indicate that this effect is dominated by the desire of CRAs to provide more timely information to better reflect the absolute credit risk.

7.3.4 Incentives for market communication

A potential explanation for the finding that upgrades and downgrades are associated with different amounts of private information could be the incentive for the management to communicate with the market. It is likely that the management is more inclined to communicate favourable than negative information about its performance. Hence, downgrades should generally be less anticipated. This is also supported by the fact that CRAs claim to have access to private information that the management is unwilling to communicate directly to the market.

Table 7.1 **Overview of individual aspects of the analysis related to predictions by hypotheses**

	Existence/magnitude			Asymmetric effect		
Aspect of the analysis	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
Announcement effects	*(✓)*			✓		
Information relevance and implication		✓				
Wealth redistribution and information relevance		✓				
Differential relevance due to rating class and transition		✓				
Relevance related to confidence in the rating process		✓				
Differential relevance due to timing						
Differential relevance due to industry						
Market anticipation			✓			✓
Issuer specific anticipation			✓			
Market uncertainty						
Anticipation effect due to timing			*(✓)*			*(✓)*
Incentives for market communication			✓			✓

✓ indicates that the arguments associated with the individual aspect of the analysis support the prediction by the hypothesis. Parenthesis indicates that the argument is partly supported or that the aspect is likely to be of limited importance.

Table 7.2 **Summary of conclusions related to the predictions by the hypotheses**

Existence and magnitude of announcement effect	
H1:	*Changes in credit ratings are associated with abnormal share price returns.*
Conclusion:	Not rejected for downgrades
H2:	*The magnitude of the reaction is greater if the relevance and implication of the information associated with the rating announcement is larger for equity investors.*
Conclusion:	Not rejected
H3:	*The magnitude of the reaction is larger if the market's anticipation of the event is lower.*
Conclusion:	Not rejected
Differential effect between upgrades and downgrades	
H4:	*The announcement effect due to credit rating changes differ between downgrades and upgrades.*
Conclusion:	Not rejected
H5:	*The potential differential effect is affected by the relevance and implication of the rating information.*
Conclusion:	Rejected
H6:	*The potential differential effect is affected by the degree of market anticipation.*
Conclusion:	Not rejected

The table summarises the conclusions related to the predictions by the hypotheses. The conclusions are based on the support provided for the individual hypotheses by the different aspects of the analysis as illustrated in table 7.1.

Table 7.1 and *7.2* relates the various aspects of the analysis to the predicted effects outlined by the hypotheses. We find partial support for the predictions of hypothesis 1 and full support for hypothesis 4 by the existence of a significant negative abnormal share price reaction for downgrades. The effect predicted by hypothesis 2 is supported by arguments related to wealth redistribution, the design of the rating model as well as the market's confidence in the rating process. The effects outlined in hypothesis 3 are confirmed by the incentives for market communication and various measures of the issuer specific anticipation whereas the timing of the rating announcement has ambiguous effects. The predicted effect by hypotheses 5 is rejected since no evidence for the suggested reaction are provided either by the obtained results or the arguments in the analysis. Finally, based primarily on evidence of asymmetric incentives for the management's market communication the prediction by hypothesis 6 is supported. Below we summarise the analytical arguments supporting these conclusions.

7.4 Summary of analytical arguments

We argue that due to wealth redistribution, shareholders benefit from increased credit risk exposure if the rating decision is primarily based on changes related to capital structure and financing options. Also, the information related to such rating drivers could be of lower relevance for shareholders than information related to financial performance. Additionally, we argue that the relevance of the rating information differs with respect to the credit quality of the issuer. The design of the rating methodology

suggests that input parameters related to financial risks are weighted heavier for issuers with lower credit quality, whereas business risk is of larger importance for higher rated issuers. Furthermore, we argue that the differential effects for upgrades and downgrades have several explanations. The incentive for the management to communicate with investors is lower for negative than positive information. Hence, downgrades are less anticipated. Also, the relative rigidness of credit ratings with respect to changes in default risk may deviate between upgrades and downgrades. If investors are more concerned with measures of absolute credit risk in cases of deteriorating credit quality, CRAs have incentive to provide more timely rating changes for downgrades. On the other hand, the implications of a downgrade are likely to be larger and therefore the CRAs should be more concerned with avoiding incorrect rating decisions for downgrades. Hence, the effect on anticipation due to timing is less clear. Overall, the analysis of the rating process suggests that market anticipation primarily is affected by incentives for market communication.

7.5 Robustness discussion

7.5.1 Efficient market assumption

The implicit assumption of market efficiency underlying both the event study approach and the cross-sectional regression model may be problematic due to systematic institutional and/or behavioural biases in equity markets. Hence, share prices are not necessarily based solely on fundamental analysis of the financial performance of the issuers, but also on the potential existence of factors such as market timing, herding behaviour as well as under or overreactions.

In order to validate the conclusions of our study we also consider a set of alternative explanations, which are based on assumptions of market inefficiency. A potential explanation of announcement effects due to credit rating changes is that these are effective coordination mechanisms for investor sentiments. For instance, if share prices are characterized by overoptimism, then credit rating changes may drive share prices towards their fundamental value. However, this theory does not provide a reliable explanation for the differential effects between upgrades and downgrades. Despite the finding that investors generally overreact to uncertain information and underreact to certain information, we find no evidence that downgrades should exhibit less reliability than upgrades. Also, the systematic cross-sectional results based on measures of information relevance and market anticipation indicate that investors react rationally reflecting the underlying information of the announcement. Furthermore, the fact that the results are consistent with the vast majority of the findings of previous studies reduces the possibility that announcement effects are driven by market inefficiencies. For instance, factors such as market liquidity or the existence of short sale constraints are likely to affect the degree of market efficiency. These factors are likely to vary both over time and

across markets. Since the results seem to be robust with respect to the composition of the sample, it is not probable that explanations based on market inefficiencies are of particular relevance.

7.5.2 Data discussion

There are several inherent difficulties associated with our choice of models related to the characteristics of the data. In particular, event studies on share prices generally suffer from problems of separating the effects of the studied event from those of unrelated events. However, there is no evidence that our sample suffers from this problem to a larger extent than other related studies based on similar data. Nevertheless, we recognize that our result to some extent may be influenced by sample specific noise.

Another concern related to the data may be the large number of financial institutions relative to other types of issuers. This effect is, however, to some degree controlled for through the cross-sectional analysis. Also, differential effects associated with financial institutions are rarely addressed in previous studies.

7.6 Conclusion

We conclude that announcements of credit rating changes for issuers listed in the Nordic countries are associated with negative abnormal equity returns for downgrades whereas no similar effect is associated with upgrades.

When controlling for the underlying rationale for rating updates we find evidence that downgrades triggered by changes in financial performance, such as profitability, competitiveness and cash flow generation, systematically generate larger negative abnormal returns than changes related to capital structure or financing options. Also, we find that market anticipation, as indicated by rating outlook opinions, affects the magnitude of the announcement effect negatively.

