International Evidence on Corporate Rating Changes

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This research aims to study the reaction of the International stock market around the corporate bond rating change announcements by Moody's between 2015-2021 using stocks and rating data from Datastream. The empirical result shows a significantly positive reaction after the upgrades announcement and a negative reaction around the downgrades event date. Specifically, the impact of rating changes on stock prices is larger around downgrades. The results imply that there is an information effect but no price pressure effect since there is a significant reaction in response to downgrades for all samples insignificance impact following downgrades for sub-sample of the changes across investment- or speculative-grade boundary. Furthermore, the absolute change in rating is statistically significantly related to the cumulative abnormal return.

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1. Introduction

A corporate credit rating is an independent evaluation of a firm's ability to pay which are debt payment and equity's holder payment in a timely fashion. It assesses the creditworthiness which assigned and reviewed by credit rating agency (CRA). It distilling multitude of credit risk info into letter grades on credit scale. The grades range from Aaa to, respectively, C, the lowest rate (Moody's). The change in credit rating informed signals a change of company's financial condition and company's credit quality has improved (upgrade) or deteriorated (downgrade). Additionally, ratings influence the yield spreads of corporate bonds and affect a change in price. For instance, High credit ratings implies lower default risk, lower bond yield and higher bond price respectively. Consequently, the ratings initially became known to investors as a tool for investment decisions and essential for shareholders as well.

The informativeness of credit ratings has been repeatedly challenged. The Efficient Market Hypothesis, or EMH, is asymmetric information between firms and outside investors. If market response efficiently, the information being released by agencies is generally a summary of public information which requires the prices to fully reflect and should have no impact on stock price. As a consequence, investors should not be able to generate profit based on rating changes. If the credit ratings reveal new information, then the rating announcements should have an immediately significant impact to the financial markets on the announcement date and no further reaction on subsequent trading days. The negative announcements

(downgrades) should result in negative change on equity price. Similarly, positive announcements (upgrades) should result in positive change on equity price. Since rating agencies possess private information such as minute of management meeting, new products plan or their research and ratings may provide additional information to the market about a firm's total value. In addition, the credit rating change can be viewed as a signal to the market about future earnings and cash flow of the issuer which affects asset prices.

Specifically, for downgrade or negative events, not only information effects which occur from the changes in firm fundamentals but also price pressure effect arises from the act of selling oy buying large quantity of security (Ambrose, Cai et al. 2008, Ambrose, Cai et al. 2011). For example, Insurance companies face regulatory pressure to sell bonds that no longer carry investment grade ratings as they need to hold over one-third of investment-grade corporate bonds (Schultz 2001). Forced sales or fire sales of fallen angels is most likely to occur in downgraded bonds which reflect lack of liquidity and can generate significant price pressure. Moreover, in the case that the announcement information is a news together with force selling will impact more on price reduction negative returns. In particular, we also investigate the existence of price pressure effect by using downgrade events of cross investment- to speculative grade rating sub-sample.

Therefore, we could use rating announcement to alleviate these information asymmetries between firm and outside investors. (Ederington, Yawitz et al. 1987, Caton and Goh 2003) This study examines whether information asymmetry and

price effect exist around bond rating change announcements. If so, whether this information or price effects from credit rating change announcements is consolidated into stock prices and achieve abnormal stock return.

An event study was commonly used to assess the impact of events occur on stock price reaction such as the initial public offering, dividend announcement, CEO turnover, share repurchasing and stock split. (Ikenberry, Lakonishok et al. 1995, Loughran, Ritter et al. 1995, Spiess and Affleck-Graves 1995, Zuguang and Ahmed 2010). In our study, we use rating changes reported by rating agency as the main interesting event. Generally, the significant stock price reactions occur in response to the news which contains information by analyzing stock price react to rating changes, and evaluate the information occurrence following the rating changes event. Hence, we could measure the informativeness of bond credit ratings, based on publicly available information, from abnormal return in response to the rating changes (around the announcement).

The remainder paper proceeds as follows. Section 2 reviews the literature. Section 3 describes sample selection and methodology. Section 4 contains our main results while Section 5 reports additional analyses and robustness tests. Section 6 concludes.

2. Literature review

There are numerous studies examine impact of credit ratings changes on both stock and bonds markets and provide mixed evidence on its reaction to rating change. Most of studies focus on stock markets. Following Hite and Warga (1997), Elayan, Hsu et al. (2003), Li, Visaltanachoti et al. (2004), Han, Shin et al. (2009) reported evidence that there is price-relevant information; negative share abnormal returns for downgrades and positive share abnormal returns for upgrades. Nevertheless, another common finding is the asymmetric response to rating change announcements implies a significant negative reaction to downgrades, whereas there is no reaction associated with upgrades (Holthausen and Leftwich 1986, Hand, Holthausen et al. 1992, Nayar and Rozeff 1994, Dichev and Piotroski 2001, Li, Shin et al. 2006, Creighton, Gower et al. 2007, Reddy, Bosman et al. 2014, Amin, Jain et al. 2020)

Hite and Warga (1997) found that rating upgrades result in a positive effect on firm returns, specifically when a debt issue is upgraded from a speculative rating level to an investment grade in a specific month and a further 6 months preceding the event. Abad-Romero and Robles-Fernandez (2006) observed negative returns for upgraded firms and no significant returns for the downgraded firms. Creighton, Gower et al. (2007) observed the impact of rating changes in the Australian market and showed that only downgrades contain price-relevant information. found that there is price relation in either way of rating changes (upgrade or downgrade) and the market tends to react more strongly to

downgrades than upgrades. However, these previous researches were conducted equity analysis on ratings changes announcement for specific country. Thus, this paper builds on extend of existing literatures by examine the impact of rating change announcements through all the worldwide events that have not been studied by previous research.

