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Return-Generating Models - Simple Model or Advanced Model? The Case of Bond Rating Changes Announcement

HASNIZA MOHD TAIB

Department of Finance, School of Economics, Finance and Banking, Universiti Utara Malaysia

ABSTRACT

This paper compares the usability of return-generating models in detecting the abnormal returns of shares during the corporate bond rating change announcements by S&P and Moody's for 10 years. These models are the market model, the quadratic model, the downside model and the higher-order downside model. Based on daily data, there was insufficient evidence to support the private information hypothesis during upgrade announcements using all the models. Hence, no conclusion on the performance of the return-generating models could be derived in relation to rating upgrades. During the downgrade announcements, the higher-order downside model was not found to perform at the same level as the other models. This indicates that even the simplest model, like the market model, is adequate to estimate the abnormal return of share prices.

JEL Classification: G14, G31

Keyword: Capital market, corporate bond, return-generating models, rating revision and event study

INTRODUCTION

The capital asset pricing model (CAPM) is popular among researchers in pricing the assets (see, for example Banz 1981; Basu 1983; Bossaerts & Plott 2002; Faff & Chan 1998; Roll 1983). However, it may not be suitable if the share price data suffer from non-normality and the distribution is asymmetric. For the past 50 years, researchers have tried to find ways to develop more sophisticated models suitable for pricing shares. Hence, there is a need to investigate the suitability of other return-generating models in detecting abnormal returns during bond rating change announcements. This paper uses four different return-generating models – the

*Corresponding author: Tel: +604926876 Email :hasniza@uum.edu.my

market model, the quadratic market model, the downside model and the higher-order downside model – to assess the impact of the UK corporate bond rating changes announced by S&P and Moody's on the share price. The UK market is chosen in this study as there is a lack of evidence on the impact of bond rating changes in the UK market. A study conducted by Barron, Clare and Thomas (1997) tested the equity reactions of 23 bond rating changes by S&P from 1984 to 1992 in the UK. Note that the findings by Barron, Clare and Thomas (1997) are based on a small number of observations, which could affect the generalisation of the results. Until now, no further research has been carried out in the UK to clarify this matter. This study explores broadly the information value of 299 UK corporate bond rating changes as published by S&P and Moody's for 10 years from 1997 to 2006.

One of the main criticisms of the CAPM is that the assumptions for the underlying model are unrealistic. For example, the asset pricing model assumes that all investors are risk averse. According to this assumption, the relationship between the risk of the asset and its expected return is positive. This means the higher the risk taken by the investors, the higher the investments return will be. Surprisingly, based on the past literature, there is only weak statistical evidence of a positive relationship between risk and return (see, for example Black 1972; Fama & MacBeth 1973; Lintner 1965; Sharpe 1964). Researchers such as Kraus and Litzenberger (1976), Harvey and Siddique (2000) and Estrada (2002, 2004, 2007) have created enhanced models that overcome the weakness of the CAPM. Among examples of these alternative return-generating models created are the quadratic model, the downside model and the higher-order downside model.

Researchers such as Barone-Adesi (1985); Kraus and Litzenberger (1976); and Prakash, Chang and Pactwa (2003) have been concerned with the skewness of the share price return distribution, which is not considered in the CAPM. They have thus incorporated the systematic market skewness in the quadratic model. Furthermore, the skewness of share price return distribution can be either left (negative skewness) or right (positive skewness). Downside risk happens when the distribution of the share price is left skewed. Focusing on the issue of downside risk, Estrada (2002, 2004, 2007) incorporated semivariance into the return-generating models. Another recently developed model, the higher-order downside model, accounts for both semivariance and semiskewness (Galagedera & Brooks 2007). All of these augmented models have been described as superior because they incorporate many important factors that are excluded from the market model.

However, most of the available literature on the impact on share prices of corporate bond rating changes announcements uses the market model to calculate abnormal returns (see, for example Akhigbe, Madura & Whyte 1997; Barron, Clare & Thomas 1997; Hand, Holthausen & Leftwich 1992; Pinches & Singleton 1978), and there is a dearth of alternative return-generating models used in the previous research to investigate the effect of bond rating changes on share returns. The major contribution of this paper is to consider different approaches to calculating the abnormal return and using the market model as a comparison benchmark in investigating the impact of the bond rating change announcements.