Through a cross-sectional analysis of the obtained estimates of abnormal returns we find more systematic and intuitive results for downgrades than for upgrades. For downgrades both the importance of effects associated with information relevance as well as market anticipation are confirmed. More specifically, multiple-step rating transitions and rating changes for lower rated issuers are associated with larger abnormal announcement effects. Additionally, a larger pre-announcement drift in abnormal returns, a larger market capitalisation and an outlook opinion consistent with the rating update are found to affect the magnitude of abnormal return negatively. For upgrades, on the contrary, the results of the cross-sectional analysis suggest that the effects are either substantially less significant or contradictory to fundamental economic arguments.

Through analysis of the credit rating process and by relating them to the obtained results we are able to support these conclusions and gain a deeper understanding of the results. In particular, the design of the rating model, conflicts of interests between bond and equity investors, the rigidness of credit ratings as well as incentives for issuers and CRAs to provide relevant and timely information are

suggested as relevant parameters for the understanding of the dynamics of the link between indicators of credit risk and equity returns.

The aim of this thesis was to answer the following research questions based on the analysis of announcement effect on equity returns due to updated credit ratings:

Is there a systematic link between credit ratings, as indicators of credit risk, and the return patterns on equity markets?

How can variations in issuer and event specific characteristics explain potential announcement effects on equity returns associated with credit rating changes?

Based on the results of this thesis we can conclude that there is no systematic link between indicators of credit risk and equity market returns which applies to all credit rating events. However, the information associated with credit rating changes may be pricing relevant for equity investors depending on several issuer and event specific characteristics. In particular, we find that the major explanatory factors for the magnitude of the announcement effect as well as the differential effect between rating events are related to indicators of information relevance and implications for shareholders as well as the degree of market anticipation.

A series of recent spectacular defaults, such as Enron and Worldcom, have put an increasing focus on the link between bond and equity markets. This thesis provides insights to the dynamics of the relationship between bond market risks and stock market returns. By studying the announcement effects associated with credit rating updates as well as various aspects of the rating process, this study confirms the role of the CRAs as effective information providers and that the information is of interest for a broader clientele than merely bond market investors.

8. SUGGESTIONS FOR FURTHER RESEARCH

In this thesis we have attempted to provide a comprehensive analysis of the rating process and to analyse the dynamics of announcement effects associated with updates of credit ratings with focus on equity returns. Despite the large amount of research related to the area, we still think that several aspects remain to be investigated.

First, the access to various types of additional data would potentially enable the construction of variables that are more successful in explaining the importance of various aspects related to the two identified dimensions; anticipation and relevance. For instance, a market based measure of market anticipation could possibly be based on bond market data, since the pricing of these securities may indicate the amount of information known by the market at the time of the announcement. Additionally, issues related to the inherent conflicts of interests in the rating process, and the implication for the relevance of the information, may be better understood with more inside information about the practical routines of the rating process. For instance, it could be important to consider to what extent issuers use the option not to disclose unfavourable ratings.

Second, applications of alternative measures of credit risk may enhance the understanding of the implied information of credit ratings and hence the relation between bond market risks and equity market returns.

Third, more sophisticated tests for the existence of inefficiencies in financial markets may contribute to establish or reject the applicability of assuming market efficiency. In particular, it may be relevant to relate the obtained results to indicators of insider trading or short selling constraints as well as the market dynamics associated with announcements of profit warnings.

9. APPENDIX A

Table A.1 **Rating assignments and definitions**

Moody's	S&P	Comment
Aaa	**AAA**	Obligations rated Aaa are judged to be of the highest quality, with minimal credit risk.
Aa	**AA**	Obligations rated Aa are judged to be of high quality and are subject to very low credit risk.
A	**A**	Obligations rated A are considered upper-medium grade and are subject to low credit risk.
Baa	**BBB**	Obligations rated Baa are subject to moderate credit risk. They are considered medium-grade and as such may possess certain speculative characteristics.
Ba	**BB**	Obligations rated Ba are judged to have speculative elements and are subject to substantial credit risk.
B	**B**	Obligations rated B are considered speculative and are subject to high credit risk.
Caa	**CCC**	Obligations rated Caa are judged to be of poor standing and are subject to very high credit risk.
Ca	**CC**	Obligations rated Ca are highly speculative and are likely in, or very near, default, with some prospect of recovery of principal and interest.
C	**C**	Obligations rated C are the lowest rated class of bonds and are typically in default, with little prospect for recovery of principal or interest.
D	**D**	Regulatory actions are taken. The issuer is placed under an order of rehabilitation and liquidation.

Each rating class, from Aa (AA) to Caa (CCC) are divided into subsections numbered 1-3(+, neutral or -) where 1(+) indicates that the obligation is ranked within the higher part of the rating class and 3(-) indicates that it is within the lower part of the rating class.

Table A.2 **Distribution of rating changes across and within rating classes and between agencies**

	Moody´s		**Standard & Poor's**		**Total**	
Downgrades **Period**	**Across classes *(%)***	**Within class *(%)***	**Across classes *(%)***	**Within class *(%)***	**Across classes *(%)***	**Within class *(%)***
-90	1	2	0	2	1	4
	(0.7)	*(1.3)*	*(0.0)*	*(1.3)*	*(0.7)*	*(2.7)*
91-94	10	9	8	13	18	22
	(6.7)	*(6.0)*	*(5.3)*	*(8.7)*	*(12.0)*	*(14.7)*
95-98	0	0	2	3	2	3
	(0.0)	*(0.0)*	*(1.3)*	*(2.0)*	*(1.3)*	*(2.0)*
99-02	15	16	12	16	27	32
	(10.0)	*(10.7)*	*(8.0)*	*(10.7)*	*(18.0)*	*(21.3)*
03-06	10	11	8	12	18	23
	(6.7)	*(7.3)*	*(5.3)*	*(8.0)*	*(12.0)*	*(15.3)*
Total	36	38	30	46	66	84
	(24.0)	*(25.3)*	*(20.0)*	*(30.7)*	*(44.0)*	*(56.0)*
Upgrades **Period**						
-90	0	0	0	0	0	0
	(0.0)	*(0.0)*	*(0.0)*	*(0.0)*	*(0.0)*	*(0.0)*
91-94	1	0	1	1	2	1
	(1.0)	*(0.0)*	*(1.0)*	*(1.0)*	*(1.9)*	*(1.0)*
95-98	3	6	8	7	11	13
	(2.9)	*(5.8)*	*(7.7)*	*(6.7)*	*(10.6)*	*(12.5)*
99-02	4	13	3	7	7	20
	(2.9)	*(12.5)*	*(2.9)*	*(6.7)*	*(6.7)*	*(11.5)*
03-06	12	17	12	9	24	26
	(11.5)	*(16.4)*	*(11.5)*	*(8.7)*	*(23.1)*	*(25.0)*
Total	20	36	24	24	44	60
	(19.2)	*(34.6)*	*(23.1)*	*(23.1)*	*(42.3)*	*(57.7)*

Summary statistics for the original sample of 254 rating changes for the period 1990-2006. Downgrades and upgrades are classified according to agency, time-period and rating transition.

