

**HAVE RATING AGENCIES BECOME MORE CONSERVATIVE?
EVIDENCES FROM CHINESE CORPORATE BOND MARKET**

by

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PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN FINANCE

In the Master of Science in Finance Program
of the
Faculty
of
Business Administration

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SIMON FRASER UNIVERSITY
Fall, 2014

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Abstract

Beginning in 2008, rating agencies have loosen their rating criteria of Chinese corporate bond rating. The change in rating standard remains statistically significant after considering the macroeconomic factors. A lack of diversification in ratings and failure to rate through economic cycle are found. As for the factors that have impact on the rating, Bigger size, higher profitability and better solvency help increase the rating for a corporate bond issuer, while higher liquidity, and lower leverage do harm to the credit rating. Such discoveries are consistent with the conditions in US corporate debt market. Our conclusion is robust after multicollinearity test and adding additional macroeconomic explanatory variables.

Key Words: Rating Agencies; Corporation Bond; Long-term Issuer Credit Rating

Acknowledgements

We could like to extend our thanks to our senior supervisor, Andrey Pavlov, for his instructive advice and useful suggestions. In addition we would like to give special thanks to Derek Yee for his support to our project.

Table of Contents

Approval.....	ii
Abstract	iii
Acknowledgements	iv
Table of Contents	v
1. Introduction.....	1
2. Literature Review	3
3. Data	5
4. Methodologies.....	10
4.1 Multiple Linear Regression with Year Dummies.....	10
4.2 Difference of Coefficients Matrix	10
4.3 Revised Multiple Linear Regression With Period Dummies	11
4.4 Cross Sectional Regression	11
5. Empirical Regression Result.....	13
5.1 Results From the Basic Regression Model.....	13
5.2 Difference of Year Dummies Coefficients Matrix	15
5.3 Results From the Revised Regression Model	16
5.4 Results From Cross-Sectional Analysis	17
6. Robustness Test.....	18
6.1 Multicollinearity Test.....	18
6.2 Additional Specifications of the Explanatory Variables	19
7. Conclusion	24
Bibliography	25
Appendices	27
1. Regression Results of Basic Model with Year Dummies	27
2. Regression Results of Revised Model with Period Dummies.....	29
3. Results From Cross-Sectional Analysis	32
4. Robustness Results Adding Macroeconomic Variables.....	37

1: Introduction

Based on the analysis of US corporate bond market, the rating agencies have become more conservative on the issuer ratings during the period 1985-2009 (Baghai, 2014). As corresponding research about Chinese corporate bond market is limited, we would like to determine whether the credit rating standards of Chinese rating agencies have changed over time.

In China, companies can issue debt through two different concurrently existing systems. The first system began in 1993 at the time of planned economy. This issue system is political approval system with limited issuance offering each year. Under such a system, the criteria before issuance are quite strict. For example, the debt structure of the company should below 40%, and banks should fully guarantee the debt. However, after issuance, credit rating updates are not required. Another system is a more international one, beginning in 2007, called trading registration system. If the issuer meets all the requirement and register relative information in the trading exchange, the debt can be issued without approval from regulation commission.

After the latter corporate bond issuing system showed up, public companies are able to issue corporation bond through two stock exchanges in China after they get credit rating grades from the rating agencies. Their credit ratings are continuously updated by those agencies after issuance if expected default risk changes. Nowadays, the small private enterprises still rely on the first issuing system, while huge government-owned enterprises have already turned their face to the latter system, especially after they are transferred to public-owned corporations. Our study is focused on the corporation debt issuing from the latter system. Besides, we focus on long-term corporation bond, ignoring SCP((Short-term Commercial Paper).

First, we obtain all the credit rating data of corporate bond issuers from Wind database during the sample period 2007 to 2014. Then we choose 27 essential factors as explanatory variables to the rating variable, calculated from the financial statement of the issuers between 2006 and 2013, one-year lag is added to ensure that the ratings are graded based on available information at the time point.

In the panel data described below, we introduce year dummies in the regression model to measure the time effect on rating. As a result, we find all the coefficients of the dummies are statistically significant. Based on the discovery, we divide whole period to two sub-periods. We

redo the regression model with one period dummy for five possible cut-off point choices and get consistent result with the basic model, implying that the credit rating standards relax have happened after the financial crisis.

Further, we try to determine the change in the rating standard between the two sub-periods. We conduct two cross sectional regressions in two periods (without dummies) and compare the estimates of the explanatory variables, using 2011 as a cut-off point in the analysis.

At last, we check the robustness of the rating model to exclude two potential threatens for our discovery. We use the VIF value to exclude the possibility of multicollinearity in explanatory variables. Besides, macroeconomic factors are added to ensure that the inflation in ratings is not simply because of a better economy.

Based on our limited date and research, we can obtain the conclusion that Chinese credit rating agencies become less conservative through time, which indicate an opposite discovery for US agencies.

2: Literature Review

The credit rating agencies play an important role on assessing the financial situations about securities and bonds. There are three main rating agencies in the USA, Fitch Ratings, Moody's Investors Service, and Standard & Poor's. After the subprime crisis in 2008, however, the creditworthiness information of rating agencies was criticized by public as they cannot reflect the market conditions immediately (White (2010)).

Mason and Rosner (2007) advocate the agency ratings were misapplied by the investors. Due to the conflicts between different rating agencies, investors became confused. Additionally, Griffin and Tang (2012) argue that top rating agencies always made positive adjustments beyond its standard model.

There are several government authorized rating agencies in China, such as Dagong Global Credit Rating Co., Golden Credit Rating International Co., United Credit Ratings Co., China Lianhe Credit Rating Co., China Cheng Xin International Credit Rating Co. and so on. The competition between different agencies has occurred. Becker and Milbourn (2011) report that the highly competitive phenomenon will affect the rating market, the effectiveness of ratings will decrease and the ratings agencies may feel pressure to adjust the rating levels to benefit the companies who issued securities.

As investors will make decision based on the rating information, well-known credit ratings agencies will motivate by issuing "friendly" ratings results to protect their excellent reputations (Covitz and Harrison (2003)).

According to these comprehensive situations, financial institutions feel that they cannot rely on these rating reports any more. Partnoy (2009) suggests the overdependence on credit ratings cause the financial crisis and rating policies should be revised to "build trust" between rating agencies and investors.

From several researches, financial institutions find that, even in the same rating, downgraded corporate bond issuers will face different rating transition and default risk compared to upgraded issuers (Hamilton and Cantor (2004)). Based on the data from Chinese market, rating

transition is efficient, imply that in the long term, the credit rating standards are stable in China and the default rate is relatively low.

In this paper, we would like to analyze what kinds of elements will affect the credit rating policy based on the Chinese securities market. In 1998, Blume, Lim and MacKinlay propose that the downgrades of securities credit rating do not mean the securities qualities decline. An alternative explanation is, however, the standard policy of rating agencies become stricter.

There are four main factors which influence Chinese rating standards, the size of company asset portfolio, the debt ratio, investment opportunities and securities issuers' conditions (Tang 2014).

As we mentioned before, Becker and Millbourn (2011) thought the competition between different rating agencies will affect the standard policies of credit ratings. Meanwhile, Jorion, Shi, and Zhang (2008) found that the downward trend in ratings may have occurred regarding to different issuers. The time value of accounting qualities may tight the standards of investment-grade issuers, as well as Alp (2010) show that the structural shift will occur tighten ratings standards.

Regarding to the comparative research between Standard and Poor's (S&P) and Moody's, in 2012, Jiang, Stanford, and Xie demonstrate that who pays for the ratings will impact the rating results. It is obvious that issuer-pay method will obtain a higher securities ratings. Therefore, these findings suggest that the standard policies are attributed to "who pay the bills". At the same time, Zhang and Chen (2014) also point out that, because rating agencies in China are new to some content, the rating results will under pressure of issuer-pay model. Therefore, it's hard to say whether increasing rating level is due to low credit risk.

3: Data

In this paper, all the data is from Wind database, the most widely used finance database in China. Because the history of corporation bond with registration issuance system began in 2007, we investigated the credit rating panel data of all the firms over the period 2007 to 2014 for a total number of 10394 observations. We input the last day of each year in Wind database and get eight cross sectional data outputs, including the rating information of all the existing corporate bonds at that time. For year 2014, we choose 2014-11-30 as the last day. We employ the domestic long-term issuer credit rating, which is used in prior works (e.g. Baghai(2014) & Kisgen(2006)). Governmental enterprises, financials, and utilities are removed from the sample. For many firms in our sample, the credit ratings are not updated annually. In such cases, we use previous rating update to fill up the following years until a new update came out. For those firms issuing more than one corporate bonds at that time, we keep one record and delete others, as they have same long-term issuer credit ratings.

The credit rating data is from a list of qualified Chinese credit rating agencies: Dagong International, Eastern Jincheng, CCXI, Lianhe Rating, China Rating, Shanghai Brilliance Credit Rating, Shanghai Yuandong Credit Rating. Most of the agencies are co-funded with one of the three international rating agencies: S&P, Moody's and Fitch, although the control rights are within Chinese. With international background, these credit rating agencies generally follow the S&P's rating categories although slight differences in judging the risk for each level exist. We adjust the ratings data from all the rating agencies into S&P's rating categories with 22 categories: AAA,AA+,AA,AA-,A+,A,A-,BBB+,BBB,BBB-,BB+,BB,BB-,B+,B,B-,CCC+,CCC,CCC-,CC+,CC,C. When rating decrease, expected default risk increases. In S&P's category, firms with BBB-rating or above are called investment grade firms, and firms with BBB- rating or below are called noninvestment grade or junk-rated firms. However, considering that the credit rating measures the relative default risk compared to other firms, rather than absolute default risk (Standard & Poor's, 2008), and the strict debt issuing policy in China which claims that only the firms with rating higher than AA are qualified for issuing debt, we schedule AA as a more appropriate cut-off point between investment grade and noninvestment grade, with the actual distributions of the ratings in China.

