CREDIT RATINGS AND THEIR INFORMATION VALUE: EVIDENCE FROM THE RECENT FINANCIAL CRISIS

Gabriela Kuvíková

CERGE EI

Charles University
Center for Economic Research and Graduate Education
Academy of Sciences of the Czech Republic
Economics Institute

WORKING PAPER SERIES (ISSN 1211-3298)
Electronic Version

544

Working Paper Series **544**
(ISSN 1211-3298)

Credit Ratings and Their Information Value: Evidence from the Recent Financial Crisis

Gabriela Kuvíková

CERGE-EI
Prague, June 2015

ISBN 978-80-7343-349-9 (Univerzita Karlova. Centrum pro ekonomický výzkum a doktorské studium)
ISBN 978-80-7344-341-2 (Akademie věd České republiky. Národohospodářský ústav)

Credit Ratings and Their Information Value: Evidence from the Recent Financial Crisis

Gabriela Kuvíková*

Abstract

This paper examines the accuracy and timeliness of credit ratings in explaining the financial health of debt issuers over the recent financial crisis. Using annual financial statement data and macroeconomic indicators covering 2005-2013 for 2500 financial and non-financial institutions, this paper identifies the determinants of credit rating changes by two incumbent rating agencies: Moody's and Standard & Poor's. Empirical evidence suggests that while Moody's is consistently more conservative in the assessment of default risk for non-financial institutions, Standard and Poor's is consistently more conservative in the assessment of default risk for financial institutions. Fitch's increasing market share deepens the rating disagreement between S&P and Moody's. The results also suggest that sovereign ceilings cease to be restrictive for non-financial institutions over the recent financial crisis. S&P is a follower in its rating actions when compared to Moody's for both financial and non-financial institutions.

Keywords: Credit rating agencies, Rating change, Information value

JEL Classification Numbers: G20, G24

* CERGE-EI is a joint workplace of Charles University in Prague and the Economics Institute of the Academy of Sciences of the Czech Republic. Address: CERGE-EI, P.O. Box 882, Politických vězňů 7, Prague 1, 111 21, Czech Republic.

I am grateful to Randall K. Filer, Jan Hanousek and Štěpán Jurajda for their valuable comments and guidance. All errors remaining in this text are the responsibility of the author.

Abstrakt

Tato studie zkoumá přesnost a včasnost vydaných ratingů, které popisovaly finanční zdraví dlužníků v průběhu nedávné finanční krize. S využitím ročních finančních výkazů a makroekonomických indikátorů získaných od 2 500 finančních a nefinančních institucí v rozmezí let 2005 až 2013 tato studie poukazuje na klíčové faktory změn úvěrových ratingů, které proběhly u dvou ratingových agentur - Moody's a Standard & Poor's. Empirické výsledky ukazují, že agentura Moody's je v drtivé většině případů konzervativnější při vyhodnocování rizika defaultu nefinančních institucí. Standard and Poor's je naopak konzervativnější v případě hodnocení míry defaultu finančních institucí. Rostoucí tržní podíl agentury Fitch prohlubuje rozdíly v ratinzích mezi S&P a Moody's. Výsledky rovněž naznačují, že v průběhu finanční krize ratingové stropy jednotlivých zemí přestaly pro nefinanční instituce působit restriktivně. Změny ratingů jak finančních tak i nefinančních institucí oznamovaných agenturou S&P zpravidla reagují na změny odpovídajících ratingů agentury Moody's.

1.Introduction

The financial crisis in the early 2000s has underscored the financial markets' reliance on credit ratings. Credit ratings express rating agencies' opinion about the ability and willingness of debt issuers to meet their financial obligations in full and on time. They assist investors in evaluating the financial health of debt issuers and regulatory authorities in overseeing the financial market through rating-contingent policies.

Nevertheless, there are at least three issues financial market participants should consider when relying on credit ratings. First, inflated credit ratings failed to predict the recent financial crises. This has evoked widespread debate on the quality of credit ratings. Second, credit ratings are costly for companies. Although unrated companies may have financial difficulties they do not wish to reveal, the lack of a credit rating does not necessarily convey a negative signal about the company's creditworthiness in certain markets. Third, credit ratings can differ across the three rating agencies, Standard and Poor's (hereafter, S&P), Moody's Investor Services (hereafter, Moody's), and Fitch Ratings (hereafter, Fitch), depending on their prevailing rating methodology.

Inconsistency in credit ratings becomes essential when ratings are used to fulfil financial regulatory requirements. Although a debt issuer can be rated by more than one agency, financial market participants can only use one rating to evaluate the credit risk related to the issuer. For instance, the capital requirements of banks can substantially increase when banks use the more conservative (worse) rating. Recent empirical papers (Morgan, 2002; Livingston, Wei, and Zhou, 2010) find that disagreement in issuer ratings is substantial both in the case of financial and non-financial institutions. Livingston, Naranjo, and Zhou (2008) argue that rating splits (disagreement) between rating agencies might trigger subsequent rating changes. The authors show that rating splits can increase the probability of rating upgrade/downgrade within one year by up to 6%, and rating splits influence the pricing (credit spreads) of the issued debt. However, no study has tested which rating agency is consistently more prudent [1] within the individual industry sectors, crisis periods or rating grades. The information

whether rating splits are industry-, time- and rating-dependent might be of high prominence for bond investors, as they often alter their behavior based on rating actions, and bond yields often rely on the rating of the more prudent agency (Livingston et al., 2010). The first hypothesis tested in this paper is that the distribution of credit ratings across the two major rating agencies[2] (Moody's and S&P) is identical for different industry sectors, crisis periods and rating grades.

Regulators and policymakers view increasing competition between credit rating providers as a fundamental driver of precise and prompt ratings. Nevertheless, rating agencies' reputational concerns and their costs of information acquisition vary over the business cycle. The theoretical model of Bar-Isaac and Shapiro (2013) suggests that the accuracy of ratings is determined by the extent of competition (the reputation losses) among rating agencies. Becker and Milbourn's (2011) empirical findings support this prediction and find that the rating quality (defined as 'the ability of rating to be informative about bond values and the ability to be accurate in predicting issuer default') of S&P and Moody's decreased after Fitch's market share increased. The existence of a third rating opinion is highly relevant for regulatory rating classification, which accepts only one credit rating classification (the Basel Accord). If an issuer is rated by two or more rating agencies, the prevailing institutional rule is to use the 'second best' rating. In their recent paper, Bongaerts, Cremers, and Goetzmann (2012) find that gaining a third rating opinion results in regulatory rating improvement. Nevertheless, while the above studies focus on the ratings information value for investors and their accuracy in predicting default, no empirical evidence exists on how the incidence of rating split was affected by increased competition over the recent financial crises. The question is important due to the risk of 'rating shopping' (the hypothesis positing that issuers are prone to paying for a third rating opinion in the hope of enhancing their rating) that might result in more favorable 'second best' ratings. This

[1] While more prudent rating agencies prefer to protect their reputational capital by assigning timely and accurate ratings; less prudent rating agencies prefer to increase their own profits (credit ratings are issuer-paid) by assigning favorable issuer ratings.

[2] Fitch was established in 1997 and over 2005 and 2014 it had a much smaller rating coverage than S&P and Moody's (established in the early 1900s). Thus, unless stated otherwise, this paper focuses on credit ratings assigned by the two incumbent rating agencies, S&P and Moody's. Fitch's credit ratings are only used to measure how competitive the rating market is (unless stated otherwise).

paper tests the hypothesis that any disagreement between the issuer ratings of S&P and Moody's is independent of the competition between rating providers.

The recent financial crisis attracted the attention of the financial market to the severity of sovereign rating deterioration. This also has a direct effect on the private sector, as distressed economies often restrict the financial leverage of corporations (Borensztein, Cowan, and Valenzuela, 2013). Consequently, rating agencies may cap issuer ratings by the country rating in which they operate (henceforth referred to as 'ceiling effect'). Chen, Chen, Chang, and Yang (2013) emphasize that sovereign downgrades have a significant impact on declines in private investments. The influence of sovereign rating change is more substantial in low-rated economies (Ismailescu and Kazemi, 2010). Despite the broad empirical research on the effect of sovereign ratings on issuer ratings, no previous literature has explored its importance over the recent sovereign debt crisis for both financial and non-financial industry sector. The third hypothesis of this paper tests whether the sovereign ceilings cease to be restrictive for issuer ratings.

Rating agencies aim to provide timely information about the credit quality of issuers. When rating changes occur, they have extensive power to alter the decisions of financial market participants. Thus, identifying the rating agency that is consistently more prompt in capturing the changing creditworthiness of the issuers is of crucial importance. Although Hill, Brooks, and Faff (2010) and Alsakka and Gwilym (2010) find interdependence in sovereign rating actions, there is limited related research into the timeliness of rating actions for corporations. Thus, the final hypothesis tested in this paper is that there is no leader-follower relationship between rating agencies for financial and non-financial institutions.

The empirical results of this paper draw on extensive financial statement and credit rating data of over 2500 financial and non-financial institutions. Credit ratings assigned by Moody's, S&P and Fitch are available both for financial/non-financial institutions that issued debt (i.e. issuer company rating) and their country of domicile[3] (i.e. issuer

[3] The country of domicile (country in which the company has its headquarters) is a good proxy for 'country of risk' (International Organization for Standardization country code taking into account management location, country of primary listing, country of revenue and reporting currency of the issuer) – for 98% of the examined issuers, the country of domicile and the country of risk coincide.

sovereign rating). The panel data includes information about the companies from December 2005 to October 2014.

2.Credit Ratings

2.1 The Process of Credit Rating Assessment

Accurate and timely information is one of the key prerequisites of credit risk assessment and investment decisions. Information, however, is not evenly distributed among investors, borrowers, lenders and other market participants. Rating agencies, which assess the creditworthiness of debt issuers and issues (corporate or government financial obligation, such as a bond), aim to mitigate information asymmetry on the financial market by translating their credit risk assessment of issuers/issues into a rating grade from AAA to D. There are three major global rating agencies, each providing a comparable and independent credit risk assessment of debt issuers/issues. The rating assessment is based on publicly available methodologies, which creates a common comparison basis for all end users. Thus, rating agencies offer two pivotal benefits for financial markets in the form of credit rating: i) easy comparability of ratings in a global context, ii) favorable access to capital market funding for rated issuers.

Rating requests are assumed to be randomly ordered, as credit ratings are issuer-paid and one rating is sufficient to fulfill most rating-based regulations (Livingston et al. 2010). Nevertheless, as issuers pay for the rating, they have incentives to solicit positive bias in credit rating by switching between rating agencies or by paying for multiple rating assessments. The motivation of issuers to pay for multiple credit ratings can be interpreted by three hypotheses. First, according to the ‘information production’ hypothesis, multiple ratings reduce the market participants’ uncertainty about the creditworthiness and the default probability of the issuer (Güntay and Hackbarth, 2010). Second, according to the ‘rating shopping’ hypothesis, issuers will apply for an extra rating assessment if they anticipate an enhancement in average credit rating (Skreta and Veldkamp, 2009). Third, according to the ‘regulatory certification’ hypothesis, issuers

rated close to the investment– noninvestment grade boundary (i.e. with BBB and BB ratings) are often highly motivated to pay for two or more credit ratings. The main reason is that when an issuer is differently rated by two or more rating agencies, the prevailing institutional rule is to use the 'second best' rating. Thus, avoiding noninvestment grade 'second best' rating might allow debt issuers to borrow at lower interest rates (Bongaerts et al., 2012). In general, most thorough issuers seek rating services from at least two agencies. This approach strengthens the issuer's reliability compared to its peers who seek ratings by a single agency only, and appreciates its debt issuances (rated companies can issue debt/borrow at lower interest rates).

Based on the best practice of rating agencies, the process to obtain a rating takes approximately 90 days. In the first 30 days contracts are set up and signed. The issuer is then transferred to the analytical team within the rating agency, which collects the required documentation and sets meeting dates with the issuer over the next 30 days. During the meetings, the agencies' analysts and the issuer's representatives discuss all outstanding points required for credit rating assessment. After this rating visit, the analytical team has an additional 30 days to carry out the rating analysis, present the rating to an internal rating committee for approval[4] and announce the rating to the issuer. Subsequently, depending on the timeliness of the issuer's publication consent, the credit rating is publicly released.

Once the rating is released to the market, the issuer is regularly monitored until the rating is withdrawn or, in case of debt issue ratings, the debt matures. The rating agency's analytical team monitors the rated issuer regularly (reviews financial reports, industry development) and arranges a meeting with the issuer prior to the update of the rating analysis (usually annually). Nevertheless, the issuer's rating can be changed outside of the dates reserved for annual review. If the rating agency identifies material changes in the issuer's idiosyncratic risk profile or material shocks in exogenous factors (for instance, overall deterioration of the industry's performance or a change in the issuer's country rating), the rating is immediately adjusted. The rating action (rating downgrade, rating upgrade, change in rating outlook) can be released quickly, within

[4]A rating committee has at least 5 voting members – the lead analyst for the issuer, three other attendees with voting rights and a rating chair who is usually the most senior committee attendee. The chair casts his vote last so his opinion does not influence more junior voters.

days from the moment the rating agency learns the new information. In case of issuers rated by multiple rating agencies, a rating change from one rating agency does not necessarily trigger a rating change by its competitor(s).

The building block of any rating assessment is an industry-specific methodology that describes in detail the rating scorecard used to derive the credit rating. The rating scorecard is comprised of quantitative and qualitative rating factors. In general, quantitative factors (financial profile) play a key role (70-90% weight on final rating). The qualitative factor assessment (business profile) often rests on the subjective evaluation of the rating analysts (10-30% weight on final rating). [5] The rating derived based on the scorecard serves then as a basis for approval by the internal rating committee. If the rating committee members fail to reach mutual agreement, the assigned rating may deviate from that proposed by the scorecard.

2.2 Why Financial Institutions Are Different

Before examining the determinants and the quality of credit ratings, the specific features of the financial sector must be highlighted. Unlike non-financial corporations, the creditworthiness of financial institutions is particularly difficult to evaluate for at least two reasons. One is that their asset quality is determined mainly by their leading line of business. For instance, a bank mainly issues loans to different types of borrowers (e.g. individuals, corporations, and public organizations), so the financial strength of the institution stems from the quality of loans that it provides to borrowers with different levels of riskiness. Nevertheless, external market participants cannot accurately estimate the embedded riskiness of these loans. The second difficulty is that financial institutions are highly leveraged, and therefore the shareholders' equity (i.e. capital) at stake is low. Consequently, regulators and investors view the high (low) capital-to-asset ratio as particularly useful signal of a financial institution's conservative (aggressive) business strategy, reflecting asset quality with low (high) risk. Recent research by Mehran and Thakor (2011) provides theoretical justification that higher capital has a positive impact

[5]Similarly to the existing research on credit ratings, this paper cannot fully control for the qualitative rating factors and thus considers the financial indicators essential credit rating determinants.

on financial institutions' asset and liability structure. This view is supported by the empirical findings of Berger and Bouwman (2013), which show that companies with higher capital monitor their asset bases more strictly and focus on more conservative investment strategies.

The importance of capital in the performance of financial institutions has been highlighted over the recent financial crisis. To restrain risk and potential losses by the financial sector, the Basel Committee on Banking Supervision set out specific requirements regarding the capital of financial institutions. These regulatory capital requirements aim to strengthen the stability of the financial sector and define how much capital the financial institution must hold. The level of capital becomes a concern as soon as the assets of the company shrink due to losses in the company's business (e.g. defaults on granted loans). As the volume of assets drops, the volume of liabilities and shareholders' equity (capital) must also decrease on the balance sheet. In the first place, the shareholders' equity is used to cover the losses on the company's assets. If the level of capital is not sufficient, the financial institutions' liabilities must go down (e.g. individuals lose their deposits). To protect the financial sector from such scenarios, capital must be at a level that absorbs the company's losses before depositors' funds must be tapped.