Several related research studies the cross-sectional variation in market reaction. For instance, across versus within investment(speculative) grade, high versus low magnitudes of rating change, between business sectors, small versus large size of firm and leverage ratio. In order to analyze other determinants of market response to announcement rather than upgrades and downgrades event. (Hand, Holthausen et al. 1992, Behr and Güttler 2008), Behr and Guttler (2008) and Avramova et al. (2008)

Motivated by existing literature on information effect of bond rating changes has produced conflicting and incomplete results. Additionally, several previous research considered only in one country or one event. The contribution of this paper is to provide new perspective by using influence of corporate credit rating changes across the globe from 2015 to 2021 in order to explore the corporate bond rating changes by Moody's effects on international stock market returns. Three benchmarks of stock returns performance are considered: (1) Rating changes upgrades or downgrades directly reflect private information, then we should observe significant price reaction (2) Rating changes for cross investment and speculative-grade boundary should have higher magnitude of price reaction

compared with the changes within investment- or speculative-grade classes (3) Rating changes with higher magnitudes should observe higher impact on price reaction compared with low magnitudes of rating changes.

In this paper, we examine the information content and cumulative abnormal return on affected firms across global due to Moody's rating changes. In particular, we investigate whether information content of ratings changes, information uncertainty faced by analysts and to identify variables that might help to explain the magnitude of investors' reaction to the news in the cross-section between ratings changes announcements and international stock returns.

3. Data & Methodology

3.1 Data

Our sample consists of corporate bond rating announcements data for each issuers collected from Datastream with respect to long-term credit ratings of public corporations in local or foreign currencies from January 2015 to December 2021. Only rating upgrades and downgrades were considered. The initial sample comprised of all rating announcements by Moody's providing almost 1,260 issuers and 2,779 rating announcements extracted from Moody's Senior Unsecured and Moody's Long-term issuer rating sources providing rating announcements over the period and merge with firm characteristics data for each rated company. The final sample must meet the following criteria: (i) rated firms must be publicly listed and only credit ratings for long-term instruments were

included in the analysis; and (ii) no other corporate announcements 2 days before and after the date of credit rating announcement. (iii) observations categorized as rating unchanged, rating affirmations, new rating, watch, outlook or withdrawal are excluded from our sample. Another part of data, we use the adjusted daily stock price, market return index for each country and financial information from Datastream. Firms with incomplete stock return data are dropped from our sample.

After applied all the criteria, Table 1 presents the distribution of rating changes announcements by year. There are 354 different issuers and 453 related events after applied all the criteria, consisting of 199 upgrades (44%) and 254 downgrades (56 %). The number of rating changes fluctuates from year to year and more proportion on rating downgrades than upgrades. Negative announcements show a concentration during 2020, the year of COVID-19 crisis.

Table 1 Distribution of Rating Changes Announcements by year
The sample includes all rating changes over the period of January 1, 2015 through December 31, 2021.

Year	Rating Upgrades	Rating Downgrades	Total
2015	26	22	48
2016	21	38	59
2017	36	37	73
2018	51	40	91
2019	27	34	61
2020	10	49	59
2021	28	34	62
Total	**199**	**254**	**453**

The Moody's ratings are transformed into conventional numerical scores. Specifically, 1 represents Aaa rating and 21 represents a C rating. Hence, a higher numerical score reflects higher credit risk. Numerical ratings of 10 or below (Baa3 or above) are specified as investment-grade bonds, while ratings of 11 or higher (Ba1 or worse) are considered high-yield or non-investment grade bonds.

Table 2 shows the distribution of downgrades and upgrades which moved across the investment- or speculative grade boundary. In our analysis, the investment-grade refers to ratings of Baa3 and above. This table illustrates that Moody's events that changes within grade (Investment to Investment grade or Speculative to Speculative grade). There are 307 issuers with 426 rating changes within investment or speculative grade and 26 issuers with 27 rating changes across investment and speculative grade which account for 95% of our sample.

Table 2 Distribution across investment and speculative grade changes.
The sample includes all rating changes over the period of January 1, 2015 through December 31, 2021.

	Rating Upgrades	Rating Downgrades	Total
Across	12	15	27
Within	187	239	426
Total	**199**	**254**	**453**

Table 3 shows the distribution of rating changes by magnitude of change. There are 414 events (around 90%) of 1 grade change (one-notch) and 39 events of more than 1 grade change (multi-notches)

Table 3 describes distribution by size (magnitude) of Rating Changes.
The notch of rating change is calculated by absolute magnitude of the numerical rating change. The sample includes all rating changes over the period of January 1, 2015 through December 31, 2021.

Rating change	Rating Upgrades	Rating Downgrades	Total
1 grade	192	222	414
2 grades	7	22	29
3 grades	0	7	7
Above 4 grades	0	3	3
Total	**199**	**254**	**453**

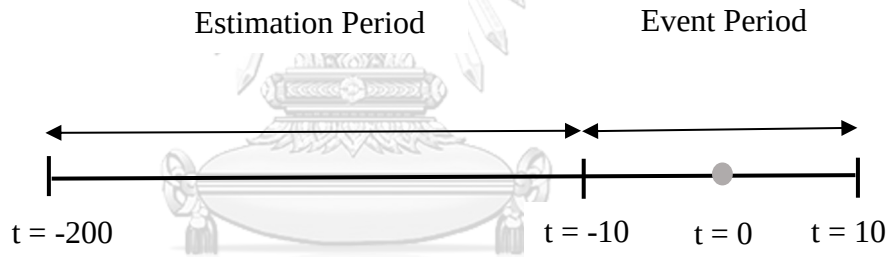
Table 4 presents the distribution of full samples by country. During our study period, the most rating actions are occurred in United States (118 events or 26%), followed by Japan (60 events or 13%) and United Kingdom (37 events or 8%) respectively. For cross-sectional analysis, we ignore the country that has less than 20 events. We limit our attention to the sub-sample of 201 events (81 upgrades and 120 downgrades) from 5 countries where there are sufficient events data to make the result generalizable and will used as fixed effect variable for cross-sectional multivariate regressions and robustness check in additional analysis section.