Table 3.1 contains the distributions of the ratings during the sample period on annual basis. Figure 3.1 plots the annual distribution of the corporation bond issuers in rating categories as well as the total number of the issuers during the period. The total number of the issuers experienced an exponential growth during the sample period. We next divide the whole sample into investment grade and non-investment grade with level AA as the cut-off point in Figure 3.2. Different from US corporate debt market, where decline was shown in investment grade debt and increase was shown in noninvestment grade (Baghai (2014)), Chinese corporate debt market show an increase in investment grade firms and a decline in non-investment grade firms. This trend appears to suggest that the credit quality of Chinese corporate debt issuers has improved during the period. As we exposed in the paper, a complementary explanation for this trend is that Chinese rating agencies tend to be more relaxing over time¹.

Besides, we notice that the ratings tend to be more centralized in AA ratings. It comes with a decline in the standard deviation. A failure to diversify the ratings implies that the ratings don't fairly represent the risk of the firms to the investors.

Table 3.1 *Number of companies by year and rating categories*
The table contains the distribution of ratings for the sample period. As the table is generated from the annual statistics pages of corporation bond from Wind database, due to different access to data, this number is slightly different from our sample size.

Rate	AAA	AA+	AA	AA-	A+	A	A-	BBB&below	Sum
2007	47	40	63	83	61	21	2	3	320
	14.69%	12.50%	19.69%	25.94%	19.06%	6.56%	0.63%	0.94%	100.00%
2008	78	65	92	109	57	18	1	1	421
	18.53%	15.44%	21.85%	25.89%	13.54%	4.28%	0.24%	0.24%	100.00%
2009	133	120	160	158	39	9	2	1	622
	21.38%	19.29%	25.72%	25.40%	6.27%	1.45%	0.32%	0.16%	100.00%
2010	191	162	310	190	32	13	2	1	901
	21.20%	17.98%	34.41%	21.09%	3.55%	1.44%	0.22%	0.11%	100.00%
2011	261	276	495	280	57	11	4	8	1392
	18.75%	19.83%	35.56%	20.11%	4.09%	0.79%	0.29%	0.57%	100.00%
2012	317	397	886	437	100	8	3	12	2160
	14.68%	18.38%	41.02%	20.23%	4.63%	0.37%	0.14%	0.56%	100.00%
2013	370	492	1279	528	103	11	10	23	2816
	13.14%	17.47%	45.42%	18.75%	3.66%	0.39%	0.36%	0.82%	100.00%
2014	460	604	1598	534	59	10	5	23	3293
	13.97%	18.34%	48.53%	16.22%	1.79%	0.30%	0.15%	0.70%	100.00%

¹ Another possible explanation is that the credit ratings increase simply because of a better economy. We will evaluate this alternative explanation later in Robustness chapter.

Figure 3.1 Percentage Distribution of the rating categories
 The main axis measures the number of existing corporate bond issuers in each rating categories (bar graph). The sub axis measures the total number of the issuers during the period 2007-2014 (line graph).

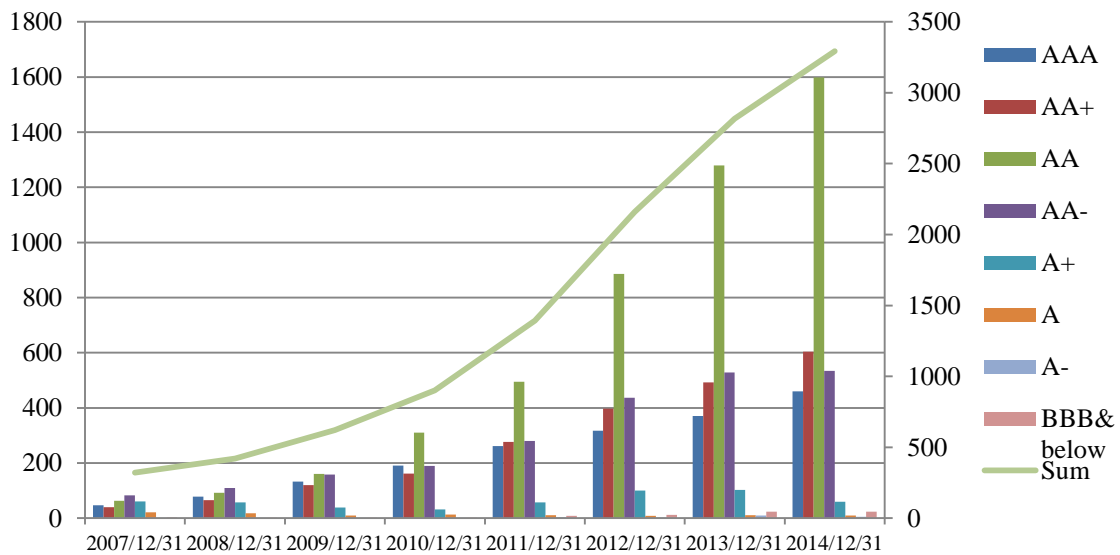
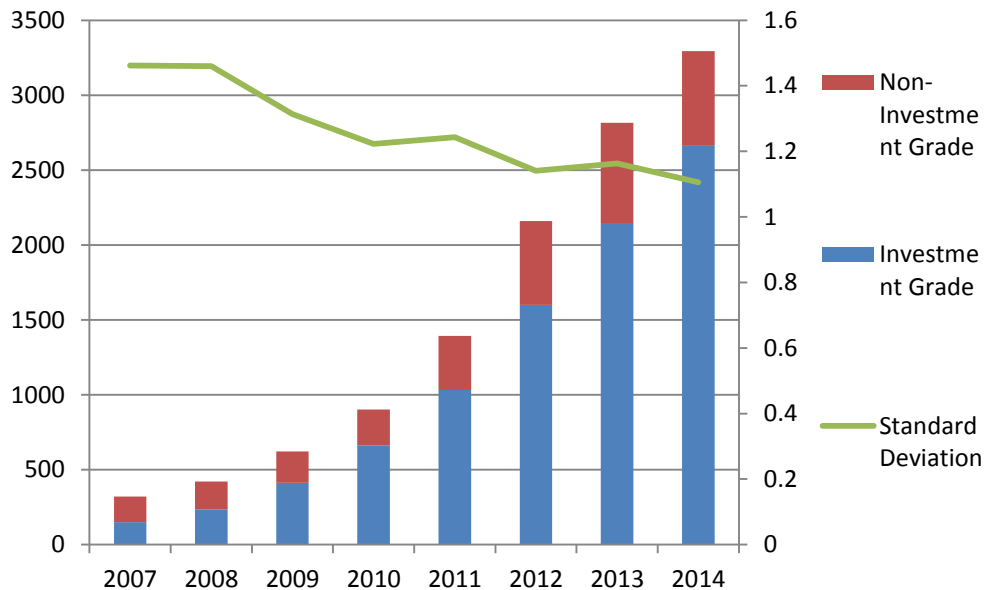


Figure 3.2 Number of investment grade and non-investment grade
 This graph employs the rate AA as a cut-off point and presents the changes in number of the firms of investment grade and non-investment grade on main axis (left). Standard Deviation of the ratings are plotted on The sub axis (right).



Before we do regression, we translate the alphanumeric credit rating levels into numerical scores by adding one point for each rating level. For example, a AAA rating is translated to 22, AA+ is translated to 21, etc. The lowest rating C is translated to 1. Under such translation form, the higher the score is, the higher the credit rating, and the lower the expected default risk is. After the translation, we are able to estimate the impact of the financial statement data on the credit rating.

Afterwards, we match ratings data (dependent variables) with annual financial statement data (explanatory variables) for each firm during the period 2007-2014.

When selecting the explanatory variables, we first follow the prior literature such as Baghai (2014), and then conduct an interview to current professionals in CCXI (one of the most authorized rating agencies) to fit Chinese market. Some variables are removed based on the high correlation (for example, we remove total asset and total cash, and keep cash/asset ratio). Given the limitation of the database and the short sample period, some variables that are included in Baghai (2014)'s paper have to be ruled out, such as PPE/Asset, Rent Payment/Asset, Volatility of profitability (In fact, these variables are also statistically insignificant in the rating model).

After the initial selection, we employ the following explanatory variables in our analysis: 1) total cash divided by total asset (Cash/Asset); 2) log of the total asset (Size 1); 3) total debt, including long-term and short-term debt; 4) Interest Bearing Debt; 5) total debt minus cash (Net Debt); 6) Operating Cash Flow; 7) Investing Cash Flow; 8) Financing Cash Flow; 9) log of total revenue (Size 2); 10) EBITDA; 11) Net Profit; 12) total operating income divided by total sales (Operating Margin); 13) the difference of operating income in two continuous year divided by the operating income of previous year (Operating Income Growth); 14) ROA; 15) ROE; 16) EBITDA/Revenue; 17) Operating Cash Flow/EBITDA; 18) Current Ratio; 19) Quick Ratio; 20) Inventory Turnover; 21) Book Leverage (Debt/Assets); 22) Short-term Debt/Total Debt; 23) Interest-bearing Debt/Invested Capital; 24) Cash/ Short-term debt; 25) Cash/Total Debt; 26) Interest Coverage Ratio; 27) EBITDA/Interest-bearing Debt.

To ensure that the annual financial statement information is available for the rating agency when rating the firm for that year, we set a one-year lag for the financial statement data, which means that we employ the annual financial statement data for corresponding firms during the period 2006-2013. We choose annual report as the source of the financial data to maintain consistency of the period. For those firms failing to match their ratings data with their lagged

financial statement data, we give up the observations. At last we got a total number of 8774 valid observations in our final panel database.

In addition, we obtain year dummies in our model to detect the impact of different years on the rating variables. To exclude the perfectly multicollinearity in year dummies, we set the first year 2007 as benchmark, and then add seven year dummies for 2008, 2009...2014, respectively. The year dummies are replaced by one period dummy in a further regression model. The value of the dummies is 1 if the ratings were graded in that time, 0 if not.

Later, in the robustness section, we introduced macroeconomic data in the regression model following Baghai's paper(2014): (1) GDP growth. We employ the GDP YoY growth. As the GDP growth for 2014 has not announced, we calculate the GDP growth for 2014 using the GDP Month to Month growth data, from Nov, 2013 to Oct, 2014. (2) Inflation rate. We employ the CPI YoY growth. We calculate CPI growth of 2014 using the same approach as GDP growth of 2014. (3) Slope of the term structure, computed as the yield on the constant-maturity 10-year Treasury bond minus the yield on the constant-maturity three-month T-bill in US market. Here in China, we compute it as the yield on the 10-year government bond minus the three-month government bond. Both the yield information is from the ChinaBond.com. (4) Corporate debt market index annual return volatility. Because the corporate debt market index began in 2008-1-2, we set the volatility as zero in 2007. The volatility in 2014 is calculated based on the daily data from 2014-1-1 to 2014-12-02.

