J Bank Regul (2018) 19:299–316
https://doi.org/10.1057/s41261-017-0059-7

ORIGINAL ARTICLE

Was Regulation (EC) No 1060/2009 on Credit Rating Agencies effective?

Olivier Nataf[1] · Lieven De Moor[1] · Rosanne Vanpée[2]

Published online: 15 December 2017

Abstract The purpose of this paper is (1) to put the Regulation (EC) No 1060/2009 on Credit Rating Agencies (henceforth, CRA I) into historical perspective, including a comparison with the Dodd–Frank Act, and (2) to examine whether the CRA I Regulation effectively influenced the ratings issued by credit rating agencies in EU financial markets. This paper presents a historical review of regulations existing prior to the 2007 crisis and describes the mechanisms put in place after the event both in the USA and the EU. Following this part, two ordered logistic regressions based on a sample of ratings attributed to Eurozone companies examine the influence of CRA I on the rating process. A study of the repercussions of Regulation (EC) No 1060/2009 on 'false warnings' issued by rating agencies is finally presented in the last section of this paper. The regressions point out that CRA I had a double impact on how rating agencies use financial, accounting and geographical indicators during the rating process, as it influenced (1) the grading process and (2) the magnitude of the up- or downgrades. It is also underlined in this study that the regulation had no significant influence on 'false warnings'. The findings of this study may help EU regulators to better design future regulations on rating agencies and to curb weaknesses of CRA I that were not addressed by 'CRA II' (2011) and 'CRA III' (2013) regulations. To our knowledge, this paper is the first one to examine the efficiency of the CRA I regulation and to adopt a European-oriented approach by focusing on Eurozone members.

Keywords Credit rating · Regulation (EC) No 1060/2009 · CRA I · False warnings

This paper is dedicated to my greatest friend, Claire (1991–2015).
She was the most brilliant, open-minded, and tolerant person
I have ever met.
She was like a sister for me.
Olivier Nataf

Credit rating agencies (hereafter CRAs) are companies that issue 'qualified opinions' on the creditworthiness of a variety of financial products. This evaluation aims to reduce information asymmetry on markets and to give an objective view on how risky is the rated product, leading to higher confidence from market players. The fact that ratings reduce uncertainty and have an informative function gave them an important role in regulatory frameworks in both the EU and the USA. A good example of this reliance on ratings from regulators can be found in the ongoing asset purchase programmes of the European Central Bank, in which qualified bonds are determined by their ratings.

The credit rating industry can be viewed as an oligopoly market, with three main agencies (the so-called Big Three) accounting together for 95% of total market shares [1]. These Big Three are Standard & Poor's (S&P), Moody's

✉ Olivier Nataf
Olivier.Nataf@vub.be

Lieven De Moor
lieven.de.moor@vub.be

Rosanne Vanpée
rosanne.vanpee@kuleuven.be

[1] Faculty of Economic and Social Sciences and Solvay Business School, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium

[2] Faculty of Economics and Business/Finance, Accountancy and Tax, KU Leuven, Campus Brussels, Warmoesberg 26, 1000 Brussels, Belgium

(each of them accounting for 40% of market share) and Fitch ratings (15% of market share).

During the last decades, both investors and regulators tended to have an excessive reliance on ratings with noxious consequences in some cases. A representative case is the Enron one (2001): 4 days before its bankruptcy the company still had an investment-grade status from S&P and Moody's [2]. This case and the more recent debacle of the subprime financial products shed light on the risk implied by an over-reliance on ratings, and called for a new and better-designed regulation of CRAs activities. The next section will present a historical overview of regulatory regimes in the USA and the EU, followed by a comparison between these regimes. It will shed light on structural differences across regions prior to the 2007 crisis, explaining why a massive regulatory change had to be made in the EU, while it was not the case in the USA. This historical review will also point out how CRAs and ratings became a cornerstone of financial regulations, making changes quite hard to implement.

In order to allow an easy and unequivocal comparison of regulatory frameworks, we decided to adopt a chronological view. US and EU regulations will be presented together and finally compared at the end of the section. A timeline of the most important reforms is presented in "Appendix 1".

Credit rating agency reforms before the subprime crisis (1934–2007)

Ratings were already informally used by the Federal Reserve since 1930 in order to evaluate the quality of banks' assets [3]. The very first reference to CRA in a legally binding text can be found in the *Securities Exchange Act* [4] (hereinafter SEA) (1934), aiming to set a governance framework for markets and to protect the investors. The original document was amended in 1936, prohibiting any investment from banks in bonds rated below investment grade. Although the original aim of this regulation (i.e. improving the global quality of banks' balance sheets) is clearly positive and beneficial, some imperfections or perverse effects can also be pointed out. First of all, including ratings and CRA's activities in law allowed them to acquire a crucial role in both market behaviour and future regulatory frameworks. This point is clearly underlined by Partnoy [5] with the so-called regulatory license phenomenon. From this time, CRAs have the power to unlock access to the market, leading even small issuers to have an incentive to have their debt rated by the rating agencies. Second, even if the SEA clearly mentions ratings, it does not give any precise reference on who can issue ratings. A simple unclear reference to 'recognized rating manuals' is made, leading White [3] to conclude that probably only the Big Three (S&P, Moody's and Fitch) were allowed to issue ratings at that time.

This last imperfection was partially curbed in 1975 by a *Securities and Exchange Commission* (hereafter SEC) rule targeting capital requirements for broker-dealers (Rule 15c3-1 [6]). This rule linked capital requirements to ratings for each product detained by market players and, more remarkably, created the concept of 'Nationally Recognized Statistical Rating Organizations' (NRSRO) whose ratings were the only ones that could be used in order to determine capital requirements. Despite this step, the Rule did not totally address concerns about CRAs, as it led de facto to a greater reliance on ratings from market players [5]. Moreover, as it was pointed out by Conte and Parmeggiani [7], the selection procedure of NRSROs was very opaque and not formally designed. The SEC only sent 'no-action letters' to the recognised CRA, without giving any further detail on why they were admitted in the NRSRO category. In 1997 the SEC proposed a clear framework on how to designate NRSROs, but this framework was 'mercifully' [3] not implemented due to inherent contradictions in the proposal (to be nationally recognised was a prerequisite for the candidates who wanted to obtain the NRSRO status and to be nationally recognised).

Bond raters came back at the centre of attention in the early 2000s after the debacle of Enron, this company being granted an investment-category rating by two of the Big Three until a few days before its bankruptcy on 2 December 2001. This event led the US Congress to include a special section in the Sarbanes–Oxley Act [8] constraining the SEC to shortly issue a report analysing *the role and function of credit rating agencies in the operation of the securities market* (section 702). Such a report was released in 2003, but it failed to address concerns raised by the Sarbanes–Oxley Act and even shed light on new issues about NRSROs' actual and future regulation.

In 2006 the USA adopted the Credit Rating Agency Reform Act of 2006 [9], containing new regulatory regimes for CRAs. The main targets of this Act were to increase the quality of ratings, to formalise the NRSRO designation procedure and to give to the SEC the status of sole enforcement authority over all NRSROs. This regulation gave clear steps for the designation of NRSROs, but also put a great emphasis on the possible abuses made by these NRSROs.

Before the presentation of binding rules that were adopted in the EU in 2009, we now turn to the regulatory framework which was previously built. Before a specific regulatory framework was set out at the European level in 2009, CRAs were nationally regulated and had to do self-regulation following the *IOSCO* (*International Organization of Securities Commissions*) *Code Of Conduct*

Fundamentals For Credit Rating Agencies [10] under the 'comply-or-explain' principle: if a CRA decided not to follow a specific point of the Code or adopted a different approach, it had to publicly explain why it did so. In addition to that, CRAs had to submit an annual report to the *Committee of European Securities Regulators* (CESR), and this procedure was considered as being sufficient to ensure a good conduct of business from CRAs.

The first (indirect) reference to CRAs in a European legislation text can be found in the 'Market Abuse Directive' of 2003 [11], which particularly targeted insider trading and market manipulation by forcing companies to disclose the name of their staff members having access to privileged information. CRAs were also cited the same year in the Directive 2003/125/EC [12] underlying the fact that ratings are not recommendations to invest but only 'opinions', and separating CRAs from institutions providing investment advisory. CRAs were, moreover, supposed to underline this point and had to disclose any potential conflict of interest that could have occurred during the rating process. The MiFID Directive [13] indirectly impacts CRAs consultancy activities, but does not say anything about ratings issuance, which is their main activity. A 2005 report [14] from CESR adopts a 'wait-and-see' position, arguing that no specific regulation is needed and that the effects of the application of the IOSCO code seem to be sufficient. This report also underlines the fact that the issues raised by CRAs have to be regulated within a global framework.