Although financial institutions must strictly follow the regulatory capital requirements, the recent financial crises have shown that these were insufficient to restore prudent risk-taking at the financial institutions. Hence, the determinants, the quality and the implications of credit ratings as important inputs for financial market regulations should be closely monitored.

3.Methodology

The four key hypotheses of this paper can be summarized as follows.

Hypothesis 1 (H1). The distribution of credit ratings across the two major rating agencies (Moody's and S&P) is identical for different industry sectors, crisis periods and rating grades.

The alternative hypothesis to H1 is that a significant disagreement exists between the credit rating of the two incumbent rating agencies. This would suggest that given the same public information, the ratings of S&P or Moody's are systematically different when compared for the same company. Rating splits across industry sectors, crisis periods and rating grades might appear for the following reasons: (i) Rating splits are likely to vary by the industry coverage of the rating agency (i.e. if the two agencies have different rating coverage in the given industry, the probability of rating split is higher); (ii) Rating disagreements are expected to deepen over time (i.e. as a result of improvements in the credit rating agencies' regulation during the recent financial crises[6], rating agencies are gradually forced to protect their reputational capital and to restrict ratings that follow the issuers' preferences or other rating agencies' actions); (iii) Rating splits are anticipated to be more frequent around the investment-noninvestment grade boundary (i.e. as the difference in bond credit spreads is often the highest between investment-noninvestment grade bonds).

In order to test for the null hypothesis that the distribution of credit ratings across rating agencies differ, the non-parametric Wilcoxon signed rank sum test is conducted. It tests the equality of matched pairs of observations ($H_0 : median_{Moody's} = median_{S\&P}$). As opposed to previous studies (Galil and Sofer, 2011), the distribution of credit ratings is also compared across industry sectors, crisis periods and rating grades.

Hypothesis 2 (H2). Any disagreement between the issuer ratings of S&P and Moody's is independent of the competition between rating providers.

The alternative hypothesis to H2 is that besides the analysts' different expert judgments, the rating disagreement (split) is affected by the increased competition on the credit rating market after the expansion of Fitch. If Fitch's issuer rating is different

[6] For example, the Dodd-Frank Wall Street Reform and Consumer Protection Act (effective from July, 2010) increases the credit rating agencies' liability for issuing inaccurate ratings.
Source: https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf

from the ratings assigned by S&P or Moody's, then Fitch's entry to the market might serve as a trigger for the two main rating agencies to reassess the creditworthiness of the issuer. This might then result in the rating split of S&P and Moody's issuer ratings.

To test whether competition on the credit rating market also contributes to rating disagreement, the probit model[7] is estimated with fixed effects controlling for average industry-, region- and time-characteristics:

$$\begin{aligned} SPLIT^{*}_{i,j,c,t} &= \delta_0 + INDUSTRY_j + REGION_c + PERIOD_t + \delta_1 FINANCIALS_{i,t} + \\ &+ \delta_2 NIG\_SOVEREIGN_{c,t} + \delta_3 NIG\_ISSUER_{i,t} + \\ &+ \delta_4 MARKET\_SHARE\_FIT_{j,t} + \mu_{i,j,c,t} \end{aligned} \quad (1)$$

where $SPLIT_{i,j,c,t}$ is a binary variable that takes the value of 1 if credit ratings (of issuer *i* from industry *j*, region *c*, at year *t*) assigned by Moody's and S&P are different, and takes the value of 0 if the credit ratings of the two agencies are consistent.[8]

$INDUSTRY_j, REGION_c, PERIOD_t$ are categorical variables for industry sector, geographical region and crisis period. The variable $FINANCIALS_{i,t}$ expresses the financial statement data[9], which is industry-specific. For financial institutions the choice of financial indicators is motivated by the CAMEL model (Caouette, Altman, Narayanan, and Nimmo, 2008; Golin and Delhaise, 2013), and for non-financial institutions it is motivated by the Altman Z score model (Altman, 1968; Altman and Rijken, 2004). Both are discussed in detail in a later section. Variables $NIG\_SOVEREIGN_{c,t}$ and $NIG\_ISSUER_{i,t}$ are dummy variables that take the value

[7] One of the drawbacks of the identification strategy is that it does not account for the selection having two ratings and does not consider the sequence of rating requests from the issuer.

[8] The rating split between the two main rating agencies is evaluated at year-ends. Rating updates on arrival of new information are disregarded in testing the effect of increased rating completion on the rating split. This paper focuses on the sequence of rating updates when studying the leader-followership between the rating agencies.

[9] The incorporation of financial statement data as determinant of rating split is motivated by Morgan (2002), who estimates the disagreement between rating agencies based on the banks' asset structure. The author suggests that disagreement between rating agencies is a gauge of uncertainty about the financial health of the company. He argues that banks with high share of loans and trading asset might encompass risk that is difficult to assess (due to the unknown risk of borrowers and counterparties), and hence these banks might be rated differently.

of 1 if the sovereign rating / issuer rating (assigned by S&P, as the rating agency with widest rating coverage) is non-investment grade. The error term $\mu_{i,j,c,t}$ is assumed to be normally distributed.

Similarly to Becker and Milbourn (2011), Fitch's market share is used as a measure of competition in the ratings industry. The variable $MARKET\_SHARE\_FIT_{j,t}$ denotes the share of debt issues rated by Fitch on the total number of debt issues rated by the three rating agencies (the ratio is derived based on Bloomberg's rated debt issue universe). Fitch's market share captures the variation in the competition between rating providers both across industry sectors and over time. This paper focuses on testing the null hypothesis that the increased competition of Fitch has no effect on the disagreement between ratings assigned by S&P and Moody's ($H_0 : \delta_4 = 0$).

Hypothesis 3 (H3). The sovereign ceilings cease to be restrictive for issuer ratings.

The alternative hypothesis to H3 is that the issuer's credit rating remains inherent to its operational or regulatory environment.

To estimate which predictors carry significant weight in explaining credit rating changes, the probit model is adopted. Motivated by the literature (Williams, Alsakka, and Gwilym, 2013) this paper explores the determinants of credit ratings separately for issuer rating upgrades and issuer rating downgrades:

$$\begin{aligned}\Delta R^{A}_{i,j,c,t} &= \beta_0 + INDUSTRY_j + REGION_c + YEAR_t + \\ &+ \beta_1 FINANCIALS_{i,t} + \beta_2 \Delta FINANCIALS_{i,t} + \beta_3 MACRO_{c,t} + \beta_4 \Delta MACRO_{c,t} + \\ &+ \beta_5 NIG\_SOVEREIGN_{c,t} + \beta_6 NIG\_ISSUER_{i,t} + \beta_7 MARKET\_SHARE^{A}_{j,t} + \\ &+ \beta_8 SOVEREIGN_{c,t} + \beta_9 \Delta SOVEREIGN_{c,t} + \beta_{10} \Delta R^{B}_{i,j,c,t} + \beta_{11} \Delta R^{C}_{i,j,c,t} + \varepsilon_{i,j,c,t}\end{aligned} \quad (2)$$

$$\begin{aligned}\Delta R^{B}_{i,j,c,t} &= \beta_0 + INDUSTRY_j + REGION_c + YEAR_t + \\ &+ \beta_1 FINANCIALS_{i,t} + \beta_2 \Delta FINANCIALS_{i,t} + \beta_3 MACRO_{c,t} + \beta_4 \Delta MACRO_{c,t} + \\ &+ \beta_5 NIG\_SOVEREIGN_{c,t} + \beta_6 NIG\_ISSUER_{i,t} + \beta_7 MARKET\_SHARE^{B}_{j,t} + \\ &+ \beta_8 SOVEREIGN_{c,t} + \beta_9 \Delta SOVEREIGN_{c,t} + \beta_{10} \Delta R^{A}_{i,j,c,t} + \beta_{11} \Delta R^{C}_{i,j,c,t} + \varepsilon_{i,j,c,t}\end{aligned} \quad (3)$$

where $\Delta R^{A}_{i,j,c,t}, \Delta R^{B}_{i,j,c,t}, \Delta R^{C}_{i,j,c,t}$ are binary variables of rating upgrade/downgrade originated by the rating agencies S&P, Moody's and Fitch(A, B, C, respectively).

Besides fluctuations in the issuer's financial ratios (defined by the Altman Z-score model for non-financial institutions and defined by the CAMEL model for financial institutions), the variable $FINANCIALS_{i,t}$ also considers the size of the company (Hau, Langfield, and Marques-Ibanez's2013 study shows that larger banks are more highly rated) and the earnings per share (Ederington and Goh's 1998 empirical paper argues that a decline in earnings is a good proxy for market expectations and efficiently forecasts downgrades). As deteriorations in the macroeconomic conditions (in the issuer's country of domicile) might enhance the exposure of public and private debt and hence influence credit ratings, selected macroeconomic indicators ($MACRO_{c,t}$) are also incorporated in the model (similarly to Borensztein et al., 2013). Motivated by Ismailescu and Kazemi (2010), who show that rating changes are more severe in countries with low ratings, dummy variables for countries/issuers rated by non-investment grade ($NIG\_SOVEREIGN_{c,t}$ and $NIG\_ISSUER_{i,t}$) are part of the empirical specification.

$SOVEREIGN_{c,t}$ refers to the rating of the issuer's country of domicile. It is expected to be a significant determinant of issuer rating as negative fluctuations in sovereign ratings also have an adverse impact on the issuer's rating (Cantor and Packer, 1996; Hills et al., 2010; Borensztein et al., 2013 and Williams et al., 2013). On the other hand, the magnitude of sovereign risk on issuer rating might be fundamentally different before (pre-crises period, subprime lending crisis) and during the sovereign debt crisis. Using the above econometric specification, this paper tests the null hypothesis that sovereign ceilings cease to be restrictive for issuer ratings ($H_0 : \beta_9 = 0$).

Apart from financial statement data, macroeconomic indicators or sovereign ratings, rating actions of the competitors ($\Delta R^{A}_{i,j,c,t}, \Delta R^{B}_{i,j,c,t}, \Delta R^{C}_{i,j,c,t}$) might also contribute to the yearly changes in the issuer's credit assessment. As replicating the rating upgrades/downgrades of the competitor is less time- and cost-intensive than performing their own independent credit assessment, rating agencies tend to react upon the competitors' behavior (Guttler and Wahrenburg, 2007). These prompted rating actions are then highly appreciated by investors, who after the downgrade/upgrade might experience loss/gain in the rating-driven borrowing costs.

Hypothesis 4 (H4). There is no leader-follower relationship between rating agencies.

The alternative hypothesis is that some rating agencies are systematically dependent on their competitors' rating actions, even though investors are highly sensitive to timely and accurate information about credit quality changes.

In order to quantify the effect of an issuer rating change (i.e. rating upgrade/downgrade) by rating agency A on an issuer rating change by rating agency B, the Granger-like ordered logit model[10] is utilized. The Granger-like model reflects the serial correlation in rating changes. It assumes that past rating changes influence the future rating changes, and past rating actions carry unique information about the future rating changes.[11] The ordinal model's key advantage is that it accounts for the ordinal scale of credit ratings. Similarly to Guttler and Wahrenburg (2007) and Alsakka and Gwilym(2010), the daily rating change is modelled for the two major rating agencies(S&P and Moody's) separately:

$$\Delta R^{*A}_{i,d} = \sum_{h'=1}^{4} \theta^{1}_{h} U^{B}_{i,h} + \sum_{h=1}^{4} \theta^{2}_{h} D^{B}_{i,h} + \sum_{h'=1}^{4} \theta^{3}_{h} U^{A}_{i,h} + \sum_{h=1}^{4} \theta^{4}_{h} D^{A}_{i,h} + \nu_{i} \qquad (4)$$

[10]The model assumes that rating agencies have access to the same publicly available information, and past rating changes internalize any shocks affecting the rating.

[11] Rating changes indicate the speed of rating analysis required to re-assess the issuer's creditworthiness. They do not correspond to the sequence of the initial rating requests (as rating agencies are obliged to update the issuer's rating immediately after observing changes in its idiosyncratic risk profile or material shocks in exogenous factors), but might reflect the initial rating mistakes made by one of the rating agencies (rating changes could be faster for the agency that was more wrong in its previous rating).

$$\Delta R_{i,d}^{*B} = \sum_{h'=1}^{4} \theta_h^1 U_{i,h}^A + \sum_{h=1}^{4} \theta_h^2 D_{i,h}^A + \sum_{h'=1}^{4} \theta_h^3 U_{i,h}^B + \sum_{h=1}^{4} \theta_h^4 D_{i,h}^B + \nu_i \tag{5}$$

where $\Delta R_{i,d}^{*A}$ and $\Delta R_{i,d}^{*B}$ are the unobserved latent variables of rating changes of issuer *i* at day *d* originated by the rating agencies A and B, respectively, while $\Delta R_{i,d}$ refers to the observed difference in the rating grades.

$$\Delta R_{i,d} = \begin{bmatrix} -2 \ \ (i.e.\ \ downgrade\ \ by\ \ two\ \ or\ \ more\ \ notches)\ \ if\ \ \Delta R_{i,d}^{*} \le \lambda_1 \\ -1 \ \ (i.e.\ \ downgrade\ \ by\ \ one\ \ notch)\ \ if\ \ \lambda_1 < \Delta R_{i,d}^{*} \le \lambda_2 \\ 1 \ \ (i.e.\ \ upgrade\ \ by\ \ one\ \ notch)\ \ if\ \ \lambda_2 < \Delta R_{i,d}^{*} \le \lambda_3 \\ 2 \ \ (i.e.\ \ upgrade\ \ by\ \ two\ \ or\ \ more\ \ notches)\ \ if\ \ \lambda_3 < \Delta R_{i,d}^{*} \end{bmatrix} \tag{6}$$

The terms $U_{i,h}^A$ and $U_{i,h}^B$ are dummy variables for an issuer rating upgrade, $D_{i,h}^A$ and $D_{i,h}^B$ are dummy variables for an issuer rating downgrade.

The leader-follower relationship might take several forms. Specifically, as a result of one agency's rating action, the second agency might update the issuer's rating methodology (e.g. changing thresholds or weights that drive the rating change), review the issuer's credit quality or it might make a rating change release strategically dependent on the first-mover (Güttler and Wahrenburg, 2007). As any of these scenarios are equally likely, the leader/follower sequence is examined in time span ranging from 1 day to 180 days. Specifically, following Alsakka and Gwilym (2010) the rating changes of the potential follower (dependent variable) are examined in h time windows after the rating change by the potential leader: $h = 1$ denotes 1-15 days, $h = 2$ denotes 16-90 days, $h = 3$ denotes91-180 days, and $h = 4$ denotes more than 180 days. Rating reaction within a few days might indicate that the rating agencies independently reacted to the same publicly available rating drivers, but the follower was either slow in processing the rating change or made its rating change strategically dependent on the leader's reaction. On the other hand, rating reaction after 180 days is expected to have no relation to the original rating changes and it can be considered as a result of a new fundamental event happening half a year late.

4.Data

The dataset is described in three steps. First, I outline how the sample of financial and non-financial companies was acquired. Next, separately for the financial and non-financial sectors, I describe the selected financial indicators and their expected impact on company performance. Finally, I illustrate the credit rating distribution of the companies across industry sectors and credit rating agencies.

4.1 Data Collection

Bloomberg, one of the largest market data providers, is the source of financial statement and credit rating data used. The data were collected in the following steps:

1) Using Bloomberg's IMEN function, the list of 500 major equity indices traded on Bloomberg was gained. The equity indices are performance indicators of a particular equity market and are derived from the prices of selected stocks (most frequently using a weighted average). The index members are companies based in 65 countries worldwide.
2) The initial list of financial and non-financial institutions was defined using the constituents of these 500 major equity indices.
3) To enlarge the sample, Bloomberg's peer group assignment was utilized to identify competitive companies for the initial list of financial and non-financial institutions.
4) After eliminating duplicates of companies on several markets, the final list consists of over 2500 financial and non-financial institutions.
5) For the final list of 600 financial and 1900 non-financial institutions, comprehensive financial statement and credit rating data (observed at the end of years from 2005 to 2013) was obtained. Specifically, the following information was downloaded: (1) basic company information (industry sector, country of domicile, parent company), (2) financial statements and financial indicators, (3) long term issuer company and sovereign ratings[12] assigned by S&P, Moody's and Fitch. Sovereign ratings are available for 61 countries (48% of issuers are

[12]The issuer is attributed a sovereign rating based on its country of domicile.

from the USA) observed for 9 years (2005 – 2013). The dataset covers 10 regions (United States, Euro Area, Japan, Other Advanced Economies, Commonwealth of Independent States, Emerging and Developing Asia, Emerging and Developing Europe, Latin America and the Caribbean, the Middle East and North Africa and Sub-Saharan Africa).