Table 4 Distribution of Rating Changes Announcements by Country (Full sample)
The sample includes all rating changes over the period of January 1, 2015 through December 31, 2021.

Country	Rating Upgrades	Rating Downgrades	Total
United States	47	71	118
Japan	14	46	60
United Kingdom	12	25	37
China	21	15	36
Australia	13	11	24
Canada	6	12	18
Italy	5	12	17
South Korea	8	8	16
Hong Kong	9	6	15
Switzerland	5	7	12
Vietnam	11	1	12
Finland	7	3	10
Spain	7	3	10
Taiwan	9	1	10
Denmark	3	2	5
Indonesia	5	0	5
Nigeria	0	4	4
Saudi Arabia	2	2	4
Singapore	1	3	4
Sri Lanka	0	4	4
Austria	1	2	3
Bangladesh	0	3	3
Israel	0	3	3
Mexico	1	2	3
Ireland	2	0	2
New Zealand	2	0	2
Peru	0	2	2
Slovakia	2	0	2
Sweden	2	0	2
Thailand	1	1	2
United Arab Emirates	1	1	2
Argentina	0	1	1
Chile	0	1	1
Guernsey	1	0	1
Jersey	0	1	1
Netherlands	1	0	1
Togo	0	1	1
Total	**199**	**254**	**453**

3.2 Methodology

The event study methodology is adopted to investigate the stock price reaction around the credit rating change announcement. The announcement date would capture the day when information is provided in the market. The event date (date 0) is defined as the announcement date of rating change assigned to issuers. To capture the information content of rating changes for stock analysts, five different event windows will be used. The windows examined are the pre-event [-10, −2], the event periods [-1, 1] and [0,1], and [2,10] in order to investigate reaction before, during, and after the rating change at day 0.



Calculation of daily returns

We calculate the actual return on each asset i (Campbell, Lo and Mackinlay, 1997) by the following equation:

$$R_{it} = \ln(\frac{P_{i,t}}{P_{i,t-1}})$$

Where ln is the natural logarithm

$P_{i,t}$ is the price of asset i on day t

$P_{i,t-1}$is the price of asset i on day t-1.

Calculation of Abnormal returns

We employ two procedures or models to isolate the excess, or abnormal, stock returns (ARs) around rating change announcements. Our first model is Market-adjusted returns model discussed in Shevlin (1981), Brown and Warner (1980) and Kloeckner (1995), taking the difference between actual and relative specific benchmarks for each country in our sample, which estimated by following equation

$$AR_{it} = R_{it} - R_{mt}$$

Another model is Standard Market model (Brown and Warner, 1980, 1985) taking the difference between actual and predicted return, using daily stock returns data from day -200 to day – 10 relatives to the announcement, a total of 190 trading days, as an estimation window. The α_i and β_i, market model parameters, are estimated by ordinary least square regression in order to predict estimated return.

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})$$

The Cumulative abnormal return (CARs) is the summation of the abnormal returns for the event windows selected for investigation.

$$CAR_{it} = \sum_{i=1}^{t} AR_{it}$$

Where AR_{it} is the day t abnormal return on for firm i.

CAR_{it} is the day t cumulative abnormal return on for firm i.

R_{it} is the day t return on firm i, calculated using stock price data

R_{mt} is the day t return on specific benchmarks for each country.

α_i, β_i are ordinary least square estimates of market model parameters.

We then examine the average abnormal return (AARs) for each day in the event window and Cumulative average abnormal return (CAAR) over T days in the event window.

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

$$CAAR_T = \sum_{t=1}^{T} AAR_t$$

Significance testing

Parametric T-test

To test the significance of abnormal returns and cumulative abnormal return of various event windows. We use Crude Dependence Adjustment test statistics or CDA test outlined by Brown and Warner (1980, 1985) which compensates for possible dependence of returns across events by estimate standard deviation using sample mean returns from estimation period. The standard errors are estimated from daily portfolio abnormal returns calculated over day -200 to -10 relative to rating changes announcement.

With Crude Dependence Adjustment, the test statistics is given by

$$t_{AAR_t} = \frac{AAR_t}{SD_{\text{AAR}}}$$

$$t_{CAAR} = \frac{CAAR\ (T_1, T_2)}{\sqrt{T_2 - T_1} SD_{AAR}}$$

and the standard deviation of AAR_t for all t is:

$$SD_{\text{AAR}} = \sqrt{\frac{1}{190} \sum_{t=-200}^{-11} (AAR_t - \overline{AAR_t})^2}$$

Where

SD_{CAAR} is the standard deviation of cumulative abnormal return across the sample