Ratings gained importance in the EU legislation in March 2006 through the 'Capital Requirements Directives' (2006/48/EC & 2006/49/EC, hereafter CRD) [15, 16], translating the Basel II framework (2004) into legally binding texts. The CRD directive gives a fundamental role to ratings in the computation of capital requirements imposed to banks, the amount depending on how each component of the balance sheet is rated. In order to ensure the quality of ratings a list of recognised CRAs is created (as it was previously done in the USA), reinforcing de facto the oligopolistic character of CRAs industry by making market entry more difficult for potential new players. No further regulation on CRAs was planned at that time, except if it was *strictly necessary for the achievement of public policy objectives* [17]. In December of the same year, a report from the CESR to the European Commission [18] points out that punctual deviations from the IOSCO code of conduct are observed in each of the major CRAs. A particular emphasis is made on ancillary services proposed by CRAs, services that are supposed to be fully separated from rating activities. Nevertheless, the report underlines that all major CRAs consider the 'rating assessment service' (study of the potential impact on a rating of an event, such as a merger) as being an ancillary service, while the IOSCO code does not do so. The report shows that this specific point is particularly important for the structured finance products leading to potential risks, and calls for an improvement of the definition of ancillary services in the IOSCO code.

It turned out during the so-called subprime crisis in 2007–2008 that the CESR warnings were justified and consistent. These events allowed regulators to become aware that regulations were not sufficient nor well designed, and that a change had to occur.

Credit rating agency reforms after the subprime crisis (2007–present)

In May 2008, a CESR report [19] points out that a stricter regulation of CRAs is needed at the European level and that the IOSCO code has to be modified, and calls for the creation of a European monitoring body. Nevertheless, this report does not consider self-regulation as being harmful and does not plan specific measures against it.

Following a 2008 proposal from the European Commission [20], the very first real and powerful common regulatory framework at the EU level was set up in 2009 with Regulation (EC) No 1060/2009 on Credit Rating Agencies [21], also known as 'CRA I'. This text has the double objective to restore confidence and ensure the stability of markets, by targeting four main areas:

1. *Avoidance of conflicts of interest*, notably by ensuring the independence of administrative/supervisory boards and by preventing CRAs to give consultancy services to rated entities or to related third parties (article 6; Annex I-A and Annex I-B).
2. *Improvement of the quality of ratings*, notably by ensuring the quality of methodologies, models and key assumptions that are used (article 8).
3. *Increased transparency*, by setting disclosure requirements with the publication of a yearly transparency report showing detailed information, notably on the legal structure of the CRA, on internal control mechanisms and on the sources of revenues of the CRA (articles 11 to 13 and Annex II). As underlined by De Haan et al. [22], this regulation is also the first one to make mandatory the disclosure of methodologies and quantitative assumptions used by CRAs.
4. *Increased efficiency of registration and surveillance frameworks*: the enforcement of the rules is supervised by CESR and national authorities (Title III).

Despite these improvements, it is important to notice that some aspects of the regulation are present in the preamble but not in the text of the regulation, and then are not enforced. For example, a call for more competition is

made in point 55 of the preamble, but is not present in the legally binding text.

Covering numerous aspects of financial markets, the US *Dodd–Frank Wall Street Reform and Consumer Protection Act* [23] (2010, hereinafter DFA) also tightens CRAs regulation in several ways. An increase in the SEC powers, linked with the creation of the Office of Credit Rating (OCR) which monitors and examines registered NRSROs and verifies their compliance with statutory and SEC requirements, is one of the improvements allowed by the DFA. Nevertheless, this text also showed the great power that CRAs had at this time on financial markets. In its section 939G, the DFA intended to remove rule 436(g) of the *Securities Act* (1933) [24] and then to make possible lawsuits against CRAs in case of adverse practices. The CRAs obviously did not appreciate such a possibility and retaliated by deciding to refuse the use of their ratings in the SEC fillings for asset-backed securities, leading to a freeze of this market. The removal of rule 436(g) was promptly suspended by the SEC, but this episode allowed CRAs to demonstrate their power and to continue to push against the DFA [25]. The DFA finally intended to remove reliance on NRSROs in new regulations (section 939). The idea was to create independent creditworthiness standards and to reduce the over-reliance on CRAs that was observed in the previous regulatory frameworks. It nevertheless turned out that creating new models was a difficult task, and the fact that many financial activities (such as collateral agreements) still rely on ratings from CRAs gave them a crucial role and made a complete removal in future legislations almost impossible. Then only section 939A is applied, removing all *reference* to NRSROs ratings in the future legislation.

As demonstrated above, the enforcement of the DFA 'CRA aspects' was not an easy task and was not completed. Indeed, the DFA allowed regulators to become aware of the fact that CRAs have a great place in the financial system but also in existing regulations, leading them to be able to freeze markets. This implication of CRAs could constitute a hindrance to the development of future legally binding rules, both in the EU and in the USA.

In line with what was done in 2009, the EU reinforced its powers by creating the *European Securities and Markets Authority* (ESMA) in 2010, replacing the CESR and aiming to centralise all aspects of CRA regulations in the EU. This point was confirmed by the Regulation (EC) No 513/2011 [26], known as 'CRA II' (May 2011). The major improvement made by CRA II is to give to the ESMA the status of only supervisory power in the EU for registering and supervising CRAs, in order to benefit from advantages of centralisation (no risk of bias from national authorities and homogeneity of rules across countries). Other regulation aspects present in CRA I are kept and remain unchanged in CRA II.

The excessive reliance from investors on ratings was pointed out by various market players and institutions representatives during a roundtable which took place at the European Commission on 6 July 2011 [27]. This point was targeted in the latest EU regulation, known as 'CRA III'.

The Regulation (EU) No 462/2013 [28], known as 'CRA III' (May 2013), is a new big step forward made by the EU. Consumers and investors protection is a clear objective of the text, which includes shareholders and members of CRAs in its scope. The regulation calls for a reduction in the reliance on external ratings, preventing all European Authorities, the European Parliament and the European Council from using reference to external rating in 'their guidelines, recommendations and draft technical standards where such references have the potential to trigger sole or mechanistic reliance on credit ratings' (Article 5b-1). CRAs are also told to put in place and to document an 'effective internal control', and to clearly underline that their ratings are only an opinion. Finally, tougher rules in the rating process of structured finance products are included in the text, making their rating recognised only if the issuer appointed at least two independent CRAs.

Intermediate conclusion

It is clear from what was exposed previously that, prior to the disastrous situation faced during the 2007–2008 financial crisis, the USA had a quite effective regulatory framework, while the EU had an obviously inadequate set of rules targeting CRAs. The financial crisis, followed by the sovereign debt crisis faced by the EU, pushed authorities to take further and stronger actions in order to better regulate the industry of CRAs. If the goal of the newly introduced texts, namely to restore confidence in markets and reduce the reliance on CRAs ratings, is shared between the EU and the USA the areas targeted differ between the two blocs. Indeed, the USA call for more transparency in the registration requirements and for the removal of references to external ratings from existing rules, while the EU mainly focuses on the quality and the clarity of ratings and ratings computations. This wish of better quality of ratings is probably induced by the sovereign debt crisis that some EU members had to face since 2010, and during which the accuracy and the objectivity of ratings were questioned (a more detailed study of this phenomenon can be found in Gärtner et al. [29]). Despite these differences, John Coffee Jr. underlines in a 2011 paper [30] that the EU and the USA tend to converge on some areas of their regulation, e.g. in targeting conflicts of interest.

It also turns out that the implementation process of the new binding rules is relatively slow in both the EU and the USA. This process also highlights the unexpected power that CRAs effectively have on markets and the paradoxical aspect of the current situation, because this power partly comes from previous regulations such as the CRD directive. This phenomenon, referred to as 'regulatory license' by Frank Partnoy [5], is a great hindrance to a smooth and swift implementation of the regulations in the USA and in the EU, although this phenomenon is less pronounced in Europe where there is historically a lower variety of debt issuers.

Despite this difficult path towards full implementation, the *European Securities and Markets authority* (ESMA) points out some tangible progress through time. After having underlined failures in a 2012 report [31, 32], the regulator launched a consultation paper in December 2012 to better address these issues and implement the new rules more efficiently [33]. As highlighted in a 2013 press release [34], the CRAs made some improvements, but some areas still had to be improved, such as the monitoring and the surveillance of ratings. These issues were addressed by CRAs, as the ESMA does not point them out in a 2015 press release [35], although other issues are underlined in this document. Moreover, in an October 2015 press release [36], the authority recognises that *the EU CRA Regulation has improved the governance and operation of CRAs*. It can be said from this institutional literature that the implementation of regulations on CRAs was indeed tough, but some objective and relevant progresses were made since the implementation of CRA I.

Finally, it seems interesting to underline that, since the implementation of regulation 1060/2009, the number of registered credit ratings agencies has remarkably increased to reach 27 in the EU by the end of 2011 according to the ESMA website [37]. This point could appear as being problematic, as Becker and Milbourn highlight in a paper [38] that increased competition leads to a decrease in ratings quality. Conversely, Behr et al. [39] underline that a lower level of competition associated with a stronger regulatory framework also leads to a deterioration in ratings accuracy. These mixed conclusions certainly explain why competition is not included in the scope of European regulations. However, in spite of the great increase in the number of players since 2009, it is important to note that competition has not been affected due to the persisting unequal distribution of market shares (ESMA [40], p. 10), allowing us to make a study without distortions in the data.