6) Finally, daily data on company and sovereign rating actions (over 14 000 downgrades, upgrades, and changes in rating outlook) were obtained. The rating changes were implemented by the three rating agencies from December 2005 to October 2014. In particular, for the sample of 2 500 financial and non-financial institutions both initial [13] and new ratings are observed along with the date of the rating change.

Bloomberg's rated universe is used for the derivation of the individual rating agencies' market share across industry sectors and over time. Specifically, the market share of S&P, Moody's and Fitch is derived for 9 industry sectors (Basic Materials, Communications, Consumer – Cyclical, Consumer – Noncyclical, Diversified, Energy, Industrial, Technology and Utilities) and 9 years (2005 – 2013). The market share of a rating agency is determined as a portion of debt issues rated by this agency and the total number of debt issues rated by the three rating agencies in a given year and industry sector.

The World Bank, the database of World Development Indicators[14], is the source of the macroeconomic indicator data. The downloaded dataset includes current account balance (% of GDP), GDP growth (annual %), GDP per capita (US$ of 2014) and inflation (GDP deflator, annual %).

4.2 Sample Statistics of Financial Indicators

A wide range of industry sectors is represented in the dataset. The data on the financial sector includes primarily banks, insurance companies and real estate investment trusts (REITS). The data on the non-financial sectors cover the following

[13]The issuer's first rating in the dataset is considered to be the initial rating.
[14]*Source:* The World Bank; http://data.worldbank.org/data-catalog/world-development-indicators

industry sectors (defined by Bloomberg Industry Classification System[15]): Basic Materials (e.g. Chemicals, Mining, Iron/Steel), Communications (e.g. Telecommunications, Media, Internet), Consumer – Cyclical (e.g. Retail, Entertainment, Auto Manufacturers), Consumer – Noncyclical (e.g. Food, Commercial Services, Pharmaceuticals), Diversified (e.g. Holding Companies), Energy (e.g. Oil&Gas, Pipelines, Coal), Industrial (e.g. Transportation, Electronics, Building Materials), Technology (e.g. Semiconductors, Computers, Software) and Utilities (e.g. Electric, Gas, Water).

It is necessary to distinguish between the credit rating determinants based on industry sector. Caouette et al. (2008)and Golin and Delhaise (2013) suggest that financial institutions should be evaluated according to the Capital-Assets-Management-Earnings-Liquidity (CAMEL) model, which defines a set of financial indicators that capture capital adequacy, asset quality, profitability and liquidity assessment. [16]

Panel A in Table A1 in the Appendix shows the selected financial indicators for the credit rating prediction of financial institutions. In particular, the industry sub-sector of banks is used as an example to illustrate the mean values of these ratios across companies with different rating grades.

- ***Capital Adequacy*** – Basel III[17] requires that the Tier 1 Capital of banks must be at least 6.0% of risk-weighted assets. The Tier 1 ratio, calculated as the sum of core capital and disclosed reserves relative to risk-weighted assets, measures the company's financial strength. The higher the ratio, the higher the company's buffer against unexpected losses.
- ***Asset Quality*** – Non-performing Loans / Total Loans ratio indicates the severity of problems regarding the credit quality of the company's borrowers is. A loan

[15]The BICS (Bloomberg Industry Classification System) classification is based on the issuer's business characteristic and, similarly to GICS (Global Industry Classification Standard), it consists of 10 sectors. The classification of BICS (Basic Materials, Communications, Consumer - Cyclical, Consumer - Non-cyclical, Energy, Industrial, Utilities, Financial and Diversified) and GICS (Materials, Telecommunication Services, Consumer Discretionary, Consumer Staples, Energy, Industrials, Utilities, Financials and Health Care) are almost identical.

[16] As management (corporate governance) quality is a qualitative factor and it is hard to find a proxy for that indicator, this paper had to neglect its impact on the company's rating.

[17]*Source*: Third Basel Accord issued by the Bank for International Settlements; http://www.bis.org/publ/bcbs189.pdf

is considered to be non-performing if the borrower is more than 90 days overdue on any payment connected with the loan. Indeed, the higher the Non-performing Loans / Total Loans ratio, the worse the company's asset quality. The situation is even worse if the bank does not create enough Loan Loss Reserves to cover Non-Performing Loans (NPL), that is, it has low NPL coverage.

- ***Profitability*** –the profitability of banks is most frequently measured by the Return on Equity (ROE) and the Return on Assets (ROA). ROE expresses the profit generated from the shareholders' investments, while ROA shows how efficiently the management uses the company's assets to generate earnings. The rule of thumb in most markets is that a ROE of between 10 and 20 percent and a ROA of between 1 and 2 percent indicate acceptable performance. Companies below (above) these ranges have weak (very strong) profitability.
- ***Liquidity*** – the ratio between Total Loans and Total Deposits is a key measure of a company's liquidity. A ratio below 100 percent means that the company is funding its loan portfolio from core deposits, while a ratio above 100 percent signals that it uses also other types of market funding. The strength and stability of the bank's customer deposit base can be also measured by the Deposit to Funding ratio. If the ratio is high, it indicates that the company is less dependent on more volatile interbank or commercial sources of funding.

A broad set of control variables is also available for non-financial institutions. However, to avoid multicollinearity, only selected financial ratios are used to assess the credit quality of the company. Guided by Altman (1968) and Altman and Rijken (2004), non-financial institutions are evaluated based on the Z-score model. The model is comprised of five financial ratios that have the highest discriminating power in predicting corporate bankruptcy (Altman, 1968). These include proxies for liquidity (Working Capital / Total Assets), profitability (Retained Earnings / Total Assets, Earnings before Interest and Taxes / Total Assets), leverage (Total Equity / Total Liabilities) and the efficient use of assets (Sales / Total Assets).

Panel B in Table A1 in the Appendix presents descriptive statistics of selected financial ratios for the non-financial sector. Specifically, on the example of cyclical

consumer goods the mean values of financial indicators are summarized by rating grades.

- ***Working Capital / Total Assets*** – The ratio is a measure of liquidity; the company's short-term financial health. Working Capital is calculated as the difference between Current Assets and Current Liabilities and expresses the ability of the company to cover its short-term obligations with short-term assets. Thus, the Working Capital / Total Assets ratio shows the percentage of remaining liquid assets (after repayment of current liabilities) on the total assets. As reported in Panel B of Table A1, this measure increases by the credit quality of the company.
- ***Retained Earnings / Total Assets*** - The ratio provides insight into the cumulative profitability of the company. Altman (1968) argues that the ratio effectively reflects the age of the company in terms of its probability of bankruptcy: companies in their earlier years accumulate relatively low retained earnings and, accordingly, are more exposed to financial difficulties. As the company grows older, it should enhance its Retained Earnings / Total Assets ratio. The higher the ratio, the better the company's financial performance.
- ***Earnings before Interest and Taxes / Total Assets*** – The ratio expresses the general profitability of the company's assets. It considers the company's earnings before tax and leverage reductions are taken into account. As Panel B in Table A1 indicates, the Earnings before Interest and Taxes / Total Assets ratio can take negative values if the company generates losses and is close to default.
- ***Total Equity / Total Liabilities***– The ratio is the measure of the company's leverage. It shows how much short-term and long-term debt the company can take and still be covered by its equity. The lower the Total Equity / Total Liabilities ratio, the lower the company's solvency.
- ***Net Sales / Total Assets*** –The ratio indicates how efficiently the company deploys its assets to generate net sales. Net sales (calculated as the difference between total revenue and any allowances or discounts provided to the customer) compared to total assets are heavily industry-specific. For instance, industries with low (high) assets and high (low) sales may have a ratio above

200 (below 50) percent. Panel B in Table A1 reports that the Net Sales / Total Assets ratio of cyclical consumer goods increases with higher credit ratings, but does not reach 100 percent.

4.3 Sample Statistics of Issuer Ratings

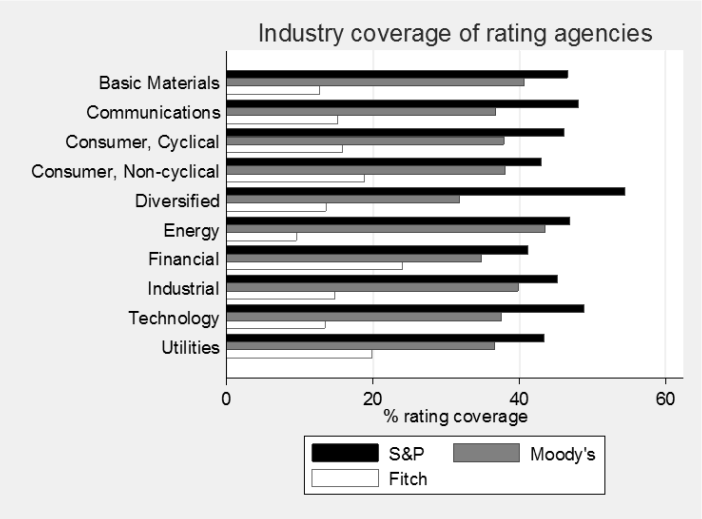
To express the forward-looking predictions of rating agencies about the credit risk of the individual financial and non-financial institution, long term issuer credit ratings[18] assigned by three rating agencies (Moody's, S&P and Fitch) are utilized. Credit ratings assessing the creditworthiness of obligors range from AAA (highest quality) to D (default). Nevertheless, S&P/Fitch and Moody's rating grades differ slightly. To make them comparable, the ratings need to be mapped into a common numeric scale. Table A2 in the Appendix summarizes the credit ratings together with their interpretation and the assigned rating grades on finer/wider scales.

The following sample statistics of issuer ratings guide the hypotheses formulated in this paper:

Figure 1 indicates that the rating coverage of rating agencies across the individual industry sectors (i.e. the share of each agency in the total number of issuer ratings within industry sectors) differs significantly. The sample statistics confirm the expectations that S&P and Moody's (both established in early 1900) have much higher rating coverage than Fitch (established in 1997). While in each industry sector both S&P and Moody's rate at least 40% of the issuer ratings, the rating coverage of Fitch is well below 20% (except in the financial industry sector).Therefore, this paper examines the credit ratings of S&P and Moody's (if not stated otherwise), and the rating coverage of Fitch is only used as a measure of varying competition between rating agencies.

[18] "Credit ratings express the agency's opinion about the ability and willingness of an issuer, such as a corporation or state or city government, to meet its financial obligations in full and on time. Credit ratings can also speak to the credit quality of an individual debt issue, such as a corporate note, a municipal bond or a mortgage-backed security, and the relative likelihood that the issue may default."
Source: Standard & Poor's; http://www.standardandpoors.com/ratings/definitions-and-faqs/en/us

Figure 1.Industry coverage by S&P, Moody's and Fitch



Source: Author's calculations. *Note:* The figure depicts the share of each agency on total number of issuer ratings within industry sectors. The total number of 3 955 issuer ratings is gained using the sample of 2 486 issuers. The rating coverage is evaluated at the end of 2013.

Table 1 suggests that the discrepancy in issuer ratings between these agencies is substantial. It summarizes the number of times Moody's and S&P differently rated the issuer, given the issuer was rated by both agencies. The disagreement is measured on the sample of 2 486 issuers at the end of years 2005 - 2013. From a total amount of 22 374 observations, the two agencies assigned different rating to the issuers in 5 839 cases. [19] In the case of financial institutions, the two rating agencies significantly disagree when assigning ratings A and BBB. In the case of non-financial institutions, credit ratings across the two agencies also vary for issuers rated BBB and BB (i.e. at the investment– noninvestment grade boundary).

[19]Although the distance between the two ratings would provide a more precise measure of the rating split, this paper focuses only on the existence of a disagreement between Moody's and S&P. In the examined sample, one notch rating difference constitutes 75 percent of total rating splits between the agencies.

Table 1. Disagreement between S&P and Moody's in issuer ratings

(A) Financial institutions

Number of Moody's Issuer Ratings Different from S&P Issuer Ratings

Number of S&P Issuer Ratings Different from Moody's Issuer Ratings	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	Total
AAA			1																	1
AA+			5																	5
AA	1	24		19	3															47
AA-	9	37	52		33	4		1												136
A+		12	28	81		53	9	3		3										**189**
A			10	51	138		42	18	5				2							**266**
A-			3	17	53	102		58	36	3	1									**273**
BBB+				2	17	51	64		88	31	2		1							**256**
BBB					1	10	30	80		71	13	1	4							**210**
BBB-						2	11	30	52		32	8	11	2	2					**150**
BB+								1	2	26		20	6	4						59
BB						2		1		7	19		36	16						81
BB-											5	8		42	9	2				66
B+											1	13	11		6	8	4			43
B											1		4	13		9	3			30
B-											1		2	4	2		7			16
CCC+																2		1	1	4
CCC													1	1	1	2	4			9
CCC-																	2			2
CC															1					1
Total	10	73	99	170	**245**	**224**	**156**	**192**	**183**	**141**	75	50	78	82	21	23	20	1	1	1844

(*continued on next page*)

(B) Nonfinancial institutions

Number of Moody's Issuer Ratings Different from S&P Issuer Ratings

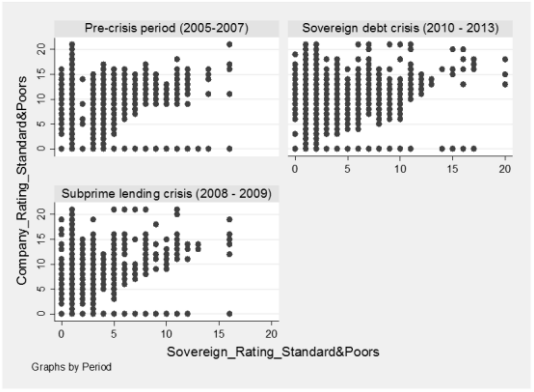
Number of S&P Issuer Ratings Different from Moody's Issuer Ratings	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC+	CCC	CCC-	CC	Total
AAA		7																			7
AA+			7	2																	9
AA		53		13	21	1															88
AA-		17	37		44	24	4	2													128
A+			17	45		70	31	2													165
A			4	8	90		84	29	1												216
A-			1		29	90		174	63	9	12										378
BBB+					3	16	113		249	43	5										**429**
BBB	1				1	2	29	131		271	37	3					1				**476**
BBB-	2			5		2	2	6	147		157	41	9							1	**372**
BB+							2	2	15	47		142	33	2	1						**244**
BB							1		12	6	117		203	47	2	1				6	**395**
BB-									1	1	15	106		193	36	3				2	**357**
B+										1	1	10	106		139	20	5	1		2	285
B													12	83		115	23	5	2		240
B-													5	7	51		61	11	7	4	146
CCC+															3	16		5	2	4	30
CCC																2	2		5		9
CCC-																		1			1
CC																	1	2	4		7
D															3	1	1	1	3	4	13
Total	3	77	66	73	188	205	266	**346**	**488**	**378**	**344**	**302**	**368**	332	235	158	94	26	23	23	3995

Source: Author's calculations. *Note*: The table summarizes the number of times Moody's and S&P differently rated the issuer, given the issuer was rated by both agencies. It is based on credit ratings of 2 486 issuers observed at the end of years 2005 - 2013 (i.e. over 9 years totaling 22 374 observations). While for financial institutions a rating disagreement is observed in 1 844 cases, for non-financial institutions the disagreement is observed in 3 995 cases.