Several hypotheses have been developed in past research to analyse the reaction of the market during the announcements of bond rating revisions. The first hypothesis is the efficient market hypothesis, which proposes that there should be no abnormal market reaction during an upgrade or downgrade of a corporate bond, as the share price will adjust simultaneously to new information on the market (see, for example, Weinstein (1977)). Another hypothesis is known as private information hypothesis. This hypothesis assumes that the announcements of rating changes by rating agencies contain information about the long-term financial prospects of the bond issuer, particularly since the rating agency is exposed to both the public and private information of the bond issuer. Additionally, the rating agency is exposed to insider information while undertaking its research to determine the bond rating. Based on this hypothesis, the bond upgrade announcements should cause a positive market reaction, as the rating implies the good financial health of the bond issuer in the future. In contrast, the market should react negatively to downgrade announcements as they signal the weak financial health and prospects of the issuer (see, for example, Abad-Romero & Robles-Fernandez 2006; Akhigbe, Madura & Whyte 1997; Zaima & McCarthy 1988).

Specifically, the objective of this paper is to assess alternative return-generating models in terms of measuring the abnormal performance of share prices during the corporate bond rating changes announcements by S&P and Moody's. Three return-generating models, the quadratic model, the downside model, and the higher-order downside model, will be used. The market model will be the benchmark model. The benchmark model will be compared to the three return-generating models in terms of the context of the bond rating changes announcements in the United Kingdom from 1997 to 2006.

LITERATURE REVIEW

After more than 30 years of continuing development of the market model, researchers have tried to create the best return-generating models by refurnishing the existing model so that it will become more realistic in pricing the share. The best return-generating models should be selected based on the condition and the nature of the data distribution and whether the share return is symmetric or asymmetric.

The mean-variance framework was first developed by Markowitz (1952) when he formulated a modern portfolio theory based on the mean and variance of share returns. Modern portfolio theory provided a foundation for the later development of asset pricing model (see, for example Black 1972; Kraus & Litzenberger 1976; Lintner 1965; Sharpe 1964). The CAPM has been used extensively in many empirical studies for numerous applications such as performance measurement and market efficiency testing. Roy (1952), who is also a pioneer in modern portfolio theory (MPT), proposed that the investment choices should be made based on the mean and variance of the portfolio as a whole. Other researchers such as Black, Jensen and Scholes (1972), Black (1972), Sharpe (1964) and Lintner (1965) have independently introduced and explored the value of the capital asset pricing model. Since this early work, the CAPM has been used extensively in many studies for numerous applications such as performance measurement and market efficiency testing. In short, the CAPM investigates an asset's sensitivity to systematic risk, which is denoted by beta (β), as well as the expected market returns and expected risk-free returns. The CAPM has been widely criticised for its absurd and unrealistic assumptions. Among those researchers who have criticised the CAPM is Estrada (2002), who pointed out that there are two major conditions in which the CAPM is considered inappropriate to calculate the share return: (i) when the distribution of returns is asymmetric and (ii) when the distribution of returns is not normal.

According to Schwert (1983), there is no successful explanation of return share anomalies, and most researchers have found evidence of the misspecification of the CAPM rather than evidence of inefficient capital markets. Such anomalies of share return as discussed by Schwert (1983) are the 'time effect' (i.e. weekly effect), associated with the high and low returns at a particular condition and time, and the size effect, which indicates that bigger companies have a lower risk-adjusted rate of return in comparison to smaller companies. Hence, many researchers are refining and developing new return-generating models in order to overcome the weakness of the CAPM (see, for example Barone-Adesi, Gagliardini & Urga 2000; Harvey & Siddique 2000; Kraus & Litzenberger 1976).

One of the main flaws in the CAPM is its exclusion of systematic (nondiversifiable) skewness. Based on observations of monthly portfolio returns in the US from 1936 to 1970, Kraus and Litzenberger (1976) incorporated the skewness effect in the equilibrium rates of returns and, by performing a quadratic characteristic line analysis, they found that the systematic skewness is relevant to market valuation. Furthermore, they later extended their research (1983) and succeeded in providing evidence that the quadratic characteristic line is sufficient for assets to be priced based on the three moments in the CAPM (mean, variance and skewness). Thus, there is a negative relationship between the systematic market skewness and returns of asset.