4: Methodologies

4.1 Multiple Linear Regression with Year Dummies

In our basic model, we conduct one multiple linear regression with year dummies added in the overall panel data, to measure the impact of the year effect on the rating variables. The dependent variable is the numeric credit rating score of one firm at a specific time, and the explanatory variables are information of the firms that may have impact on the rating.

Besides, OLS is used in the basic model other than ordered logit, as OLS is more straightforward to study economic significance. Moreover, as unobservable firm specific variables exist, OLS is able to avoid bias from incidental parameter problems.

The explanatory variables have one year lag than the rating variable and we have a total number of 27 explanatory variables.

For n observations in year t , the multiple linear regression model is:

$$y_{i,t} = \beta_{0,i,t} + \beta_{1,i,t}x_{1,i,t-1} + \beta_{2,i,t}x_{2,i,t-1} + \dots + \beta_{27,i,t}x_{27,i,t-1} + \gamma_1Y_{2008} + \dots + \gamma_7Y_{2014} + \varepsilon_{i,t},$$
$$i = 1, 2, \dots, n; t = 2007, 2008, \dots, 2014$$

In this basic model, $y_{i,t}$ is the rating variable of the i^{th} observation in year t . $\beta_1, \beta_2, \dots, \beta_{27}$ represent the coefficients of the explanatory variables. x_1, x_2, \dots, x_{27} represent the 27 one-year-lagged explanatory variables. $Y_{2008}, Y_{2009}, \dots, Y_{2014}$ are year dummies. $\gamma_1, \gamma_2, \dots, \gamma_7$ represent the coefficients of the year dummies. The key variables in this regression are year dummies.

4.2 Difference of Coefficients Matrix

On the basis of the coefficients of the year dummies, we employ the method to calculate the difference matrix between each coefficients, also the t-stat value for each difference to test their significance.

When calculating the standard error of the difference of the coefficients, we use the formula below:

$$SD(Diff_{a,b}) = \sqrt{Var_a + Var_b - 2 * Cov_{a*b}}$$

The degree of freedom is the number of the observations minus the number of the parameters.

4.3 Revised Multiple Linear Regression with Period Dummies

On the basis of the initial linear model, we partitioned the panel data in the sample period 2007-2014 to two sub-periods, the pre-period and post-period, then employ one period dummy to replace the year dummies. Pre-period is benchmark and the period dummy stands for the post-period (the value of the period dummy is 1 if it is post-period, 0 if it is pre-period). OLS estimation method, rating variables and explanatory variables unchanged.

To satisfy the constraint that each sub-period should at least contain two years, we have five possible cut-off year point choices². Five revised regressions are conducted based on those cut-off year point choices.

For n observations in year t, the revised multiple linear regression model is:

$$y_{i,t} = \beta_{0,i,t} + \beta_{1,i,t}x_{1,i,t-1} + \beta_{2,i,t}x_{2,i,t-1} + \dots + \beta_{27,i,t}x_{27,i,t-1} + \gamma_1P + \varepsilon_{i,t},$$

$$i = 1, 2, \dots, n; t = 2007, 2008, \dots, 2014$$

In this revised model, $y_{i,t}$ is the rating variable of the i^{th} observation in year t. $\beta_1, \beta_2, \dots, \beta_{27}$ represent the coefficients of the explanatory variables. x_1, x_2, \dots, x_{27} represent the 27 one-year-lagged explanatory variables. P is period dummy. If year t belongs to P, then P=1, or P=0 if not. γ_1 represent the coefficient of the period dummy, which is our key interest.

4.4 Cross Sectional Regression

Further, we try to find out how the rating standard changes between pre-period and

² The cut-off point year is categorized in the post-period, thereby a starting year of the post-period.

post-period. Therefore, for each cut-off point choice, we conduct two cross-sectional regressions based on the pre-period and on post-period respectively. As we have five cut-off point choices, we report 5 groups in a total of 10 regression results here, and focus on the coefficient of the explanatory variables this time.

Given each cut-off year point Y , for n observations in year t , the two cross sectional regression models are:

$$y_{i,t} = \beta_{0,i,t} + \beta_{1,i,t}x_{1,i,t-1} + \beta_{2,i,t}x_{2,i,t-1} + \dots + \beta_{27,i,t}x_{27,i,t-1} + \varepsilon_{i,t},$$

$$i = 1, 2, \dots, n; t \in [2007, Y); Y \in [2009, 2013]$$

$$y_{i,t} = \beta_{0,i,t} + \beta_{1,i,t}x_{1,i,t-1} + \beta_{2,i,t}x_{2,i,t-1} + \dots + \beta_{27,i,t}x_{27,i,t-1} + \varepsilon_{i,t},$$

$$i = 1, 2, \dots, n; t \in [Y, 2014]; Y \in [2009, 2013]$$

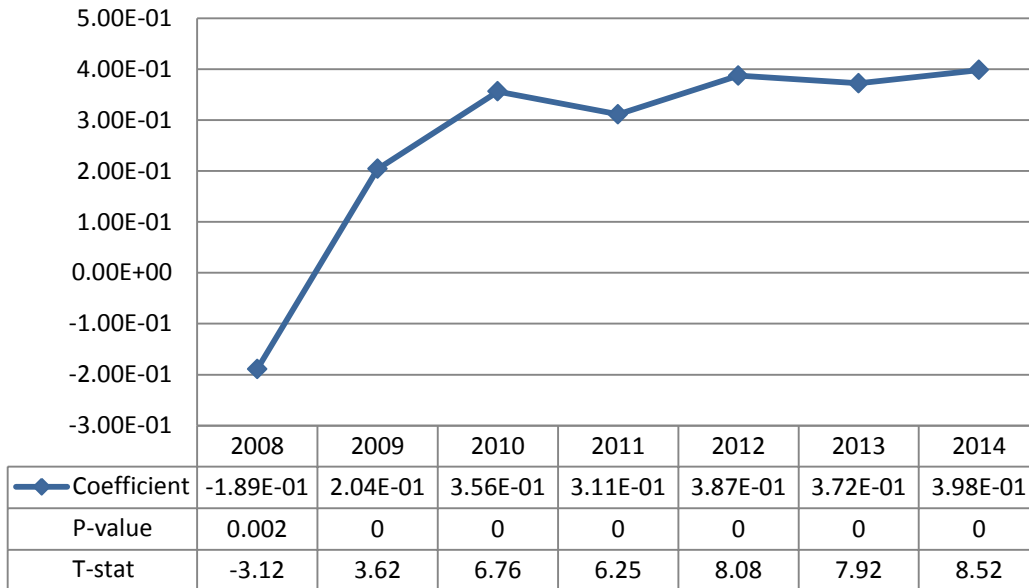
$y_{i,t}$ is the rating variable of the i^{th} observation in year t . $\beta_1, \beta_2, \dots, \beta_{27}$ represent the coefficients of the explanatory variables. x_1, x_2, \dots, x_{27} represent the 27 one-year-lagged explanatory variables. We analyse changes in $\beta_1, \beta_2, \dots, \beta_{27}$ both in-group and between-group.

5: Empirical Regression Result

5.1 Results From the Basic Regression Model

Table 5.1 presents the basic regression result for the panel data (See Appendix 1). The model is generated from STATA. Missing values are considered as invalid observations and removed so that a total number of 8774 observations are obtained in the model. Figure 5.1 plots the coefficients of the seven year dummies during period 2008-2014.

Figure 5.1 *Coefficients of year dummies during period 2008 to 2014*
 The main axis (left) plots the coefficients of the year dummies from 2007 to 2014 (blue line).
 The sub axis (right) plots the standard deviation of the numeric ratings from 2007 to 2014 (red line).



Observing the coefficient of the eight year dummies, we found that all the year dummies show positive statistically insignificant impact on the ratings, except for 2008, which has a negative sign. The coefficients show an increasing trend, from -0.189 at year 2008 to 0.398 at year 2014. It appears to suggest that the rating standard keeps relaxing through 2008 to 2014, compared to 2007 the benchmark.

As for other explanatory variables, we obtain the result that 11 of 27 finance statement variables show statistically significance at 95% significance level. They are: (1) Cash/Asset; (2) Size 1(log of Total Asset); (3) Size 2(log of Total Revenue); (4) ROA; (5) ROE; (6) Current Ratio; (7) Debt/Assets; (8) Short-term Debt/Total Debt; (9) Cash/Short-term Debt; (10) Cash/Total Debt; (11) EBITDA/Interest-bearing Debt. Of all the significant variables, (2) Size 1(log of Total Asset); (3) Size 2(log of Total Revenue); (4) ROA; (5) ROE; (7) Debt/Assets; (9) Cash/Short-term Debt; (10) Cash/Total Debt; (11) EBITDA/Interest-bearing Debt have positive impact on the rating, and (1) Cash/Asset; (6) Current Ratio; (8) Short-term Debt/Total Debt have negative impact on the rating.

This result is consistent with the interview to the professionals in CCXI rating agencies that size, profitability, liquidity, solvency and capital structure of a firm play the most important role in ratings. Size1(log of Total Asset) and Size2(log of Total Revenue) measure the size of a firm. When the size increases, the rating level becomes better; ROA, ROE measure the profitability of a firm. A better profitability implies a better credit rating. As for the solvency of the firm, Cash/short-term Debt, Cash/Total Debt, EBITDA/interest-bearing Debt increase with a better solvency, thereby a better credit quality, while Short-term Debt/Total Debt decrease with a better solvency.

However, we also find some interesting phenomenon which reverses the common sense. First, the coefficients of the liquidity of the firm (Cash/asset and Current Ratio) are both negative, implying that a better liquidity worsens the credit rating. Moreover, the positive correlation between capital structure (Debt/Asset) and rating leads to the argument that a higher leverage benefits the credit rating. Both discoveries are contrary to the public belief that a better liquidity and a lower leverage should imply a higher credit quality of the corporation debt.