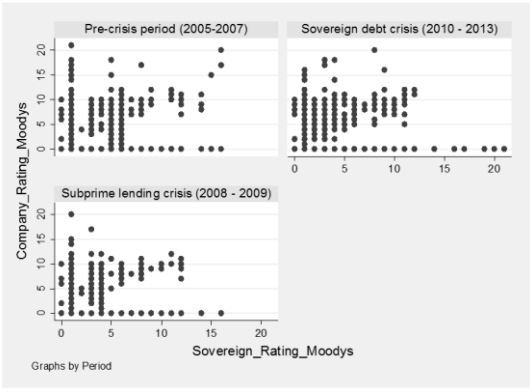
From the early 2000s, rating agencies have gradually changed their approach to reflecting the country ratings in the issuer's rating. The cases in which issuer ratings are higher than their country rating have become more frequent. Figure 2 provides some preliminary insight about the relationship of issuer and sovereign ratings during the pre-crisis period (2005-2007), during the subprime lending crisis (2008-2010) and during the sovereign debt crisis (2011-2013). It suggests that after the subprime lending crises, rating agencies ceased restricting company ratings by sovereign rating. When comparing the three rating agencies, Moody's relaxes the sovereign cap most frequently.

Figure 2. The relationship between company and sovereign ratings

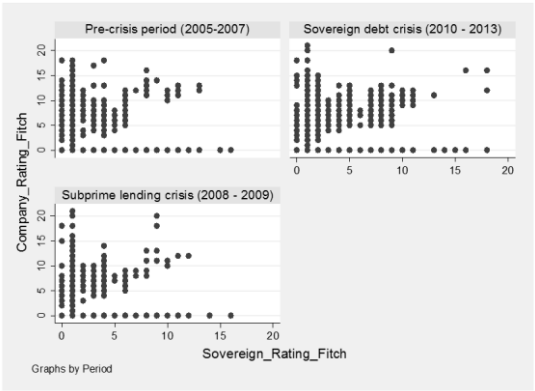
(A) Ratings assigned by S&P



(B) Ratings assigned by Moody's



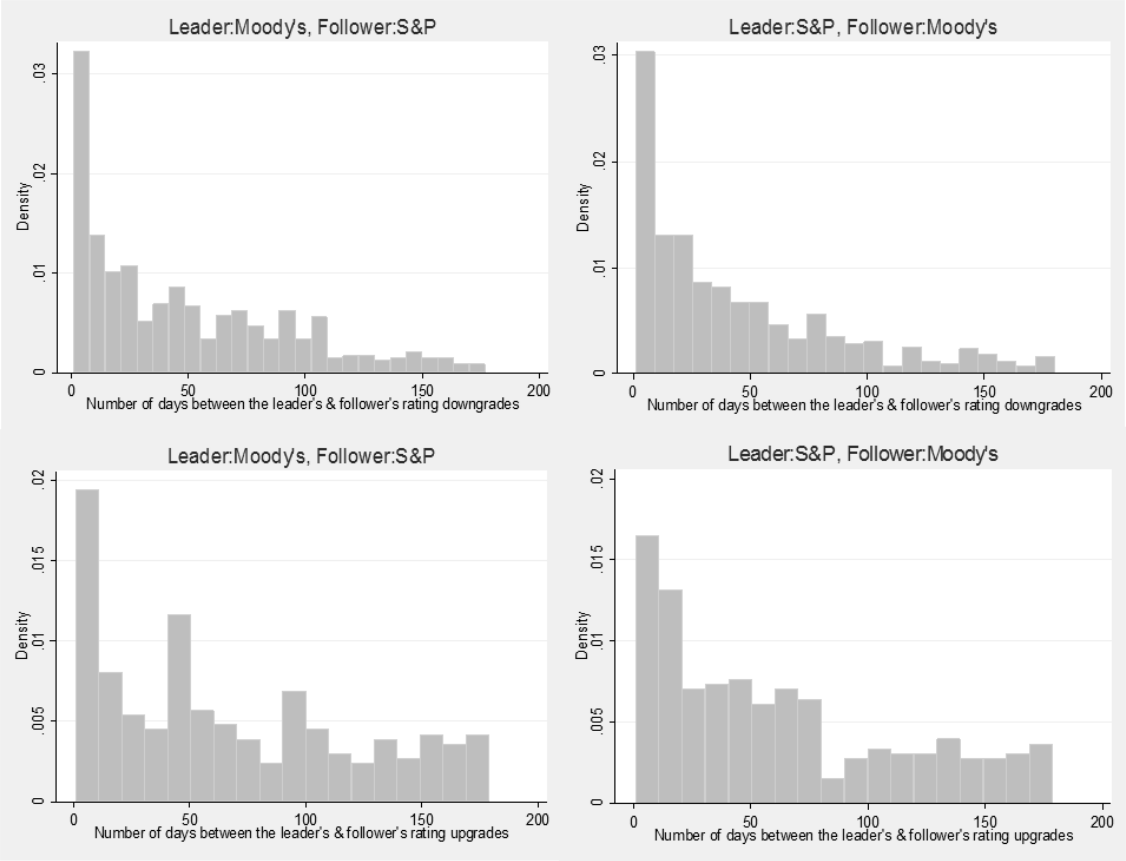
(C) Ratings assigned by Fitch



Source: Author's calculations using the sample of 2 486 issuer ratings and their sovereign ratings assigned by S&P, Moody's and Fitch. *Note:* (1) The figures illustrate the relationship between sovereign ratings and the issuer ratings during three periods: pre-crisis period (2005-2007), subprime lending crisis (2008-2010) and sovereign debt crisis (2011-2013). It depicts to what extent issuer ratings are capped by sovereign ratings. (2) The numeric rating grades range from Aaa=1 to D=21.

To see whether there is a potential leader-follower relationship between S&P and Moody's, daily information on rating actions are utilized. For the sample of rating actions observed for 2 486 issuers between December 2005 and October 2014, Figure 3 depicts the distribution of time elapsed between rating actions originated by Moody's and S&P. Specifically, it illustrates the probability that the potential follower's rating action is within a certain time window after the potential leader's rating action. The figures suggest that while upgrades of the potential leader do not evoke immediate actions by the potential follower, both agencies most likely react to the downgrade of the other agency within 50 days.

Figure 3.The distribution of time between rating actions



Source: Author's calculations using S&P and Moody's rating changes observed on the sample of 2 486 issuers between December 2005 and October 2014. *Note:* (1) The figures illustrate the probability that the potential follower's rating action is in certain time window after the potential leader's rating action. (2) Only rating changes within 1- 180 days are plotted.

Table 2 summarizes the magnitude of the follower's rating change on the preceding rating change of the leader.[21] In particular, Panel A and B show what share of S&P's rating change is a reaction to a prior rating change by Moody's, and Panel C and D present what share of Moody's rating change is a reaction to a prior rating change by S&P. Panel B for non-financial institutions suggests that if Moody's downgrades/upgrades at some point in time, on average 80% of these rating actions are followed by S&P within 90days. Panel D for non-financial institutions shows that Moody's reaction to S&P's rating changes is lower, at 67% on average. The leader-follower relationship for financial institutions is slightly different. Considering the same time window, around 65% of Moody's downgrades/upgrades are followed by S&P (Panel A), while only 56% of S&P's rating actions are copied by Moody's (Panel C). These preliminary statistics suggest that S&P is likely to be the follower on the credit rating market.

5.Results

5.1 Disagreement in Rating Assessments across Industry, Time and Rating

As investors tend to differentiate between ratings and bond yields often reflect the rating of the more prudent agency, the rating disagreement across industry sectors is of high prominence for the financial market participants. Based on the results of the Wilcoxon signed rank sum test summarized in Table 3 (Panel A), I reject the null hypothesis that the choice of rating agency has no effect on the credit rating of the issuer. Moody's is consistently more prudent in rating non-financial institutions. This

[21]Rating change refers only to a downgrade or an upgrade in the issuer's rating. New rating assignments (by an additional rating agency) or rating withdrawals are not considered in the analysis of leader-follower relationship, as these are driven by the decision of the issuer and there might be several reasons for them. For example, new rating assignments might correspond to the issuer asking for a second rating opinion either because the first agency assigned an unfavorable rating, or because the industry peers are strengthening their market position through an additional rating opinion. The opposite logic might motivate rating withdrawals.

Table 2.The magnitude of the follower's rating change on the preceding rating change of the leader

Panel A - Leader: Moody's,Industry: Financial

	Downgrade by Moody's in previous 1-15days	Downgrade by Moody's in previous 16-90days	Downgrade by Moody's in previous 91-180days	Downgrade by Moody's in previous more than 180 days	Upgrade by Moody's in previous 1-15days	Upgrade by Moody's in previous 16-90days	Upgrade by Moody's in previous 91-180days	Upgrade by Moody's in previous more than 180 days	Total rating action by S&P
S&P downgrade by 2 or more notches	**28,2%**	**18,4%**	11,6%	5,8%	0,0%	0,0%	0,0%	0,0%	130
S&P downgrade by 1 notch	**43,6%**	**42,9%**	25,6%	43,5%	0,0%	4,2%	0,0%	13,0%	447
No rating change	28,2%	36,7%	53,5%	34,8%	40,0%	29,2%	14,8%	35,9%	2266
S&P upgrade by 1 notch	0,0%	2,0%	9,3%	15,9%	**60,0%**	**62,5%**	77,8%	50,0%	400
S&P upgrade by 2 or more notches	0,0%	0,0%	0,0%	0,0%	**0,0%**	**4,2%**	7,4%	1,1%	29
Grand Total	39	98	43	69	5	24	27	92	3272

Panel B -Leader: Moody's; Industry: Non-financial

	Downgrade by Moody's in previous 1-15days	Downgrade by Moody's in previous 16-90days	Downgrade by Moody's in previous 91-180days	Downgrade by Moody's in previous more than 180 days	Upgrade by Moody's in previous 1-15days	Upgrade by Moody's in previous 16-90days	Upgrade by Moody's in previous 91-180days	Upgrade by Moody's in previous more than 180 days	Total rating action by S&P
S&P downgrade by 2 or more notches	**26,2%**	**18,3%**	8,0%	3,4%	0,0%	1,1%	1,5%	1,0%	427
S&P downgrade by 1 notch	**55,9%**	**54,3%**	45,0%	38,2%	3,0%	0,0%	3,0%	8,9%	1576
No rating change	16,6%	26,4%	43,0%	31,4%	16,7%	13,8%	22,4%	34,0%	7543
S&P upgrade by 1 notch	0,7%	0,0%	3,0%	25,0%	**63,6%**	**71,3%**	68,7%	53,6%	1593
S&P upgrade by 2 or more notches	0,7%	1,0%	1,0%	2,0%	**16,7%**	**13,8%**	4,5%	2,4%	227
Grand Total	145	197	100	204	66	87	67	291	11366

(*continued on next page*)

Panel C – Leader: S&P,Industry: Financial

	Downgrade by S&P in previous 1-15days	Downgrade by S&P in previous 16-90days	Downgrade by S&P in previous 91-180days	Downgrade by S&P in previous more than 180 days	Upgrade by S&P in previous 1-15days	Upgrade by S&P in previous 16-90days	Upgrade by S&P in previous 91-180days	Upgrade by S&P in previous more than 180 days	Total rating action by Moody's
Moody's downgrade by 2 or more notches	**28,6%**	**31,4%**	16,7%	3,8%	0,0%	0,0%	0,0%	0,0%	142
Moody's downgrade by 1 notch	**20,4%**	**26,7%**	16,7%	37,7%	5,4%	0,0%	0,0%	4,9%	306
No rating change	51,0%	41,9%	66,7%	54,7%	21,6%	57,1%	55,6%	53,4%	2473
Moody's upgrade by 1 notch	0,0%	0,0%	0,0%	3,8%	**43,2%**	**14,3%**	38,9%	35,0%	285
Moody's upgrade by 2 or more notches	0,0%	0,0%	0,0%	0,0%	**29,7%**	**28,6%**	5,6%	6,8%	66
Grand Total	49	105	18	53	37	7	18	103	3272

Panel D – Leader: S&P,Industry: Non-financial

Leader: S&P, Follower: Moody's	Downgrade by S&P in previous 1-15days	Downgrade by S&P in previous 16-90days	Downgrade by S&P in previous 91-180days	Downgrade by S&P in previous more than 180 days	Upgrade by S&P in previous 1-15days	Upgrade by S&P in previous 16-90days	Upgrade by S&P in previous 91-180days	Upgrade by S&P in previous more than 180 days	Total rating action by Moody's
Moody's downgrade by 2 or more notches	**23,2%**	**19,2%**	10,1%	2,7%	1,3%	2,5%	0,0%	0,0%	205
Moody's Sowngrade by 1 notch	**46,4%**	**46,6%**	46,8%	28,7%	1,3%	2,5%	4,3%	6,7%	889
No rating change	29,8%	32,4%	43,0%	55,3%	34,8%	25,3%	21,3%	44,2%	9323
Moody's upgrade by 1 notch	0,7%	0,5%	0,0%	12,8%	**53,5%**	**55,7%**	66,0%	46,8%	838
Moody's upgrade by 2 or more notches	0,0%	1,4%	0,0%	0,5%	**9,0%**	**13,9%**	8,5%	2,2%	111
Grand Total	151	219	79	188	155	79	94	267	11366

Source: Author's calculations. *Note:* The table presents the magnitude of the rating changes of the follower (downgrade by more than 2 notches, downgrade by 1 notch, no rating change, upgrade by 1 notch, upgrade by 2 notches), given the leader's actions (downgrade, upgrade) in previous 1-15 days, 16-90 days, 91-180 days or more than 180 days. For example, the first column of Panel C suggests that 15days after S&P downgraded the issuers; Moody's subsequently downgraded the issuers by more than 2 notches in 28.6% of cases, downgraded the issuers by 1 notch in 20.4% cases and did not change its rating in 51% of cases. The rating change statistics express the magnitude and the timing between subsequent rating updates (rating changes could be faster for the agency that was more wrong in its previous rating), where the initial rating is the first rating in the dataset. In total, the table covers 5 572 rating changes by Moody's and 9 066 rating changes by S&P observed on the sample of 2 236 issuers between January 2005 and October 2014 (for the remaining 250 issuers no rating changes was observed).

finding is in line with Livingston et al. (2010) who on the sample non-financial U.S. corporations show that conservative ratings assigned by Moody's are also detected by the investors (when two ratings are available and Moody's rating is higher, bond yields are at a lower level than when S&P's rating is higher). Nevertheless, this paper extends the results of the recent literature by examining rating split also within the nonfinancial sector. Contrary to expectations, the results of the Wilcoxon signed rank sum test suggest that rating agencies agree in creditworthiness of issuers from the Technology and Communications industry sectors. For the other non-financial industry sectors the numerical rating grades provided by S&P are lower (indicating a better rating) than the numerical rating grades provided by Moody's (Column 8 of Table 3, Panel A) and the disagreement is statistically significant at least at the 5% level(Column 5 of Table 3, Panel A). Interestingly, in the assessment of default risk for financial institutions S&P is the more conservative rating agency. These results might be explained by the difference in rating methodologies or the higher costs of overrating[22] financial institutions for S&P.

The difference between S&P and Moody's credit ratings deepens over time (Table 3, Panel B). During the pre-crisis period (2005-2007), it is statistically significant only at a 10% level, while during the subprime lending crisis (2008-2010), it is statistically significant at a 5% level and during the sovereign debt crisis (2011-2013), it is statistically significant at a 1% level.

According to Table 3 (Panel C), the two rating agencies also differ across rating grades divided into investment grade (ratings from AAA to BBB) and non-investment grade (ratings from BB to D). For investment grade ratings, the Wilcoxon sum rank test for the equality of median ratings is rejected at a 5% statistical significance level, while for non-investment grade ratings, the equality of median ratings between S&P and Moody's is already rejected at 1%.

[22] Although credit ratings are issuer paid, rating agencies seek to protect their reputational capital by assigning timely and accurate ratings.