The skewness of the share return could be skewed to the right (positive skewness) or to the left (negative skewness). Most researchers agree that skewness does matter in terms of pricing the share, and investors have a preference for a right-skewed portfolio over a left-skewed one (see, for example, Harvey & Siddique (2000) and Smith (2007)). Downside risk exists when the distribution is left skewed. The correct perception of risk by investors should be based neither on the deviation of the actual return from the expected return nor in terms of deviation below the expected return, but more in terms of whether it can achieve the minimum target rate. [1] Hogan and Warren (1974) and Nantell and Price (1979) incorporated the semivariance within the CAPM. Furthermore, Estrada (2002) proposed that it is essential to incorporate the semivariance in the return-generating model, which he then named D-CAPM, which stands for the downside capital asset pricing model.

Semivariance defines risk as the volatility below the benchmark or minimum target rate. Semivariance is associated with downside risk. According to Estrada (2007), there are four reasons that incorporating the semivariance in a return-generating model is useful, the first of which is that investors are not entirely averse to volatility, but they do not like downside volatility, and semivariance is considered to be a credible measure of risk, as it captures downside risk. Second, semivariance can be used for both symmetric and assymmetric share

[1] According to Nantell and Price (1979) the minimum target rate of return demanded by investors is at least at the same value as the risk-free rate of return.

return distribution. Third, semivariance can measure both skewness and variance in one model; lastly, semivariance of returns can be used to generate mean-semivariance hypotheses. Based on D-CAPM, Estrada (2004) found that semivariance can be applied to both emerging markets, where the asymmetric return distribution occurs, and to established markets, where the return distribution is symmetric. Similar results from Estrada (2004) are observed in Estrada (2002, 2007).

Downside risk is a condition resulting from downside market movements. Previous research (see, for example Kraus & Litzenberger 1976; Lee, Moy & Lee 1996) has generally incorporated skewness in the return-generating model (also known as the three-moment CAPM) without specifically addressing the skewness when the market is up and down (semiskewness). Galagedera and Brooks (2007) compared both downside risk (semivariance) and downside gamma (semiskewness) in explaining the variation in the market. Based on monthly indices from 27 emerging markets from 1987 to 2004, they found that downside skewness could better explain the variation in market returns in the emerging markets than the downside beta.

DATA AND MODELLING FRAMEWORK

The announcement dates for the UK corporate bond rating changes are based on the data provided by both S&P and Moody's, covering a 10-year study period from 1 January 1997 to 31 December 2006. The analysis was based on bonds issued by UK public companies sold in the local market. The daily share prices and market indexes were taken from the DataStream. The FTSE All Share was used to represent the overall price direction of the UK market. As seen in Table 1, there were 299 rating changes events as announced by S&P and Moody's in the United Kingdom for the event period. These rating announcements were selected following the specified filtering process to ensure that strong conclusions can be derived and the results are free from bias. The filtering process includes the following steps:

i. All initial bond rating announcements are eliminated from the sample.
ii. Companies with double rating changes in the same year for the same bond issue are excluded from the sample.
iii. Issuing companies categorised as private companies are excluded from the sample.
iv. Announcements related to the same issuing companies which issued different types of bonds on the same date are also eliminated.
v. In order to obtain uncontaminated samples, other company-specific announcements (i.e. dividend announcements and profit and loss announcements) are sourced using Factiva for two weeks surrounding the rating changes events. If company-specific announcements occur in this two-week period, the event is eliminated from the sample.

Table 1 Number of rating announcements based on bond grade in the UK

	Remain Investment Grade		Remain Speculative Grade		Move up / Drop Below Investment Grade		Total
	Upgrade	Downgrade	Upgrade	Downgrade	Upgrade	Downgrade	
Announcements by S&P	17	59	10	11	3	5	105
Announcements by Moody's	36	110	13	23	4	8	194
	53	169	23	34	7	13	299

An event study was undertaken in order to identify the market reactions during the period of the corporate bond rating revisions in the UK from January 1997 to December 2006. The abnormal returns of the securities are computed based on four return-generating models: the market model, quadratic model, downside model, and higher-order downside model. The estimation period of the return-generating models for this study is around 100 days, which is calculated based on 6 months of daily return observations beginning 120 days to 21 days before the corporate bond rating changes were announced to the public. The event period ranges from 20 days prior to the rating revisions to 20 days after (41 days in total).