To conclude, it can be said that the recent events demonstrated that there is room for a tightening of rules regulating the CRA industry. Even if undeniable efforts are made in order to correct mistakes that were previously made, the way towards a global and efficient regulation of CRAs seems to be long and difficult.

Data collection and variables

The aim of this paper is to determine whether the EU regulation had an influence on the rating process of Moody's. It is important to focus on that specific point because Dimitrov et al. [41] pointed out that the US regulation that entered into force in 2010 (*Dodd–Frank Act*) had no impact on CRA discipline or accuracy. Thus, to conduct a study at the EU level appears to be necessary in order to see whether the European regulation is better designed than the one in the USA.

We focus only on ratings issued by Moody's in order to assess the efficiency of the first EU implemented regulation on credit rating agencies, given that this CRA is the only one giving free access to all rating actions that were taken. Moreover, it is reasonable from our point of view to assume that Regulation 1060/2009 had a similar impact on the three main rating agencies, allowing to study its repercussions on a single entity. To curb the influence of the global crisis faced in 2007–2008, we collected both rating actions (up- and downgrades) and announcements (reviews, first-time assignments) between 1 January 2009, and 31 December 2011. We, moreover, only focused on Eurozone firms publishing financial statements and balance sheet labelled in Euro, this in order to avoid any bias induced by currency conversion during the collection of the data.

We kept three types of rating in our sample: the *corporate family rating* (CFR) targeting the entire company and considering it as having a single class of debt, and the ratings of senior secured and unsecured debt, these types of debts being the first ones to be reimbursed in case of bankruptcy of the firm. For each type of debt, we only considered ratings covering the overall category and not targeting a specific emission.

At the company level, we took into consideration specific types of entities and cases. The head of a group was always included in the database through the CFR. For subsidiaries, we only considered rating announcements or actions specifically targeting the subsidiary and not the consequences of a CFR modification. As a result, subsidiaries having their ratings modified through the CFR were not included in our sample. We finally decided not to include financial-related firms and banks in order to avoid fear-driven rating actions or announcements.

For each company we compiled profitability, solvency and liquidity indicators as well as information derived from the balance sheet (such as total assets); almost all these data[1] come from AMADEUS (Analyse MAjor Databases

[1] Only three observations were (partially) collected from other sources: one from the financial statements of the company and the other ones from the BELFIRST database (Bureau van Dijk).

from EUropean Sources—Bureau van Dijk), a database compiling accounting data of European companies. This allows us to avoid any bias induced by regional and/or country-specific definitions of accounting indicators and gives a necessary homogeneity across observations of the sample.

Given that Moody's does not give a specific rating when a company defaults, we also checked the current status of each firm appearing in our database with a speculative grade. This will allow us to measure the repercussions of the 2009 regulation on what is called *false warning*, i.e. a company does not default within a year after being rated in the speculative category.

We obtained a sample containing 338 rating observations (97 before CRA I and 241 after the regulation) linked with various accounting indicators, each of them being the one appearing in the latest balance sheet of the company prior to the rating action. This relatively small sample is explained by the shortness of the analysed period in order to obtain data not 'contaminated' by the financial crisis or the second European regulation on credit rating agencies ('CRA II'), which was implemented in May 2011. However, it is important to underline that, even if not very large, our sample contains a sufficient number of observations to obtain robust results from an econometric point of view. Moreover, the limitation of the period allows our database to avoid 'contamination', which certainly reinforces the robustness of the results showed later in this study.

We decided to follow as closely as possible the quantitative methodology adopted by Moody's during its rating process, which is based on three main categories of balance sheet items.[2] The first one is the scale of the company, which is measured by the total amount of assets detained by the company. The second category encompasses profitability and efficiency indicators, with four variables: profit margin (in %), cash-flow variation (in % compared to the previous year, indicates the ability of the company to generate cash), liquidity ratio (showing how a company is likely to face short-term debt obligations) and solvency ratio (in %, measures the ability of a company to face both short-term and long-term debt obligations). We also included the leverage by computing the long-term debt leverage, defined as total long-term debt divided by total assets.

We finally created a dummy variable in order to assess the impact of reviews for downgrade, this variable equalling one if the company's rating was placed under review for downgrade at most 6 months before the action (upgrade, downgrade or confirmation of the rating). A similar dummy associated with reviews for upgrade was not created as no observation of such reviews was made before CRA I, leading to the impossibility to assess the impact of the regulation on this type of review (Table 1).

A correlation matrix is presented in "Appendix 2". It can be noticed that a great majority (425 out of 435, i.e. 97.7%) of the observed correlations are below 0.3 in absolute value, which can be considered as a threshold for problematic correlations. Moreover, 9 of the 10 remaining pairs are correlated below 0.4 in absolute value, which is not econometrically problematic.

CRA I influence on ratings

Our study has similar aims as the one of Dimitrov et al. [41], namely studying the influence of a regional regulation on credit rating agencies. However, our contribution is different from an econometric point of view: Dimitrov et al. measure the overall impact of the Dodd–Frank Act through a single dummy variable, while we decided to use time-varying coefficients to test change in behaviour from Moody's. This will allow a finer study of the impact of CRA I on ratings.

This paper can also be related to Alsakka et al. [42], as this study measures the influence of the establishment of the ESMA (induced by CRA I) on the reactions of stock returns to banking rating actions. Although the main goal of our work and Alsakka et al.'s work is to measure the influence of CRA I, our study clearly distinguishes from Alsakka et al. on three mains points. First, we focus on all industrial sectors but the financial one, i.e. the exact opposite of Alsakka et al. Second, these authors use an event-study methodology, while we adopted an ordered logistic configuration. Finally, we do not focus on market reactions, but on the determinants of ratings. In spite of these differences, it could be interesting to compare our results with the results of Alsakka et al., as they do not find clear evidence on the effects of the new regulatory regime. This will be done later in this paper.

One of the aims of our study is to determine whether CRA I had an impact on the way rating agencies decide to assign or to modify ratings of companies. As we use grades assigned to corporate bonds we decided to estimate an ordered logistic model in this part, using a numerical conversion of ratings ranging from 1 to 20 (i.e. from Ca to Aaa, see Table 2) as dependent variable.

As a first approach, we decided to run an OLS model using all variables presented previously. We also created new variables, based on the existing ones and obtained by multiplying each existing variable by zero if the rating action was operated before the entry into force of CRA I,

[2] As Moody's uses different non-numerical variables (such as expectations about the future financial policy of the company) among industrial sectors, we only kept common numerical data in the scope of this study.

Table 1 Descriptive statistics of variables

Variable	Obs	Mean	SD	Min	Max
Current grade	338	11.15	4.163	1	20
Magnitude	338	− 0.28	0.819	− 5	4
Magnitude, if ≠ 0	145	− 0.66	1.151	− 5	4
After CRA I	338	0.71	0.453	0	1
Profit margin	338	6.05	18.075	− 78.4	96.68
Cash-flow var.	338	270.3	2474.972	− 1362.5	32,355
log(Total assets)	338	7.05	0.702	4.81	8.42
LT debt leverage	338	26.2	17.234	0	94.572
Solvency ratio	338	30.06	15.737	− 24.44	70.89
Liquidity ratio	338	1.19	0.711	0.01	6.16
Reviewed for downgrade	338	0.13	0.337	0	1
Austria—before	338	0	0	0	0
Austria—after	338	0.006	0.077	0	1
Belgium—before	338	0.009	0.094	0	1
Belgium—after	338	0.044	0.206	0	1
Estonia—before	338	0	0	0	0
Estonia—after	338	0.003	0.054	0	1
Finland—before	338	0.003	0.054	0	1
Finland—after	338	0.015	0.12	0	1
France—before	338	0.056	0.23	0	1
France—after	338	0.115	0.32	0	1
Greece—before	338	0.003	0.054	0	1
Greece—after	338	0.021	0.142	0	1
Ireland—before	338	0.003	0.054	0	1
Ireland—after	338	0.006	0.077	0	1
Italy—before	338	0.044	0.206	0	1
Italy—after	338	0.127	0.334	0	1
Luxembourg—before	338	0	0	0	0
Luxembourg—after	338	0.018	0.132	0	1
The Netherlands—before	338	0.018	0.132	0	1
The Netherlands—after	338	0.021	0.142	0	1
Portugal—before	338	0.003	0.054	0	1
Portugal—after	338	0.036	0.185	0	1
Spain—before	338	0.038	0.193	0	1
Spain—after	338	0.101	0.301	0	1
Germany—after	338	0.201	0.401	0	1

Remark: the high mean value of cash-flow variations is induced by some extreme observations, as the 10th percentile of this variable equals − 75.5644 and its 90th percentile is equal to 117.5815

Table 2 Numerical conversion of ratings

Investment grades	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3
	20	19	18	17	16	15	14	13	12	11
Speculative grades	Ba1	Ba2	Ba3	B1	B2	B3	Caa1	Caa2	Caa3	Ca
	10	9	8	7	6	5	4	3	2	1

and by one otherwise. The newly created variables capture the potential breaks in data before and after CRA I, leading to the possibility to run a Chow test on the model. This procedure tests each coefficient of the new variables against zero and leads in our case to the conclusion that CRA I had an effect on at least one parameter of our model. Following this, it seems interesting to have a finer look at this impact and on its direction for each parameter.