Table 3. Wilcoxon signed rank test of issuer ratings

Panel A

Industry sector	Rating agency	Complete sample	Sub-sample of issuers rated by both S&P & Moody's		Sub-sample of issuers with different rating from S&P & Moody's				
		N	N	Wilcoxon signed-rank p-value	N	Split % of Complete Sample	Mean	Median	Standard deviation
Basic Materials	S&P	1 728	792	0.016	330	19%	10.1	10.0	2.7
	Moody's						10.3	10.0	2.7
Communications	S&P	1 827	787	0.530	388	21%	10.9	11.0	3.7
	Moody's						10.8	11.0	3.7
Cyclical	S&P	2 853	1 298	0.000	661	23%	11.7	12.0	3.3
	Moody's						12.2	13.0	3.4
Non-cyclical	S&P	2 898	1 427	0.000	743	26%	9.2	9.0	3.6
	Moody's						9.7	10.0	3.6
Diversified	S&P	126	53	0.004	18	14%	10.4	11.0	1.8
	Moody's						11.4	12.5	2.5
Energy	S&P	1 620	947	0.000	449	28%	10.5	11.0	3.5
	Moody's						10.8	11.0	4.1
Financial	S&P	5 490	2 874	0.000	1 844	34%	8.0	8.0	3.0
	Moody's						7.6	7.0	3.5
Industrial	S&P	3 411	1 465	0.000	726	21%	10.0	10.0	3.5
	Moody's						10.6	11.0	3.8
Technology	S&P	1 008	308	0.764	161	16%	9.8	9.0	3.4
	Moody's						9.8	9.0	3.8
Utilities	S&P	1 413	883	0.000	519	37%	8.2	8.0	2.5
	Moody's						8.3	8.0	2.8
Total	S&P	22 374	10 834	0.000	5 839	26%	9.4	9.0	3.5
	Moody's						9.5	9.0	3.9

(*continued on next page*)

Table 3. Wilcoxon signed rank test of issuer ratings

Panel B

Time period	Rating agency	Complete sample	Sub-sample of issuers rated by both S&P & Moody's		Sub-sample of issuers with different rating from S&P & Moody's				
		N	N	Wilcoxon signed-rank p-value	N	Split % of Complete Sample	Mean	Median	Standard deviation
Pre-crisis period (2005-2007)	S&P	7 458	3 179	0.073	1 705	23%	9.0	9.0	3.4
	Moody's						9.1	9.0	3.9
Subprime lending crisis (2008-2010)	S&P	7 458	3 686	0.025	2 055	28%	9.4	9.0	3.6
	Moody's						9.5	9.0	4.0
Sovereign debt crisis (2011-2013)	S&P	7 458	3 969	0.000	2 079	28%	9.6	9.0	3.4
	Moody's						9.9	10.0	3.7
Total	S&P	22 374	10 834	0.000	5 839	26%	9.4	9.0	3.5
	Moody's						9.5	9.0	3.9

Panel C

Rating grade	Rating agency	Complete sample	Sub-sample of issuers rated by both S&P & Moody's		Sub-sample of issuers with different rating from S&P & Moody's				
		N	N	Wilcoxon signed-rank p-value	N	Split % of Complete Sample	Mean	Median	Standard deviation
Investment grade (AAA to BBB-)	S&P	10 699	7 195	0.025	3 801	36%	7.3	7.0	2.0
	Moody's						7.3	8.0	2.6
Non-investment grade (BB+ to D)	S&P	11 675	3 639	0.000	2 038	17%	13.3	13.0	1.8
	Moody's						13.6	14.0	2.1
Total	S&P	22 374	10 834	0.000	5 839	26%	9.4	9.0	3.5
	Moody's						9.5	9.0	3.9

Source: Author's calculations. *Note*: (1) The table compares Moody's and S&P issuer ratings by industry sector (Panel A), by time period (Panel B) and by rating grade (Panel C). The first part of the table summarizes the *complete sample* hat consists of credit ratings of 2 486 issuers observed at the end of years 2005 - 2013 (i.e. over 9 years totaling 22 374 observations). The second part of the table shows the results of Wilcoxon signed-rank test conducted on the *sub-sample of issuers rated by both S&P and Moody's* at year-ends. The third part of the table presents the descriptive statistics of credit ratings on the *sub-sample of issuers with different rating from S&P & Moody's.* (2) Cyclical denotes consumer goods industries that rely heavily on the business cycle and economic conditions. Non-cyclical denotes consumer goods industries that are immune to economic fluctuations.

5.2 Rating Split is Dependent on Competition between Rating Providers

The simple probit model was used to estimate the relationship between rating splits and selected rating determinants. The estimation results conducted separately for financial and non-financial institutions are summarized in Table 4. These show that Fitch's increasing market share has a positive and statistically significant (at a 5% level) effect on the rating split between S&P and Moody's in the non-financial sector (the impact in the financial sector is not statistically significant). These results extend the findings of Becker and Milbourn (2011), who show that the quality of issuer-paid credit ratings lowered (the rating's information value for investors and their accuracy in predicting default decreased) after Fitch entered the market.[23] Nevertheless, Fitch's increasing market share not only lowers the rating quality of S&P and Moody's, but it also increases the likelihood of rating split (as shown in Table 4). If Fitch's issuer rating is different from the ratings assigned by S&P or Moody's, then Fitch's entry to the market might serve as a trigger for the two main rating agencies to reassess the creditworthiness of the issuer. This might then result in the rating split of S&P and Moody's issuer ratings. Another possible explanation is that some rating agencies might prefer to protect their reputational capital by assigning timely and accurate ratings (i.e. likely to issue lower ratings); other rating agencies might prefer to increase their own profits (credit ratings are issuer-paid) by assigning favorable issuer ratings (i.e. likely to issue higher ratings). The results of this paper suggests that rating shopping (acquiring an additional rating opinion in the hope of rating improvement) fosters further disagreement between rating agencies, and hence reinforces the use of 'second best' issuer rating for regulatory purposes.

Other determinants of rating splits are also in line with expectations. The disagreement between issuer ratings deepens over time. During the sovereign debt crisis, the rating split is, on average, higher by 3.4 percentage points than during the pre-crisis period. Interestingly, for non-investment grade issuers, the rating split is less frequent. The results also suggest that rating disagreement is present even in relation to

[23] Xia (2014) and Cornaggia and Cornaggia (2013) show that rating quality increases when investor-paid rating agencies are present on the credit rating market.

the key financial indicators (the choice of key financial indicators predicting the rating of financial and non-financial institution is in line with the literature - Altman, 1968; Altman and Rijken, 2004; Caouette et al., 2008; Golin and Delhaise, 2013; Hau et al., 2013). This can be partially explained by the different weights the rating agencies place on individual financial fundamentals.

The one-year change in the earnings-per-share (EPS), as the measure of performance volatility, does not influence rating splits. Although Ederington and Goh (1998) argue that a decline in earnings is a good proxy for market expectations and efficiently forecasts downgrades, the estimation results summarized in Table 4 suggest that the volatility of EPS has no statistically significant effect on the rating disagreement between Moody's and S&P.

5.3 Sovereign Ceilings Are Restrictive Only for Financial Institutions

Table 5 summarizes the key determinants of S&P and Moody's issuer rating changes estimated based on model (2) and (3). The regressions are run separately for financial and nonfinancial institutions. Yet Panel A demonstrates that in the case of financial institutions, S&P increased the reliance of issuer rating on sovereign (i.e. country of domicile) rating during the sovereign debt crisis (one notch sovereign upgrade leads to a 13.2% higher likelihood of issuer upgrade; one notch sovereign downgrade leads to a 8.6% higher likelihood of issuer downgrade), Panel C suggests that Moody's reflected the country ratings in its issuer ratings over all the examined periods (although the magnitude of sovereign effect is decreasing).This finding is most likely driven by the dominant foreign ownership of financial institutions, where the high rating of the parent company is limited by the lower rating of the issuer's country. A recent contribution from Williams et al. (2013) similarly shows the importance of sovereign ratings for financial institutions in emerging markets for 1999 - 2009. Nevertheless, the findings in Table 5 suggest that the role of sovereign rating change is also essential in other than emerging market and remains statistically significant at 1% in the sovereign debt crisis. Possessing a non-investment grade issuer/sovereign rating has no statistically significant impact on rating downgrade/upgrade.

Table 4.Determinant of rating disagreement between S&P and Moody's

Dependent variable – Rating disagreement	Financial institutions (Marginal effects)	Non-financial institutions (Marginal effects)
Sovereign debt crisis	0.003	0.034***
	(0.033)	(0.011)
Fitch market share	1.310	0.281**
	(2.152)	(0.127)
Non-investment grade issuer	-0.437***	-0.134***
	(0.031)	(0.009)
Non-investment grade sovereign	0.256***	-0.002
	(0.052)	(0.031)
Total asset	-0.000	-0.000***
	(0.000)	(0.000)
Volatility of Earnings per Share	-0.000	0.000***
	(0.000)	(0.000)
Net interest margin	0.000**	-
	(0.000)	-
Non-performing assets to total assets	0.016***	-
	(0.005)	-
Deposits to funding	-0.002***	-
	(0.001)	-
Retained Earnings / Total Assets	-	0.000**
	-	(0.000)
Total Equity / Total Liabilities	-	-0.001***
	-	(0.000)
Net Sales /Total Assets	-	-0.000***
	-	(0.000)
Euro Area	0.077	-0.097***
	(0.051)	(0.015)
Japan	-0.158***	-0.250***
	(0.055)	(0.014)
Other Advanced Economies	0.104**	-0.114***
	(0.041)	(0.013)
Commonwealth of Independent States	0.001	0.138***
	(0.125)	(0.051)
Emerging and Developing Asia	-0.138***	-0.081**
	(0.050)	(0.032)
Emerging and Developing Europe	0.304***	-0.125*
	(0.089)	(0.067)
Latin America and the Caribbean	-0.030	-0.105***
	(0.058)	(0.022)
Middle East, North Africa	0.180***	-
	(0.045)	
Materials	-	-0.055***
	-	(0.020)
Communications	-	-0.039**
	-	(0.019)
Industrials	-	-0.043***
	-	(0.016)
Technology	-	-0.060**
	-	(0.025)
Observations	1,553	10,238
R-squared	0.2001	0.0938

Source: Author's calculations using data issuers that are rated by S&P or Moody's over 2005-2013. *Note:* (1) Estimation results presented only for variables that were statistically significant at least in one model. (2) For Sovereign debt crisis the reference value is the Pre-crisis period, for Region the reference value is USA, for Industry sector of non-financial institutions the reference value is the financial sector. (3) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The two major rating agencies put significantly less weight from sovereign ratings on the rating of non-financial institutions. In almost all time periods the sovereign rating change does not affect the issuer rating for S&P or Moody's (Panel B and D). Borensztein et al. (2013) analyze the relationship between sovereign and issuer ratings and find the same results for ratings assigned by S&P. This paper contributes to the literature by an important finding – over the recent financial crises, neither of the two incumbent rating agencies applied sovereign restriction on the rating of non-financial institutions.

Turning to the other determinants of issuer rating change, Table 5 shows that competition is one of the key triggers of rating action. While the effect of the rating agencies' industry coverage is particularly strong in the case of financial institutions, for non-financial institutions the competitors' rating actions drive the rating update. Compared to other agencies' rating actions, the impact of fluctuations in financial and macroeconomic data on issuer rating upgrade/downgrade is much weaker and often insignificant - Table 3A in the Appendix reports the coefficients on financial and macroeconomic data of the estimated models (2) and (3).

5.4 S&P Tends to be the Follower in Rating Actions

Having confirmed a tight linkage between several rating actions, this sections turns to examining the leader-follower relationship of rating agencies. Table 6 presents the results of the ordered logit model for rating changes, where S&P (Moody's) is a potential follower and Moody's (S&P) is a potential leader. The estimation is conducted using daily rating changes between December 2005 and October 2014. The rating actions are analyzed in four time windows: the follower's rating action is 1-15 days[24], 16-90 days, 91-180 days or more than 180 days after the leader's rating action.

[24] Rating changes within two days account for only 1% of the total number of rating actions.

Table 5. Determinants of issuer rating change

Panel A – Issuer rating: S&P, Industry: Financial

	Dependent variable - Issuer rating upgrade by S&P			Dependent variable - Issuer rating downgrade by S&P		
Rating change determinants	Pre-crisis (up grade) - Financial inst. – Marg effects	Subprime lending crisis (up grade) - Financial inst. – Marg effects	Sovereign debt crisis (up grade) - Financial inst. – Marg effects	Pre-crisis (downgrade)- Financial inst. – Marg effects	Subprime lending crisis (downgrade) - Financial inst. – Marg effects	Sovereign debt crisis (downgrade) - Financial inst. – Marg effects
Upgrade of Sovereign by S&P	0.135	0.096***	0.132***			
	(0.086)	(0.032)	(0.040)			
Upgrade of Issuer by Moody's	0.256***	0.020	0.075*			
	(0.053)	(0.034)	(0.039)			
Upgrade of Issuer by Fitch	0.124*	0.051*	0.087**			
	(0.066)	(0.026)	(0.043)			
Downgrade of Sovereign by S&P				-0.144*	-0.034	0.086***
				(0.078)	(0.028)	(0.021)
Downgrade of Issuer by Moody's				-0.104***	0.080***	0.032*
				(0.040)	(0.021)	(0.018)
Downgrade of Issuer by Fitch				-0.016	0.084***	0.025
				(0.064)	(0.024)	(0.027)
Sovereign rating by S&P	0.018	-0.008*	-0.004	0.007	0.012*	0.004
	(0.014)	(0.005)	(0.005)	(0.016)	(0.007)	(0.007)
Non-investment grade issuer	-0.246***	-0.056**	-0.112***	-0.255***	-0.082**	-0.139***
	(0.092)	(0.025)	(0.029)	(0.095)	(0.038)	(0.041)
Non-investment grade sovereign	0.047	0.124***	0.012	0.144	0.141**	0.046
	(0.117)	(0.038)	(0.057)	(0.127)	(0.062)	(0.072)
S&P industry market share	21.359***	0.483	1.004*	13.223**	-15.778**	0.021
	(6.039)	(4.591)	(0.590)	(6.268)	(6.872)	(0.790)
Pseudo R2	0.2804	0.3506	0.3335	0.2172	0.3860	0.3197
Observations	293	496	638	293	631	638

(*continued on next page*)

Table 5. Determinants of issuer rating change

Panel B – Issuer rating: S&P, Industry: Non-financial

	Dependent variable - Issuer rating upgrade by S&P			Dependent variable - Issuer rating downgrade by S&P		
Rating change determinants	Pre-crisis (up grade) - Non-financial inst. – Marg. effects	Subprime lending crisis (up grade) - Non-financial inst. – Marg. effects	Sovereign debt crisis (upgrade) - Non-financial inst. – Marg. effects	Pre-crisis (downgrade)- Non-financial inst. – Marg. effects	Subprime lending crisis (downgrade)- Non-financial inst. – Marg. effects	Sovereign debt crisis (downgrade)- Non-financial inst. – Marg. effects
Upgrade of Sovereign by S&P	0.088***	0.026	0.042			
	(0.025)	(0.026)	(0.032)			
Upgrade of Issuer by Moody's	0.185***	0.150***	0.152***			
	(0.019)	(0.013)	(0.014)			
Upgrade of Issuer by Fitch	0.143***	0.123***	0.099***			
	(0.028)	(0.022)	(0.022)			
Downgrade of Sovereign by S&P				-0.131***	-0.030	0.021**
				(0.032)	(0.025)	(0.010)
Downgrade of Issuer by Moody's				-0.029	0.048***	0.029*
				(0.022)	(0.013)	(0.015)
Downgrade of Issuer by Fitch				0.074***	0.039**	0.022
				(0.024)	(0.017)	(0.023)
Sovereign rating by S&P	0.001	-0.003	-0.006*	-0.015	0.006	0.004
	(0.007)	(0.005)	(0.004)	(0.009)	(0.007)	(0.005)
Non-investment grade issuer	-0.010	0.006	0.002	-0.053***	-0.021	-0.032**
	(0.014)	(0.009)	(0.010)	(0.018)	(0.014)	(0.014)
Non-investment grade sovereign	-0.002	0.034	-0.024	-0.046	0.034	-0.031
	(0.047)	(0.034)	(0.032)	(0.062)	(0.046)	(0.046)
S&P industry market share	0.144	0.149	-0.243	0.074	-0.021	-0.234
Pseudo R2	0.1342	0.1728	0.1573	0.0575	0.0910	0.0742
Observations	2,595	4,057	3,889	2,595	4,060	3,908