Table A.3 **Distribution of rating changes over issuer domicile**

Country	**Agency**	**Downgrades**	**Upgrades**	**Total**
Sweden	Moody's	36	31	
	S&P	34	24	125
Finland	Moody's	17	10	
	S&P	20	10	57
Norway	Moody's	12	12	
	S&P	12	6	42
Denmark	Moody's	9	4	
	S&P	10	8	31

Summary statistics for the original sample of 254 rating changes for the period 1990-2006. Upgrades and downgrades are classified according to agency and issuer domicile.

Table A.4 **Transition matrix for rating changes across classes**

		Revisited rating									
		AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**CC**	**C**	**D**	**Total**
Prior rating	**AAA**		4									4
	AA		26	17								43
	A		15	52	21							88
	BBB			18	50	12	1					81
	BB				6	14	5					25
	B					5	3	1				9
	CCC						1		2			3
	CC										1	1
	C											0
	D											0
	Total	0	45	87	77	31	10	1	2	0	1	254

Transition matrix of rating changes for the original sample of 254 observations during the period 1990-2006. Ratings are translated into Standard and Poor's rating definition and changes between sub rating classes are eliminated and considered within class.

Table A.5 **Critical values for elimination of information contaminated observations**

	Upgrades		Downgrades	
Trading day	Lower critical value	Higher critical value	Lower critical value	Higher critical value
-10	-0.0912	0.1193	-0.2085	0.1556
-9	-0.0988	0.1074	-0.2352	0.1618
-8	-0.1358	0.1026	-0.1867	0.1324
-7	-0.1024	0.0831	-0.2891	0.1959
-6	-0.0985	0.1642	-0.3095	0.1651
-5	-0.0751	0.1051	-0.1946	0.1571
-4	-0.1002	0.1298	-0.1986	0.2601
-3	-0.1077	0.1432	-0.2499	0.2526
-2	-0.1723	0.0698	-0.2597	0.1836
-1	-0.1180	0.1138	-0.1848	0.2369
0	-0.1244	0.1120	-0.3149	0.1887
1	-0.0855	0.1055	-0.2566	0.2128
2	-0.0803	0.1109	-0.2799	0.1413
3	-0.0863	0.1024	-0.1966	0.2164
4	-0.1027	0.0924	-0.2033	0.1470
5	-0.1111	0.0976	-0.1758	0.1994
6	-0.0793	0.0816	-0.2113	0.1977
7	-0.1079	0.0708	-0.2185	0.1959
8	-0.1037	0.1022	-0.2444	0.2227
9	-0.1263	0.1152	-0.1969	0.2599
10	-0.1067	0.0683	-0.2865	0.2196

Critical values for elimination of information contaminated observations. Abnormal returns are sorted by size for each of the 21 days in the event period (t = -10 to t = +10). The values of the observations corresponding to the 10th and 90th percentiles are multiplied by five to arrive at the critical value for elimination. Observations larger than the higher critical value and lower than the lower critical value are eliminated if associated with unrelated events.

Table A.6 **Reasons for omission of observations in the event window**

Company	Announcement date	Reason for omission	Day in event period
		Downgrades	
ABB	31 October 2002	News about filing Chapter 11 bankruptcy for the US division due to asbestos claims	-7
ABB	31 October 2002	ABB tries to settle the group claims in the asbestos cases	2
ABB	31 October 2002	EU confirms the sale of ABB structural finance activities	4
Petroleum Geo-Services	31 July 2002	Veritas needs more time to think about the merger with Petroleum Geo-services	-8
Petroleum Geo-Services	31 July 2002	Merger between Veritas and Petroleum Geo-services is cancelled	0
Royal Caribbean Cruises	1 October 2001	New statistics that Americans will cut their travelling after 9/11	-10
SEB	1 December 1992	SEB agrees to sell Göta Banken	8
		Upgrades	
Nordea	12 December 1997	Nordbanken holding AB accepts the merger conditions	-4
Nordea	12 December 1997	EU approves the merger between Nordbanken and Merita	-2
Royal Caribbean Cruises	1 February 2000	Royal Caribbean invests together with other investors in Masa-yards	9

Values corresponding to these rating events are eliminated for individual trading days during the event period. The reason for the elimination is reported as well as the date of the announcement.

Figure A.1 **Abnormal return distribution upgrades**

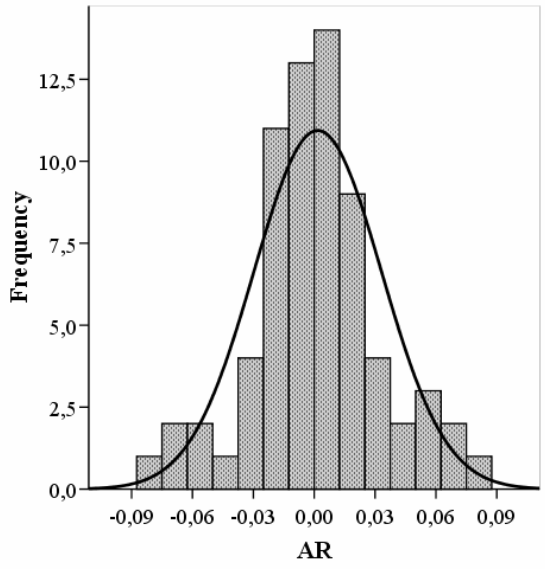
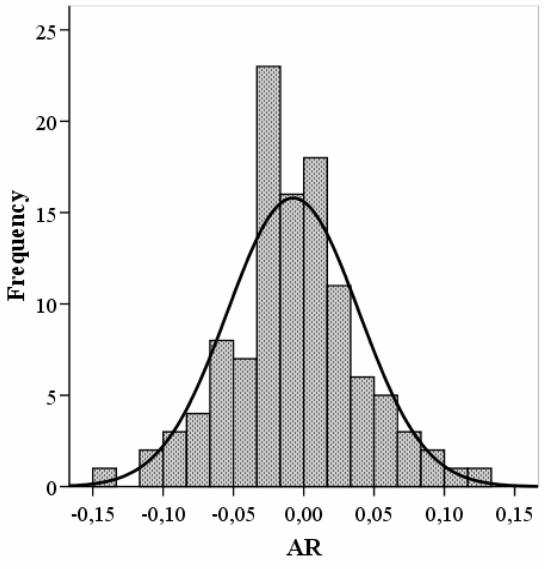


Figure A.2 **Abnormal return distribution downgrades**



Sample distributions of abnormal returns for upgrades and downgrades corresponding to the event window defined over the period t = 0 to t = +1 for the 188 observations for which abnormal return estimates are obtained.