Return-Generating Models

Below are discussions of the four return-generating models used to calculate the abnormal return (AR) during the bond rating changes announcements in the UK.

a) Market Model

The conventional market model assumes that share returns are normally distributed. The market model is based on an equilibrium in which the investors are maximising their utility function based on the mean and variance of returns in their portfolio. The expected returns for share i at time t is calculated as follows:

$$E(R_{i,t}) = E(\alpha_i) + E(\beta_i)R_{m,t} + \in_{i,t}$$

where $E(\alpha_i)$ is an expected return of share *i* when the expected return of the market ($E(R_{m,t})$) is zero, and $E(\beta_i)R_{m,t}$ is the systematic component assumed to have a linear relationship between the company's share returns and market returns, α and β and are estimated using a regression model for which the parameters are calculated using the ordinary least squares (OLS) method. The term $\in_{i,t}$ indicates the unsystematic risk component or error term (also known as the residual), which incorporates the impact of a company-specific event announcement (assuming that the information signal and the return of the market are independent). Measurement of abnormal return is introduced if is brought to the left side of the equation:

$AR_{i,t} = \in_{i,t} = R_{i,t} - E(\alpha_i) - E((\beta_i) R_{m,t})$

and t is constrained to the period t_{-20} through t_{+20} .

b) Quadratic Market Model

The quadratic market model has been extensively used by previous researchers (see, for example, Kraus & Litzenberger (1976); Kraus & Litzenberger (1983); Harvey & Siddique (2000); Mishra *et al*. (2007)) in order to test market equilibrium with non-normal returns. The quadratic market model is an extension of the market model with two factors: the market return and the square of the market return. The calculation of realised returns for share i at time t is as follows:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_i R_{m,t}^{\;2} + \varepsilon_{i,t},$$

where $R_{i,t}$ and $R_{m,t}$ are the return of share i and market return during period t. $R_{m,t}^2$ is the skewness of the market return incorporated in the quadratic market model. β_i is the systematic component of share i, while γ_i is the market gamma or the systematic market skewness. The error term $\mathcal{E}_{i,t}$ is assumed to satisfy the usual stationarity assumptions.

Using the estimated parameters α_i, β_i and γ_i, the abnormal return of the share i is obtained by:

$$AR_{i,t} = \mathcal{E}_{i,t} = R_{i,t} - \alpha_i - \beta_i R_{m,t} - \gamma_i R_{m,t}^2$$

and t is constrained to the period t_{-20} through t_{+20} .

c) Downside Model

The downside model is also known as the D-CAPM. This model has been extensively discussed and used by Estrada (2002, 2004, 2007). The downside model was developed to address the alternative measure of risk: the downside beta.

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \beta_i^{\,D} D_{Down} R_{m,t} + \varepsilon_{i,t}$$

where D_{down} is a dummy variable that takes a value of positive unity for days in which $R_{m,t}$ is negative and a value of zero otherwise ($D_{down\,=\,1}$ if $R_{m,t} < 0$). β_i is the market risk for share i while β_1^D is the systematic downside risk for share i. All other variables are defined as above.

The calculation of abnormal return of share i is as follows:

$AR_{it} = \mathcal{E}_{i,t} = R_t - \alpha_i - \beta_i R_{mt} - \beta_1^D D_{DOWN} R_{mt}$,

where $D_{down} = 1$ if $R_{mt} < 0$

d) Higher-Order Downside Model

The higher-order downside model is used specifically to address the skewness when the market is down (semiskewness) (see Galagedera & Brooks (2007)).