An efficient way to do so is to estimate an ordered logistic model using the original variables and their interaction with the CRA I dummy. The first advantage of this procedure is to allow a finer treatment of subsets (in our case before and after CRA I) with different variances into a single model compared to the pooled specification we used previously. It secondly allows to disentangle the effects of CRA I on each variable and to see precisely their direction and significance. The model is presented on the left-hand side of Table 4 and follows the equation presented below:

$$\begin{aligned}\text{Current grade}_i = {} & (\alpha + \delta_{1,i}) * \text{Profit margin}_i + (\beta + \delta_{2,i}) \\ & * \text{Cash-flow var.}_i \\ & + (\gamma + \delta_{3,i}) * \log(\text{total assets})_i \\ & + (\varepsilon + \delta_{4,i}) * \text{LT debt leverage}_i \\ & + (\zeta + \delta_{5,i}) * \text{Solvency}_i \\ & + (\eta + \delta_{6,i}) * \text{Liquidity}_i \\ & + \theta_i * D_{\text{CRAI}} \times D_{\text{reviewed}} \\ & + \iota_i * D_{\text{country,period}}\end{aligned}$$

with

- α,…, η coefficients of variables before CRA I,
- $\delta_{1,i}$,…, $\delta_{6,i}$ measuring the impact of CRA I on the influence of each variable (equalling 0 if the rating action/announcement of observation i occurred before CRA I),
- θ_i capturing the interaction between CRA I and the fact of being reviewed for downgrade (baseline: before CRA I, not reviewed), and
- ι_i coefficient of the dummy variable combining the country of the observed company and the period of the observation (before or after CRA I) (baseline: Germany, before CRA I).

In this setting, coefficients measure the impact of a variation of each indicator on the probability that the assigned rating belongs to a higher level, holding everything else constant. Thus, it can be said that each coefficient can be interpreted as measuring the overall influence of the variable on the rating. As an example, it can be inferred from Model 1 (Table 4) that a higher profit margin tends to have a significant and positive influence on ratings in both periods. A specific attention will be given to the interaction between dummy variables later in this part.

After having looked at the influence of continuous variables on ratings, an interesting question is to see whether CRA I had an impact on the way Moody's uses these indicators. A way to do so is to test whether the coefficients are statistically different before and after the implementation of CRA I. The results presented in Table 3 clearly show that CRA I modified the way Moody's uses some accounting and financial indicators. It turns out from our model that Regulation (EC) No 1060/2009 led to a more cautious use of 'profit margin' and 'long-term debt leverage', as we observe a significant decrease in the absolute value of the coefficient.

A new point has to be made about the interaction between dummies, presented just above geographical indicators in Table 4. The baseline for comparison is a company observed before CRA I which was not reviewed for downgrade. Table 4 confirms the impact on companies of being reviewed before CRA I, as we observe a significantly negative coefficient for this interaction. However, due to collinearity issues, it is not possible to entirely measure the influence of CRA I on reviews for downgrade.

Finally, it turns out from Model 1 that CRA I had some repercussions on how the domicile of a company influences its rating, as some coefficients of country dummies are statistically different across the two periods. As an example, coefficients associated with Belgium underline that Moody's tends to be more severe with Belgian companies after the implementation of the regulation. It can, moreover, be highlighted that all coefficients associated with these dummies are negative for the post-CRA I period, leading us to assert that Moody's tends to be more severe since CRA I is applied, independent of the nationality of the company.

Results shown in Tables 3 and 4 demonstrate that CRA I had repercussions on how Moody's employs some quantitative indicators and geographical information. It can, however, be surmised that the relative influence of each variable is not linear and varies across rating levels. This hypothesis is tested on the right-hand side of Table 4 by considering four levels of ratings: B3 (low grade), Ba1 (middle grade), A2 (high grade) and Aa2 (really high grade). In this table, each coefficient measures the influence of variables on the probability of belonging to the considered grade. Significances are reported with stars: (***) for the 1% level, (**) for the 5% level and (*) for the 10% level.

As it was asserted, the relative influence of indicators is not linear among rating categories. A cogent example is the one of log(*total assets*) (after CRA I), as we observe a switch in coefficient sign across categories and a greater influence of this variable for 'non-extreme' ratings. The first observation is not surprising at all, the negative (*positive*) sign noticed for 'bad' ('*good*') grades meaning that a

Table 3 Comparison between coefficients—before CRA I (97 obs.) versus after CRA I (241 obs.) (Model 1)

	$\chi 2$	Prob > χ^2	Impact of CRA I?
Profit margin	5.08	0.0243	Yes
Cash-flow variation	0.02	0.8991	No
log (Total assets)	0.81	0.3676	No
LT debt leverage	4.97	0.0257	Yes
Solvency ratio	2.35	0.125	No
Liquidity ratio	1.74	0.1872	No
Review for downgrade			
Reviewed before versus not rev. after	0.73	0.3942	No
Belgium	3.43	0.0639	Yes
Finland	1.81	0.1779	No
France	2.22	0.1362	No
Greece	1.66	0.1976	No
Ireland	4.77	0.029	Yes
Italy	2.22	0.1359	No
The Netherlands	1.6	0.206	No
Portugal	4.01	0.0453	Yes
Spain	1.43	0.2311	No

greater amount of total assets reduces (*increases*) the probability of belonging to such a category. The greater influence of variables on 'non-extreme' ratings, also observed for the profit margin and solvency and liquidity ratios after CRA I, tends to prove that Moody's relies more on other indicators (such as expectations on the future of the considered company) for very bad and very good grade levels.

Even if only a few coefficients associated with countries are significant, it is, however, possible to draw some conclusions about the geographical influence on ratings. Firstly, for all countries and all periods, a reversal of sign is observed when the rating goes from Ba1 to A2. This leads us to assert that Moody's considers each country as being beneficial or detrimental for its companies, depending on their overall economic health. Second, the impact of nationalities is almost always greater for 'non-extreme ratings', following the observation made previously.

From what was previously shown, it can be said that CRA I constrained Moody's to modify its rating methodology as we observe significant variations after CRA I compared to the baseline situation. Even if some of the underlined effects are not statistically significant, it can be said that CRA I attained some of its targets. A further research question is now to determine whether CRA I also had effects on the magnitude of rating movements operated by Moody's.

CRA I influence on magnitudes

In this part, we restrict the sample to rating actions (upgrades and downgrades), ratings announcements being associated with a magnitude of 0. The retained variables and the methodology used in the previous part remain the same. The Chow test leads us to the conclusion that CRA I had a significant impact on magnitudes of moves.

This intuition is confirmed by Table 5 and by Model 2 (Table 6), based on the same methodology as the one used for Model 1.

Interesting conclusions can be derived from Model 2 and Table 5. The first one is that, after CRA I, not reviewed companies tend to face greater magnitudes of changes in line with what could be expected. It also appears that CRA I had an effect on the influence of reviews for downgrade on rating actions. A major increase in the coefficient is observed for reviewed firms when moving from before to after CRA I, meaning that reviewed companies are more likely to face a greater magnitude after the entry into force of the regulation.

As this result might seem counter-intuitive at the first sight, we have to remind that '− 1' (downgraded by one notch) is greater than '− 2' (two-notch downgrade), leading to the conclusion that CRA I reduced the *absolute value* of downgrades, but did not turn them into upgrades.

This point is confirmed in Table 7, as no structural difference arises between the two periods. It can then be concluded that CRA I led Moody's to adopt a less severe attitude when it downgrades companies previously under review.