Figure A.3 **Q-Q normality plot, upgrades**

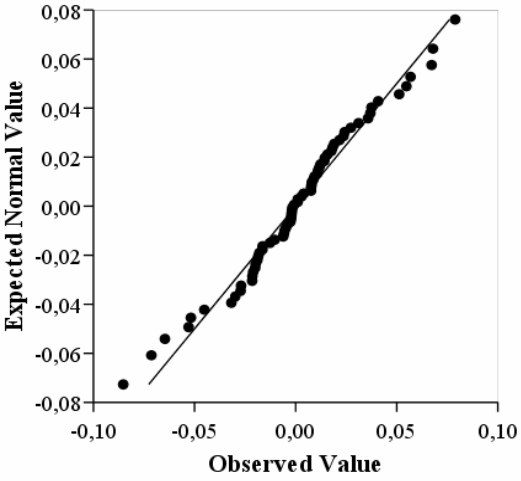
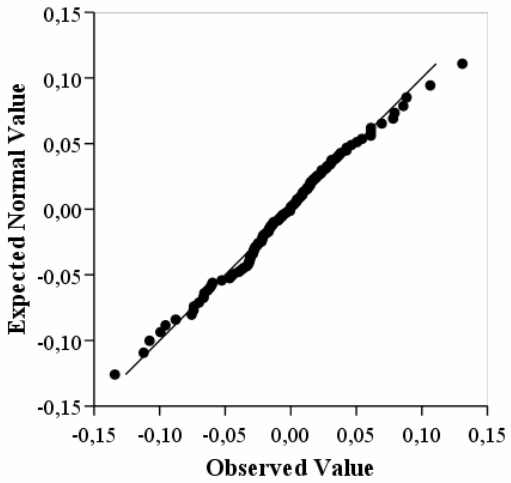


Figure A.4 **Q-Q normality plot, downgrades**



Q-Q normality plots for sample distributions of abnormal returns for upgrades and downgrades corresponding to the event window defined over the period t = 0 to t = +1 for the 188 observations for which abnormal return estimates are obtained. Deviations from the straight line indicate non-normality.

Table A.7 **Development of sample average abnormal returns around rating update announcements**

	Upgrades		Downgrades	
Trading days	**SACAR**	**Aggregated SACAR**	**SACAR**	**Aggregated SACAR**
-200 to -61	0.00372	0.003727	-0.40176	-0.40176
-60 to -51	0.02301	0.026737	-0.04158	-0.44334
-50 to -41	0.00671	0.033454	-0.01802	-0.46137
-40 to -31	-0.00390	0.029552	-0.02702	-0.48839
-30 to -21	0.00150	0.031053	-0.03161	-0.51999
-20 to -11	0.00222	0.033273	-0.01058	-0.53058
-10	0.00211	0.035384	-0.00181	-0.53238
-9	-0.00091	0.034471	-0.00491	-0.53729
-8	-0.00311	0.031364	-0.00157	-0.53886
-7	-0.00161	0.029757	-0.00568	-0.54454
-6	0.00326	0.033019	-0.00830	-0.55284
-5	0.00257	0.035593	-0.00264	-0.55548
-4	0.00215	0.037749	0.00240	-0.55308
-3	0.00400	0.041757	-0.00170	-0.55478
-2	-0.00789	0.033868	-0.00298	-0.55777
-1	-0.00085	0.033023	0.00040	-0.55737
0	-0.00137	0.031652	-0.00500	-0.56237
1	0.00241	0.034066	-0.00449	-0.56686
2	0.00351	0.037581	-0.01380	-0.58066
3	-0.00034	0.037242	-0.00162	-0.58228
4	-0.00064	0.036607	-0.00305	-0.58532
5	-0.00043	0.036180	0.00234	-0.58298
6	0.00051	0.036694	-0.00122	-0.58420
7	-0.00235	0.034342	-0.00033	-0.58453
8	-0.00095	0.033389	-1.6E-05	-0.58454
9	0.00073	0.034121	0.00148	-0.58306
10	-0.00261	0.031509	-0.00099	-0.58405
11 to 20	-0.00507	0.026437	-0.00949	-0.59355
21 to 30	0.00612	0.032556	-0.03183	-0.62538
31 to 40	0.01490	0.047466	0.00223	-0.62314
41 to 50	-0.00513	0.042336	-0.02985	-0.65299
51 to 60	-0.00300	0.039338	0.00480	-0.64819

Development of sample aggregated cumulative abnormal returns from t = -200 to t = 60 as well as the corresponding number aggregated over time for the entire period as well as various sub periods. The calculations are based the 188 observations for which abnormal return estimates are obtained.

10. APPENDIX B PREVIOUS RESEARCH

Table B.1 **Summary previous findings**

Author(s)/Research category	Year	Main findings
Market anticipation/Information content		
Pinches and Singleton	1978	The information content of bond rating changes is very small and capital markets are efficient.
Griffin and Sanvicente	1982	Downgrades convey new information and upgrades do not. It is important to control for concurrent information and noise in share prices.
Holthausen and Leftwich	1986	"Non-contaminated" credit rating events are associated with smaller share price reactions, but they are still significant. Downgrades are pricing relevant and upgrades are not. The sign and magnitude of the reaction should depend on the degree of anticipation and the underlying reason.
Hsueh and Liu	1992	Rating change announcements are more valuable in periods of uncertain market conditions and ownership dispersion is negatively related to the magnitude of the share price impact of downgrades.
Hand et al	1992	Anticipated Watchlist inclusions are associated with smaller bond and stock price impacts.
Chandy et al	1993	Firms with more concentrated ownership experience lower share price reactions.
Matolcsy and Lianto	1995	Bond ratings provide new information even after controlling for concurrent accounting numbers.
Gropp and Richards	2001	Downgrades are associated with abnormal share price impact and upgrades are not. If the issuer is added to the Credit Watchlist the reaction is smaller and if a consensus rating is established the reaction is larger.
Purda	2003	Very few rating changes are unanticipated and the degree of anticipation is related to the timing of the event.
Cross-sectional difference		
Cornell at al	1989	Share price reactions associated with rating updates are related to the relative amount of intangible assets on the firm's balance sheet.
Ederington and Goh	1993	Share price reactions associated with downgrades are conditional on the underlying reasons for the rating changes.
Akhigbe et al	1997	Downgrades provide information not only about the issuer but also about its industry peers.
Ederington and Goh	1999	The market reacts more strongly to rating changes from investment to non-investment grade ratings.
Gropp and Richards	2001	Banks and highly regulated companies react stronger to rating changes than industrials.
Cantor	2004	The magnitude of the rating change effects depend on the level of previous ratings and previous rating events.
Garlappi et al	2005	The rating change effect is larger for downgrades of firms in which shareholders have low bargaining power against bondholders.
Inefficient markets		
Eberhart et al	1998	The negative rating effects for downgrades are driven by errors in market expectations rather than mismeasurement of risk.
Dichev and Piotroski	2001	Stock prices underreact to the information content in downgrade announcements.
Löffler	2002	The rigidness of credit ratings can be explained by psychological underreactions.
Odders-White and Ready	2005	Credit rating updates are negatively related to measures of adverse selection.
Boot et al	2005	CRAs may play an important role as a coordination mechanism on financial markets.