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \beta_{2i}{}^{D} D_{Down} R_{m,t} + \gamma_i R_{m,t}{}^{2} + \gamma_{2i}{}^{D} D_{Down} R_{m,t}{}^{2} + \varepsilon_{i,t}\,,$$

where D_{down} is a dummy variable which takes a value of positive unity for days in which is negative and a value of zero otherwise ($D_{down} = 1$ if $R_{mt} < 0$). β_i is the systematic risk share for share i; γ_i is the systematic downside risk for share i; $\gamma_{2i}{}^{D}$ is the systematic market skewness[2] (market gamma); and is the downside skewness. All other variables are defined as above.

The calculation of abnormal return of share i is as follows:

$AR_{i,t} = \mathcal{E}_{i,t} = R_{i,t} - \alpha_i - \beta_i R_{mt} - \beta_1{}^{D} D_{DowN} R_{m,t} - \gamma_i R_{m,t}{}^{2} - \gamma_{2i}{}^{D} D_{DowN} R_{m,t}{}^{2}$

where $D_{down} = 1$ if $R_{mt} < 0$

Average Abnormal Return and Cumulative Abnormal Return

After obtaining the abnormal return, the average abnormal return and cumulative abnormal return are calculated. The daily cross-sectional average abnormal returns (AAR_t) for a specific day, t . Is calculated by summing all of the daily abnormal returns for the whole event period and dividing them by the number of observations.

$$AAR_t = \sum_{i=1}^{N} AR_{i\,t} / N_t$$

where N_t is the number of observations on event day t

Next, the cross-sectional average abnormal return (CAR_t) is summed. This is done by adding the daily average abnormal returns in time periods t_1 and t_2. The formula used is as follows:

$$CAR\ t = \sum_{k=t-T}^{t} AAR_t$$

where T is some number of event days prior to day t

[2]Downside skewness is also known as systematic co-semi-skewness risk (downside gamma) (see Galagedera & Brooks (2007)).

EMPIRICAL RESULTS

Table 2 presents the data on the daily market reactions generated by the four model frameworks—the market model, quadratic model, downside model and higher-order downside model—during the corporate bond upgrade announcements, whilst Table 3 is meant for bond downgrades. As expected, the AAR and CAR values are not consistent (see, for example, day=0) between all models. This is due to different factors used in different models. The sign of AAR (either negative or positive) is the most important indicator for this study, as it indicates the market reactions during bond rating changes announcements.

Panel A of Table 2 reports the daily market reactions for the 11-day event period (5 days before and 5 days after the upgrade announcements) for corporate bond upgrades announced by S&P with 30 observations in the respective sample. According to the private information hypothesis, the share price should react positively to rating upgrade announcement.

Overall, there is no significant positive abnormal return observed on the day of the rating upgrade announcements (day 0) by S&P and Moody's. As shown in Panel A of Table 2, there is no significant AAR in all the return-generating models, which indicates that there is not enough evidence to support the private information hypothesis. Panel B of Table 2 presents the share price reactions to the upgrade announcements by Moody's, and there are 53 uncontaminated upgrade announcements available for the period of 1997–2006. There is no significant positive abnormal return observed in the market model, downside model, and higher-order downside model, as presented in Panel B. However, the quadratic model seems to be able to detect positive abnormal returns during the upgrade announcement by Moody's on day -3 and day +5. Unlike S&P, no consistency could be observed across the models for upgrade announcements by Moody's. The market model, downside model, and higher-order downside model have a comparable negative AAR result with a significance level of 1% on day -4. Note that the AAR values are not consistent between all models, because of different factors used in different models.