Nevertheless, such controversy is consistent with the US debt market, where a higher liquidity and a lower leverage also play a negative role in rating (Baghai 2014). Baghai argues that, the reason of the phenomenon is that a bad credit rating tends to have impact on the firm's

decision about the cash holding and the capital structure. Firms will hold more cash and lower their leverage when they are disadvantaged by worse credit rating.

5.2 Difference of Year Dummies Coefficients Matrix

Table 5. 2 *Difference of the year dummies coefficients matrix*
The coefficients of the year dummies are generated from the original multiple linear model with year dummies. For the cell of row i , column j, the first number in it is difference=coefficient(i)-coefficient(j). The number in the bracket is t-stat of the difference

Diff	2007	2008	2009	2010	2011	2012	2013	2014
2007	0							
2008	-0.189** (-3.115)	0						
2009	0.204*** (3.616)	0.393*** (7.039)	0					
2010	0.356*** (6.755)	0.545*** (10.462)	0.152** (3.266)	0				
2011	0.311*** (6.249)	0.500*** (10.163)	0.107* (2.469)	-0.045 (-1.182)	0			
2012	0.387*** (8.079)	0.576*** (12.162)	0.183*** (4.444)	0.031 (0.865)	0.076* (2.440)	0		
2013	0.372*** (7.916)	0.562*** (12.040)	0.168*** (4.198)	0.016 (0.477)	0.061* (2.068)	-0.014 (-0.552)	0	
2014	0.398*** (8.516)	0.587*** (12.663)	0.194*** (4.883)	0.042 (1.240)	0.087** (2.981)	0.011 (0.442)	0.026 (1.095)	0

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Looking into the table, we find that most of the differences between the coefficients of the year dummies are statistically significant on 95% confidence level. The result further proves that the difference of the rating standard do exist through time.

5.3 Results From Revised Regression Model

According to the coefficient of year dummies during the sample period (from 2007 to 2014), the figure illustrate a relaxing rating standard trend occurred. We would like to further figure out whether the trend still exist when we use dummies for periods longer than one year.

Table 5.3 Cross Section Regression Results in Two Sub Periods
Model(1) is the original regression result with year dummies as a comparison. Model(2) to model(6) are revised regression results with cut-off period points of 2009,2010,...,2013, respectively. See full regression result in Appendix 2.

	(1)	(2)	(3)	(4)	(5)	(6)
year2008	-0.189** (-3.12)					
year2009	0.204*** (3.62)					
year2010	0.356*** (6.76)					
year2011	0.311*** (6.25)					
year2012	0.387*** (8.08)					
year2013	0.372*** (7.92)					
year2014	0.398*** (8.52)					
Post0914		0.455*** (14.13)				
Post1014			0.340*** (13.39)			
Post1114				0.216*** (10.23)		
Post1214					0.171*** (9.31)	
Post1314						0.106*** (6.16)

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.3 contains the regression results for the period dummies from all cut-off point year choices, from 09 to 13. (See full regression result in Appendix 2). We don't include 08 and 14 in the results, as in such cases, only one year include in one of the two sub-periods, which may be unpersuasive. We can see that all the coefficients of the period dummies in five models are statistically significant based on 99.9% confidential level. This table obviously implies that Chinese credit rating agencies have loosen their standards during time.

As for the coefficients of the explanatory table, all the signs and significance of the explanatory variables stay consistency in all the original and revised models. Therefore, the discoveries about the impact on the ratings from the original model stay the same in revised model.

5.4 Results From Cross-Sectional Analysis

See Appendix 3.

6: Robustness Test

In this section, we test a series of potential problems that may undermine our conclusion. The first problem is that, as our explanatory variables are from the financial statement of firms, the variables may have multicollinearity effects. We use STATA to calculate the VIF value for each explanatory variable to test the effect. Next, our finding about the rating standard relax has another possible interpretations, which is that the rating agencies simply have adjusted their criteria over time to respond to the changes in the macroeconomic environment. To test this argument, we add additional explanatory variables to explain the impact of the macroeconomic environment on ratings, and focus on the new coefficients of time dummies. If the time effects still exist in our model after we add macro-economic explanatory variables, then we can exclude the alternative explanation.

6.1 Multicollinearity Test

Considering that there may exists multicollinearity in the explanatory variables, we first conduct a VIF test for the variables of the basic regression model with year dummies, and the variables of the further regression model with two sub-period year dummies. The result is exhibited in table 6.1. All the VIF value of the year dummies and the period dummy are below 10. Therefore, the possibility of multicollinearity in the time dummies can be excluded.

However, we also notice some variables have high VIF. Although those variables are all insignificant in the model, a high average VIF implies that the whole model may be unstable in the multicollinearity. A future solution for this problem would be excluding those explanatories and redo the regressions.

Table 6.1 *VIF value of the explanatory variables*
Model(1) is the original regression result with year dummies; Model(2) is the revised regression model with two sub-period dummies.

	(1)	(2)
Period (2011-2014)		1.06
year2008	1.97	-
year2009	2.35	-
year2010	3.00	-

	(1)	(2)
year2011	3.81	-
year2012	4.86	-
year2013	5.76	-
year2014	6.21	-
Cash/Asset	6.22	6.20
Size 1	3.37	3.36
Total Debt	36.87	36.83
Interest Bearing Debt	101.90	101.88
Net Debt	42.28	42.27
Operating Cash Flow	44.04	43.83
Investing Cash Flow	54.04	53.77
Financing Cash Flow	7.77	7.74
Size 2	3.92	3.91
EBITDA	85.60	85.45
Net Profit	18.85	18.84
Operating Margin	1.00	1.00
Operating Income Growth	1.01	1.00
ROA	1.59	1.56
ROE	1.15	1.15
EBITDA/Revenue	1.05	1.04
Operating Cash Flow/EBITDA	1.00	1.00
Current Ratio	3.22	3.22
Quick Ratio	6.86	6.86
Inventory Turnover	1.01	1.01
Debt/Assets	7.01	7.00
Short-term Debt/Total Debt	2.29	2.28
Interest-Bearing Debt/Invested Capital	5.83	5.83
Cash/Short-term Debt	4.60	4.59
Cash/Total Debt	6.39	6.39
Interest Coverage Ratio	1.00	1.00
EBITDA/Interest Bearing Debt	1.10	1.10
Mean VIF	14.09	16.11

6.2 Additional Specifications of the Explanatory Variables

The purpose of this test is to evaluate the alternative explanation for our findings: Rating agencies might just simply raise all the rating levels of the firms to fit a better macro-economic condition, rather than relaxing their standard.

Following the Baghai's paper (2014), we add four macroeconomic variables which may have impact on the ratings variables in our regression model: (1) GDP growth; (2) Inflation; (3) the Slope of Term Structure; (4) Corporation Debt Market Volatility³.

The first way to evaluate the explanation is to add these variables in both the model with year dummies and the revised regression models with different period dummies. However, the year dummies absorb the variation in the macro variables, several of the coefficients on the year dummies are therefore no longer identified. This phenomenon is similar in Baghai's paper (2014) about US market. As such, it becomes impossible to interpret the coefficients on the remaining year dummies. (Baghai, 2014).

To address the problem, we conduct a second way: follow the solution in Baghai's paper, including a linear time trend variable instead of the year dummies. The linear time trend variable value equals to 1 when the observation happened at 2007, equals to 2 when 2008,....etc. After we generate this trend variable, we first report a regression model with a time trend and without the macroeconomic variables in model(11), then include a regression model with a time trend and with the macroeconomic variables in model(12). The results are presented at table 6.2.

The result from the first way is not perfect: With cut-off point 2010, 2011, 2013, the period dummy coefficients are statistically significant at 95% confidence interval after adding the macroeconomic variables. However, with cut-off point 2009 and 2012, the dummy is no longer significant.

The result from the second way is more satisfactory. As we proposed in the paper, in model (11), the linear trend variable shows a statistically significant positive impact on ratings on 99.9% confidence level. After we add the macro variables on the basis of model(11), the coefficient of linear trend variable falls to 95% confidence level, but still stays positive and statistically significant. Such finding further proves our conclusion that, even excluding the explanatory power on the macro economy changes from the time effect, the inflation on the ratings still exist through time.

Looking into the coefficients of the macroeconomic variables, we found almost all of them are statistically significant at least on 95% confidence interval. Only group1 (09-14) and group2 (10-14) are exceptions. The GDP growth and market volatility have negative impact on

³ The method to calculate those variables are shown on Data chapter. See Appendix 4 for full database.

rating, while the CPI and Term Structure slope have positive impact on rating. ⁴The signs of GDP growth variable and CPI variable are inverted from the result in US market and also opposite to our common sense. A possible explanation about the discovery may be the unstable estimation.

Nevertheless, the statistically significant coefficients of the macro economic variables at least imply an embarrassing failure of the rating job, since the rating agencies should “rate through the cycle” (Standard&Poors, 2008).

⁴ Nevertheless, these discoveries are not warranted, because the model consist some variables which have high VIFs, so estimations here may be unstable.

Table 6.2 Robustness result adding macro-economic variables

Results from 5 groups with different cut-off year plus a result from linear model are presented in the table. The first row gives the five groups, named by the range of their post-period .e.g. Post0914 means this group is cut off by 2009, and the post-period is from 2009 to 2014. Model (1), Model (3)...Model (9) are without macro-economic variables, compared to Model (2), Model (4)...Model (10) with macro-economic variables. Model (11) is regression model with only the linear trend variable; model (12) is regression model with both the linear trend variable and with macro-economic variables.