Risk and volatility		
Pinches and Singleton	1978	Downgraded firms have lower stock betas.
Kliger and Sarig	2000	Implied volatilities on stock options decline as rating changes are better than anticipated and vice versa.
Dichev and Piotroski	2001	Downgrades are only seemingly associated with abnormal share price reactions. Rather it is compensations for some risk that is not captured in the measurement method.
Vassalou and Xing	2003	When controlling for alternative measures of credit risk, abnormal share price reactions for downgrades disappear.
Strategic game between equity and bond holders		
Zaima and McCarthy	1988	There is wealth redistribution between bondholders and shareholders around credit rating changes.
Garlappi et al	2005	The relative negotiation advantage between shareholders and bondholders in case of bankruptcy affects the abnormal returns associated with rating changes.
Timing vs stability		
Löffler	2002	Credit ratings are relatively stable and rating changes are serially correlated and preceded by changes in default risk.
Cantor	2004	A rating change occurs as the difference between the market implied credit risk and the risk consistent with the credit rating reaches a critical level.
Odders-White and Ready	2005	The inaccurate timing of a rating event decreases the amount of relevant information released.
Altman and Rijken	2005	Credit ratings are rigid and more timely for downgrades.
Larger response to negative information		
Holthausen and Leftwich	1986	The loss function of the CRA is not symmetric between upgrades and downgrades and management has little incentive to release negative information.
Chandy et al	1993	Management has less incentive to release negative information implying that downgrades are more informative than upgrades.
Matolscy and Lianto	1995	Management has less incentive to release negative information.
Johnson	2003	Downgrades from investment to non-investment grades include more information.
Micu et al	2004	The larger reactions associated with low credit quality issuers is due to the aversion that it will become a fallen angel.
Boot et al	2005	Management has less incentive to release negative information.
Altman and Rijken	2005	Management has less incentive to release negative information.
Non-US findings		
Matolscy and Lianto	1995	Australian data generate results consistent with US studies in which downgrades are pricing relevant and upgrades are not.
Barron et al	1997	Rating changes in both directions are not associated with significant share price reactions in the UK.
Gropp and Richards	2001	Due to less stringent disclosure requirements for several industries in Europe, CRAs provide more information than in the US.
ECB	2004	The penetration of credit ratings is lower in the EU than in the US, which suggests a less important role of ratings in the EU.
Mollemans	2004	Japanese data generate results consistent with US studies in which downgrades are pricing relevant and upgrades are not.
Abad-Romero and Robles Fernández	2005	Spanish upgrades are associated with a negative abnormal share price reaction and downgrades do not experience any reaction.

In this section we provide an overview of previous research related to the topic of this thesis. *Table B.1* provides a summary overview of the previous findings discussed in this section. Most research is based on US data and the results do not provide entirely consistent conclusions about the informational impact of credit ratings on equity returns. However, in general downgrades are found to have larger pricing impact than upgrades. In addition, there are a number of aspects that have been found to be of importance for the understanding of the observed announcement effects. Following the outline in *Table B.1* these are categorised and described below.

10.1 Market anticipation

In one of the earlier studies of equity price reactions Pinches and Singleton (1978) conclude that both upgrades and downgrades are anticipated by the market. Hence, the study suggests that the information content of bond rating changes is very small and that capital markets are highly efficient in processing this information.

Contradicting results are found in the study by Griffin and Sanvicente (1982). The results indicate that downgrades convey relevant information to shareholders whereas upgrades do not. However, the study also highlights the importance of understanding whether the price reaction can be fully attributed to the rating update per se or whether part of the adjustment is a response to information which is merely correlated to the rating event.

Recognizing the shortcomings of previous research, Holthausen and Leftwich (1986) perform a study on a large sample of rating updates in the US, in which they attempt to control for contemporary firm specific events. The results show that “non-contaminated” rating changes are associated with smaller share price reactions than rating updates which are contaminated by announcements of other pricing relevant information. The study also confirms the results that downgrades are pricing relevant and that upgrades are not. Additionally, Holthausen and Leftwich challenge the implicit assumption that the signs of the abnormal returns for upgrades and downgrades respectively are homogenous.

A number of studies have attempted to measure and control of market anticipation. Hand et al (1992), Hsueh and Liu (1992), Matolcsy and Lianto (1995) and Gropp and Richards (2001) define various variable related to this aspect and confirm the importance for the announcement effect.

Additionally, Chandy et al (1993) use equity ownership dispersion as a proxy for market anticipation and find that firms with concentrated ownership experience lower abnormal share price reactions when their credit ratings are downgraded.

Finally, Purda (2003) constructs a model to measure the degree of market anticipation. The expected rating event depends on the size of the firm as well as various publicly known measures of financial performance and capital strength. The results suggest that once controlling for these measures very few rating updates are unanticipated.

10.2 Cross-sectional differences

Several papers focus on detecting differential price impact due to underlying characteristics of the events as well as the issuers. Cornell et al (1989) argue that issuers with a larger dependence on the sale of goods and services with implicit claims as well as a higher ratio of intangible assets are expected experience more pronounced announcement effects due to changed credit ratings.

Ederington and Goh (1993) find that stock price reactions associated with downgrades are conditional on the underlying reason for the rating change. Downgrades following information about deteriorating financial prospects are associated with larger share price reactions than those following news about increased leverage.

In a later study by Ederington and Goh (1999) it is found that the market reacts more strongly to rating changes from investment grade to non-investment grade ratings. Also, they find that downgrades among non-investment grade bonds are associated with larger price reactions. This argument is further reinforced by the results of Cantor (2004) who finds that the magnitude of the share price performance depends on the level of previous rating as well as previous rating events.

Akhigbe et al (1997) present evidence that bond rating downgrades provide new information not only about the issuer but also about its industry peers Gropp and Richards (2001) support the existence of differential industry effects by arguing that banks and highly regulated entities are more likely to react strongly to rating downgrades than industrial corporates.

According to Garlappi et al (2005) the negative relationship between default risk and expected return should be more pronounced in firms with a large asset base, low R&D expenditure, high liquidation cost and a low market-to-book ratio.

10.3 Inefficient markets

Several later studies have challenged the underlying assumption of informational efficiency in financial markets. Explanations based on these arguments rely on the presence of a number of well-documented behavioural biases observed among various types of investors.

Eberhart et al (1998) find evidence of positive excess equity returns for firms emerging from chapter 11 bankruptcy. It is suggested that these results are driven by errors in market expectations rather than mismeasurement of risk.

In a study by Dichev and Piotroski (2001) it is argued that stock prices underreact to the information content in downgrade announcements. This argument is supported by the finding that negative abnormal returns are of limited duration and most pronounced for small and low credit quality firms. Hence, even though investors are fully aware of the negative information, stock prices do not react accordingly due to various information processing, behavioural or institutional biases. A similar

argument is proved by Löffler (2002) who argue that the observed rigidness of credit ratings could be explained by psychological underreactions to information about credit risks.

Odders-White and Ready (2005) find that credit rating updates are negatively related to measures of adverse selection, such as bid-ask spreads and probabilities of informed traders. This possibly indicates that over and underreactions are less likely around announcements of credit rating changes. This view is supported by Boot et al (2005) who argue that herding behaviour may characterise financial markets and that CRAs may play an important role in coordinating investors' beliefs.

10.4 Risk and volatility

Several studies have examined the risks associated with credit rating updates and found various possible explanations for the observed share price reactions.

Pinches and Singleton (1978) find a relationship between equity betas and the level of the bond ratings implying that downgrades should be associated with lower stock betas. Also, Kliger and Sarig (2000) find that volatilities implied by prices of options on the issuers' stocks decline as a rating announcements are better than expected and vice versa.

Dichev and Piotroski (2001) argue that the returns observed at the time of rating downgrades are only seemingly abnormal as they represent a compensation for some risk which is not captured by the research methodology. This argument implies that downgraded firms underperform because they hedge against some sort of systematic risk.