Table 4 Model 1: Ordered logistic regression of ratings (lhs) and influence of variables across rating categories (rhs) (Pseudo R^2 = 0.1407)

	Coef.	$P > \|z\|$	[95% Conf.	interval]	B3	Ba1	A2	Aa2
Profit margin								
Before CRA I	0.073	0.000	0.036	0.110	− 0.0021611 (***)	− 0.0009417	0.0019365 (***)	0.0004047 (**)
After CRA I	0.025	0.015	0.005	0.045	− 0.0003525 (**)	− 0.0014052 (**)	0.0012081 (**)	0.0003003 (*)
Cash-flow variation								
Before CRA I	0.000	0.835	− 0.001	0.001	3.54E−06	1.54E−06	− 3.17E−06	− 6.63E−07
After CRA I	0.000	0.184	0.000	0.000	6.65E−07	2.65E−06	− 2.28E−06	− 5.66E−07
log(Total assets)								
Before CRA I	1.829	0.000	1.261	2.398	− 0.0542169 (***)	− 0.0236243	0.0485807 (***)	0.0101537 (**)
After CRA I	2.145	0.000	1.682	2.607	− 0.030566 (***)	− 0.1218361 (***)	0.1047521 (***)	0.0260419 (***)
LT debt leverage								
Before CRA I	− 0.048	0.000	− 0.075	− 0.021	0.0014229 (***)	0.00062	− 0.001275 (***)	− 0.0002665 (**)
After CRA I	− 0.008	0.458	− 0.031	0.014	0.0001204	0.0004798	− 0.0004125	− 0.0001026
Solvency ratio								
Before CRA I	− 0.009	0.664	− 0.048	0.031	0.0002576	0.0001122	− 0.0002308	− 0.0000482
After CRA I	0.025	0.008	0.007	0.044	− 0.0003619 (**)	− 0.0014427 (**)	0.0012404 (**)	0.0003084 (**)
Liquidity ratio								
Before CRA I	− 0.354	0.585	− 1.625	0.918	0.0104909	0.0045713	− 0.0094003	− 0.0019647
After CRA I	0.540	0.008	0.140	0.941	− 0.0077035 (**)	− 0.0307061 (**)	0.0264004 (**)	0.0065633 (**)
Review for downgrade								
(Not reviewed)*(after CRA I)	− 0.461	0.362	− 1.452	0.530	0.0372109 (*)	− 0.0049261	− 0.0226822 (**)	− 0.0046674 (**)
(Reviewed)*(before CRA I)	− 1.017	0.014	− 1.827	− 0.206	− 0.0055079	− 0.0273958	0.0252172	0.006745
(Reviewed)*(after CRA I)	Omitted							
Austria								
Before CRA I	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
After CRA I	− 1.519	0.609	− 7.335	4.298	0.0216486	0.0862913	− 0.0741914	− 0.0184444
Belgium								
Before CRA I	2.597	0.006	0.757	4.437	− 0.0769739 (**)	− 0.0335404	0.068972 (**)	0.0144157 (**)
After CRA I	− 3.111	0.298	− 8.968	2.746	0.0443452	0.17676	− 0.1519744	− 0.0377816
Estonia								
Before CRA I	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
After CRA I	− 4.434	0.192	− 11.094	2.226	0.0631989	0.2519112	− 0.2165878	− 0.0538448
Finland								
Before CRA I	− 1.084	0.482	− 4.102	1.935	0.0321194	0.0139956	− 0.0287804	− 0.0060153
After CRA I	− 5.695	0.057	− 11.570	0.181	0.0811681 (*)	0.3235361 (*)	− 0.2781694 (*)	− 0.0691543 (*)
France								
Before CRA I	− 0.524	0.302	− 1.518	0.470	0.0155287	0.0067664	− 0.0139144	− 0.0029082

Table 4 continued

	Coef.	$P > \|z\|$	[95% Conf.	interval]	B3	Ba1	A2	Aa2
After CRA I	− 4.871	0.097	− 10.626	0.884	0.0694247	0.2767269	− 0.2379238	− 0.0591491
Germany								
Before CRA I	Basis	Basis	Basis	Basis	Basis	Basis	Basis	Basis
After CRA I	− 4.724	0.111	− 10.526	1.078	0.0673326	0.268388	− 0.2307543	− 0.0573667
Greece								
Before CRA I	4.317	0.488	− 7.892	16.526	− 0.127942	− 0.0557491	0.1146417	0.023961
After CRA I	− 4.929	0.094	− 10.688	0.831	0.070247	0.2800049	− 0.2407422	− 0.0598497
Ireland								
Before CRA I	4.616	0.016	0.875	8.356	− 0.1367927 (**)	− 0.0596057	0.1225723 (**)	0.0256185 (*)
After CRA I	− 3.502	0.275	− 9.794	2.790	0.0499114	0.1989468	− 0.1710502	− 0.042524
Italy								
Before CRA I	− 0.355	0.543	− 1.498	0.789	0.0105079	0.0045787	− 0.0094156	− 0.0019679
After CRA I	− 4.790	0.107	− 10.618	1.039	0.0682659	0.2721081	− 0.2339527	− 0.0581618
Luxembourg								
Before CRA I	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted	Omitted
After CRA I	− 3.067	0.266	− 8.468	2.333	0.0437208	0.1742713	− 0.1498347	− 0.0372497
The Netherlands								
Before CRA I	− 0.185	0.839	− 1.976	1.605	0.0054951	0.0023944	− 0.0049239	− 0.0010291
After CRA I	− 4.009	0.169	− 9.727	1.709	0.0571431	0.2277727	− 0.1958341	− 0.0486854
Portugal								
Before CRA I	1.144	0.448	− 1.812	4.101	− 0.0339146	− 0.0147779	0.030389	0.0063515
After CRA I	− 5.466	0.063	− 11.224	0.292	0.077908	0.3105416 (*)	− 0.266997 (*)	− 0.0663768 (*)
Spain								
Before CRA I	0.741	0.266	− 0.565	2.047	− 0.0219593	− 0.0095685	0.0196765	0.0041125
After CRA I	− 2.664	0.363	− 8.407	3.079	0.0379753	0.1513697	− 0.1301444	− 0.0323546

Table 5 Comparison between coefficients—before CRA I (50 obs.) versus after CRA I (95 obs.) (Model 2)

	χ^2	Prob > χ^2	Impact of CRA I?
Profit margin	0	0.978	No
Cash-flow variation	0.14	0.7093	No
log(Total assets)	6.96	0.0083	Yes
LT debt leverage	0	0.9902	No
Solvency ratio	2.98	0.0841	Yes
Liquidity ratio	0.49	0.485	No
Review for downgrade			
Reviewed versus not reviewed (after)	3.42	0.0644	Yes
Reviewed—before versus after	6.67	0.0098	Yes
Reviewed before versus not rev. after	11.77	0.0028	Yes
Belgium	4.29	0.0383	Yes
France	0.08	0.7833	No
Greece	0.28	0.5965	No
Italy	6.19	0.0129	Yes
The Netherlands	8.33	0.0039	Yes
Portugal	4.82	0.0282	Yes
Spain	1.54	0.2149	No

Table 6 Model 2: Ordered logistic regression of magnitudes (Pseudo $R^2 = 0.3303$)

	Coef.	$P > \|z\|$	[95% Conf.	interval]		Coef.	$P > \|z\|$	[95% Conf.	interval]
Profit margin					Belgium				
Before CRA I	0.028	0.371	− 0.034	0.090	Before CRA I	0.405	0.852	− 3.850	4.660
After CRA I	0.029	0.142	− 0.010	0.068	After CRA I	− 5.491	0.002	− 9.042	− 1.939
Cash-flow variation					France				
Before CRA I	− 0.004	0.669	− 0.024	0.016	Before CRA I	− 1.751	0.138	− 4.066	0.565
After CRA I	− 0.001	0.577	− 0.002	0.001	After CRA I	− 2.270	0.124	− 5.166	0.625
log(Total assets)					Germany				
Before CRA I	0.264	0.702	− 1.087	1.614	Before CRA I	Basis	Basis	Basis	Basis
After CRA I	− 2.014	0.000	− 3.024	− 1.004	After CRA I	− 0.651	0.637	− 3.353	2.050
LT debt leverage					Greece				
Before CRA I	0.020	0.540	− 0.044	0.083	Before CRA I	50.628	0.647	− 166.350	267.606
After CRA I	0.019	0.265	− 0.015	0.053	After CRA I	− 8.030	0.000	− 11.485	− 4.575
Solvency ratio					Italy				
Before CRA I	− 0.039	0.357	− 0.123	0.044	Before CRA I	− 0.612	0.670	− 3.423	2.199
After CRA I	0.042	0.020	0.007	0.077	After CRA I	− 5.694	0.000	− 8.630	− 2.758
Liquidity ratio					The Netherlands				
Before CRA I	− 0.525	0.732	− 3.527	2.478	Before CRA I	2.991	0.186	− 1.441	7.423
After CRA I	− 1.634	0.000	− 2.458	− 0.809	After CRA I	− 6.032	0.004	− 10.164	− 1.900
Review for downgrade					Portugal				
(Not reviewed)*(after CRA I)	20.030	0.004	6.323	33.737	Before CRA I	− 0.185	0.952	− 6.263	5.892
(Reviewed)*(before CRA I)	− 0.327	0.716	− 2.088	1.433	After CRA I	− 8.589	0.000	− 12.998	− 4.181
(Reviewed)*(after CRA I)	17.979	0.011	4.114	31.845					
					Spain				
					Before CRA I	− 1.776	0.294	− 5.093	1.542
					After CRA I	− 4.713	0.006	− 8.040	− 1.385

Our second model also sheds light on some influence of the country on the way Moody's assigns grades. It is important to notice that, in this setting, dummy variables without any observation were dropped in order to limit

Table 7 Distribution of magnitudes—before and after CRA I (reviewed companies only)

	− 3 (%)	− 2 (%)	− 1 (%)	+ 1 (%)
Before CRA I (18 obs.)	5.56	11.11	77.78	5.56
After CRA I (8 obs.)	0.00	25.00	75.00	0.00

collinearity issues faced in Model 1. These variables are the ones for Austria, Estonia, Finland, Ireland and Luxembourg.