(*continued on next page*)

Table 5. Determinants of issuer rating change

Panel C – Issuer rating: Moody's, Industry: Financial

	Dependent variable - Issuer rating upgrade by Moody's			Dependent variable - Issuer rating downgrade by Moody's		
Rating change determinants	Pre-crisis (upgrade) - Financial inst. – Marg effects	Subprime lending crisis (upgrade) - Financial inst. – Marg effects	Sovereign debt crisis (upgrade) - Financial inst. – Marg effects	Pre-crisis (down-grade) - Financial inst. – Marg effects	Subprime lending crisis (down-grade)- Financial inst. – Marg effects	Sovereign debt crisis (down-grade)- Financial inst. – Marg effects
Upgrade of Sovereign by Moody's	0.458***	0.607***	0.201***			
	(0.082)	(0.118)	(0.033)			
Upgrade of Issuer by S&P	0.192***	0.015	0.037			
	(0.039)	(0.023)	(0.024)			
Upgrade of Issuer by Fitch	0.097	0.303***	0.050*			
	(0.061)	(0.069)	(0.027)			
Downgrade of Sovereign by Moody's				-0.485***	-0.081***	-0.010
				(0.084)	(0.028)	(0.020)
Downgrade of Issuer by S&P				-0.189***	0.052**	0.045*
				(0.039)	(0.024)	(0.025)
Downgrade of Issuer by Fitch				-0.041	0.028	0.033
				(0.048)	(0.029)	(0.030)
Sovereign rating by Moody's	-0.018	0.003	0.009*	-0.012	0.015**	-0.008
	(0.014)	(0.006)	(0.005)	(0.014)	(0.006)	(0.007)
Non-investment grade issuer	-0.353**	-0.011	0.029	-0.390**	-0.135***	0.092**
	(0.159)	(0.025)	(0.024)	(0.157)	(0.045)	(0.039)
Non-investment grade sovereign	0.474***	0.067	0.033	0.517***	0.054	0.063
	(0.141)	(0.047)	(0.037)	(0.149)	(0.072)	(0.069)
Moody's industry market share	89.031***	-43.147***	-1.052	86.166***	18.423***	5.150***
	(16.600)	(13.377)	(1.023)	(17.831)	(6.938)	(1.702)
Pseudo R2	0.4823	0.8019	0.5575	0.476	0.3835	0.2809
Observations	289	411	575	289	631	632

(*continued on next page*)

Table 5. Determinants of issuer rating change

Panel D – Issuer rating: Moody's, Industry: Non-financial

	Dependent variable - Issuer rating upgrade by Moody's			Dependent variable - Issuer rating downgrade by Moody's		
Rating change determinants	Pre-crisis (upgrade) - Non-financial inst. – Marg. effects	Subprime lending crisis (upgrade) - Non-financial inst. – Marg. effects	Sovereign debt crisis (upgrade) - Non-financial inst. – Marg. effects	Pre-crisis (downgrade)- Non-financial inst. – Marg. effects	Subprime lending crisis (downgrade)- Non-financial inst. – Marg. effects	Sovereign debt crisis (down-grade)- Non-financial inst. – Marg. effects
Upgrade of Sovereign by Moody's	-0.012	0.026	0.042*			
	(0.025)	(0.017)	(0.023)			
Upgrade of Issuer by S&P	0.093***	0.075***	0.087***			
	(0.010)	(0.007)	(0.008)			
Upgrade of Issuer by Fitch	0.087***	0.068***	0.057***			
	(0.017)	(0.012)	(0.015)			
Downgrade of Sovereign by Moody's				0.014	-0.022*	0.005
				(0.039)	(0.013)	(0.009)
Downgrade of Issuer by S&P				-0.016	0.029***	0.008
				(0.012)	(0.007)	(0.009)
Downgrade of Issuer by Fitch				0.043**	0.003	0.007
				(0.019)	(0.013)	(0.020)
Sovereign rating by Moody's	0.006	-0.003	0.001	-0.006	0.016**	0.010***
	(0.006)	(0.004)	(0.003)	(0.009)	(0.006)	(0.004)
Non-investment grade issuer	-0.006	0.003	0.014*	-0.046***	-0.027**	0.003
	(0.009)	(0.007)	(0.009)	(0.014)	(0.011)	(0.012)
Non-investment grade sovereign	-0.068**	0.005	0.007	-0.017	-0.058	-0.076**
	(0.032)	(0.021)	(0.024)	(0.045)	(0.044)	(0.036)
Moody's industry market share	0.175	-0.043	0.666**	0.171	-0.328**	0.705*
	(0.259)	(0.108)	(0.285)	(0.350)	(0.162)	(0.390)
Pseudo R2	0.1906	0.2386	0.1930	0.0599	0.0791	0.0680
Observations	2,567	3,994	3,882	2,567	4,060	3,908

Source: Author's calculations. *Note*: (1) The table presents the results of probit estimation (Eq. (2) and Eq. (3)) with robust standard errors. It reports the impact of own/other agency's sovereign/issuer ratings on the probability of the issuer rating change (marginal effects) originated by S&P and Moody's. The dependent variable is a binary variable for rating upgrade/downgrade observed at the end of years 2005 – 2013 for the sample of 2486 financial and non-financial institutions. Rating downgrades and upgrades are examined separately due to their different determinants. The determinants of issuer rating changes are presented for three different periods: pre-crisis period (2005-2007), subprime lending crisis (2008-2010) and sovereign debt crisis (2011-2013). The impact of financial and macroeconomic data on issuer rating change is presented in Table 3A. (2) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The rating downgrade/upgrade of the competitor is statistically significant at the 1% level in all examined time windows. In line with expectations, the more time has passed after the leader's rating action, the less likely it is that the follower will downgrade/upgrade its rating (i.e. the impact of a 1 notch rating change is more substantial in magnitude than a 2 notch rating change). Comparing the reaction of one rating agency 1-15 days after the other agency's downgrade/upgrade, the following can be concluded: (1) Moody's issuer downgrade/upgrade increases the likelihood of S&P's issuer downgrade/upgrade by 25-30% on average (Panel A and Panel B); (2) S&P's issuer downgrade/upgrade increases the likelihood of Moody's issuer downgrade/upgrade by only 15-19% on average (Panel C and Panel D). This suggests that S&P is more likely to be the follower in rating actions when compared to Moody's. The results do not vary substantially for financial and non-financial institutions. Overall, rating actions are less likely to be affected by the agency's own previous rating downgrades/upgrades. The result is qualitatively similar to the findings of Alsakka and Gwilym (2010), which show that Moody's is the first mover on the sovereign credit rating market.

After measuring market reaction (stock return movement) to rating outlook[25] changes, Bannier and Hirsch (2010) argue that outlooks have not only an informative role, but serve as early warning indicators. As a robustness check, a model utilizing rating outlook changes was also estimated. However, the results of model (4) and (5) with rating outlook are very similar to those predicted using credit rating changes; the findings are not presented in this paper.

[25]"A rating outlook assesses the potential direction of a long-term credit rating over the intermediate term (typically six months to two years). In determining a rating outlook, consideration is given to any changes in the economic and/or fundamental business conditions. An outlook is not necessarily a precursor of a rating change."
Source: Standard & Poor's;
https://www.standardandpoors.com/ratings/articles/en/us/?articleType=HTML&assetID=1245378053126

Table 6. Leader-follower relationship between S&P and Moody's

Panel A - Follower: S&P, Industry: Financial

	Financial institutions (Marginal effects)			
Dependent variable	S&P upgrade by 1 notch	S&P upgrade by more than 2 notches	S&P downgrade by 1 notch	S&P downgrade by more than 2 notches
Downgrade by Moody's in previous 1-15days	-0.245***	-0.015***	0.283***	0.071***
	(0.025)	(0.003)	(0.030)	(0.008)
Downgrade by Moody's in previous 16-90days	-0.204***	-0.012***	0.235***	0.059***
	(0.017)	(0.003)	(0.021)	(0.006)
Downgrade by Moody's in previous 91-180days	-0.121***	-0.007***	0.140***	0.035***
	(0.029)	(0.002)	(0.034)	(0.009)
Downgrade by Moody's in previous 180 and more days	-0.126***	-0.008***	0.145***	0.036***
	(0.025)	(0.002)	(0.029)	(0.007)
Upgrade by Moody's in previous 1-15days	0.249***	0.015***	-0.288***	-0.072***
	(0.048)	(0.004)	(0.056)	(0.015)
Upgrade by Moody's in previous 16-90days	0.239***	0.015***	-0.277***	-0.069***
	(0.030)	(0.003)	(0.035)	(0.010)
Upgrade by Moody's in previous 91-180days	0.275***	0.017***	-0.318***	-0.079***
	(0.032)	(0.003)	(0.036)	(0.012)
Upgrade by Moody's in previous more than 180 days	0.162***	0.010***	-0.188***	-0.047***
	(0.021)	(0.002)	(0.024)	(0.007)
Downgrade by S&P in previous 1-15days	-0.135***	-0.008***	0.156***	0.039***
	(0.046)	(0.003)	(0.053)	(0.014)
Downgrade by S&P in previous 16-90days	-0.177***	-0.011***	0.204***	0.051***
	(0.023)	(0.002)	(0.027)	(0.008)
Downgrade by S&P in previous 91-180days	-0.172***	-0.010***	0.199***	0.049***
	(0.027)	(0.003)	(0.032)	(0.009)
Downgrade by S&P in previous more than 180 days	-0.107***	-0.006***	0.123***	0.031***
	(0.024)	(0.002)	(0.030)	(0.008)
Upgrade by S&P in previous 1-15days	0.033	0.002	-0.038	-0.010
	(0.027)	(0.002)	(0.031)	(0.008)
Upgrade by S&P in previous 16-90days	-	-	-	-
	-	-	-	-
Upgrade by S&P in previous 91-180days	0.153***	0.009***	-0.177***	-0.044***
	(0.039)	(0.003)	(0.046)	(0.012)
Upgrade by S&P in previous more than 180 days	0.065**	0.004**	-0.075**	-0.019**
	(0.031)	(0.002)	(0.035)	(0.009)
Observations	3,766			
Pseudo R2	0.0862			

(*continued on next page*)

Table 6. Leader-follower relationship between S&P and Moody's

Panel B - Follower: S&P, Industry: Non-financial

	Non-financial institutions (Marginal effects)			
Dependent variable	S&P upgrade by 1 notch	S&P upgrade by more than 2 notches	S&P downgrade by 1 notch	S&P downgrade by more than 2 notches
Downgrade by Moody's in previous 1-15days	-0.305***	-0.041***	0.296***	0.075***
	(0.015)	(0.004)	(0.015)	(0.005)
Downgrade by Moody's in previous 16-90days	-0.262***	-0.035***	0.254***	0.065***
	(0.014)	(0.003)	(0.014)	(0.004)
Downgrade by Moody's in previous 91-180days	-0.179***	-0.024***	0.173***	0.044***
	(0.020)	(0.003)	(0.019)	(0.005)
Downgrade by Moody's in previous more than 180 days	-0.063**	-0.008**	0.061**	0.016**
	(0.027)	(0.004)	(0.027)	(0.007)
Upgrade by Moody's in previous 1-15days	0.309***	0.041***	-0.299***	-0.076***
	(0.024)	(0.004)	(0.023)	(0.007)
Upgrade by Moody's in previous 16-90days	0.319***	0.043***	-0.309***	-0.079***
	(0.019)	(0.003)	(0.018)	(0.006)
Upgrade by Moody's in previous 91-180days	0.265***	0.035***	-0.256***	-0.065***
	(0.019)	(0.003)	(0.019)	(0.006)
Upgrade by Moody's in previous more than 180 days	0.186***	0.025***	-0.180***	-0.046***
	(0.014)	(0.002)	(0.013)	(0.004)
Downgrade by S&P in previous 1-15days	0.121*	0.016*	-0.117*	-0.030*
	(0.065)	(0.009)	(0.063)	(0.016)
Downgrade by S&P in previous 16-90days	-0.193***	-0.026***	0.187***	0.047***
	(0.016)	(0.003)	(0.016)	(0.004)
Downgrade by S&P in previous 91-180days	-0.174***	-0.023***	0.168***	0.043***
	(0.018)	(0.003)	(0.017)	(0.005)
Downgrade by S&P in previous more than 180 days	-0.030**	-0.004**	0.029**	0.007**
	(0.015)	(0.002)	(0.014)	(0.004)
Upgrade by S&P in previous 1-15days	-0.008	-0.001	0.007	0.002
	(0.012)	(0.002)	(0.011)	(0.003)
Upgrade by S&P in previous 16-90days	-	-	-	-
	-	-	-	-
Upgrade by S&P in previous 91-180days	0.075**	0.010**	-0.073**	-0.018**
	(0.035)	(0.005)	(0.034)	(0.009)
Upgrade by S&P in previous more than 180 days	0.097***	0.013***	-0.094***	-0.024***
	(0.011)	(0.002)	(0.010)	(0.003)
Observations	10,872			
Pseudo R2	0.0748			

(*continued on next page*)

Table 6. Leader-follower relationship between S&P and Moody's

Panel C - Follower: Moody's, Industry: Financial

	Financial institutions (Marginal effects)			
Dependent variable	Moody's upgrade by 1 notch	Moody's upgrade by more than 2 notches	Moody's downgrade by 1 notch	Moody's downgrade by more than 2 notches
Downgrade by S&P in previous 1-15days	-0.140***	-0.029***	0.156***	0.062***
	(0.019)	(0.005)	(0.021)	(0.009)
Downgrade by S&P in previous 16-90days	-0.153***	-0.032***	0.171***	0.068***
	(0.014)	(0.005)	(0.016)	(0.007)
Downgrade by S&P in previous 91-180days	-0.102***	-0.021***	0.113***	0.045***
	(0.025)	(0.006)	(0.027)	(0.011)
Downgrade by S&P in previous more than 180 days	-0.095***	-0.020***	0.106***	0.043***
	(0.016)	(0.004)	(0.018)	(0.007)
Upgrade by S&P in previous 1-15days	0.186***	0.039***	-0.207***	-0.083***
	(0.064)	(0.014)	(0.071)	(0.029)
Upgrade by S&P in previous 16-90days	0.218***	0.046***	-0.243***	-0.097***
	(0.022)	(0.006)	(0.024)	(0.012)
Upgrade by S&P in previous 91-180days	0.142***	0.030***	-0.158***	-0.063***
	(0.027)	(0.006)	(0.030)	(0.013)
Upgrade by S&P in previous more than 180 days	0.125***	0.026***	-0.140***	-0.056***
	(0.013)	(0.004)	(0.015)	(0.007)
Downgrade by Moody's in previous 1-15days	-0.149**	-0.032**	0.166**	0.067**
	(0.059)	(0.013)	(0.066)	(0.027)
Downgrade by Moody's in previous 16-90days	-0.132***	-0.028***	0.147***	0.059***
	(0.021)	(0.005)	(0.023)	(0.010)
Downgrade by Moody's in previous 91-180days	-0.134***	-0.028***	0.149***	0.060***
	(0.019)	(0.005)	(0.021)	(0.008)
Downgrade by Moody's in previous more than 180 days	0.004	0.001	-0.005	-0.002
	(0.024)	(0.005)	(0.027)	(0.011)
Upgrade by Moody's in previous 1-15days	0.045	0.009	-0.050	-0.020
	(0.139)	(0.029)	(0.154)	(0.062)
Upgrade by Moody's in previous 16-90days	0.010***	0.002***	-0.011***	-0.004***
	(0.002)	(0.001)	(0.003)	(0.001)
Upgrade by Moody's in previous 91-180days	0.061	0.013	-0.068	-0.027
	(0.075)	(0.016)	(0.084)	(0.034)
Upgrade by Moody's in previous more than 180 days	0.105***	0.022***	-0.117***	-0.047***
	(0.013)	(0.003)	(0.015)	(0.007)
Observations	3,766			
Pseudo R2	0.0973			