	Post0914		Post1014		Post1114		Post1214		Post1314		Linear Trend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post0914	0.455*** (14.13)	0.153 (1.39)										
Post1014			0.340*** (13.39)	0.220** (2.87)								
Post1114					0.216*** (10.23)	-0.194* (-2.31)						
Post1214							0.171*** (9.31)	4.23E-03 (0.07)				
Post1314									0.106*** (6.16)	0.0732* (2.45)		
Linear Trend											0.0544*** (12.17)	0.0276* (1.99)
GDP Growth		-7.382 (-1.90)		-4.989 (-1.69)		-16.16*** (-7.37)		-12.38*** (-8.37)		-14.12*** (-8.74)		-10.09*** (-5.47)
CPI Growth		3.146 (1.47)		0.308 (0.14)		7.301*** (5.12)		5.695** (2.91)		8.256*** (5.06)		5.939*** (4.82)
Term Structure Slope		0.14		0.138* (0.14)		0.225*** (5.12)		0.271*** (2.91)		0.375*** (5.06)		0.296*** (4.82)

	Post0914		Post1014		Post1114		Post1214		Post1314		Linear Trend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		(1.36)		(2.13)		(4.49)		(3.42)		(5.84)		(6.04)
Market Volatility		-165.8**		-114.7*		-291.3***		-230.3***		-247.8***		-202.8***
		(-3.25)		(-2.53)		(-8.68)		(-11.07)		(-11.31)		(-8.14)
<i>N</i>	8774	8774	8774	8774	8774	8774	8774	8774	8774	8774	8774	8774

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7: Conclusion

After analyzing the credit rating data of a sample size of 8774 valid observations through the period 2007 to 2014, our research leads to the conclusion that rating agencies in China tend to loose their rating standard through time especially after the financial crisis, which is opposite to the findings in US debt market.

Besides, we explore the factors that may have impact on the ratings. Size, profitability, capital structure, solvency and liquidity would influence a firm's rating. The result is consistent with the claims of the rating agency professionals, except for an interesting discovery that better liquidity and lower book leverage will harm the rating, rather than benefit the rating.

Then, we compare changes in the rating standard between the pre-period 2007 to2010, and the post-period 2011 to 2014.

Last but not least, a decreasing standard deviation of the rating and failure to rate through the economic cycle imply that the rating agencies need to improve their rating quality in the future.

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Appendices

1. Regression Result of Basic Model with Year Dummies

Table 5.1: This model includes all data from 2007 to 2014, with a total number of 8774 valid observations.

Source	SS	df	MS	Number of obs	=	8.77E+03
Model	7.40E+03	3.40E+01	2.18E+02	F(34, 8739)	=	3.63E+02
Residual	5.24E+03	8.74E+03	6.00E-01	Prob > F	=	0.00E+00
Total	1.26E+04	8.77E+03	1.44E+00	R-squared	=	5.86E-01
				Adj R-squared	=	5.84E-01
				Root MSE	=	7.74E-01

Rating	Coef.	Std.Err.	t	P> t	[95% Conf.	Interval]
year2008	-1.89E-01	6.08E-02	-3.12E+00	2.00E-03	-3.09E-01	-7.03E-02
year2009	2.04E-01	5.64E-02	3.62E+00	0.00E+00	9.33E-02	3.14E-01
year2010	3.56E-01	5.26E-02	6.76E+00	0.00E+00	2.52E-01	4.59E-01
year2011	3.11E-01	4.97E-02	6.25E+00	0.00E+00	2.13E-01	4.08E-01
year2012	3.87E-01	4.78E-02	8.08E+00	0.00E+00	2.93E-01	4.80E-01
year2013	3.72E-01	4.70E-02	7.92E+00	0.00E+00	2.80E-01	4.64E-01
year2014	3.98E-01	4.67E-02	8.52E+00	0.00E+00	3.06E-01	4.89E-01
Cash/Asset	-7.45E-01	2.65E-01	-2.81E+00	5.00E-03	-1.27E+00	-2.25E-01
Size 1	1.44E+00	3.14E-02	4.57E+01	0.00E+00	1.37E+00	1.50E+00
Total Debt	-1.55E-06	6.59E-05	-2.00E-02	9.81E-01	-1.31E-04	1.28E-04
Interest Bearing Debt	-7.65E-05	1.87E-04	-4.10E-01	6.82E-01	-4.42E-04	2.89E-04
Net Debt	1.50E-05	1.44E-04	1.00E-01	9.17E-01	-2.66E-04	2.96E-04
Operating Cash Flow	-2.36E-04	3.81E-04	-6.20E-01	5.36E-01	-9.83E-04	5.11E-04
Investing Cash Flow	3.11E-04	3.56E-04	8.70E-01	3.82E-01	-3.87E-04	1.01E-03
Financing Cash Flow	1.10E-04	3.18E-04	3.50E-01	7.30E-01	-5.13E-04	7.32E-04
Size 2	5.32E-01	2.19E-02	2.43E+01	0.00E+00	4.89E-01	5.75E-01
EBITDA	-3.03E-05	4.60E-04	-7.00E-02	9.48E-01	-9.32E-04	8.72E-04
Net Profit	-9.87E-04	5.38E-04	-1.83E+00	6.70E-02	-2.04E-03	6.82E-05
Operating Margin	-6.02E-07	4.37E-07	-1.38E+00	1.68E-01	-1.46E-06	2.54E-07
Operating Income Growth	-1.20E-05	6.75E-06	-1.78E+00	7.60E-02	-2.52E-05	1.25E-06
ROA	9.06E-03	2.33E-03	3.90E+00	0.00E+00	4.50E-03	1.36E-02

Rating	Coef.	Std.Err.	t	P> t	[95% Conf.	Interval]
ROE	6.13E-03	3.41E-04	1.80E+01	0.00E+00	5.46E-03	6.80E-03
EBITDA/Revenue	2.19E-05	8.91E-06	2.46E+00	1.40E-02	4.46E-06	3.94E-05
Operating Cash Flow/EBITDA	2.28E-04	2.49E-04	9.20E-01	3.60E-01	-2.60E-04	7.15E-04
Current Ratio	-1.39E-02	2.60E-03	-5.33E+00	0.00E+00	-1.90E-02	-8.77E-03
Quick Ratio	-6.62E-04	7.65E-03	-9.00E-02	9.31E-01	-1.56E-02	1.43E-02
Inventory Turnover	1.57E-05	1.27E-05	1.24E+00	2.17E-01	-9.23E-06	4.07E-05
Debt/Assets	4.94E-03	1.38E-03	3.58E+00	0.00E+00	2.23E-03	7.64E-03
Short-term Debt/Total Debt	-7.18E-03	5.33E-04	-1.35E+01	0.00E+00	-8.23E-03	-6.14E-03
Interest-Bearing Debt/Invested Capital	-1.79E-03	1.03E-03	-1.74E+00	8.20E-02	-3.81E-03	2.29E-04
Cash/Short-term Debt	3.98E-02	1.27E-02	3.13E+00	2.00E-03	1.48E-02	6.47E-02
Cash/Total Debt	5.87E-01	1.14E-01	5.14E+00	0.00E+00	3.63E-01	8.11E-01
Interest Coverage Ratio	1.42E-06	1.60E-06	8.90E-01	3.76E-01	-1.72E-06	4.57E-06
EBITDA/Interest Bearing Debt	2.70E-04	7.28E-05	3.71E+00	0.00E+00	1.27E-04	4.13E-04
Constant	1.65E+01	1.01E-01	1.64E+02	0.00E+00	1.63E+01	1.67E+01

2. Regression Result of Revised Model with Period Dummy

Table 5.3: Model(1) is the original regression result with year dummies as a comparison. Model(2) to model(6) are revised regression results with cut-off period points of 2009, 2010, ..., 2013, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
year2008	-0.189** (-3.12)					
year2009	0.204*** (3.62)					
year2010	0.356*** (6.76)					
year2011	0.311*** (6.25)					
year2012	0.387*** (8.08)					
year2013	0.372*** (7.92)					
year2014	0.398*** (8.52)					
Post0914		0.455*** (14.13)				
Post1014			0.340*** (13.39)			
Post1114				0.216*** (10.23)		
Post1214					0.171*** (9.31)	
Post1314						0.106*** (6.16)
Cash/Asset	-0.745** (-2.81)	-0.782** (-2.95)	-0.751** (-2.82)	-0.664* (-2.49)	-0.638* (-2.39)	-0.692** (-2.58)
Size 1	1.435*** (45.69)	1.426*** (45.41)	1.432*** (45.54)	1.433*** (45.33)	1.430*** (45.20)	1.420*** (44.81)
Total Debt	-1.55E-06 (-0.02)	6.43E-06 (0.10)	1.25E-05 (0.19)	1.89E-05 (0.28)	2.22E-05 (0.33)	3.15E-05 (0.47)
Interest Bearing Debt	-7.65E-05 (-0.41)	-7.31E-05 (-0.39)	-8.40E-05 (-0.45)	-6.79E-05 (-0.36)	-6.87E-05 (-0.37)	-7.43E-05 (-0.39)
Net Debt	1.50E-05 (0.10)	1.52E-05 (0.11)	8.68E-06 (0.06)	-3.50E-06 (-0.02)	-2.03E-06 (-0.01)	3.18E-08 0.00