AAR_t is average abnormal return of day t

$[T_2 - T_1]$ denotes the number of days in event periods

Non parametric T-test

To test the significance of CAR for rating changes across investment grade are different from zero, based on small sample size of 27 events (12 upgrades and 15 downgrades), the distribution is non-normal. Wilcoxon signed-rank test (two-sided test) was employed to investigate the following hypotheses:

$$H_0 : The\ median\ CARs\ is\ equal\ to\ zero$$

$$H_1 : The\ median\ CARs\ is\ not\ zero$$

Cross-sectional analysis of abnormal return

To investigate whether the impact of rating announcements event on stock price depend on the magnitude of the rating change, the change across investment and speculative-grade boundary or other control variables. In this section, we examine the cross-sectional variation of CARs (-1,+1) which is the main variable of interest to describe which firm or country characteristics are affect to CARs using the following regression:

$$CAR_{i,t} = \beta_0 + \beta_1 UP_t + \beta_2 RATGCH_t + \beta_3 CROSS_t + \sum_{k=4}^{6} \beta_k F_i^k + \sum_{k=7}^{8} \beta_k C_i^k + \varepsilon_{it}$$

Where CAR_{it} represent cumulative abnormal return around the announcement (event) period (days -1 to +1) which has strong statistically significant in our sample for both models and can capture the reaction of investors well.

UP_t denotes dummy variable taking value of 1 for upgrade announcement event and 0 otherwise.

$RATGCH_t$ denotes the absolute magnitude of the rating change.

$CROSS_t$ denotes a dummy variable set equal to 1 if bond ratings downgrades (upgrades) occurs from investment (speculative) to speculative (investment) grade and 0 otherwise.

F_i^k is a set of firm-level control variables including firm size, leverage ratio and book to market ratio are used relative to the rating change date. Firm size which is the logarithm of market capitalization. According to Rajan and Zingales (1995), Baker and Wurgler (2006) and Avramov et al. (2009), the

firm size may have positively affected to cumulative abnormal return of stock price due to more access of information and transparency. Leverage ratio is measured by divide long-term debt by equity may have negatively affected to abnormal returns since higher leverage ratio may lead to higher probability of default. Book to market is ratio of firm's book value over market value may affect abnormal returns positively due to high book-to-market ratio earn higher return than low book-to-market ratio.

C_i^k is a set of country-level control variables including GDP growth and inflation which taken from World Development Indicators (WDI) of World Bank.

ε_{it} is an error term.

4. Empirical findings

4.1 The stock reaction to bond rating changes announcements

Figure 1 shows the average CAR behavior for upgrades and downgrades across the day -10 to +10 window for both models. The downgrades announcement, CARs start being statistically significantly different from zero before the event with more proportion of changes than positive announcements. For upgrades announcement, standard market model shows changes in returns of opposite sign from expectation (negative sign) while market-adjusted model presents expected sign for all returns changes (positive sign) without clear pattern of CARs reaction around event period. These figures emphasize that on the day of announcement, there is a stronger market reaction to downgrades than upgrades.

According to figure 1, CAAR from Market-adjusted model, we find that negative (positive) announcements are associated with positive (negative) returns on most of event period around the announcement which consistent with our hypotheses. The cumulative average changes on the day of the announcement and the day following the announcement (days 0 and +1) is 0.17% (−0.2%). For figure 2, CAAR from Market model, illustrates that after announcement date CAAR of positive and negative event trend to decrease which CAAR of negative event consistent with our hypotheses but not for positive event. The cumulative average changes on the day of the announcement and the day following the announcement (days 0 and +1) is 0.14% (-0.16%)

Figure 1 Average cumulative abnormal returns from day -10 to +10 for Market-adjusted return model

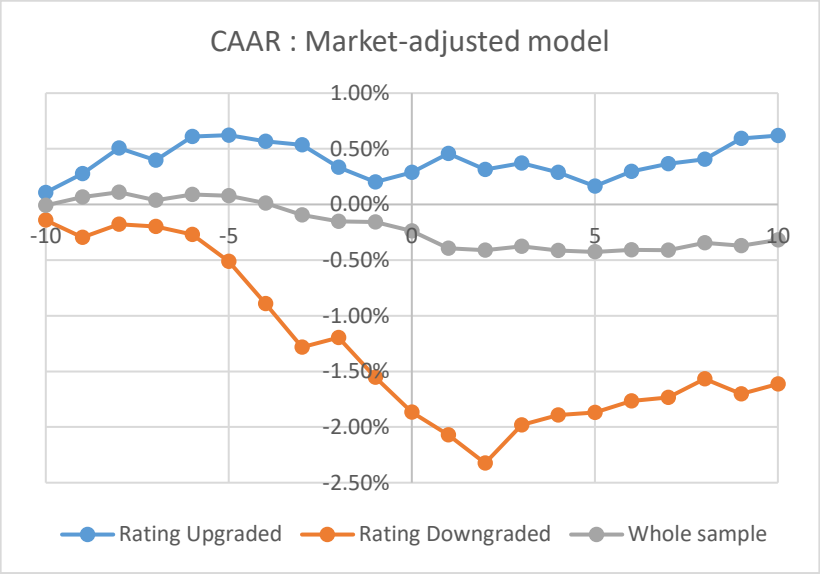


Figure 2 Average cumulative abnormal returns from day -10 to +10 for Standard market model