It is also important to underline that some of the impacts of CRA I highlighted in this part might be strengthened by other factors, such as the economic cycle. However, the conclusions derived from Model 2 are statistically robust and can be imputed (at least partially) to the regulation.

The first observation derived from this model is that Moody's changed quite heavily its mind on how to take nationalities into account before and after the reform. It can indeed be noticed in Table 6 that all coefficients of dummies 'before CRA I' are not significant, while almost all geographical variables after CRA I are significant at the 1% level.

Secondly, it turns out from Model 2 that Regulation 1060/2009 led to a tougher way of modifying grades from Moody's, as a sharp decrease in coefficients is noticed for each country when moving from before to after the reform. This means that, in case of modification of the existing rating, the probability of being upgraded or not severely downgraded has been reduced by the entry into force of CRA I.

Finally, Table 5 shows that our conclusions about the influence of countries are robust, as a majority of the associated dummies are significantly different between the two periods. This leads us to assert that CRA I had some impact on how Moody's uses the nationality of a company during the grading process.

Contrary to Alsakka et al. [42], our study points out some effects of CRA I on the way Moody's assigns and modifies its ratings. It can be inferred from Tables 3 and 5 that CRA I had some impact on a great majority of the variables that are used in our models, but also that some of them influence ratings, while the others have repercussions on how ratings evolve. Even if the observed effect is quite low, it can be said from our study that CRA I had an influence on the way Moody's uses almost all accounting parameters during the rating process. It can finally be concluded that CRA I led Moody's to smooth its downgrades and reduced the relative impact of some variables on ratings.

CRA I influence on false warnings

Another way to measure the influence of CRA I on Moody's is to have a look at false warnings, which can be viewed as a proxy measuring the quality of the ratings. In order to measure these warnings, we only took companies with a non-investment grade (i.e. below Baa3, or strictly smaller than 11) into account and we observed whether each firm defaulted within a year after this non-investment grade was assigned. If this situation did not occur we considered the corresponding dummy variable as equal to 1, and to 0 otherwise. As we use a dummy as dependent variable, a test of differences in proportions between the two periods is used, the null hypothesis being that this difference is equal to zero. The following results are shown in Table 8.

As we want to know whether a reduction in false warnings occurred, we focus on the difference in the respective proportions. If CRA I effectively had an impact on the issuance of false warnings, this difference should be significantly greater than 0, i.e. prop(before) > prop(after), which is not the case according to Table 8. Moreover, this hypothesis is the most strongly rejected among the three alternatives, leading to the conclusion that CRA I was inefficient in reducing the proportion of false warnings released by Moody's.

Table 8 Proportions of false warnings, before and after CRA I

Variable	Mean	SE	# Of obs.	z	$P > \|z\|$	95% Conf. interval
Before CRA I	0.948	0.025	77	–	–	[0.898; 0.998]
After CRA I	0.964	0.014	167	–	–	[0.936; 0.992]
diff.	− 0.016	0.0291				[− 0.073; 0.041]
	Under H_0	0.0273		− 0.59	0.557	
diff = prop(before)−prop (after)						
H_0: diff = 0						
H_a: diff < 0			H_a: diff ≠ 0		H_a: diff > 0	
$Pr(Z < z) = 0.2787$			$Pr(\|Z\| < \|z\|) = 0.5575$		$Pr(Z > z) = 0.7213$	

Companies with investment-grade ratings are not included in the scope of this test

Conclusions

The historical review presented in the first part of this paper showed how a regulatory framework targeting rating agencies was necessary to be put in place, but also demonstrated that such a change would be uneasy to make. In addition, this review sheds light on the great role acquired by CRAs in both financial markets and existing regulations prior to the 2007–2008 global crisis, underlying the great need to reform this type of companies.

Based on a sample of about 350 observations, our models allow to conclude that CRA I had some influence on Moody's ratings. It first turned out from Chow tests that the regulation modified both the grading process and magnitudes of moves that occurred. The first specification of ordered logistic regression demonstrates that CRA I had a significant impact on how Moody's uses some quantitative variables and geographical information in order to determine which grade will be granted to a company. This model also underlines a more cautious use of indicators after the implementation of the regulation.

Similar conclusions can be derived from Table 5 on the consequences of CRA I on magnitudes of rating changes. Model 2 highlights the fact that Regulation (EC) No 1060/2009 led to more limited notches moves when reviewed companies are up- or downgraded, this effect being statistically significant at the 5% level. Following this regression, the test on false warnings clearly shows that CRA I failed to address this issue, as we do not observe a significant difference between the two periods.

It is certain that, in spite of the robustness of the models we used, our conclusions could be strengthened, notably by using data from the three major CRAs and by considering a greater range of years. This would certainly help to obtain even more robust results and to conduct a finer study on the impact of the recent EU regulations on ratings.

It is finally important for us to underline that the findings of this paper are not only relevant within the theoretical debate on CRAs, but also consistent from a practical point of view. Indeed, our study of the impact of the first important legally binding text on the regulated entities in the EU can directly be used by legislators in order to improve further the credit rating market.

Appendix 1

See Table 9.

Table 9 Timeline of EU and US regulations

EU		US
	1934	Securities Exchange Act
	1975	SEC, Rule 15c3-1
	1997	SEC proposal on NRSROs (not implemented)
	2002	Sarbanes–Oxley Act
Market Abuse Directive (2003/6/EC)	2003	
MiFID Directive (2004/39/EC)	2004	
Capital Requirements Directives (2006/48/EC & 2006/49/EC)	2006	Credit Rating Agency Reform Act
European Commission proposal 2008/0217 (COD)	2008	
Regulation (EC) No 1060/2009 ('CRA I')	2009	
	2010	Dodd–Frank Wall Street Reform and Consumer Protection Act
Regulation (EC) No 513/2011 ('CRA II')	2011	
Regulation (EU) No 462/2013 ('CRA III')	2013	

Appendix 2

See Table 10.

Table 10 Correlation matrix

	CRA I dummy	Profit margin	CF variation	Solvency ratio	Liquidity ratio	Previously reviewed	log(Total assets)	LT debt levg.	Belgium—before	Finland—before
CRA I dummy	1									
Profit margin	0.1253	1								
CF variation	0.0363	0.0143	1							
Solvency ratio	0.0434	0.2125	0.0453	1						
Liquidity ratio	0.0684	− 0.0912	0.1031	0.0974	1					
Previously reviewed	− 0.2599	0.1189	− 0.0314	0.0401	− 0.1161	1				
log(Total assets)	0.0148	0.1001	− 0.0174	0.1018	− 0.1357	− 0.0231	1			
LT debt levg.	− 0.0176	− 0.1245	− 0.0325	− 0.3693	0.0283	− 0.0065	− 0.1686	1		
Belgium—before	− 0.1492	0.0231	− 0.0077	0.0424	− 0.0263	0.0571	− 0.0047	− 0.0364	1	
Finland—before	− 0.0859	− 0.0426	− 0.0069	0.0558	− 0.0231	− 0.0211	0.0028	− 0.0629	− 0.0052	1
France—before	− 0.3847	− 0.0599	− 0.0285	− 0.0415	− 0.0846	0.0201	0.0362	− 0.1147	− 0.0231	− 0.0133
Greece—before	− 0.0859	− 0.1411	0.232	0.095	0.1365	− 0.0211	− 0.0861	− 0.0341	− 0.0052	− 0.003
Ireland—before	− 0.0859	− 0.1392	− 0.0034	− 0.1462	0.0774	− 0.0211	− 0.0723	0.2164	− 0.0052	− 0.003
Italy—before	− 0.3397	− 0.0213	− 0.026	0.0514	− 0.0402	0.2155	− 0.0572	0.0284	− 0.0204	− 0.0117
The NL—before	− 0.2119	− 0.2452	− 0.0202	− 0.0439	− 0.0437	0.0812	− 0.1072	0.0425	− 0.0127	− 0.0073
Portugal—before	− 0.0859	0.0272	− 0.0058	0.0133	0.016	− 0.0211	0.0172	0.0176	− 0.0052	− 0.003
Spain—before	− 0.3152	0.0826	− 0.0207	− 0.0188	− 0.0852	0.1055	− 0.049	0.1867	− 0.0189	− 0.0109
Austria—after	0.0489	0.0074	− 0.0071	− 0.011	− 0.0696	− 0.0298	− 0.0567	− 0.1175	− 0.0073	− 0.0042
Belgium—after	0.1367	− 0.0014	− 0.0247	0.3137	0.0903	− 0.0407	0.0782	− 0.1277	− 0.0204	− 0.0117
Estonia—after	0.0346	0.0823	− 0.0056	0.129	0.2692	− 0.0211	− 0.0681	− 0.0125	− 0.0052	− 0.003
Finland—after	0.0777	− 0.0115	− 0.011	0.132	− 0.0122	− 0.0474	− 0.0178	− 0.1474	− 0.0116	− 0.0067
France—after	0.2291	− 0.008	0.1007	− 0.0497	− 0.161	− 0.1122	0.15	− 0.1535	− 0.0342	− 0.0197
Greece—after	0.0923	− 0.0347	− 0.017	− 0.1063	− 0.126	− 0.0563	− 0.093	0.1009	− 0.0138	− 0.0079
Ireland—after	0.0489	− 0.193	− 0.01	− 0.151	0.0852	− 0.0298	− 0.0995	0.2346	− 0.0073	− 0.0042
Italy—after	0.2422	− 0.0393	− 0.0411	0.0556	0.0009	− 0.1213	0.0715	0.0216	− 0.0361	− 0.0208
Luxembourg—after	0.0853	0.0648	− 0.0045	− 0.1709	0.008	− 0.052	− 0.3253	− 0.1807	− 0.0127	− 0.0073
The NL—after	0.0923	− 0.0121	− 0.0306	0.0707	− 0.0783	0.0055	− 0.0724	− 0.0566	− 0.0138	− 0.0079
Portugal—after	0.1217	0.5722	0.0133	0.0568	− 0.193	0.1633	− 0.0226	− 0.028	− 0.0182	− 0.0105
Spain—after	0.2122	− 0.0075	− 0.0223	− 0.0136	− 0.0934	0.1045	− 0.0749	0.3175	− 0.0316	− 0.0182
Germany—after	0.3184	− 0.0542	0.0439	− 0.092	0.3517	− 0.1722	0.0746	− 0.0077	− 0.0475	− 0.0273