	(1)	(2)	(3)	(4)	(5)	(6)
Operating Cash Flow	-2.36E-04 (-0.62)	-3.04E-04 (-0.80)	-3.74E-04 (-0.99)	-1.70E-04 (-0.44)	-2.89E-04 (-0.76)	-4.69E-04 (-1.22)
Investing Cash Flow	3.11E-04 (0.87)	3.40E-04 (0.95)	1.87E-04 (0.53)	2.95E-04 (0.82)	2.12E-04 (0.59)	1.80E-04 (0.50)
Financing Cash Flow	1.10E-04 (0.35)	3.20E-05 (0.10)	-6.14E-06 (-0.02)	9.88E-05 (0.31)	1.38E-05 (0.04)	-7.87E-05 (-0.25)
Size 2	0.532*** (24.30)	0.533*** (24.31)	0.532*** (24.27)	0.524*** (23.80)	0.525*** (23.81)	0.526*** (23.81)
EBITDA	-3.03E-05 (-0.07)	3.29E-05 (0.07)	-3.90E-05 (-0.08)	-1.66E-04 (-0.36)	-1.60E-04 (-0.34)	-3.11E-05 (-0.07)
Net Profit	-9.87E-04 (-1.83)	-9.80E-04 (-1.82)	-1.03E-03 (-1.90)	-9.75E-04 (-1.80)	-9.33E-04 (-1.72)	-9.86E-04 (-1.81)
Operating Margin	-6.02E-07 (-1.38)	-6.23E-07 (-1.42)	-6.25E-07 (-1.43)	-6.03E-07 (-1.37)	-5.80E-07 (-1.32)	-5.91E-07 (-1.34)
Operating Income Growth	-1.20E-05 (-1.78)	-1.29E-05 (-1.91)	-1.33E-05* (-1.97)	-1.28E-05 (-1.89)	-1.05E-05 (-1.55)	-1.16E-05 (-1.71)
ROA	9.06E-03*** (3.90)	7.96E-03*** (3.44)	7.79E-03*** (3.36)	7.00E-03** (3.01)	7.44E-03** (3.19)	7.16E-03** (3.05)
ROE	6.13E-03*** (17.98)	6.12E-03*** (17.92)	6.09E-03*** (17.81)	6.10E-03*** (17.77)	6.13E-03*** (17.82)	6.12E-03*** (17.75)
EBITDA/Revenue	2.19E-05* (2.46)	2.16E-05* (2.42)	2.17E-05* (2.43)	2.56E-05** (2.86)	2.44E-05** (2.71)	2.31E-05* (2.56)
Operating Cash Flow/EBITDA	2.28E-04 (0.92)	2.21E-04 (0.89)	2.23E-04 (0.89)	2.26E-04 (0.90)	2.27E-04 (0.91)	2.30E-04 (0.92)
Current Ratio	-1.39E-02*** (-5.33)	-1.38E-02*** (-5.31)	-1.37E-02*** (-5.25)	-1.41E-02*** (-5.39)	-1.40E-02*** (-5.33)	-1.38E-02*** (-5.27)
Quick Ratio	-6.62E-04 (-0.09)	1.46E-04 (0.02)	-7.58E-04 (-0.10)	-8.87E-04 (-0.12)	-7.40E-04 (-0.10)	8.02E-04 (0.10)
Inventory Turnover	1.57E-05 (1.24)	1.62E-05 (1.27)	1.64E-05 (1.29)	1.59E-05 (1.24)	1.50E-05 (1.16)	1.77E-05 (1.38)
Debt/Assets	4.94E-03*** (3.58)	4.91E-03*** (3.56)	4.60E-03*** (3.33)	4.50E-03** (3.25)	4.71E-03*** (3.39)	4.72E-03*** (3.39)

	(1)	(2)	(3)	(4)	(5)	(6)
Short-term Debt/Total Debt	-7.18E-03***	-7.30E-03***	-7.18E-03***	-7.34E-03***	-7.51E-03***	-7.60E-03***
	(-13.47)	(-13.69)	(-13.44)	(-13.68)	(-14.02)	(-14.13)
Interest-bearing Debt/Invested Capital	-1.79E-03	-1.95E-03	-1.69E-03	-1.61E-03	-1.77E-03	-1.96E-03
	(-1.74)	(-1.90)	(-1.64)	(-1.55)	(-1.71)	(-1.88)
Cash/Short-term Debt	0.0398**	0.0381**	0.0389**	0.0415**	0.0412**	0.0375**
	(3.13)	(2.99)	(3.05)	(3.24)	(3.21)	(2.92)
Cash/Total Debt	0.587***	0.593***	0.585***	0.571***	0.580***	0.597***
	(5.14)	(5.18)	(5.11)	(4.96)	(5.03)	(5.17)
Interest Coverage Ratio	1.42E-06	1.44E-06	1.45E-06	1.44E-06	1.41E-06	1.62E-06
	(0.89)	(0.90)	(0.90)	(0.89)	(0.87)	(1.00)
EBITDA/Interest Bearing Debt	2.70E-04***	2.74E-04***	2.68E-04***	2.62E-04***	2.60E-04***	2.51E-04***
	(3.71)	(3.76)	(3.67)	(3.58)	(3.55)	(3.41)
Constant		16.48***	16.59***	16.74***	16.80***	16.89***
		(170.67)	(175.53)	(179.06)	(181.38)	(183.74)
<i>N</i>	8774	8774	8774	8774	8774	8774

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3. Results From Cross-Sectional Analysis

Further, we try to find out how the rating standard changes between pre-period and post-period. Therefore, we conducted 5 groups of the cross-sectional analysis in a total of 10 regressions. Results are exhibited in table 5.3. As a comparison analysis in 10 regressions would be too much, we choose the cut-off point 2011 to conduct the further analysis below.

As we can see, in the post-period model (5), most of the signs and significance of the explanatory variables stay consistent with our discoveries in the original model.

However, when it comes to the period 1, many explanatory variables show a different significance compared with model (1) and model (2). First, most of the explanatory variables measuring solvency (Cash/Asset, Cash/Short-term Debt, Cash/Total debt), all the explanatory variables measuring profitability of firms (ROA and ROE) lose their statistical significance in the rating model. Second, New statistically significant explanatory variables show up, such as EBITDA/Interest-bearing Debt, showing a positive impact on the ratings.

Regarding to the significant factors in post-period, we believed that financial crisis in 2008 has affected Chinese rating standards. Because of the financial crisis in 2008, Chinese rating agencies pay more attention to company debt liability. Securities issuers who have much debt obligation and do not have enough liquidity cash to operate the business will face downgrade risk.

On the other hand, a significant result of EBITDA/Interest-bearing Debt, which is under 99% confidential intervals, only appears in pre-period (2007-2010). Therefore, in the pre- period, only if the issuer companies can payback loan interest to banks, their securities credit rating grade will not influence a lot.

In 99% confidential interval, total assets (Size1), total revenue (Size2) and current ratio have significant results both in pre-period and post-period. The total asset (Size1) coefficient declines after 2011 while total revenue increase slightly. However, current ratio has a negative coefficient to influence the credit rating standards, which increase a lot after 2011.

Table 5.4 Cross Section Regression Results for 5 groups with different cut-off points.

The first row gives the five groups, named by the range of their post-period .e.g. Post0914 means this group is cut off by 2009, and the post-period is from 2009 to 2014.

Model (1), Model (3)...Model (9) is for pre-period of each group. Model(2),Model(4)...Model(10) is for post-period of each group.

	Post0914		Post1014		Post1114		Post1214		Post1314	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cash/Asset	-1.286 (-0.91)	-0.780** (-2.85)	-1.961 (-1.77)	-0.750** (-2.69)	-1.032 (-1.24)	-0.748* (-2.57)	-0.386 (-0.75)	-0.767* (-2.41)	-0.488 (-1.36)	-0.776 (-1.90)
Size 1	2.117*** (14.82)	1.365*** (42.31)	2.086*** (19.37)	1.344*** (40.67)	1.992*** (26.62)	1.290*** (36.86)	1.805*** (29.96)	1.268*** (34.10)	1.620*** (34.94)	1.189*** (25.53)
Total Debt	6.31E-04 (1.75)	4.05E-05 (0.56)	1.46E-04 (0.62)	3.72E-05 (0.51)	5.65E-05 (0.33)	5.04E-05 (0.64)	2.00E-05 (0.16)	5.90E-05 (0.69)	7.34E-05 (0.79)	6.02E-05 (0.59)
Interest Bearing Debt	-1.22E-03 (-1.30)	-9.57E-05 (-0.47)	-2.41E-04 (-0.38)	-7.63E-05 (-0.37)	-1.17E-04 (-0.27)	-1.07E-04 (-0.48)	-2.04E-04 (-0.62)	-1.04E-04 (-0.42)	-3.21E-04 (-1.25)	1.94E-05 (0.06)
Net Debt	4.56E-04 (0.77)	1.45E-05 (0.09)	-8.60E-05 (-0.22)	-5.06E-06 (-0.03)	6.06E-05 (0.20)	4.90E-06 (0.03)	1.97E-04 (0.83)	-3.63E-05 (-0.18)	2.38E-04 (1.26)	-1.83E-04 (-0.75)
Operating Cash Flow	-2.96E-03 (-1.60)	-5.46E-04 (-1.40)	-1.50E-03 (-1.22)	-4.44E-04 (-1.09)	-8.40E-04 (-1.13)	-7.10E-04 (-1.45)	-7.69E-04 (-1.30)	-9.44E-04 (-1.73)	-7.00E-04 (-1.41)	-1.30E-03 (-1.74)

Investing Cash Flow	-1.42E-03 (-1.04)	2.47E-04 (0.67)	-1.15E-03 (-1.13)	3.52E-04 (0.92)	-4.66E-04 (-0.61)	2.17E-04 (0.51)	-3.29E-04 (-0.59)	4.62E-04 (0.91)	2.28E-04 (0.52)	-5.05E-05 (-0.08)
Financing Cash Flow	-3.60E-04 (-0.33)	-1.56E-04 (-0.47)	-4.99E-04 (-0.57)	-1.48E-04 (-0.43)	-4.60E-04 (-0.78)	-2.99E-04 (-0.72)	-2.31E-04 (-0.49)	-3.52E-04 (-0.75)	7.14E-05 (0.19)	-8.24E-04 (-1.33)
Size 2	0.441*** (4.34)	0.533*** (23.72)	0.376*** (5.06)	0.536*** (23.16)	0.323*** (6.75)	0.567*** (22.40)	0.412*** (10.62)	0.556*** (20.39)	0.456*** (14.79)	0.627*** (17.23)
EBITDA	-2.06E-03 (-1.00)	2.17E-04 (0.45)	-1.62E-03 (-1.04)	2.76E-04 (0.56)	-1.31E-03 (-1.33)	4.43E-04 (0.82)	-9.89E-04 (-1.31)	1.18E-03 (1.80)	-1.96E-04 (-0.31)	1.11E-03 (1.39)
Net Profit	3.04E-03 (1.43)	-1.27E-03* (-2.26)	8.94E-04 (0.54)	-1.32E-03* (-2.29)	5.64E-04 (0.53)	-1.43E-03* (-2.26)	3.11E-04 (0.38)	-2.19E-03** (-2.86)	-2.74E-04 (-0.41)	-2.51E-03* (-2.48)
Operating Margin	-8.69E-05 (-1.37)	-6.04E-07 (-1.39)	-1.39E-04* (-2.38)	-6.00E-07 (-1.39)	-2.26E-06 (-0.73)	-5.51E-07 (-1.26)	-3.89E-06 (-1.53)	-4.76E-07 (-1.10)	-4.45E-06 (-1.82)	-4.93E-07 (-1.11)
Operating Income Growth	6.78E-05 (0.23)	-1.28E-05 (-1.91)	-1.42E-04 (-0.51)	-1.29E-05 (-1.94)	6.36E-06 (0.43)	-1.57E-05* (-2.07)	-7.99E-06 (-0.90)	-1.38E-05 (-1.25)	-1.05E-05 (-1.25)	-1.21E-05 (-1.06)
ROA	2.48E-03 (0.17)	8.41E-03*** (3.50)	1.27E-02 (1.31)	8.73E-03*** (3.52)	2.27E-03 (0.28)	6.87E-03** (2.61)	2.52E-03 (0.40)	7.92E-03** (2.81)	0.0110* (2.38)	5.45E-03 (1.44)
ROE	7.91E-03 (1.22)	6.19E-03*** (18.22)	2.91E-03 (0.74)	6.21E-03*** (18.28)	6.69E-03* (1.98)	6.26E-03*** (18.37)	7.36E-03** (2.96)	6.28E-03*** (18.64)	2.76E-03 (1.51)	6.38E-03*** (18.31)