(*continued on next page*)

Table 6. Leader-follower relationship between S&P and Moody's

Panel D - Follower: Moody's, Industry: Non-financial

	Non-financial institutions (Marginal effects)			
Dependent variable	Moody's upgrade by 1 notch	Moody's upgrade by more than 2 notches	Moody's downgrade by 1 notch	Moody's downgrade by more than 2 notches
Downgrade by S&P in previous 1-15days	-0.175***	-0.015***	0.190***	0.031***
	(0.010)	(0.002)	(0.011)	(0.003)
Downgrade by S&P in previous 16-90days	-0.166***	-0.014***	0.180***	0.030***
	(0.009)	(0.002)	(0.009)	(0.002)
Downgrade by S&P in previous 91-180days	-0.143***	-0.012***	0.155***	0.025***
	(0.012)	(0.002)	(0.012)	(0.003)
Downgrade by S&P in previous more than 180 days	-0.064***	-0.006***	0.069***	0.011***
	(0.014)	(0.001)	(0.015)	(0.003)
Upgrade by S&P in previous 1-15days	0.178***	0.015***	-0.194***	-0.032***
	(0.013)	(0.002)	(0.014)	(0.003)
Upgrade by S&P in previous 16-90days	0.160***	0.014***	-0.174***	-0.029***
	(0.009)	(0.002)	(0.010)	(0.003)
Upgrade by S&P in previous 91-180days	0.181***	0.016***	-0.197***	-0.032***
	(0.011)	(0.002)	(0.012)	(0.003)
Upgrade by S&P in previous more than 180 days	0.128***	0.011***	-0.140***	-0.023***
	(0.008)	(0.001)	(0.009)	(0.002)
Downgrade by Moody's in previous 1-15days	-0.022	-0.002	0.024	0.004
	(0.044)	(0.004)	(0.048)	(0.008)
Downgrade by Moody's in previous 16-90days	-0.128***	-0.011***	0.139***	0.023***
	(0.014)	(0.002)	(0.015)	(0.003)
Downgrade by Moody's in previous 91-180days	-0.148***	-0.013***	0.161***	0.026***
	(0.014)	(0.002)	(0.015)	(0.003)
Downgrade by Moody's in previous more than 180 days	0.012	0.001	-0.013	-0.002
	(0.030)	(0.003)	(0.033)	(0.005)
Upgrade by Moody's in previous 1-15days	-	-	-	-
	-	-	-	-
Upgrade by Moody's in previous 16-90days	0.087***	0.008***	-0.094***	-0.015***
	(0.032)	(0.003)	(0.034)	(0.006)
Upgrade by Moody's in previous 91-180days	0.129***	0.011***	-0.140***	-0.023***
	(0.033)	(0.003)	(0.036)	(0.006)
Upgrade by Moody's in previous more than 180 days	0.092***	0.008***	-0.100***	-0.016***
	(0.013)	(0.001)	(0.014)	(0.003)
Observations		10,872		
Pseudo R2		0.1500		

Source: Author's calculations on the sample of daily rating changes between December 2005 and October 2014 originated by S&P and Moody's. *Note:* (1) The table presents the results of ordered logit estimation (Eq. (4) and Eq. (5)) with robust standard errors. It reports the impact of potential leader's/follower's rating action on the probability of the follower's rating upgrade/downgrade (marginal effects). The dependent variable is a binary variable taking the value of 1 if the follower upgraded/downgraded the issuer by one/two or more notches. The independent variables are dummy variables taking the value of 1 if the issuer is upgraded/ downgraded by the potential leader/follower in four previous time windows (1-15 days, 16-90 days, 91-180 days, more than 180 days). (2) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

6.Conclusion

The recent financial crisis has prompted increased analysis of the quality of credit ratings. Several issues focused the attention of the financial market on credit ratings: (1) significant but slow credit rating fluctuations over the past decades, (2) Basel III continues to give high prominence to ratings in bank capital requirements, (3) excessive power of ratings to influence market expectations.

This paper contributes to the recent related literature in several ways. First, empirical evidence suggests that there is a statistically significant difference in the rating evaluations of the two incumbent credit rating agencies. While Moody's is consistently more conservative in its assessment of default risk for non-financial institutions, S&P is consistently more conservative in its assessment of default risk for financial institutions. The two rating agencies systematically agree in credit ratings only in the Communications and Technology industry sectors. The difference between S&P and Moody's credit ratings has deepened over time, becoming the most substantial during the sovereign debt crisis from 2011 to 2013.

Second, empirical evidence indicates that Fitch's increasing market share has a positive and statistically significant effect on the rating split between S&P and Moody's in the non-financial sectors. This might be because some rating agencies might prefer to protect their reputational capital by assigning timely and accurate ratings; other rating agencies might prefer to increase their own profits (ratings are issuer-paid) by assigning more favorable ratings. Thus, instead of promoting rating competition, the reporting requirements about financial data should be vastly enhanced to reduce sole reliance on credit ratings. The findings of this paper also imply that rating shopping (acquiring an additional rating opinion) fosters further disagreement between rating agencies, and hence reinforces the use of 'second best' issuer rating for regulatory purposes.

Third, this paper confirms that sovereign ratings remain significant determinants of issuer ratings in the case of financial institutions, even though S&P gradually increases and Moody's gradually relaxes its weight. For non-financial institutions, the approach of rating agencies is exactly the opposite. While S&P issuer ratings reflect sovereign ceilings, Moody's does not constrain the rating of non-financial institutions by the

issuer's country rating. The findings suggest that sovereign ceilings constitute a potential source of negative externality for financial institutions in low- rated countries, given that the financial health (rating) of the issuer is much stronger than of the parent company.

Lastly, the empirical results of this paper strongly support the idea that the rating actions of one agency are considerably influenced by the prior ratings of other agencies. When compared to Moody's, S&P is a follower in its rating actions for both financial and non-financial institutions. Further research should examine at what point financial market participants internalize this fact in their investment decisions.

References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, *23* (4), 589–609.

Altman, E. I. and Rijken, H. (2004). How rating agencies achieve rating stability. *Journal of Banking and Finance* 28, 2679–2714.

Alsakka, R. and Gwilym, O. (2010). Leads and lags in sovereign credit ratings. *Journal of Banking & Finance* 34, 2614-2626.

Bannier, C. E. and Hirsch, C. W. (2010). The economic function of credit rating agencies – What does the watchlist tell us? *Journal of Banking & Finance,* 34, 3037–3049.

Bar-Isaac, H. and Shapiro, J. (2013).Ratings quality over the business cycle. *Journal of Financial Economics,* 108, 62–78.

Becker, B. and Milbourn, T. (2011). How did increased competition affect credit ratings? *Journal of Financial Economics,* 101, 493–514.

Berger, A. N. and Bouwman, C. H. S. (2013). How does capital affect bank performance during financial crises? *Journal of Financial Economics,* 109, 146–176.

Bongaerts, D., Cremers, K.J.M., and Goetzmann, W.N. (2012). Tiebreaker: Certification and Multiple Credit Ratings. *Journal of Finance, 67*(1), 113-152.

Borensztein, E., Cowan, K. and Valenzuela, P. (2007). Sovereign ceilings "lite"? The impact of sovereign ratings on corporate ratings in emerging market economies. *Journal of Banking & Finance,* 37, 4014–4024.

Cantor, R. and Packer, F. (1996). Determinants and impact of sovereign credit ratings. *Economic Policy Review,* 2, 37–54.

Caouette, J. B., Altman, E. I., Narayanan, P. and Nimmo, R.W.J. (2008). Managing credit risk: the great challenge for global financial markets. John Wiley & Sons Inc.

Cornaggia, J. and Cornaggia, K.J. (2013). Estimating the Costs of Issuer-Paid Credit Ratings. *Review of Financial Studies, 26*(9), 2229-2269.

Ederington, L.H. and Goh, J.C. (1998). Bond Rating Agencies and Stock Analysts: Who Knows What When? *Journal of Financial and Quantitative Analysis, 33*(4), 569-585.

Galil, K. and Soffer, G. (2011). Good news, bad news and rating announcements: An empirical investigation. *Journal of Banking & Finance,* 35, 3101-3119.

Golin, J. and Delhaise, P. (2013). The Bank Credit Analysis Handbook: A Guide for Analysts, Bankers and Investors. John Wiley & Sons Inc.

Güntay, L. and Hackbarth, D. (2010). Corporate Bond Credit Spreads and Forecast Dispersion. *Journal of Banking and Finance,* 34, 2328–2345.

Güttler, A. and Wahrenburg, M. (2007).The adjustment of credit ratings in advance of defaults. *Journal of Banking & Finance,* 31, 751–767.

Hau, H., Langfield, S. and Marques-Ibanez, D. (2013). Bank ratings: what determines their quality? *Economic Policy,* 289–333.

Hill, P., Brooks, R. and Faff , R. (2010). Variations in sovereign credit quality assessments across rating agencies. *Journal of Banking & Finance,* 34, 1327–1343.

Chen, S.-S., Chen, H.-Y., Chang, Ch.-Ch. And Yang, S.-L. (2013). How do sovereign credit rating changes affect private investment? *Journal of Banking & Finance,* 37, 4820-4833.

Ismailescu, I. and Kazemi, H. (2010). The reaction of emerging market credit default swap spreads to sovereign credit rating changes. *Journal of Banking & Finance,* 34, 2861-2873.

Livingston, M., Naranjo, A. and Zhou, L.(2008). Split bond ratings and rating migration. *Journal of Banking & Finance,* 32, 1613-1624.

Livingston, M., Wei J. and Zhou L.(2010). Moody's and S&P Ratings: Are They Equivalent? Conservative Ratings and Split Rated Bond Yields. *Journal of Money, Credit and Banking, 42*(7), 1267–1293.

Mehran, H. and Thakor, A. (2011).Bank Capital and Value in the Cross-Section. *Review of Financial Studies,* 24, 1019-1067.

Morgan, D.P. (2002). Rating banks: risk and uncertainty in an opaque industry. *American Economic Review, 92*(4), 874–888.

Skreta, V. and Veldkamp, L. (2009). Ratings shopping and asset complexity: A theory of ratings inflation. *Journal of Monetary Economics,* 56, 678–695.

Williams, G., Alsakka, R., and Gwilym, O. (2013).The impact of sovereign rating actions on bank ratings in emerging markets. *Journal of Banking & Finance,* 37, 563-577.

Xia, H. (2014). Can investor-paid credit rating agencies improve the information quality of issuer-paid rating agencies? *Journal of Financial Economics,* 111, 450-468.

Appendix

Table A1. Mean financial statistics per rating grade

Panel A – Financial sector: Banks

in %

Rating grade	Tier 1	Common Equity / Total Assets	Loan Loss Reserves / Non-performing Assets	Non-performing Assets / Total Assets	Return on Assets	Return on Equity	Total Loans / Total Deposits	Deposits / Funding
AAA	N/A	2.0	N/A	1.0	0.3	7.3	61.4	59.9
AA	12.0	30.0	104.3	1.2	0.6	10.8	131.1	60.3
A	11.4	111.0	77.2	2.4	0.6	5.8	108.4	68.2
BBB	12.3	62.0	134.5	3.2	0.5	5.7	94.8	80.0
BB	12.8	26.0	93.1	3.0	0.6	5.0	94.1	76.6
B	14.7	10.0	97.1	5.4	0.7	4.1	109.1	72.1
CCC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NR	11.4	59.0	117.4	2.1	0.6	6.4	82.8	88.0

Panel B – Non-financial sector: Consumer-Cyclical

in %

Rating grade	Working capital / Total Assets	Retained Earnings / Total Assets	Earnings before Interest and Taxes / Total Assets	Total Equity / Total Liabilities	Net Sales / Total Assets
AAA	N/A	N/A	N/A	N/A	N/A
AA	16.9	36.4	1.7	99.7	82.2
A	10.6	20.9	1.6	54.2	78.9
BBB	10.3	12.6	1.7	63.8	84.6
BB	14.1	4.9	1.6	53.7	77.9
B	9.8	-12.6	1.3	26.6	99.5
CCC	4.2	-19.7	0.0	29.1	71.8
C	-127.9	-52.0	-0.7	-29.5	67.4
NR	18.9	13.8	1.7	127.0	103.2

Source: Author's calculations using financial statement data from the end of 2009 credit rating assigned by S&P. *Note*: (1) As several indicators provide meaningful interpretation only if evaluated within the same sector, the table summarizes the financial ratios of only two industry sub-sectors. Based on the total number of observations in the dataset, the industry sub-sectors of banks and cyclical consumer goods were chosen to illustrate the financial indicators of the financial and non-financial sectors. (3) NR denotes issuers not rated by S&P, N/A stands for missing observations.

Table A2. Credit rating interpretation and numeric scales

Original rating grades		Interpretation	New rating grades			
S&P/ Fitch	Moody's		Fine scale		Wide scale	
			Numeric	Letter	Numeric	Letter
		Investment grades				
AAA	AAA	Extremely strong capacity to meet financial commitments	1	AAA	1	AAA
AA+	Aa1	Very strong capacity to meet financial commitments	2	AA+	2	AA
AA	Aa2		3	AA	2	AA
AA-	Aa3		4	AA-	2	AA
A+	A1	Strong capacity to meet financial commitments, but somewhat susceptible to adverse economic conditions and changes in circumstances.	5	A+	3	A
A	A2		6	A	3	A
A-	A3		7	A-	3	A
BBB+	Baa1	Adequate capacity to meet financial commitments, but more subject to adverse economic conditions	8	BBB+	4	BBB
BBB	Baa2		9	BBB	4	BBB
BBB-	Baa3	Considered lowest investment grade by market participants	10	BBB-	4	BBB
		Non- investment (speculative) grades				
BB+	Ba1	Less vulnerable in the near-term but faces major ongoing uncertainties to adverse business, financial and economic conditions	11	BB+	5	BB
BB	Ba2		12	BB	5	BB
BB-	Ba3		13	BB-	5	BB
B+	B1	More vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments	14	B+	6	B
B	B2		15	B	6	B
B-	B3		16	B-	6	B
CCC+	Caa1	Currently vulnerable and dependent on favorable business, financial and economic conditions to meet financial commitments.	17	CCC+	7	CCC
CCC	Caa2		18	CCC	7	CCC
CCC-	Caa3		19	CCC-	7	CCC
CC	Ca	Currently highly vulnerable	20	CC	8	CC
C	C	Currently highly vulnerable obligations and other defined circumstances	21	C	9	C
SD/D		Payment default on financial commitments	21		9	D

Source: Author's classification into numerical scales. *Note*:(1)The credit ratings are mapped into 21 numerical values, where AAA is the best rating category and SD/D (semi-default/default) is the worst rating category. (2)The interpretation of credit ratings is defined by S&P: http://www.standardandpoors.com/ratings/definitions-and-faqs/en/us

Table 3A . Determinants of issuer rating change
Panel A – Issuer rating: S&P, Industry: Financial