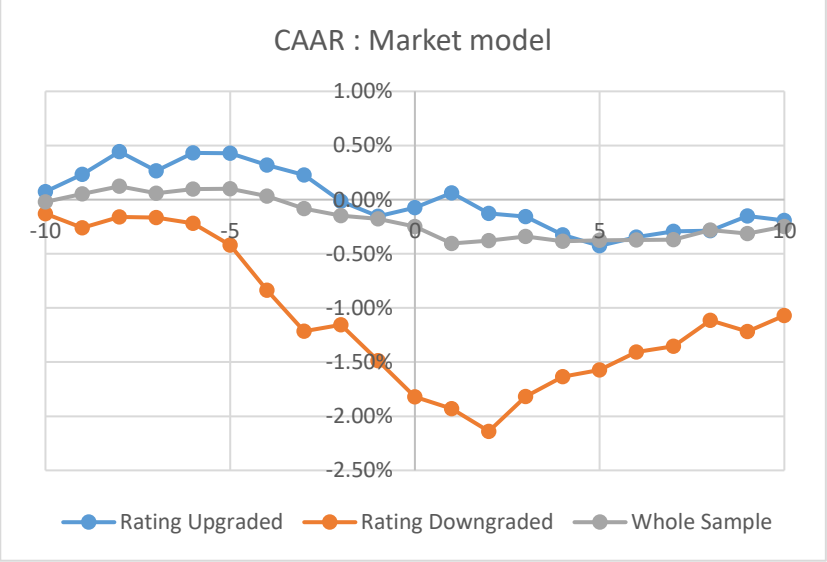


Table 5 describes that Average Abnormal Return (AAR) was positive (negative) for upgrades (downgrades) on the day of announcement (day 0). For upgrade events, the AAR continue positive on the subsequent day (day 1) then it turn negative indicating that it fails to provide benefit over longer-time horizon. Downgrade events shows significantly negative AAR from the day before (day -1) to 2 days after the announcement (day 2). The over-all CAR rises (falls) by 0.33 % (0.25%) in the post-event period. The rises (falls) in CAAR in post-event period is attributed to the movement in stock prices.

Table 5 Average abnormal return expressed as percentages and T- statistics
during event window (-10,10) for rating changes of Market-adjusted model and Market model. T-test is a t-statistics determined with reference to the standard deviation of changes in the estimation window. Significance at the 1, 5 and 10 per cent level is denoted by ∗∗∗, ∗∗ and ∗, based on two-tailed tests.

	Panel A – Average abnormal returns using Market-adjusted model				Panel B – Average abnormal returns using Market model			
Days	Upgrades		Downgrades		Upgrades		Downgrades	
	AAR	T-test	AAR	T-test	AAR	T-test	AAR	T-test
-10	0.11%	2.35**	-0.14%	-3.09***	0.07%	1.64*	-0.13%	-2.95***
-9	0.17%	3.65***	-0.15%	-3.33***	0.16%	3.69***	-0.13%	-2.99***
-8	0.23%	5.05***	0.12%	2.52**	0.21%	4.73***	0.10%	2.29**
-7	-0.11%	-2.42**	-0.02%	-0.38	-0.18%	-4.0***	-0.01%	-0.11
-6	0.21%	4.66***	-0.07%	-1.59	0.17%	3.79***	-0.05%	-1.17
-5	0.01%	0.27	-0.24%	-5.26***	0.00%	-0.0	-0.20%	-4.62***
-4	-0.06%	-1.20	-0.38%	-8.30***	-0.11%	-2.5**	-0.42%	-9.48***
-3	-0.03%	-0.73	-0.39%	-8.50***	-0.09%	-2.0**	-0.38%	-8.56***
-2	-0.20%	-4.37***	0.09%	1.87*	-0.24%	-5.5***	0.06%	1.30
-1	-0.13%	-2.87***	-0.36%	-7.75***	-0.14%	-3.1***	-0.33%	-7.52***
0	0.09%	1.89*	-0.31%	-6.84***	0.08%	1.83*	-0.33%	-7.60***
1	0.17%	3.72***	-0.21%	-4.47***	0.14%	3.09***	-0.11%	-2.44**
2	-0.14%	-3.13***	-0.25%	-5.53***	-0.19%	-4.2***	-0.21%	-4.77***
3	0.06%	1.25	0.34%	7.51***	-0.03%	-0.6	0.32%	7.31***
4	-0.09%	-1.86*	0.09%	1.89*	-0.17%	-3.8***	0.18%	4.13***
5	-0.12%	-2.69***	0.02%	0.50	-0.10%	-2.3**	0.06%	1.43
6	0.13%	2.89***	0.11%	2.30**	0.08%	1.80*	0.17%	3.76***
7	0.07%	1.53	0.03%	0.63	0.05%	1.23	0.05%	1.20
8	0.04%	0.87	0.17%	3.68***	0.01%	0.14	0.24%	5.48***
9	0.18%	4.03***	-0.14%	-2.98***	0.14%	3.07***	-0.10%	-2.37**
10	0.03%	0.58	0.09%	1.98**	-0.04%	-0.9	0.15%	3.35***

The results on the impact of upgrades and downgrades events on stock returns from 2015 to 2021 are presented in Table 6 by estimated CARs around the rating change announcement from Market-adjusted model. In sample of upgrades, the result shows all upgrades news of announcement convey positive information to the capital market and incorporate into price. In addition, we find that there is positive statistically significant response to announcement of an upgrade around the event period (day +1 and day -1 to +1) at 10% and 1% level respectively. Other return windows, there is no evidence of statistically significant response to an announcement of an upgrade. For downgrades, there is evidence of statistically significant negative abnormal returns for all windows and all significant at the 1% level and statistically significant positive abnormal returns at 5% level for event period of day +2 to +10.

Table 6 Stock market reaction to credit rating changes – Market adjusted returns model
This table shows the average cumulative abnormal (in percentages) for various announcement windows using market-adjusted model. N denotes the number of observations. T-test is a t-statistics determined with reference to the standard deviation of changes in the estimation window. Significance at the 1, 5 and 10per cent level is denoted by ∗∗∗, ∗∗ and ∗, based on two-tailed tests.