Table 10 continued

	France—before	Greece—before	Ireland—before	Italy—before	The NL—before	Portugal—before	Spain—before	Austria—after	Belgium—after	Estonia—after
France—before	1									
Greece—before	− 0.0133	1								
Ireland—before	− 0.0133	− 0.003	1							
Italy—before	− 0.0526	− 0.0117	− 0.0117	1						
The NL—before	− 0.0328	− 0.0073	− 0.0073	− 0.029	1					
Portugal—before	− 0.0133	− 0.003	− 0.003	− 0.0117	− 0.0073	1				
Spain—before	− 0.0488	− 0.0109	− 0.0109	− 0.0431	− 0.0269	− 0.0109	1			
Austria—after	− 0.0188	− 0.0042	− 0.0042	− 0.0166	− 0.0104	− 0.0042	− 0.0154	1		
Belgium—after	− 0.0526	− 0.0117	− 0.0117	− 0.0464	− 0.029	− 0.0117	− 0.0431	− 0.0166	1	
Estonia—after	− 0.0133	− 0.003	− 0.003	− 0.0117	− 0.0073	− 0.003	− 0.0109	− 0.0042	− 0.0117	1
Finland—after	− 0.0299	− 0.0067	− 0.0067	− 0.0264	− 0.0165	− 0.0067	− 0.0245	− 0.0095	− 0.0264	− 0.0067
France—after	− 0.0881	− 0.0197	− 0.0197	− 0.0778	− 0.0486	− 0.0197	− 0.0722	− 0.0279	− 0.0778	− 0.0197
Greece—after	− 0.0355	− 0.0079	− 0.0079	− 0.0313	− 0.0195	− 0.0079	− 0.0291	− 0.0112	− 0.0313	− 0.0079
Ireland—after	− 0.0188	− 0.0042	− 0.0042	− 0.0166	− 0.0104	− 0.0042	− 0.0154	− 0.006	− 0.0166	− 0.0042
Italy—after	− 0.0932	− 0.0208	− 0.0208	− 0.0823	− 0.0513	− 0.0208	− 0.0764	− 0.0295	− 0.0823	− 0.0208
Luxembourg—after	− 0.0328	− 0.0073	− 0.0073	− 0.029	− 0.0181	− 0.0073	− 0.0269	− 0.0104	− 0.029	− 0.0073
The NL—after	− 0.0355	− 0.0079	− 0.0079	− 0.0313	− 0.0195	− 0.0079	− 0.0291	− 0.0112	− 0.0313	− 0.0079
Portugal—after	− 0.0468	− 0.0105	− 0.0105	− 0.0413	− 0.0258	− 0.0105	− 0.0384	− 0.0148	− 0.0413	− 0.0105
Spain—after	− 0.0816	− 0.0182	− 0.0182	− 0.0721	− 0.045	− 0.0182	− 0.0669	− 0.0258	− 0.0721	− 0.0182
Germany—after	− 0.1225	− 0.0273	− 0.0273	− 0.1081	− 0.0675	− 0.0273	− 0.1004	− 0.0387	− 0.1081	− 0.0273

	Finland—after	France—after	Greece—after	Ireland—after	Italy—after	Luxembourg—after	The NL—after	Portugal—after	Spain—after	Germany—after
Finland—after	1									
France—after	− 0.0443	1								
Greece—after	− 0.0178	− 0.0525	1							
Ireland—after	− 0.0095	− 0.0279	− 0.0112	1						
Italy—after	− 0.0468	− 0.1379	− 0.0555	− 0.0295	1					
Luxembourg—after	− 0.0165	− 0.0486	− 0.0195	− 0.0104	− 0.0513	1				
The NL—after	− 0.0178	− 0.0525	− 0.0211	− 0.0112	− 0.0555	− 0.0195	1			
Portugal—after	− 0.0235	− 0.0693	− 0.0279	− 0.0148	− 0.0732	− 0.0258	− 0.0279	1		
Spain—after	− 0.041	− 0.1208	− 0.0486	− 0.0258	− 0.1277	− 0.045	− 0.0486	− 0.0642	1	
Germany—after	− 0.0615	− 0.1812	− 0.073	− 0.0387	− 0.1916	− 0.0675	− 0.073	− 0.0963	− 0.1678	1

References

1. Scalet, S., and T.F. Kelly. 2012. The ethics of credit rating agencies: What happened and the way forward. *Journal of Business Ethics* 111(4): 477–490.
2. Zehetner, S. 2014. *Regulation of credit rating agencies: A comparison of regulatory regimes in the EU and the US*. Saarbrücken: AV AkademikerVerlag.
3. White, L.J. 2006. Good intentions gone awry: A policy analysis of the SEC's regulation of the bond rating industry. New York: New York University. New York University Law and Economics Working Papers no. 69.
4. U.S. Securities and Exchange Commission. 1934. Securities Exchange Act of 1934 [As amended through P.L. 112-158, approved August 10, 2012]. https://www.sec.gov/about/laws/sea34.pdf. Accessed 10 Apr 2017.
5. Partnoy, F. 2009. Rethinking regulation of credit rating agencies: An institutional investor perspective. Paper prepared for the Council of Institutional Investors (Washington, D.C., USA).
6. U.S. Securities and Exchange Commission. 1975. The Securities and Exchange Commission's (SEC) uniform net capital rule (15c3-1).
7. Conte, E., et al. 2008. The Regulation of Credit Rating Agency across USA and EU: Different systems, same concerns. Sienna: University of Sienna. University of Sienna Law and Economic Working Paper Series.
8. 107th United States Congress. 2002. Public Law 107-204 an act to protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws, and for other purposes. 30 July. https://www.sec.gov/about/laws/soa2002.pdf, referred as *Sarbanes-Oxley Act.* Accessed 10 Apr 2017.
9. 109th United States Congress. 2006. Public Law 109-291 An Act To improve ratings quality for the protection of investors and in the public interest by fostering accountability, transparency, and competition in the credit rating agency industry. 29 September. https://www.sec.gov/ocr/cra-reform-act-2006.pdf, referred as Credit Rating Agency Reform Act of 2006. Accessed 10 Apr 2017.
10. International Organization of Securities Commissions (IOSCO). 2004. Code of conduct fundamentals for credit rating agencies. December. http://www.iosco.org/library/pubdocs/pdf/IOSCOPD180.pdf. Accessed 10 Apr 2017.
11. European Parliament and Council of the European Union. 2003. Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003 on insider dealing and market manipulation (market abuse). 28 January. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003L0006. Accessed 10 Apr 2017.
12. European Commission. 2003. Commission Directive 2003/125/EC of 22 December 2003 implementing Directive 2003/6/EC of the European Parliament and of the Council as regards the fair presentation of investment recommendations and the disclosure of conflicts of interest. 22 December. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:339:0073:0077:EN:PDF. Accessed 10 Apr 2017.
13. European Parliament and Council of the European Union. 2004. Directive 2004/39/EC of the European Parliament and of the Council of 21 April 2004 on markets in financial instruments amending Council Directives 85/611/EEC and 93/6/EEC and Directive 2000/12/EC of the European Parliament and of the Council and repealing Council Directive 93/22/EEC. 21 April. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32004L0039, referred as 'MiFID'. Accessed 10 Apr 2017.
14. Committee of European Securities Regulators. 2005. Annual report of the Committee of European Securities Regulators (CESR) to the European Commission and to the European Parliament the ECOFIN Council 2005 (Ref. 06-004). https://www.esma.europa.eu/sites/default/files/library/2015/11/annual_report_final_version.pdf. Accessed 10 Apr 2017.
15. European Parliament and Council of the European Union. 2006. Directive 2006/48/EC of the European Parliament and of the Council of 14 June 2006 relating to the taking up and pursuit of the business of credit institutions (recast). 14 June. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0048&from=EN, referred as 'CRD'. Accessed 10 Apr 2017.
16. European Parliament and Council of the European Union. 2006. Directive 2006/49/EC of the European Parliament and of the Council of 14 June 2006 on the capital adequacy of investment firms and credit institutions (recast). 14 June. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0049&from=EN, referred as 'CRD'. Accessed 10 Apr 2017.
17. European Commission. 2006. Communication from the Commission on Credit Rating Agencies (2006/C 59/02). 11 March. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2006:059:0002:0006:EN:PDF. Accessed 10 Apr 2017.
18. Committee of European Securities Regulators. 2006. CESRs Report to the European Commission on the compliance of credit rating agencies with the IOSCO Code (Ref. CESR/06-545). December. https://www.esma.europa.eu/sites/default/files/library/2015/11/06_545.pdf. Accessed 10 Apr 2017.
19. Committee of European Securities Regulators. 2008. CESRs Second Report to the European Commission on the compliance of credit rating agencies with the IOSCO Code and the role of credit rating agencies in structured finance (Ref. CESR/08-277). May. https://www.esma.europa.eu/sites/default/files/library/2015/11/cesr_08_277.pdf. Accessed 10 Apr 2017.
20. European Commission. 2008. Proposal for a regulation of the European Parliament and of the Council on Credit Rating Agencies (2008/0217 (COD)). 12 November. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008PC0704&from=EN. Accessed 10 Apr 2017.
21. European Parliament and Council of the European Union. 2009. Regulation (EC) No 1060/2009 of the European Parliament and of the Council of 16 September 2009 on credit rating agencies. 17 November. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009R1060&qid=1457613187721&from=EN, referred as 'CRAI'. Accessed 10 Apr 2017.
22. De Haan, J., et al. 2011. *Credit rating agencies*. Amsterdam: De Nederlandsche Bank. DNB Working Paper No. 278.
23. 111th United States Congress. 2010. An act to promote the financial stability of the United States by improving accountability and transparency in the financial system, to end 'too big to fail', to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes. 5 January. https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf, referred as 'DFA'. Accessed 10 Apr 2017.
24. Securities and Exchange Commission. 2015. Securities Act of 1933 [As Amended Through P.L. 11494, Enacted December 4, 2015]—An act to provide full and fair disclosure of the character of securities sold in interstate and foreign commerce and through the mails, and to prevent frauds in the sale thereof, and for other purposes. 4 December. http://legcounsel.house.gov/Comps/Securities%20Act%20Of%201933.pdf. Accessed 10 Apr 2017.
25. Manns, J. 2011. The revenge of the rating agencies. Website of the New York Times, 9 August, http://www.nytimes.com/2011/08/10/opinion/the-revenge-of-the-rating-agencies.html?_r=0. Accessed 10 Apr 2017.