Table 2 Market reactions during UK rating upgrades announcements

Days	Panel A: Rating Upgrade Announcements by S&P (N=30)											
	Market Model			Quadratic Model			Downside Model			Higher Order Downside		
	AAR	CAR	*t*-stat	AAR	CAR	*t*-stat	AAR	CAR	*t*-stat	AAR	CAR	*t*-stat
-5	0.006	-0.008	1.913	0.006	0.012	1.792*	0.005	0.001	1.858*	0.005	-0.024	1.414
-4	-0.001	-0.009	-0.417	0.000	0.013	0.096	0.000	0.001	-0.073	-0.001	-0.025	-0.158
-3	-0.003	-0.013	-1.100	-0.004	0.009	-1.104	-0.003	-0.002	-1.148	-0.003	-0.027	-0.694
-2	-0.003	-0.016	-1.033	-0.001	0.009	-0.172	-0.002	-0.004	-0.563	-0.006	-0.033	-1.551
-1	0.002	-0.014	0.523	0.003	0.012	0.906	0.002	-0.002	0.827	0.001	-0.033	0.149
0	0.001	-0.013	0.223	0.001	0.012	0.170	0.001	-0.001	0.241	0.002	-0.031	0.522
1	0.002	-0.011	0.818	0.005	0.017	1.563	0.004	0.003	1.323	0.000	-0.031	-0.077
2	0.002	-0.009	0.575	0.002	0.019	0.749	0.002	0.005	0.756	0.000	-0.031	0.031
3	-0.003	-0.012	-1.011	0.000	0.019	-0.077	-0.002	0.003	-0.604	0.001	-0.030	0.279
4	0.003	-0.010	0.923	0.004	0.023	1.248	0.004	0.007	1.201	0.002	-0.028	0.570
5	0.001	-0.009	0.268	0.001	0.024	0.183	0.000	0.007	0.148	0.000	-0.027	0.023

Table 2 (Cont.)

Days	Panel B: Rating Upgrade Announcements by Moody's (N=53)											
	Market Model			Quadratic Model			Downside Model			Higher Order Downside		
	AAR	CAR	*t*-stat	AAR	CAR	*t*-stat	AAR	CAR	*t*-stat	AAR	CAR	*t*-stat
-5	0.001	-0.010	0.339	-0.003	0.014	-0.262	0.001	-0.014	0.281	0.001	-0.021	0.139
-4	-0.012	-0.022	-3.22***	-0.013	0.001	-1.277	-0.013	-0.027	-3.23***	-0.014	-0.035	-2.81***
-3	0.002	-0.021	0.471	0.021	0.022	2.015**	0.002	-0.025	0.453	0.002	-0.033	0.347
-2	-0.002	-0.022	-0.388	-0.011	0.011	-1.063	-0.002	-0.027	-0.481	-0.002	-0.034	-0.331
-1	-0.003	-0.025	-0.811	-0.008	0.003	-0.756	-0.004	-0.031	-0.929	-0.005	-0.039	-0.916
0	-0.006	-0.031	-1.507	-0.005	-0.002	-0.484	-0.007	-0.037	-1.624	-0.009	-0.048	-1.821*
1	0.002	-0.029	0.485	-0.012	-0.013	-1.104	0.002	-0.035	0.416	0.002	-0.046	0.347
2	-0.005	-0.035	-1.415	0.007	-0.006	0.676	-0.006	-0.041	-1.415	-0.006	-0.052	-1.206
3	0.001	-0.034	0.312	0.005	-0.001	0.515	0.001	-0.041	0.135	-0.001	-0.053	-0.135
4	0.000	-0.034	-0.095	0.012	0.011	1.172	-0.001	-0.041	-0.173	-0.006	-0.059	-1.260
5	0.004	-0.030	1.025	0.019	0.030	1.800*	0.004	-0.038	0.891	0.003	-0.056	0.660

* significant at 10% level of confidence

** significant at 5% level of confidence

*** significant at 1% level of confidence

All calculation on this table is based on the event period of 41- day (from 20 days prior to the rating revisions to 20 days after). However, only 11-day event was reported as others were not significant.

Hence, there is insufficient evidence to support the positive market reaction to the upgrade announcements by both S&P and Moody's, which is in line with past literature by, among others, Akhigbe, Madura and Whyte (1997); Barron, Clare and Thomas (1997); and Matolcsy and Lianto (1995). According to Goh and Ederington (1993), the possible explanation for no significant share price reaction during bond rating upgrades is that the good news on rating upgrades are anticipated by the market.

There is evidence of consistencies among all of the model frameworks (market model, quadratic model, downside model, and higher-order downside model) in terms of the AAR signs that could be observed on certain days surrounding the upgrade event period. However, no conclusion could be derived regarding whether one model could outperform another during the upgrade announcements as no significant positive reaction is observed.