Panel A – Upgrades and Downgrades (N = 453)				
Event window (days)	Upgrades		Downgrades	
	All (N = 199)		All (N = 256)	
	CAR (%)	T-test	CAR (%)	T-test
(-10,10)	0.62	1.28	-1.61	-3.35***
(-10,-2)	0.33	1.61	-1.20	-5.80***
(-1,1)	0.13	1.82*	-0.87	-12.7***
(0,1)	0.26	5.61***	-0.52	-11.3***
(2,10)	0.16	0.77	0.46	2.22**

Panel B – Difference in mean CARs between Upgrades and Downgrades		
Event window (days)	All (N = 453)	
	CAR (%)	T-test
(-10,10)	2.23	4.63***
(-10,-2)	1.53	7.42***
(-1,1)	1.00	14.54***
(0,1)	0.78	16.93***
(2,10)	-0.30	-1.45

Table 6, panel B presents significant in difference in mean between CARs of upgrades and downgrades events group on all event windows with expected direction and statistically significant at 1% level except for after announcement period (day +2 to +10) which is no evidence of statistically significant difference in CARs.

Using Standard Market model, Table 7, panel A shows the statistically significant positive response to announcement of an upgrade only after event period (day 0 to +1) at 1% level with positive mean CAR of 0.22%. However, the sign of CAR is as expected between day -1 and +1. For downgrades, the result is consistent with previous model, there is evidence of statistically significant negative abnormal returns for all windows at 1% level, except the event period of day +2 to +10, the reaction are positive and significant at 5% level.

Table 7 Stock market reaction to credit rating changes – Standard Market model
This table shows the average cumulative abnormal (in percentages) for various announcement windows using Standard Market model. N denotes the number of observations. T-test is a t-statistics determined with reference to the standard deviation of changes in the estimation window. Significance at the 1, 5 and 10per cent level is denoted by ***, ** and *, based on two-tailed tests.

Panel A – Upgrades and Downgrades (N = 453)				
Event window (days)	Upgrades		Downgrades	
	All (N = 199)		All (N = 256)	
	CAR (%)	T-test	CAR (%)	T-test
(-10,10)	-0.19	-0.41	-1.07	-2.31***
(-10,-2)	-0.01	-0.07	-1.16	-5.85***
(-1,1)	0.08	1.16	-0.77	-11.7***
(0,1)	0.22	4.93***	-0.44	-10.0***
(2,10)	-0.26	-1.29	0.86	4.34**

Panel B – Difference in mean CARs between Upgrades and Downgrades		
Event window (days)	All (N = 453)	
	CAR (%)	T-test
(-10,10)	0.88	1.90*
(-10,-2)	1.14	5.78***
(-1,1)	0.85	12.89***
(0,1)	0.66	14.99***
(2,10)	-1.12	-5.64***

Table 7, panel B presents significant in difference in mean between CARs of upgrades and downgrades events group on all event windows with expected direction except after announcement period (day +2 to +10) which is negative sign and statistically significant at 1% and 10% (day -10 to +10) level. The results from Table 6 and 7 indicate that the not all downgrades (upgrades) news of announcement convey negative (positive) information to the market. They could bring positive (negative) excess return after announcement period.

Table 8 represent the mean and median CARs for upgrades and downgrades from Market-adjusted model. Specifically, the results for the sub-sample of rating changes across the investment-grade boundary. Despite the small sample size of

the 12 observations for the changes from speculative-to investment grade, The stock returns respond negatively to upgrade announcement around the event period (day -1 to +1), the average CAR is -1.46% and significant at the 10% level, which indicates that the positive news is incorporated negatively into stock prices. However, there is no evidence of statistically significant CARs for all observed event windows around downgrades announcement. Additionally, we find that downgrades from investment grade to speculative grade have more negative impact on CARs than upgrades from speculative grade to investment grade but insignificant.

Table 8 Stock market reaction to credit rating changes – Cross investment-grade or speculative-grade subsample
This table shows the average cumulative abnormal (in percentages) for various announcement windows using Market-adjusted model. N denotes the number of observations. Med is the median of CAR, and WSR is a Wilcoxon signed-rank test statistics of whether median of CAR differs from zero. Significance at the 1, 5 and 10 percent level is denoted by ***, ** and *, based on two-tailed tests.

Event window (days)	Upgrades			Downgrades		
	Cross investment-grade (N = 12)			Cross investment-grade (N = 15)		
	CAR (%)	Med	WSR	CAR (%)	Med	WSR
(-10,10)	-0.42	-0.35	38.0	-10.72	-0.06	53.0
(-10,-2)	-1.09	-0.48	38.0	-6.75	-0.52	46.0
(-1,1)	-1.46	-0.94	16.0*	-1.39	-1.79	33.0
(0,1)	-0.03	-0.32	37.0	-0.13	-1.40	40.0
(2,10)	2.12	0.51	28.0	-2.58	-1.18	57.0

Table 9 presents the mean and median CARs for upgrades and downgrades from Standard Market model. Considering sub-sample of rating changes across the investment-grade boundary, around the event period (day -10 to +1), we find more negative impact on CARs for downgrades from investment grade to

speculative grade than upgrades from speculative grade to investment grade but statistically insignificant impact on CARs at any levels and observed periods.

Moreover, comparing with the result of all samples in Table 6, downgrades(upgrades) from investment(speculative) grade to speculative(investment) grade have marginally higher negative(positive) returns reflects a significant difference in the credit risk between investment-grade and speculative-grade firms.