EBITDA/Revenue	1.21E-04 (0.30)	2.12E-05* (2.40)	7.80E-05 (0.37)	2.12E-05* (2.39)	8.77E-06 (0.91)	1.44E-04** (3.16)	1.22E-05 (1.26)	126E-04** (2.67)	1.71E-05 (1.87)	1.92E-03*** (4.99)
Operating Cash Flow/EBITDA	0.103** (2.63)	2.19E-04 (0.89)	3.81E-02 (1.94)	2.20E-04 (0.89)	2.33E-02 (1.95)	2.23E-04 (0.90)	0.0410*** (4.55)	2.03E-04 (0.84)	0.0298*** (4.24)	1.35E-04 (0.54)
Current Ratio	-0.456*** (-3.39)	-0.0138*** (-5.34)	-2.12E-02 (-0.67)	-0.0137*** (-5.30)	-3.59E-02 (-1.70)	-0.0212*** (-6.86)	7.23E-03 (1.34)	-0.0252*** (-7.52)	-6.73E-03 (-1.70)	-0.0217*** (-5.03)
Quick Ratio	0.407* (2.51)	1.27E-05 0.00	2.16E-02 (0.30)	-4.41E-04 (-0.06)	-2.30E-02 (-0.52)	7.34E-03 (0.92)	-0.0628* (-2.53)	1.28E-02 (1.59)	5.36E-03 (0.59)	-0.0335* (-2.06)
Inventory Turnover	-1.36E-04 (-0.39)	1.57E-05 (1.24)	2.03E-04 (1.04)	1.49E-05 (1.18)	1.05E-04 (0.71)	1.28E-05 (1.01)	1.77E-04 (1.33)	9.76E-06 (0.78)	1.87E-05 (1.30)	1.10E-06 (0.04)
Debt/Assets	8.34E-03 (1.39)	4.62E-03** (3.23)	0.0137** (3.09)	3.91E-03** (2.65)	8.58E-03* (2.46)	3.13E-03* (2.03)	5.81E-03* (2.20)	3.14E-03 (1.90)	6.97E-03*** (3.55)	1.15E-03 (0.57)
Short-term Debt/Total Debt	-1.99E-03 (-0.84)	-7.58E-03*** (-13.83)	-4.54E-03* (-2.50)	-7.55E-03*** (-13.42)	-4.50E-03*** (-3.57)	-7.58E-03*** (-12.61)	-5.13E-03*** (-5.11)	-7.87E-03*** (-11.80)	-6.11E-03*** (-7.97)	-7.86E-03*** (-9.89)
Interest-bearing Debt/Invested Capital	-1.28E-03 (-0.32)	-1.91E-03 (-1.79)	-1.92E-03 (-0.64)	-1.39E-03 (-1.26)	-5.98E-04 (-0.25)	-1.65E-03 (-1.42)	-1.44E-03 (-0.76)	-1.30E-03 (-1.05)	-2.15E-03 (-1.48)	-1.69E-03 (-1.12)

Cash/Short-term Debt	9.80E-02 (0.38)	0.0388** (3.07)	-1.02E-01 (-0.63)	0.0395** (3.12)	9.49E-02 (1.54)	0.0928*** (5.36)	0.0917* (2.51)	0.111*** (4.44)	7.63E-03 (0.54)	0.196*** (5.38)
Cash/Total Debt	1.012 (1.33)	0.569*** (4.89)	1.685** (2.80)	0.541*** (4.62)	0.998* (2.27)	0.429*** (3.49)	0.531* (2.17)	0.428** (3.10)	0.585*** (3.77)	0.335 (1.79)
Interest Coverage Ratio	2.23E-03* (2.42)	1.43E-06 (0.89)	1.18E-05 (0.43)	1.45E-06 (0.91)	6.58E-06 (0.25)	1.52E-06 (0.95)	1.13E-07 0.00	1.53E-06 (0.98)	1.59E-06 (0.96)	1.89E-06 (0.21)
EBITDA/Interest Bearing Debt	3.51E-04** (2.76)	2.09E-04* (2.30)	3.76E-04** (2.99)	1.95E-04* (2.15)	4.02E-04** (3.26)	1.69E-04 (1.86)	3.64E-04** (3.14)	1.67E-04 (1.76)	3.78E-04*** (3.42)	1.36E-04 (1.38)
Constant	14.89*** (32.19)	17.08*** (186.28)	14.98*** (42.90)	17.13*** (183.14)	15.63*** (60.91)	17.24*** (177.14)	16.09*** (85.35)	17.30*** (167.11)	16.42*** (121.21)	17.44*** (138.55)
<i>N</i>	652	8122	1120	7654	1826	6948	2875	5899	4422	4352

4. Robustness Result Adding Macroeconomic Variables

Part I: Macroeconomic Factors Database:

	GDP	CPI	Term Structure Slope	Volatility
2007	14.20%	4.80%	1.5403	0
2008	9.60%	5.90%	1.0615	0.003104854
2009	9.20%	-0.70%	2.3219	0.001336202
2010	10.40%	3.30%	1.7921	0.000775902
2011	9.30%	5.40%	0.8893	0.000707243
2012	7.70%	2.60%	0.8741	0.000471894
2013	7.70%	2.60%	0.6267	0.000460747
2014	7.30%	1.80%	0.8492	0.000584031

Part 2: Results from 5 groups with different cut-off year plus a result from linear model are presented in the table. The first row gives the five groups, named by the range of their post-period .e.g. Post0914 means this group is cut off by 2009, and the post-period is from 2009 to 2014. Model (1), Model (3)...Model (9) are without macro-economic variables, compared to Model (2), Model (4)...Model (10) with macro-economic variables. Model (11) is regression model with only the linear trend variable; model (12) is regression model with both the linear trend variable and with macro-economic variables.

	Post0914		Post1014		Post1114		Post1214		Post1314		Linear Trend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post0914	0.455 ^{***} (14.13)	0.153 (1.39)										
Post1014			0.340 ^{***} (13.39)	0.220 ^{**} (2.87)								
Post1114					0.216 ^{***} (10.23)	-0.194 [*] (-2.31)						
Post1214							0.171 ^{***} (9.31)	4.23E-03 (0.07)				
Post1314									0.106 ^{***} (6.16)	0.0732 [*] (2.45)		
Linear Trend											0.0544 ^{***} (12.17)	0.0276 [*] (1.99)
GDP		-7.382 (-1.90)		-4.989 (-1.69)		-16.16 ^{***} (-7.37)		-12.38 ^{***} (-8.37)		-14.12 ^{***} (-8.74)		-10.09 ^{***} (-5.47)
CPI		3.146 (1.47)		0.308 (0.14)		7.301 ^{***} (5.12)		5.695 ^{**} (2.91)		8.256 ^{***} (5.06)		5.939 ^{***} (4.82)
Term Structure Slope		0.14 (1.36)		0.138 [*] (2.13)		0.225 ^{***} (4.49)		0.271 ^{***} (3.42)		0.375 ^{***} (5.84)		0.296 ^{***} (6.04)

Market Vol		-165.8** (-3.25)		-114.7* (-2.53)		-291.3*** (-8.68)		-230.3*** (-11.07)		-247.8*** (-11.31)		-202.8*** (-8.14)
Cash/Asset	-0.782** (-2.95)	-0.738** (-2.78)	-0.751** (-2.82)	-0.742** (-2.80)	-0.664* (-2.49)	-0.739** (-2.79)	-0.638* (-2.39)	-0.730** (-2.75)	-0.692** (-2.58)	-0.739** (-2.79)	-0.648* (-2.43)	-0.732** (-2.76)
Size 1	1.426*** (45.41)	1.436*** (45.72)	1.432*** (45.54)	1.435*** (45.70)	1.433*** (45.33)	1.436*** (45.71)	1.430*** (45.20)	1.436*** (45.71)	1.420*** (44.81)	1.435*** (45.68)	1.431*** (45.42)	1.435*** (45.67)
Total Debt	6.43E-06 (0.10)	-8.61E-07 (-0.01)	1.25E-05 (0.19)	-8.18E-07 (-0.01)	1.89E-05 (0.28)	3.79E-07 (0.01)	2.22E-05 (0.33)	1.74E-07 0.00	3.15E-05 (0.47)	-2.15E-06 (-0.03)	6.85E-06 (0.10)	-1.33E-06 (-0.02)
Interest Bearing Debt	-7.31E-05 (-0.39)	-7.40E-05 (-0.40)	-8.40E-05 (-0.45)	-7.74E-05 (-0.41)	-6.79E-05 (-0.36)	-7.78E-05 (-0.42)	-6.87E-05 (-0.37)	-7.48E-05 (-0.40)	-7.43E-05 (-0.39)	-7.41E-05 (-0.40)	-5.97E-05 (-0.32)	-7.44E-05 (-0.40)
Net Debt	1.52E-05 (0.11)	1.45E-05 (0.10)	8.68E-06 (0.06)	1.51E-05 (0.11)	-3.50E-06 (-0.02)	1.57E-05 (0.11)	-2.03E-06 (-0.01)	1.43E-05 (0.10)	3.18E-08 0.00	1.36E-05 (0.09)	-6.27E-06 (-0.04)	1.33E-05 (0.09)
Operating Cash Flow	-3.04E-04 (-0.80)	-1.61E-04 (-0.42)	-3.74E-04 (-0.99)	-2.38E-04 (-0.62)	-1.70E-04 (-0.44)	-2.21E-04 (-0.58)	-2.89E-04 (-0.76)	-1.54E-04 (-0.40)	-4.69E-04 (-1.22)	-1.91E-04 (-0.50)	-2.16E-04 (-0.57)	-1.80E-04 (-0.47)
Investing Cash Flow	3.40E-04 (0.95)	3.70E-04 (1.04)	1.87E-04 (0.53)	3.05E-04 (0.86)	2.95E-04 (0.82)	3.19E-04 (0.89)	2.12E-04 (0.59)	3.66E-04 (1.03)	1.80E-04 (0.50)	3.42E-04 (0.96)	2.21E-04 (0.62)	3.43E-04 (0.96)
Financing Cash Flow	3.20E-05 (0.10)	1.50E-04 (0.47)	-6.14E-06 (-0.02)	1.05E-04 (0.33)	9.88E-05 (0.31)	1.08E-04 (0.34)	1.38E-05 (0.04)	1.51E-04 (0.48)	-7.87E-05 (-0.25)	1.41E-04 (0.45)	8.68E-05 (0.27)	1.46E-04 (0.46)
Size 2	0.533***	0.530***	0.532***	0.532***	0.524***	0.531***	0.525***	0.530***	0.526***	0.531***	0.527***	0.531***