Table 3 presents the results for the corporate bond downgrade announcements. Panel A relates to announcements by S&P and Panel B to announcements by Moody's. There are 75 uncontaminated observations of downgrade announcements by S&P and 141 downgrade events announced by Moody's. There is enough evidence found in Table 3 to support the hypothesis that the downgrade announcements contained some effect of private information, as significant negative reactions were observed in both Panel A (see day -4, day -3, day -1, and day 0) and Panel B (see day -2, day -1, day +1, and day +3).

In fact, consistency of negative significant AAR results across the market model, quadratic model and downside model was observed on day -3 and day -1 in Panel A; and on day -2, -1, and day +1 in Panel B of Table 3. Furthermore, both the market model and the quadratic model revealed negative abnormal returns on day -4 in Panel A, with a significance level of 5%, and on day +3 in Panel B, with a 10% confidence level. Interestingly, the higher-order downside model is not performing on par with the other return-generating models as no significant abnormal return was found during the downgrade announcements as shown in Table 3.

Table 3 Market reactions during UK rating downgrades[3]

Days	Panel A: Rating Downgrade Announcements by S&P (N=75)											
	Market Model			Quadratic Model			Downside Model			Higher Order Downside		
	AAR	CAR	t-stat	AAR	CAR	t-stat	AAR	CAR	t-stat	AAR	CAR	t-stat
-5	-0.003	0.022	-0.651	-0.002	0.016	-0.311	-0.002	0.032	-0.352	0.010	0.213	0.769
-4	-0.010	0.012	-2.044**	-0.012	0.005	-2.049**	-0.009	0.024	-1.798	0.005	0.218	0.350
-3	-0.013	-0.002	-2.707***	-0.015	-0.010	-2.556**	-0.013	0.011	-2.682***	0.000	0.218	-0.009
-2	0.004	0.002	0.713	0.003	-0.007	0.538	0.004	0.014	0.779	0.013	0.231	0.994
-1	-0.013	-0.011	-2.680***	-0.012	-0.019	-2.063**	-0.012	0.002	-2.549**	0.001	0.232	0.058
0	-0.011	-0.022	-2.229**	-0.005	-0.024	-0.859	-0.010	-0.008	-2.105**	0.004	0.236	0.328
1	-0.004	-0.026	-0.718	-0.001	-0.025	-0.192	-0.003	-0.011	-0.600	0.009	0.245	0.695
2	-0.002	-0.028	-0.448	-0.002	-0.026	-0.277	-0.002	-0.013	-0.425	0.012	0.257	0.914
3	0.003	-0.025	0.682	0.000	-0.026	0.025	0.004	-0.009	0.746	0.014	0.272	1.084
4	0.000	-0.025	0.024	0.005	-0.021	0.908	0.002	-0.008	0.346	0.014	0.286	1.082
5	0.002	-0.023	0.346	0.004	-0.017	0.689	0.002	-0.006	0.404	0.015	0.301	1.116
	Panel B: Rating Downgrade Announcements by Moody's (N=141)											
Days	Market Model			Quadratic Model			Downside Model			Higher Order Downside		
	AAR	CAR	t-stat	AAR	CAR	t-stat	AAR	CAR	t-stat	AAR	CAR	t-stat
-5	-0.002	0.013	-0.408	-0.001	0.013	-0.285	-0.001	0.013	-0.354	0.040	0.412	1.103
-4	-0.002	0.011	-0.584	-0.002	0.011	-0.582	-0.003	0.011	-0.674	-0.003	0.409	-0.072
-3	-0.007	0.004	-1.743*	-0.006	0.005	-1.691	-0.007	0.004	-1.822	0.005	0.414	0.142
-2	-0.012	-0.008	-3.062***	-0.011	-0.007	-3.080***	-0.012	-0.008	-3.260***	-0.004	0.411	-0.095
-1	-0.010	-0.017	-2.438**	-0.009	-0.015	-2.449**	-0.011	-0.019	-2.931***	0.011	0.422	0.295
0	-0.002	-0.019	-0.437	-0.001	-0.016	-0.300	-0.002	-0.021	-0.509	0.027	0.449	0.741
1	-0.007	-0.026	-1.901*	-0.006	-0.022	-1.645*	-0.007	-0.028	-1.8439*	-0.007	0.442	-0.196
2	0.000	-0.027	-0.046	0.000	-0.022	-0.061	-0.001	-0.029	-0.226	-0.001	0.441	-0.025
3	-0.007	-0.033	-1.720*	-0.006	-0.028	-1.661*	-0.005	-0.034	-1.251	0.038	0.478	1.030
4	-0.004	-0.038	-1.105	-0.004	-0.032	-1.127	-0.002	-0.036	-0.650	-0.005	0.473	-0.135
5	-0.001	-0.039	-0.221	0.001	-0.031	0.366	0.001	-0.035	0.258	-0.002	0.472	-0.045