	Dependent variable - Issuer rating upgrade by S&P			Dependent variable - Issuer rating downgrade by S&P		
Rating change determinants	Pre-crisis (upgrade) - Financial institutions - Marginal effects	Subprime lending crisis (upgrade) - Financial institutions - Marginal effects	Sovereign debt crisis (upgrade) - Financial institutions - Marginal effects	Pre-crisis (downgrade)- Financial institutions - Marginal effects	Subprime lending crisis (downgrade)- Financial institutions - Marginal effects	Sovereign debt crisis (downgrade)- Financial institutions - Marginal effects
Total asset	-0.000*	0.000**	-0.000	-0.000**	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return on assets	-0.023	-0.007	0.019**	-0.003	-0.023	0.006
	(0.033)	(0.009)	(0.009)	(0.036)	(0.014)	(0.014)
Common equity to total assets	-0.015*	0.003	-0.000	-0.021**	0.002	0.003
	(0.008)	(0.002)	(0.003)	(0.009)	(0.003)	(0.004)
Total loans to total deposits	0.000	0.000	0.000	0.000	0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Deposits to funding	-0.003*	0.001**	0.000	-0.003*	-0.000	-0.002**
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
1Y change in Return on assets	0.019*	0.000	-0.003***	-0.013	0.001***	-0.002***
	(0.011)	(0.000)	(0.001)	(0.012)	(0.000)	(0.001)
1Y change in Net interest margin	0.065	0.024**	0.071	0.072	0.092***	0.096
	(0.054)	(0.011)	(0.043)	(0.059)	(0.032)	(0.069)
1Y change in Common equity to total assets	-0.143	-0.044	0.004	0.076	-0.041	0.059***
	(0.137)	(0.060)	(0.005)	(0.128)	(0.073)	(0.022)
1Y change in Loan loss reserves to non-performing assets	-0.012	-0.066	-0.023	-0.004	0.000***	-0.026
	(0.011)	(0.044)	(0.025)	(0.008)	(0.000)	(0.047)
1Y change in Non-performing assets to total assets	0.026	-0.037	-0.016	0.038*	-0.001	-0.033
	(0.021)	(0.025)	(0.031)	(0.022)	(0.007)	(0.040)

(*continued on next page)*

1Y change in Total loans to total deposits	-0.031	-0.003	0.060	0.111	0.127	-0.306*
	(0.211)	(0.081)	(0.124)	(0.194)	(0.130)	(0.176)
1Y change in Deposits to funding	0.462**	-0.149	0.097	0.602***	0.155	-0.125
	(0.202)	(0.114)	(0.120)	(0.185)	(0.140)	(0.176)
Current account to GDP	-0.014***	-0.001	0.000	-0.011***	-0.006**	-0.000
	(0.003)	(0.001)	(0.002)	(0.004)	(0.002)	(0.003)
GDP per capita	-0.000	-0.000	-0.000**	-0.000	0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1Y change in Current account to GDP	-0.022***	-0.004	-0.001	-0.024***	-0.010**	0.013
	(0.006)	(0.003)	(0.007)	(0.009)	(0.005)	(0.021)
1Y GPD growth	-0.013	-0.002	-0.024***	-0.016	-0.010**	-0.042***
	(0.009)	(0.004)	(0.006)	(0.013)	(0.004)	(0.008)
1Y change in GDP per capita	0.536	0.406***	1.176***	0.729	0.436**	1.430***
	(0.685)	(0.141)	(0.288)	(0.765)	(0.211)	(0.293)
1Y change in Inflation	0.002	0.001	-0.008*	0.004	-0.000	-0.007
	(0.013)	(0.002)	(0.005)	(0.015)	(0.004)	(0.005)
Pseudo R2	0.2804	0.3506	0.3335	0.2172	0.3860	0.3197
Observations	293	496	638	293	631	638

Source: Author's calculations. *Note:* (1) The table presents the impact of financial and macroeconomic data on the probability of the issuer rating change (marginal effects) from the probit estimation (Eq. (2) and Eq. (3)). It summarizes the remaining (statistically significant) determinants of issuer rating change not presented in Table 5. The dependent variable is a binary variable for rating upgrade/downgrade observed at the end of years 2005 – 2013 for the sample of 2 486 financial and non-financial institutions.(2) Industry and region dummies included. (3) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel B – Issuer rating: S&P, Industry: Non-financial

	Dependent variable - Issuer rating upgrade by S&P			Dependent variable - Issuer rating downgrade by S&P		
Rating change determinants	Pre-crisis (upgrade) - Non-financial institutions - Marginal effects	Subprime lending crisis (upgrade) - Non-financial institutions - Marginal effects	Sovereign debt crisis (upgrade) - Non-financial institutions - Marginal effects	Pre-crisis (downgrade)- Non-financial institutions - Marginal effects	Subprime lending crisis (downgrade)- Non-financial institutions - Marginal effects	Sovereign debt crisis (downgrade)- Non-financial institutions - Marginal effects
Total asset	-0.000	-0.000	-0.000	-0.000	0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Earnings per Share	-0.000	0.000	0.000***	-0.000**	-0.000**	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Retained Earnings /Total Assets	-0.000**	0.000	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Earnings before Interest and Taxes /Total Assets	0.007***	0.005**	-0.000	0.003	-0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Total Equity / Total Liabilities	-0.000***	-0.000	-0.000	-0.001***	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net Sales /Total Assets	0.000	0.000**	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1Y change in Working capital / Total Assets	0.001	0.000**	0.000	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
1Y change in Retained Earnings / Total Assets	-0.000	-0.000	-0.001***	-0.002	-0.000	-0.001***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
1Y change in Earnings before Interest and Taxes / Total Assets	0.001	0.000	0.002**	0.001	0.000	0.002
	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)	(0.001)
1Y change in Total Equity / Total Liabilities	-0.001	0.000	-0.001	-0.001	0.001	-0.002*
	(0.002)	(0.000)	(0.001)	(0.003)	(0.001)	(0.001)
Current account to GDP	0.005**	0.001	0.003*	0.007***	-0.000	0.003
	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)

(*continued on next page)*

GDP per capita	-0.000	0.000	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.001	-0.004	0.006	0.009	-0.003	-0.001
	(0.006)	(0.003)	(0.004)	(0.008)	(0.004)	(0.005)
1Y change in Current account to GDP	-0.002	-0.001	0.019**	-0.006	0.000	0.008
	(0.004)	(0.001)	(0.009)	(0.004)	(0.001)	(0.007)
1Y GPD growth	-0.008	0.002	-0.006	-0.017	-0.002	-0.009
	(0.008)	(0.002)	(0.004)	(0.011)	(0.003)	(0.005)
1Y change in GDP per capita	0.312	0.218**	0.114	0.436	0.023	0.084
	(0.221)	(0.085)	(0.124)	(0.300)	(0.123)	(0.122)
1Y change in Inflation	0.003	-0.006**	0.000	-0.003	-0.006	-0.000
	(0.006)	(0.002)	(0.000)	(0.007)	(0.004)	(0.001)
Pseudo R2	0.1342	0.1728	0.1573	0.0575	0.0910	0.0742
Observations	2,595	4,057	3,889	2,595	4,060	3,908

Source: Author's calculations. *Note:* (1) The table presents the impact of financial and macroeconomic data on the probability of the issuer rating change (marginal effects) from the probit estimation (Eq. (2) and Eq. (3)). It summarizes the remaining (statistically significant) determinants of issuer rating change not presented in Table 5. The dependent variable is a binary variable for rating upgrade/downgrade observed at the end of years 2005 – 2013 for the sample of 2 486 financial and non-financial institutions.(2) Industry and region dummies included. (3) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel C – Issuer rating: Moody's, Industry: Financial

	Dependent variable - Issuer rating upgrade by Moody's			Dependent variable - Issuer rating downgrade by Moody's		
Rating change determinants	Pre-crisis (upgrade) - Financial institutions - Marginal effects	Subprime lending crisis (upgrade) - Financial institutions - Marginal effects	Sovereign debt crisis (upgrade) - Financial institutions - Marginal effects	Pre-crisis (downgrade)- Financial institutions - Marginal effects	Subprime lending crisis (downgrade)- Financial institutions - Marginal effects	Sovereign debt crisis (downgrade)- Financial institutions - Marginal effects
Total asset	-0.000	0.000**	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Earnings per Share	0.000	0.000***	-0.000	0.000	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return on assets	0.039	0.046**	-0.002	0.047	-0.019	-0.016
	(0.030)	(0.018)	(0.007)	(0.031)	(0.015)	(0.019)
Net interest margin	-0.000	0.000***	-0.000	-0.000	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Common equity to total assets	-0.005	0.024***	-0.005**	-0.012*	-0.018***	0.001
	(0.007)	(0.006)	(0.002)	(0.007)	(0.005)	(0.005)
Loan loss reserves /Non-performing assets	-0.000	-0.000**	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Non-performing assets / Total assets	-0.004	0.031**	0.008*	-0.002	0.013*	-0.007
	(0.016)	(0.012)	(0.005)	(0.016)	(0.007)	(0.006)
Total loans to total deposits	0.000	0.000**	0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Deposits to funding	0.003*	0.000	-0.002**	0.003*	-0.003***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1Y change in Return on assets	-0.017	-0.009**	-0.000	-0.058***	0.000*	0.002
	(0.013)	(0.004)	(0.000)	(0.014)	(0.000)	(0.002)
1Y change in Net interest margin	0.008	0.010	-0.061	0.022	0.014	-0.171*
	(0.052)	(0.018)	(0.043)	(0.056)	(0.031)	(0.103)
1Y change in Common equity / Total Assets	0.060	0.037	-0.007	0.057	0.083	-0.022*
	(0.132)	(0.034)	(0.007)	(0.149)	(0.067)	(0.012)
1Y change in Loan loss reserves to non-performing assets	-0.008	-0.075**	0.054**	-0.004	0.000***	0.061
	(0.048)	(0.032)	(0.025)	(0.052)	(0.000)	(0.046)

(*continued on next page)*

1Y change in Non-performing assets to total assets	-0.015	-0.158**	-0.012	-0.013	-0.002	-0.005
	(0.019)	(0.063)	(0.053)	(0.021)	(0.008)	(0.039)
1Y change in Deposits to funding	0.049	-0.310**	0.136	0.185	-0.120	-0.298
	(0.192)	(0.143)	(0.102)	(0.172)	(0.152)	(0.205)
Current account to GDP	0.001	0.008***	-0.008**	0.001	0.002	-0.001
	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)
GDP per capita	0.000	-0.000**	-0.000	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	-0.005	0.004	-0.003	-0.007	0.004*	-0.011*
	(0.010)	(0.003)	(0.005)	(0.011)	(0.003)	(0.007)
1Y change in Current account to GDP	-0.002	0.003***	-0.004	-0.002	0.004***	-0.022**
	(0.005)	(0.001)	(0.003)	(0.006)	(0.001)	(0.009)
1Y GPD growth	-0.020*	0.045***	-0.004	-0.020*	-0.001	-0.025***
	(0.011)	(0.010)	(0.005)	(0.011)	(0.004)	(0.009)
1Y change in GDP per capita	3.778***	0.201	-0.037	3.895***	-0.238	0.899**
	(0.739)	(0.197)	(0.141)	(0.735)	(0.211)	(0.359)
1Y change in Inflation	-0.020	0.025***	0.007***	-0.016	-0.011***	-0.002
	(0.018)	(0.006)	(0.003)	(0.016)	(0.004)	(0.003)
Pseudo R2	0.4823	0.8019	0.5575	0.476	0.3835	0.2809
Observations	289	411	575	289	631	632

Source: Author's calculations. *Note:* (1) The table presents the impact of financial and macroeconomic data on the probability of the issuer rating change (marginal effects) from the probit estimation (Eq. (2) and Eq. (3)). It summarizes the remaining (statistically significant) determinants of issuer rating change not presented in Table 5. The dependent variable is a binary variable for rating upgrade/downgrade observed at the end of years 2005 – 2013 for the sample of 2 486 financial and non-financial institutions.(2) Industry and region dummies included. (3) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel D – Issuer rating: Moody's, Industry: Non-financial

	Dependent variable - Issuer rating upgrade by Moody's			Dependent variable - Issuer rating downgrade by Moody's		
Rating change determinants	Pre-crisis (upgrade) - Non-financial institutions - Marginal effects	Subprime lending crisis (upgrade) - Non-financial institutions - Marginal effects	Sovereign debt crisis (upgrade) - Non-financial institutions - Marginal effects	Pre-crisis (downgrade)- Non-financial institutions - Marginal effects	Subprime lending crisis (downgrade)- Non-financial institutions - Marginal effects	Sovereign debt crisis (downgrade)- Non-financial institutions - Marginal effects
Total asset	0.000	0.000	-0.000*	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Earnings before Interest and Taxes / Total Assets	0.004***	0.000	0.003**	0.002	-0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Total Equity / Total Liabilities	-0.000*	-0.000	-0.000	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Net Sales / Total Assets	0.000	-0.000	-0.000	-0.000	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1Y change in Earnings per Share/ Total Assets	0.001*	-0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
1Y change in Retained Earnings / Total Assets	0.000	-0.000	0.002**	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
1Y change in Earnings before Interest and Taxes / Total Assets	-0.000	0.000	-0.000	0.000	0.000**	0.000
	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.001)
1Y change in Total Equity / Total Liabilities	-0.002	-0.000	-0.001*	0.002	-0.000	-0.002**
	(0.001)	(0.000)	(0.001)	(0.003)	(0.000)	(0.001)
1Y change in Net Sales /Total Assets	0.017**	0.001	-0.012	0.005	-0.002	-0.007
	(0.008)	(0.001)	(0.015)	(0.015)	(0.004)	(0.028)

(*continued on next page)*

Current account to GDP	0.004**	-0.000	-0.002	0.004*	0.002	-0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Inflation	-0.001	-0.007**	-0.004	-0.009	-0.007**	-0.007
	(0.004)	(0.003)	(0.004)	(0.006)	(0.003)	(0.005)
1Y GPD growth	-0.005	0.001	-0.000	-0.001	-0.003	-0.013***
	(0.006)	(0.002)	(0.004)	(0.008)	(0.003)	(0.005)
1Y change in GDP per capita	-0.077	0.260**	0.050	0.295	0.052	0.163*
	(0.160)	(0.104)	(0.093)	(0.224)	(0.109)	(0.094)
1Y change in Inflation	0.003	0.004*	0.000	-0.000	0.001	0.001
	(0.005)	(0.002)	(0.001)	(0.006)	(0.004)	(0.001)
Pseudo R2	0.1906	0.2386	0.1930	0.0599	0.0791	0.0680
Observations	2,567	3,994	3,882	2,567	4,060	3,908

Source: Author's calculations. *Note:* (1) The table presents the impact of financial and macroeconomic data on the probability of the issuer rating change (marginal effects) from the probit estimation (Eq. (2) and Eq. (3)). It summarizes the remaining (statistically significant) determinants of issuer rating change not presented in Table 5. The dependent variable is a binary variable for rating upgrade/downgrade observed at the end of years 2005 – 2013 for the sample of 2 486 financial and non-financial institutions.(2) Industry and region dummies included. (3) Standard errors are in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Working Paper Series
ISSN 1211-3298
Registration No. (Ministry of Culture): E 19443

Individual researchers, as well as the on-line and printed versions of the CERGE-EI Working Papers (including their dissemination) were supported from institutional support RVO 67985998 from Economics Institute of the ASCR, v. v. i.

Specific research support and/or other grants the researchers/publications benefited from are acknowledged at the beginning of the Paper.

Published by
Charles University in Prague, Center for Economic Research and Graduate Education (CERGE)
and
Economics Institute of the ASCR, v. v. i. (EI)
CERGE-EI, Politických vězňů 7, 111 21 Prague 1, tel.: +420 224 005 153, Czech Republic.
Printed by CERGE-EI, Prague
Subscription: CERGE-EI homepage: http://www.cerge-ei.cz

Phone: + 420 224 005 153
Email: office@cerge-ei.cz
Web: http://www.cerge-ei.cz

Editor: Marek Kapička

The paper is available online at http://www.cerge-ei.cz/publications/working_papers/.

ISBN 978-80-7343-349-9 (Univerzita Karlova. Centrum pro ekonomický výzkum
a doktorské studium)
ISBN 978-80-7344-341-2 (Akademie věd České republiky. Národohospodářský ústav)

CERGE-EI
P.O.BOX 882
Politických vězňů 7
111 21 Praha 1
Czech Republic
http://www.cerge-ei.cz