Table 9 Stock market reaction to credit rating changes – Cross investment-grade or speculative-grade subsample
This table shows the average cumulative abnormal (in percentages) for various announcement windows using Standard Market model. N denotes the number of observations. Med is the median of CAR, and WSR is a Wilcoxon signed-rank test statistics of whether median of CAR differs from zero. Significance at the 1, 5 and 10per cent level is denoted by ∗∗∗, ∗∗ and ∗, based on two-tailed tests.

Event window (days)	Upgrades			Downgrades		
	Cross investment-grade (N = 12)			Cross investment-grade (N = 15)		
	CAR (%)	Med	WSR	CAR (%)	Med	WSR
(-10,10)	-1.56	-0.99	39.0	-7.62	1.26	57.0
(-10,-2)	-1.63	-0.56	34.0	-5.86	-1.89	41.0
(-1,1)	-1.49	-1.16	18.0	-0.63	-1.61	32.0
(0,1)	-0.12	-0.44	37.0	0.48	-1.38	49.0
(2,10)	1.56	0.01	37.0	-1.12	0.86	55.0

We further explore the effect of magnitude of rating changes on abnormal returns (CARs) and investigate whether credit rating changes with higher magnitude of rating changes will convey stronger reaction than the lower magnitude by using CAR(-1,1).

Table 10, panel A and B reveals the statistically significant of magnitude impact on market reaction at 10% and 1% level for upgrades and downgrades event respectively, which indicates that positive (negative) significant stronger stock price reaction for higher magnitude than lower magnitude of rating changes for upgrades (downgrades) announcement.

Table 10 Stock market reaction to bond rating changes by Magnitude (size)
This table presents the estimated coefficients of the multiple regression. Stock market reaction is measured by the average cumulative abnormal return around announcement event period (days −1 to +1) or CAR (-1,1), RATGCH denotes the absolute magnitude of rating change and Country is added as fixed effect variable. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Magnitude (Size) of rating changes on Stock CAR(-1,1) using Market adjusted model				
Variables	Upgrades		Downgrades	
	All (N = 199)		All (N = 256)	
	Coefficients	T-test	Coefficients	T-test
Intercept	-0.2349	-1.13	0.1087	1.27
RATGCH	0.3138	1.78*	-0.0518	-5.95***

Panel B – Magnitude (Size) of rating changes on Stock CAR(-1,1) using Standard Market model				
Variables	Upgrades		Downgrades	
	All (N = 199)		All (N = 256)	
	Coefficients	T-test	Coefficients	T-test
Intercept	-0.0196	-1.25	0.1135	1.36
RATGCH	0.0245	1.83*	-0.0528	-6.21***

4.2 Cross-sectional Multivariate Regressions

We conduct multiple regression analysis to explore the effect of rating changes across or within investment- or speculative-grade subgroup (CROSS) and the magnitude of change variables (RATGCH) on abnormal returns (CARs). Using full sample from several countries, we also add country as fixed effect

variable to investigate whether the market impact is still exists by consider average cumulative abnormal return around announcement event period (days −1 to +1) or CAR (-1,1)

From Table 11, panel B shows that around positive news announcement, we found the statistically significant negative impact of rating change across investment- or speculative-grade boundary on stock price reaction which not in line with our expectation. Moreover, magnitude of change becomes more statistically significant effect on stock price. Panel A and B (Market-adjusted model and Standard Market model) are consistently observed the same result.

Table 11 Cross-section multivariate regression analyses

This table presents the estimated coefficients of the multiple regression. Stock market reaction is measured by the average cumulative abnormal return around announcement event period (days −1 to +1) or CAR (-1,1) and RATGCH denotes the absolute magnitude of rating change, CROSS is dummy variable indicates the changes across investment- or speculative grade boundary and Country is added as fixed effect variable. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Cross-sectional regression on Stock CAR(-1,1) using Market adjusted model				
Variables	Upgrades		Downgrades	
	All (N = 199)		All (N = 256)	
	Coefficients	T-test	Coefficients	T-test
Intercept	-0.0191	-1.26	0.1175	1.37
RATGCH	0.0266	2.05**	-0.0547	-6.10***
CROSS	-0.0220	-2.25**	0.0311	1.32

Panel B – Cross-sectional regression on Stock CAR(-1,1) using Standard Market model				
Variables	Upgrades		Downgrades	
	All (N = 199)		All (N = 256)	
	Coefficients	T-test	Coefficients	T-test
Intercept	-0.2881	-1.37	0.1243	1.49
RATGCH	0.3761	2.09**	-0.0564	-6.46***
CROSS	-0.2868	-2.11**	0.0382	1.67

In this analysis, we add control variables consists of firm-specific and country specific variables to our base model. Table 12 reports the parameter estimates of the regression models examining the effect of the given set of variables on abnormal returns (CARs). First, around upgrade announcements, RATGCH has a statistically significant positive impact on abnormal returns at 10% level. This result confirms that information asymmetry exists between different investor types, which is also supported by Table 10 that the higher magnitude of rating change, the more positive impact on stock price reaction. However, similar evidence is not found for downgrade announcements, which suggests that the negative abnormal returns around downgrades are more likely to be influenced by country-specific variables such as GDP than firm-specific variables. Second, a statistically significant CROSS is documented around upgrade announcements although the coefficients have slightly less impact overall with negative impact on abnormal returns at 10% level (This evidence found in standard market model but not found for market-adjusted model) but insignificant for downgrades, the result can be interpreted in line with the inference made from Table 11 which indicates that investors are more likely to consider the magnitude of rating change than the changes across investment- or speculative grade boundary.