* significant at 10% level of confidence

** significant at 5% level of confidence

*** significant at 1% level of confidence

All calculation on this table is based on the event period of 41- day (from 20 days prior to the rating revisions to 20 days after). However, only 11-day event was reported, as others were not significant.

Unlike the upgrade announcements, the market reactions during the downgrade announcements show negative market reactions, which support the private information hypothesis. The significant negative reactions during the downgrade announcements have also been observed by other researchers such as Brooks *et al*. (2004); Elayan, Maris and Young (1996); and Griffin and Sanvicente (1982). Hsueh and Liu (1992) concluded that rating changes

[3] Although the event period for this study is 41-day, only 11-day result surrounding the event are reported in Table 2 and Table 3.

convey meaningful information when there is a high degree of uncertainty in the market. The market did not expect that the bond will be downgraded and thus reacts negatively significant towards it. Although some consistency was observed between the market model, quadratic model, and downside model, the higher-order downside model did not perform as well as the other return-generating models during the downgrade announcements.

CONCLUSION

This paper used event study methodology to test whether announcements of bond rating revisions by Moody's and S&P have any information value to share market investors in the UK over the period from 1 January 1997 to 31 December 2006. In analysing the share price impact, four return-generating models were employed to estimate abnormal returns: (1) the conventional market model, (2) the quadratic market model, (3) the downside model, and (4) the higher-order downside model. The results reveal consistency in terms of the sign of AARs across the return-generating models during upgrade and downgrade announcements by rating agencies in the UK.

In general, there is not enough evidence to support the private information hypothesis from an analysis of the upgrade announcements using all of the models. Based on daily observations during the upgrade announcements, there is evidence of consistencies in terms of the sign of AAR across the models on some of the days in the event period. The same consistencies in terms of the value of AAR across the models are observed for rating upgrade announcements by S&P but not for Moody's when bond grade type is incorporated. However, no conclusion can be derived regarding the performance of the return-generating models, as no significant positive reactions were observed to the upgrade announcements in the UK.

As expected, there is evidence supporting the private information hypothesis during rating downgrades. All of the return-generating models display some consistency in indicating negative reactions in some of the days during the downgrade announcements, except for the higher-order downside model.

In conclusion, the findings demonstrate that an augmented return-generating model does not perform better in estimating the abnormal return of the share price. Consistent with the work of Brown and Warner (1980), the results show that the simple single-factor return-generating model produces results comparable to those produced by the augmented models. Allowance for asymmetry in returns and downside risk does not notably change the results.

There are a few limitations of this research. First, the limited sample period of this study may affect the generalisation of the findings for the UK share price reaction reported in this study. The number of observations based on the UK is small compared to studies conducted in the US. [4] This too may affect the generalisation of the findings. Second, this study investigated the influence of private information by focusing on the share price reaction during the bond rating changes. However, no analysis could be carried out to test the shareholder's wealth hypothesis, since this study did not investigate the effect of rating changes on the bond price

[4]For example, a previous US-based study by Hite and Warga (1997) used 2800 bonds from 1200 companies, and Hand, Holthausen and Leftwich (1992) used 1100 bond rating changes announcements in their research.

and possible bondholder-shareholder wealth transfer. The final limitation that may affect the generalisation of the findings was that approximately 70% of the rating changes announcements in the UK were for bonds that remained at the investment grade. Hence, the overall findings of this study may reflect the market reaction to rating changes for the investment grade bonds, but not for other bond grades.

For further research, bond rating announcements by smaller rating agencies such as the European Rating Agency in the UK should be compared in terms of their performance against the major international credit rating agencies, such as S&P and Moody's, in signalling valuable information to market participants. This can provide a useful explanation on the private information hypothesis of bond rating changes.

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