	(24.31)	(24.22)	(24.27)	(24.31)	(23.80)	(24.28)	(23.81)	(24.22)	(23.81)	(24.27)	(24.00)	(24.26)
EBITDA	3.29E-05 (0.07)	-5.12E-05 (-0.11)	-3.90E-05 (-0.08)	-3.70E-05 (-0.08)	-1.66E-04 (-0.36)	-4.72E-05 (-0.10)	-1.60E-04 (-0.34)	-6.51E-05 (-0.14)	-3.11E-05 (-0.07)	-4.03E-05 (-0.09)	-1.63E-04 (-0.35)	-5.31E-05 (-0.12)
Net Profit	-9.80E-04 (-1.82)	-9.76E-04 (-1.81)	-1.03E-03 (-1.90)	-9.83E-04 (-1.83)	-9.75E-04 (-1.80)	-9.74E-04 (-1.81)	-9.33E-04 (-1.72)	-9.71E-04 (-1.80)	-9.86E-04 (-1.81)	-9.88E-04 (-1.84)	-9.65E-04 (-1.78)	-9.84E-04 (-1.83)
Operating Margin	-6.23E-07 (-1.42)	-6.07E-07 (-1.39)	-6.25E-07 (-1.43)	-6.01E-07 (-1.38)	-6.03E-07 (-1.37)	-6.06E-07 (-1.39)	-5.80E-07 (-1.32)	-6.03E-07 (-1.38)	-5.91E-07 (-1.34)	-5.98E-07 (-1.37)	-5.63E-07 (-1.28)	-5.94E-07 (-1.36)
Operating Income Growth	-1.29E-05 (-1.91)	-1.23E-05 (-1.82)	-1.33E-05* (-1.97)	-1.19E-05 (-1.76)	-1.28E-05 (-1.89)	-1.19E-05 (-1.76)	-1.05E-05 (-1.55)	-1.21E-05 (-1.79)	-1.16E-05 (-1.71)	-1.22E-05 (-1.80)	-1.10E-05 (-1.62)	-1.20E-05 (-1.78)
ROA	7.96E-03*** (3.44)	8.69E-03*** (3.74)	7.79E-03*** (3.36)	8.98E-03*** (3.86)	7.00E-03** (3.01)	8.72E-03*** (3.76)	7.44E-03** (3.19)	8.55E-03*** (3.69)	7.16E-03** (3.05)	9.03E-03*** (3.88)	8.79E-03*** (3.77)	8.91E-03*** (3.83)
ROE	6.12E-03*** (17.92)	6.13E-03*** (17.96)	6.09E-03*** (17.81)	6.13E-03*** (17.98)	6.10E-03*** (17.77)	6.13E-03*** (17.96)	6.13E-03*** (17.82)	6.13E-03*** (17.96)	6.12E-03*** (17.75)	6.14E-04*** (17.99)	6.15E-04*** (17.96)	6.14E-04*** (17.99)
EBITDA/Revenue	2.16E-05* (2.42)	2.29E-05* (2.57)	2.17E-05* (2.43)	2.19E-05* (2.46)	2.56E-05** (2.86)	2.20E-05* (2.47)	2.44E-05** (2.71)	2.29E-05* (2.57)	2.31E-05* (2.56)	2.25E-05* (2.53)	2.46E-05** (2.75)	2.27E-05* (2.54)
Operating Cash Flow/EBITDA	2.21E-04 (0.89)	2.24E-04 (0.90)	2.23E-04 (0.89)	2.27E-04 (0.91)	2.26E-04 (0.90)	2.24E-04 (0.90)	2.27E-04 (0.91)	2.25E-04 (0.91)	2.30E-04 (0.92)	2.30E-04 (0.93)	2.43E-04 (0.97)	2.31E-04 (0.93)
Current Ratio	-0.0138*** (-5.31)	-0.0139*** (-5.36)	-0.0137*** (-5.25)	-0.0139*** (-5.33)	-0.0141*** (-5.39)	-0.0138*** (-5.32)	-0.0140*** (-5.33)	-0.0140*** (-5.36)	-0.0138*** (-5.27)	-0.0140*** (-5.37)	-0.0142*** (-5.45)	-0.0140*** (-5.38)

Quick Ratio	1.46E-04 (0.02)	-8.14E-04 (-0.11)	-7.58E-04 (-0.10)	-7.92E-04 (-0.10)	-8.87E-04 (-0.12)	-9.89E-04 (-0.13)	-7.40E-04 (-0.10)	-1.01E-03 (-0.13)	8.02E-04 (0.10)	-6.08E-04 (-0.08)	-4.30E-04 (-0.06)	-7.71E-04 (-0.10)
Inventory Turnover	1.62E-05 (1.27)	1.53E-05 (1.20)	1.64E-05 (1.29)	1.55E-05 (1.22)	1.59E-05 (1.24)	1.49E-05 (1.17)	1.50E-05 (1.16)	1.49E-05 (1.17)	1.77E-05 (1.38)	1.60E-05 (1.26)	1.68E-05 (1.32)	1.57E-05 (1.23)
Debt/Assets	4.91E-03 ^{***} (3.56)	4.90E-03 ^{***} (3.56)	4.60E-03 ^{***} (3.33)	4.92E-03 ^{***} (3.57)	4.50E-03 ^{**} (3.25)	4.90E-03 ^{***} (3.56)	4.71E-03 ^{***} (3.39)	4.87E-03 ^{***} (3.53)	4.72E-03 ^{***} (3.39)	4.92E-03 ^{***} (3.57)	4.77E-03 ^{***} (3.44)	4.89E-03 ^{***} (3.55)
Short-term Debt/Total Debt	-7.30E-03 ^{***} (-13.69)	-7.19E-03 ^{***} (-13.48)	-7.18E-03 ^{***} (-13.44)	-7.19E-03 ^{***} (-13.49)	-7.34E-03 ^{***} (-13.68)	-7.20E-03 ^{***} (-13.51)	-7.51E-03 ^{***} (-14.02)	-7.20E-03 ^{***} (-13.51)	-7.60E-03 ^{***} (-14.13)	-7.18E-03 ^{***} (-13.47)	-7.34E-03 ^{***} (-13.73)	-7.19E-03 ^{***} (-13.49)
Interest-bearing Debt/Invested Capital	-1.95E-03 (-1.90)	-1.76E-03 (-1.71)	-1.69E-03 (-1.64)	-1.78E-03 (-1.73)	-1.61E-03 (-1.55)	-1.77E-03 (-1.72)	-1.77E-03 (-1.71)	-1.75E-03 (-1.70)	-1.96E-03 (-1.88)	-1.77E-03 (-1.72)	-1.69E-03 (-1.63)	-1.76E-03 (-1.71)
Cash/Short-term Debt	0.0381 ^{**} (2.99)	0.0405 ^{**} (3.18)	0.0389 ^{**} (3.05)	0.0400 ^{**} (3.14)	0.0415 ^{**} (3.24)	0.0403 ^{**} (3.17)	0.0412 ^{**} (3.21)	0.0409 ^{**} (3.22)	0.0375 ^{**} (2.92)	0.0400 ^{**} (3.15)	0.0411 ^{**} (3.22)	0.0404 ^{**} (3.18)
Cash/Total Debt	0.593 ^{***} (5.18)	0.583 ^{***} (5.10)	0.585 ^{***} (5.11)	0.587 ^{***} (5.13)	0.571 ^{***} (4.96)	0.585 ^{***} (5.12)	0.580 ^{***} (5.03)	0.582 ^{***} (5.09)	0.597 ^{***} (5.17)	0.585 ^{***} (5.12)	0.576 ^{***} (5.02)	0.584 ^{***} (5.11)
Interest Coverage Ratio	1.44E-06 (0.90)	1.38E-06 (0.86)	1.45E-06 (0.90)	1.40E-06 (0.87)	1.44E-06 (0.89)	1.35E-06 (0.84)	1.41E-06 (0.87)	1.35E-06 (0.84)	1.62E-06 (1.00)	1.44E-06 (0.89)	1.55E-06 (0.96)	1.41E-06 (0.88)
EBITDA/Interest Bearing Debt	2.74E-04 ^{***} (3.76)	2.70E-04 ^{***} (3.71)	2.68E-04 ^{***} (3.67)	2.70E-04 ^{***} (3.71)	2.62E-04 ^{***} (3.58)	2.71E-04 ^{***} (3.72)	2.60E-04 ^{***} (3.55)	2.70E-04 ^{***} (3.70)	2.51E-04 ^{***} (3.41)	2.69E-04 ^{***} (3.69)	2.66E-04 ^{***} (3.64)	2.68E-04 ^{***} (3.68)

Constant	16.48*** (170.67)	17.23*** (54.56)	16.59*** (175.53)	17.02*** (70.61)	16.74*** (179.06)	18.15*** (74.33)	16.80*** (181.38)	17.63*** (106.40)	16.89*** (183.74)	17.58*** (157.69)	16.56*** (171.23)	17.23*** (73.27)
<i>N</i>	8774	8774	8774	8774	8774	8774	8774	8774	8774	8774	8774	8774

t statistics in parentheses
 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$