26. European Parliament and Council of the European Union. 2011. Regulation (EC) No 513/2011 of the European Parliament and of the Council of 11 May 2011 amending Regulation (EC) No 1060/2009 on credit rating agencies. 31 May. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:145:0030:0056:EN:PDF. Accessed 10 Apr 2017.
27. European Commission—Directorate General Internal Market and Services. 2011. Roundtable on credit rating agencies. 6 July. in *Commission staff working paper impact assessment (Ref. SEC(2011) 1354).* http://ec.europa.eu/internal_market/securities/docs/agencies/SEC_2011_1354_en.pdf. Accessed 10 Apr 2017.
28. European Parliament and Council of the European Union. 2013. Regulation (EU) No 462/2013 of the European Parliament and of the Council of 21 May 2013 amending Regulation (EC) No 1060/2009 on credit rating agencies. 31 May. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:146:0001:0033:EN:PDF. Accessed 10 April 2017.
29. Gärtner, M., et al. 2012. Rating agencies, self-fulfilling prophecy and multiple equilibria? An empirical model of the European sovereign debt crisis 2009–2011. St Gallen: Universität St. Gallen. Discussion Papers no. 2012-15.
30. Coffee Jr., J.C. 2011. Ratings Reform: The good, the bad and the ugly. *Harvard Business Law Review* 1: 231–278.
31. European Securities and Markets Authority. 2012. ESMA issues a report on its first examinations of credit rating agencies—Press release ESMA/2012/220. 22 March. https://www.esma.europa.eu/sites/default/files/library/2015/11/2012-220.pdf. Accessed 10 Apr 2017.
32. European Securities and Markets Authority. 2012. ESMAs report on the supervision of credit rating agencies (Ref. ESMA/2012/207). 22 March. https://www.esma.europa.eu/sites/default/files/library/2015/11/2012-207.pdf. Accessed 10 Apr 2017.
33. European Securities and Markets Authority. 2012. ESMA proposes guidelines on the scope of the CRA Regulation—Press release ESMA/2012/860. 20 December. https://www.esma.europa.eu/sites/default/files/library/2015/11/2012-860.pdf. Accessed 10 Apr 2017.
34. European Securities and Markets Authority. 2013. ESMA requires further improvements by CRA—Press release ESMA/2013/325. March 18. https://www.esma.europa.eu/sites/default/files/library/2015/11/2013-325.pdf. Accessed 10 Apr 2017.
35. European Securities and Markets Authority. 2015. ESMA publishes annual report and supervisory focus for CRAs and TRs—Press release ESMA/2015/281. 16 February. https://www.esma.europa.eu/sites/default/files/library/2015/11/2015-281_press_release_-_cra_tr_annual_report_and_work_plan.pdf. Accessed 10 Apr 2017.
36. European Securities and Markets Authority. 2015. ESMA sees progress in reform of EU credit rating industry—Press release ESMA/2015/1483. 2 October. https://www.esma.europa.eu/sites/default/files/library/2015/11/20151002_2015-1483_esma_sees_progress_in_reform_of_eu_credit_rating_industry.pdf. Accessed 10 Apr 2017.
37. European Securities and Markets Authority, CRA Authorisation. https://www.esma.europa.eu/supervision/credit-rating-agencies/risk. Accessed 10 Apr 2017.
38. Becker, B., and T. Milbourn. 2011. How did increased competition affect credit ratings? *Journal of Financial Economics* 101(3): 493–514.
39. Behr, P., D. J. Kisgen, and J. Taillard. forthcoming. Did government regulations lead to inflated credit ratings? July 27, 2016 version. https://ssrn.com/abstract=2412294. Accessed 10 Apr 2017.
40. European Securities and Markets Authority. 2015. Competition and choice in the credit rating industry—Market share calculation required by Article 8d of Regulation 1060/2009 on Credit Rating Agencies as amended—ESMA/2015/1879, 18 December. https://www.esma.europa.eu/sites/default/files/library/2015-1879_esma_cra_market_share_calculation.pdf. Accessed 10 Apr 2017.
41. Dimitrov, V., D. Palia, and L. Tang. 2015. Impact of the Dodd-Frank Act on credit ratings. *Journal of Financial Economics* 115(3): 505–520.
42. Alsakka, R., O. Gwilym, P. Klusak, and V. Tran. 2015. Market impact under a new regulatory regime: Credit rating agencies in Europe. *Economic Notes by Banca Monte dei Paschi di Siena SpA* 44(2): 275–307.

Olivier Nataf holds a Master of Economics with focus on economic analysis, advice and research from the Université libre de Bruxelles (ULB, 2014) and is currently a Ph.D. researcher in economics at the Vrije Universiteit Brussel (VUB). His research focuses on the credit rating industry, with a particular attention on its regulation at the European level and on the linkage between financial markets' variations and credit rating changes.

Prof. Lieven De Moor received his degree in Business Engineering (2000) and his Ph.D. in Applied Economics (2005) from KU Leuven. He is associate professor of finance at Vrije Universiteit Brussel (VUB) and KU Leuven, is chairman of the applied economics programme of study committee at VUB, and holds the VUB Chair in Public–Private Partnership. His teaching activities cover corporate and international finance and quantitative methods. His research activities include empirical asset pricing, international finance, portfolio management, ESG investing, credit rating industry, financial literacy, SME finance and infrastructure investments.

Prof. Rosanne Vanpée obtained a Ph.D. in Applied Economics from the KU Leuven, where she currently works as an assistant professor of finance. Her research handles one of the major puzzles in international finance, the equity home bias. She also is an expert of emerging bond markets and sovereign credit ratings. Rosanne has published in the *Review of Finance*, *the Journal of Empirical Finance*, *the European Journal of Finance*, *Foundations and Trends in Finance*, *Applied Financial Economics*, and *Research in International Business and Finance*. She has worked at an asset management company as a performance and risk manager in fixed income funds and has a profound practical and theoretical knowledge of the international bond markets.