Moreover, the result shows that firm-specific variables are statistically insignificant for both models indicating that the market response to rating changes (both upgrades and downgrades) is not sensitive to the these factors. Size and Leverage ratio have negatively impact to abnormal returns but statistically insignificant, which suggests that range of size and leverage ratio in our sub-sample may not significant different among firms and these variables may not

contain special information for investors. Additionally, the coefficient for Book-to-market ratio has desired sign but insignificant. This suggests the market reactions are not driven by Book-to-market ratio.

On the other hand, around downgrades announcements, GDP has a statistically significant negative effect on abnormal returns. The larger the GDP, the greater negative effect on the abnormal returns. However, we do not find that Inflation has significant impact on abnormal returns for both positive and negative credit change event announcements.

Table 12 Cross-section multivariate regression analyses including control variables

This table presents the estimated coefficients of the multiple regression. Where CAR (-1,1) represents the CARs around the announcement event period (days −1 to +1), RATGCH denotes the absolute magnitude of rating change, CROSS is dummy variable indicates the changes across investment- or speculative grade boundary, SIZE is log of market capitalization, LEV is measured by divide long-term debt by equity, BTM is ratio of firm's book value over market value and Country is added as fixed effect variable. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Cross-sectional regression on Stock CAR(-1,1) using Market adjusted model										
Variables	Upgrades (N = 81)					Downgrades (N = 120)				
	Model1	Model2	Model3	Model4	Model5	Model1	Model2	Model3	Model4	Model5
Intercept	0.0196	0.0177	0.0100	0.0859	0.0832	-0.0428	-0.0390	-0.0214	0.1016	0.1389
RATGCH	0.0346*	0.0348*	0.0348*	0.0354*	0.0351*	0.0029	0.0026	0.0020	-0.0010	-0.0027
CROSS	-0.0247	-0.0247	-0.0247	-0.0227	-0.0228	-0.0072	-0.0088	-0.0125	-0.0092	0.0044
SIZE	-0.0060	-0.0058	-0.0042	-0.0036	-0.0038	0.0046	0.0041	0.0023	0.0026	-0.0020
LEV		0.0833	0.1012	0.0613	0.1055		-0.2677	-0.3581	-0.3651	-0.0670
BTM			-0.0047	-0.0065	-0.0081			-0.0019	-0.0019	0.0002
Inflation				-0.0007	-0.0006				-0.0010*	-0.0011
GDP					-0.0010					0.0056***

Panel B – Cross-sectional regression on Stock CAR(-1,1) using Standard Market model										
Variables	Upgrades (N = 81)					Downgrades (N = 120)				
	Model1	Model2	Model3	Model4	Model5	Model1	Model2	Model3	Model4	Model5
Intercept	0.0036	0.0003	0.0396	0.0699	0.0690	-0.0368	-0.0341	-0.0202	0.1293	0.1689
RATGCH	0.0377*	0.0380*	0.5137*	0.0385*	0.0384*	-0.0018	-0.0020	-0.0025	-0.0061	-0.0079
CROSS	-0.0277*	-0.0278*	-0.3760*	-0.0259*	-0.0260	0.0024	0.0013	-0.0017	0.0023	0.0168
SIZE	-0.0042	-0.0038	-0.1880	-0.0034	-0.0033	0.0047	0.0044	0.0029	0.0033	-0.0016
LEV		0.1438	0.5301	0.1075	0.1223		-0.1896	-0.2608	-0.2693	-0.0472
BTM			-0.0454	-0.0017	-0.0022			-0.0015	-0.0014	0.0008
Inflation				-0.0006	-0.0006				-0.0013	-0.0014*
GDP					-0.0003					0.0060***

5. Additional analyses of Robustness checks

We conduct robustness checks by comparing the result between Market-adjusted returns model and Market model with several model specifications. First, Table 6 panel A and Table 7 panel A, Our results confirm a negative CAR around the event period (day -10 to +10) equal to -1.07%, significant at the 1% level, starting to be negative and significant 10 days before the announcement, and with significant under-reaction to 10 days after. We also find insignificant results for upgrades except period of day 0 to +1 which significant at 1%, confirming our findings with the market-adjust returns model. Furthermore, we compare result between Table 11 and Table 12, presents that the result of multivariate regression model with other control variables includes size, book-to-market ratio, leverage, inflation and GDP. The absolute of rating change remains significant in all these specifications.

6. Conclusion

This study examines the reaction of International stock market around the bond rating change announcements whether these events impact the abnormal return of stock measured by Cumulative abnormal return (CAR) and what extent information asymmetry exists between different investor. Consistent with the findings of previous studies, the empirical results reveal that abnormal stock returns are significantly positive reaction after the upgrades announcement and negative reaction both before and after the downgrades event date. Specifically, the impact of rating changes on stock prices is larger around downgrades. Under limitation of sample size due to data of changes across investment- or speculative-grade boundary, we also find that the CAR is higher in absolute terms when there are rating changes crossing the investment-grade or speculative-grade border. The market reacts strongly to upward changes from speculative grade to investment grade (day -1 to +1) for Market-adjusted return model but insignificant for downward rating changes. The results imply that there is an information effect but no price pressure effect since there is a significant reaction in response to downgrades for all samples insignificance impact following downgrades for sub-sample of the changes across investment- or speculative-grade boundary. Furthermore, the absolute change in rating is statistically significantly related to CAR. With respect to the multiple regressions, we found no evidence of statistically significant book to market ratio, leverage ratio and even size effect but GDP.

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