Vassalou and Xing (2003) compute an alternative measure of default risk. They find that this measure follows an inverted V-shaped development with the peak on the announcement day of the downgrade. Since default risk is found to be higher for downgrades, equity returns should be lower. When controlling for the variation of this measure, the abnormal share price reaction observed for downgraded issuers disappears. The inverted V-shape is most pronounced for low graded debt issues, which is consistent with the findings of larger negative abnormal share price reactions for small non-investment graded issuers.

10.5 Strategic game between equity and bond holders

Basic financial theory suggests that there is a potential conflict of interest between equity and bond holders. The outcome of such conflicts may to some extent depend on the relative negotiation power of the different financial stakeholders as well as changes in cash flow volatilities. This is recognized by a number of studies related to credit rating updates.

The study of Zaima and McCarthy (1988) provides evidence of wealth redistribution from bond to equity investors. They argue that credit rating changes do not necessarily indicate a change in firm value but rather a change in volatility of the issuer's cash flows. Recognizing the option resembling payoff function for equity holders, increased cash flow volatility should result in a positive effect on

share prices and vice versa. For upgrades the wealth redistribution seems to cancel out the positive information but for downgrades the negative information seems to outweigh any possible wealth redistribution effect.

Garlappi et al (2005) use several proxies for shareholder advantage to support their conclusion that firms in which shareholders have a stronger advantage in renegotiation in case of bankruptcy exhibit lower expected returns.

10.6 Timing vs. stability

A number of researchers have recognized the relative rigidness in credit ratings compared to various alternative measures of credit risk. This is generally explained by the existence of a trade-off between accurate timing and volatility. Since credit ratings are commonly used to determine investment strategies, bond covenants and market regulations excessive volatilities would prove costly due to transaction costs and other disruptions. The goal is to strike the right balance between the benefits of the monitoring and disciplining role of CRAs and a "breathing space" required by market participants in order to function efficiently.

Löffler (2002) finds that ratings are relatively stable, while rating changes are serially correlated and preceded by changes in default risk. Hence, CRAs are reluctant to change a rating that will later be reversed. Consequently, the inaccurate timing of the rating event may decrease the amount of relevant information released. The same conclusion is reached by Odders-White and Ready (2005).

In a study by Cantor (2004) it is argued that a rating change is triggered when the difference between the actual credit rating and the market implied rating reaches a certain threshold level.

Altman and Rijken (2005) confirm the rigidness of credit ratings and find that CRAs are more responsive to information relevant for downside than for upside, implying that the timing of downgrades is more accurate than for upgrades.

10.7 Larger response to negative information

Past research has provided evidence supporting various explanations for the puzzling finding that downgrades generally are associated with larger market reactions.

Holthausen and Leftwich (1986) suggest that the loss function of the CRA may be asymmetric. Hence upgrades are less timely than downgrades. Also, they argue that the management's incentive to release information differs between upgrades and downgrades. This view is confirmed in findings by Matolscy and Lianto (1995), Chandy et al (1993), Boot et al (2005) and Altman and Rijken (2005).

Johnson (2003) argue that the lower boundary of the lowest investment graded debt is set at a sufficiently high default risk that issuers with this rating need only a small deterioration in credit quality to have a risk consistent with a lower rating. Hence, downgrades from investment grade to non-investment grade would imply relatively larger information content. On the contrary, Micu et al (2004)

argue that the larger negative spreads associated with downgrades of low credit quality debt is due to investors' aversion to issues eventually becoming fallen angels.

10.8 Non-US findings

To our knowledge there are no studies of equity market impact based on data including all European financial markets. However, there are several individual studies based on data from individual European countries. Apart from the European studies there are also a few non-US studies based on data from individual financial markets.

The role of the CRA in the European context has been questioned on the ground that the penetration of ratings is much lower than in the Anglo-Saxon countries (ECB, 2004). On the contrary, Gropp and Richards (2001) argue that due to less stringent disclosure requirements of banks in some European countries, CRAs may play a more important role in Europe than in the US in bringing information to the market.

Matolcsy and Lianto (1995) investigate the information content associated with rating updates of Australian firms by controlling for concurrent annual accounting income numbers. The results indicate, consistent with US studies, that downgrades provide additional information to the equity market whereas upgrades do not.

Barron et al (1997) find evidence that rating changes in both directions do not affect equity performance on UK firms, contrary to the evidence based on US data. However, due to findings of significant reactions following Watchlist inclusion, it is argued that CRAs provide additional information to capital markets in the UK.

Mollemans (2004) find evidence consistent with American studies based on a sample of Japanese issuers for rating changes by Standard and Poor's but not by Moody's.

Abad-Romero and Robles Frenández (2005) find quite surprising evidence on the Spanish stock market of significant negative excess returns associated with rating upgrades and no significant reaction associated with downgrades. However, downgrades are preceded by a negative share price impact and rating changes in both directions are associated with decreasing systematic risk.

11. APPENDIX C EVENT STUDY CALCULATIONS

The returns of the shares and the market indices are calculated using following transformations:

$$R_{i\tau} = \ln\left(\frac{share\ price_t}{share\ price_{t-1}}\right) \text{ and } R_{m\tau} = \ln\left(\frac{index_t}{index_{t-1}}\right)$$

To measure the impact of the event we calculate the abnormal return for the shares over the event window. The abnormal return, here denoted *AR*, is the excess stock return above the *normal* return of that stock. The normal return is defined as the expected return implied by some type of pricing model. There are two commonly used methods to measure the normal return, the *constant mean return model* and the *market model*. In previous studies the market model has been the favoured method. In order to generate comparable results we also use the market model in our study.

$$\textit{Market model: } R_{i\tau} = \alpha_i + \beta_i R_{m\tau} + \varepsilon_{i\tau}$$

Estimates of α_i and β_i are obtained by running OLS regressions of the market model over the estimation window, denoted L_1 in the calculations, where b_i is the estimate of beta defined as the correlation between the share return and the market return while a_i is the intercept. Estimates of a_i and b_i are obtained for every observation in the sample and thereafter the normal return is calculated for relevant trading days using the market return as the input variable. Abnormal returns are then calculated for every day and observation in the sample using the following formula:

$$AR_{i\tau} = R_{i\tau} - a_i - b_i R_{m\tau}$$

Given that abnormal returns are calculated for every trading day, it is possible to aggregate them over the event window to obtain the cumulative abnormal return, *CAR*, which is defined as:

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau} AR_{i\tau} \text{ where } \tau \text{ indicate the days in the event window } \tau_1, ..., \tau_2$$

Since we want to test for existence of abnormal returns for the whole sample, and not for a single observation, the abnormal returns are aggregated across all observations. The result is the sample aggregated cumulative abnormal return, *SACAR*, and is calculated as:

$$SACAR(\tau_1, \tau_2) = \frac{\sum_i CAR_i(\tau_1, \tau_2)}{N}$$ where *N* is the number of observations in the sample

SACAR are calculated for all defined event windows. These results are then tested for statistical significance using a parametric test, which assumes that the population follows a normal distribution. The ratio of the SACAR and its standard deviation then follows a student t-distribution

$$SACAR(\tau_1, \tau_2) / Var(SACAR(\tau_1, \tau_2))^{1/2} \sim t \text{ with } L_1\text{-2 df}$$

The estimate of the variance of the abnormal return, denoted, $S_{\varepsilon i}^{\ 2}$, is the squared abnormal return over each trading day in the estimation window divided by the length of the estimation window less two:

$$S_{\varepsilon i}^{\ 2} = \sum_t (R_{i\tau} - a_i - b_i R_{m\tau})^2 / (L_1 - 2)$$

Thereafter, the event window variance is calculated by multiplying by the length of the event window:

$$S_i^2(\tau_1, \tau_2) = S_{ei}^2(\tau_2 - \tau_1 + 1)$$

To calculate the variance of SACAR one has to aggregate the event window variance over all observations and divide with the squared number of observations:

$$Var(SACAR) = \sum_t \sigma^2(\tau_{1,}, \tau_{2)}) / N^2$$

This basic setup of an event study corresponds to the methodology used by most previous studies related to this topic. Likewise, the choices of event and estimation windows are motivated by the experience from previous research as well as the hypotheses chosen for the study.

12. APPENDIX D ROBUSTNESS ANALYSIS

12.1 OLS assumptions

The cross-sectional regression models are estimated using the OLS methodology. This approach is based on several assumptions related the characteristics of the included variables, which are summarized in *Table D.1*. If there are indications that any of these assumptions are violated the results of the study may be questioned on the ground that the statistical measures are spurious with respect to the specification of the model (Gujarati, 2003). In this section we will perform a series of tests for the fulfilment of the assumptions with the largest relevance for our model. Based on the characteristics of the data sample, assumptions 1,2,5,6,7,8 and 9 are either fulfilled or issues of limited relevance for the specification of our model.

Table D.1 **Assumptions underlying OLS regressions**

Assumption 1	The regression model is linear in the parameters
Assumption 2	The values of the regressors are fixed in repeated sampling
Assumption 3	For given regressors, the mean value of the disturbance term u_i is zero
Assumption 4	There is no heteroscedasticity
Assumption 5	There is no autocorrelation
Assumption 6	If the regressors are stochastic, the disturbance term and the regressors are independent or at least uncorrelated
Assumption 7	The number of observations are larger than the number of regressors
Assumption 8	There must be sufficient variability in the values taken by the regressors
Assumption 9	The regression model is correctly specified
Assumption 10	There is no multicollinearity
Assumption 11	The residuals are normally distributed

12.2 Normality test

One essential assumption underlying the OLS methodology is that the residuals in the model are normally distributed. This is important primarily for the usage of *t* and *F* statistics to test for significance of the model as well as for individual variables. Consequently, without normality in the residuals we cannot validate the significance of the obtained results from the model estimation. For the purpose of testing for normality we perform two tests.

First, we plot the residuals and the distribution indicator corresponding to the normal distribution in order to visually study the characteristics of the sample distribution. *Figures D.1* and D.*2* illustrate

the distribution of the residuals for downgrades and upgrades respectively. The residuals for both downgrades and upgrades appear slightly skewed. Also, the kurtosis may be somewhat larger than that implied by the normal distribution. Also, based on the graphical analysis the assumption of a zero mean in the residuals can be confirmed for both upgrades and downgrades.

Figure D.1 **Residual distribution downgrades**

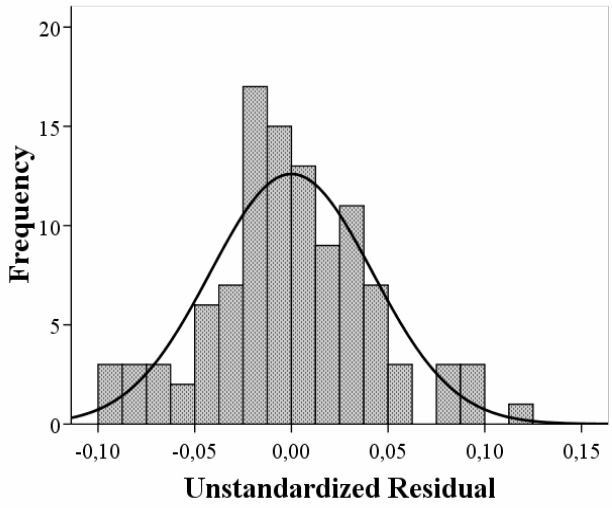
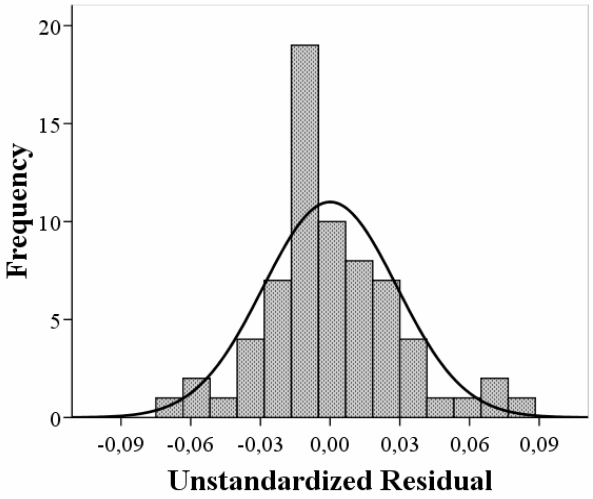


Figure D.2 **Residual distribution upgrades**



Second, in addition to the graphical analysis we perform a Jarque-Bera test for normality. The test statistic takes into account the skewness and kurtosis in the residuals:

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right]$$

The sample size is denoted by *n*, the skewness by *S* and *K* is the kurtosis. The Jarque-Bera follows a chi-square distribution with 2 degrees of freedom. The test statistics of the Jarque-Bera test and the corresponding significance levels are summarized in *Table D.2*. A significant statistic indicates that the assumption of normality could be rejected. For both upgrades and downgrades we cannot reject that the distributions follow normal distributions. The residuals for the upgrade sample generate a test statistic with somewhat lower higher significance, which nevertheless is well below the 90 percent significance level required to reject normality. Based on these tests we are able to conclude that the *F* and *t* statistics used to validate the estimation parameters of our model are reliable.

Table D.2 **Jarque-Bera test of normality**

	n	χ^2	Sign (%)
Downgrades	107	1.23	54.06
Upgrades	69	3.22	19.94

12.3 Multicollinearity

Multicollinearity occurs if there is a close linear relationship between two or several explanatory variables included in the model. With high multicollinearity the regression coefficients will be inconsistent and hard to validate since standard deviations will increase and hence make the coefficients less significant.

There are several ways to detect the problem. For instance, a high R^2 value together with few significant t-ratios could be an indicator of multicollinearity. A commonly used critical value to indicate a high R^2 value is 0.9. From *Tables 6.7 and 6.8* it can be concluded that neither of the models have R^2 values close to this level. Even if many of the t-statistics are insignificant, this alone is not evidence for the existence of multicollinearity.

Another way is to calculate at the pair-wise correlations among the regressors. If the correlation coefficient is above 0.8 for a pair of variables it can be an indication that the model suffers from multicollinearity. *Tables D.4* and *D.5* show all pair-wise correlations for the explanatory variables. All correlations are relatively low, which indicates that the existence of multicollinearity is unlikely in or model.

The variance inflation factor (VIF) can also be used to test for presence of multicollinearity. If the VIF measure increases towards infinity it is generally regarded as an indicator of high multicollinearity. A critical value of 10 is often used to determine the presence of collinearity. The VIF-statistics for all variables in the models for both upgrades and downgrades are summarized in *Table D.3*. All VIF statistics are well below the critical value, which confirms the conclusions of previous tests. Based on several test we conclude that the model does not suffer from problems associated with multicollinearity for neither downgrades nor for upgrades.

Table D.3 **Variance inflation indicator for upgrades and downgrades**

	VIF	
Variable	**Upgrades**	**Downgrades**
Financial	1.430	2.027
Leverage	1.394	1.625
GradeChanges	1.164	1.440
InterestVolatility	1.184	1.744
LOGmarket	1.742	2.160
GradeNumber	1.078	2.593
Drift30	2.048	1.093
FinInst	1.136	2.208

Table D.4 P**air-wise correlations, downgrades**

	Financial	**Leverage**	**Grade-Changes**	**Interest-Volatility**	**LOGmarket**	**GradeNumber**	**Drift30**	**FinInst**	**Opinion**
Financial	1	-.414	-.094	-.430	.296	.276	.020	-.367	.208
Leverage	-.414	1	.128	-.093	.003	.130	.095	-.235	.117
GradeChanges	-.094	.128	1	.141	-.340	.450	.007	-.030	.000
InterestVolatility	-.430	-.093	.141	1	-.382	-.225	-.084	.519	-.069
LOGmarket	.296	.003	-.340	-.382	1	-.277	.181	-.384	.170
GradeNumber	.276	.130	.450	-.225	-.277	1	-.83	-.465	.125
Drift30	.020	.095	.007	-.084	.181	-.83	1	-.131	.163
FinInst	-.367	-.235	-.030	.519	-.384	-.465	-.131	1	-.259
Opinion	.208	.117	.000	-.069	.170	.125	.163	-.259	1

Table D.5 P**air-wise correlations, upgrades**

	Financial	**Leverage**	**Grade-Changes**	**Interest-Volatility**	**LOGmarket**	**GradeNumber**	**Drift30**	**FinInst**	**Opinion**
Financial	1	-.395	.062	-.187	.234	.139	-.058	-.239	.021
Leverage	-.395	1	.134	.101	-.059	.058	-.062	-.158	-.140
GradeChanges	.062	.134	1	-.039	.224	-.032	.030	-.227	.053
InterestVolatility	-.187	.101	-.039	1	-.241	.031	-.073	.116	-.077
LOGmarket	.234	-.059	.224	-.241	1	.029	.075	.116	.119
GradeNumber	.139	.058	-.032	.031	.029	1	.460	-.627	-.024
Drift30	-.058	-.062	.030	-.073	.075	.460	1	-.120	-.188
FinInst	-.239	-.158	-.227	.116	.116	-.627	-.120	1	-.103
Opinion	.021	-.140	.053	-.077	.119	-.024	-.188	-.103	1

12.4 Heteroscedasticity

OLS requires that the variance of the residual is constant and unrelated with the dependent and explanatory variables:

$$E(u_i^2) = \sigma^2$$

If this condition is not fulfilled the model suffers from heteroscedasticity. This means that the variance in the error term varies with the dependent or some explanatory variable. In the presence of heteroscedasticity the estimated coefficients are biased and the *F* and *t* statistics cannot be used to compute their significance. Heteroscedasticity is potentially of larger concern for cross-sectional regressions due to its more frequent occurrence.

In order to quantify any possible heteroscedasticity we perform the Spearman's rank test. The test is performed in two steps. First the absolute values of the residuals and the variables are ranked in descending or ascending order. For every individual observation the difference between the residual and the variable is calculated. In the second step the Spearman's rank statistic is calculated as:

$$r_s = 1 - 6\left[\frac{\sum_i d_i^2}{n(n^2-1)}\right]$$

In this calculation d_i is the difference between the ranks and *n* is the sample size. The results from the Spearman's rank test are summarized in *Table D.6.* The results indicate that none of the variables exhibit any significant signs of heteroscedasticity.

Table D.6 **Spearman's rank test**

	Downgrades		**Upgrades**	
Variable	**Spearman rho**	**Sign. (%)**	**Spearman rho**	**Sign (%)**
AR	0.004	96.8	0.103	40.1
Financial	0.184	5.8	0.085	492
Leverage	-0.089	36.2	-0.044	71.9
GradeChanges	0.001	99.5	-0.131	28.6
InterestVolatility	0.036	71.7	0.030	81.0
LOGmarket	0.166	8.9	0.201	10.0
GradeNumber	0.012	90.2	0.107	38.6
Drift30	0.141	15.0	0.098	42.6
FinInst	0.077	43.6	-0.144	24.1
Opinion	0.068	48.6	0.123	31.9

In order to verify the results from the Spearman's rank test we also estimate the White's heteroscedasticity consistent coefficients for the variables of our model. These estimates take into account any possible heteroscedasticity. In this re-estimation p-values may deviate from the levels in the original estimation while the β coefficients remain the same. The results for the downgrade and upgrade samples are summarized in *Tables D.7* and *D.8*.

Table D.7 **White's heteroscedasticity consistent estimators, downgrades**

Variable	Unstandardized coefficients		t-value	Sign. (%)
	β	Std. Error		
Constant	-0.05391	0.05644	-0.85995	39.20
Financial	-0.00840	0.01214	-0.79433	42.90
Leverage	0.00084	0.01480	0.07098	94.35
GradeChanges	-0.00431	0.00679	-0.54974	58.33
InterestVolatility	-0.00249	0.02581	-0.09836	92.19
LOGmarket	0.01703	0.00871	1.93068	5.65
GradesNumber	-0.00682	0.00519	-1.13021	26.12
Drift30	-0.06473	0.02962	-2.66354	0.91
FinInst	0.01024	0.01320	0.65507	51.40
Opinion	0.01081	0.01084	1.12502	26.34

Table D.8 **White's heteroscedasticity consistent estimators, upgrades**

Variable	Unstandardized coefficients		t-value	Sign. (%)
	β	Std. Error		
Constant	0.11953	0.04178	2.86073	0.59
Financial	-0.01342	0.00822	-1.63347	10.78
Leverage	-0.3743	0.01644	-2.27741	2.64
GradeChanges	0.00147	0.00574	0.25704	79.80
InterestVolatility	0.00171	0.00860	0.19843	84.34
LOGmarket	-0.01071	0.00682	-1.57086	12.17
GradeNumber	-0.01070	0.00582	-1.84021	7.09
Drift30	0.01062	0.05851	0.18158	85.66
FinInst	-0.02717	0.01121	-2.42323	1.85
Opinion	-0.00947	0.00809	-1.17045	24.66

The standard errors and significance levels of these estimates do not deviate to a large extent from those based on OLS. In conclusion, based on two formal tests, we are unable to detect significant signs of heteroscedasticity.

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