

How Do Credit Rating Agencies Rate? An Implementation Perspective on the Assessment of Austerity Programs during the European Debt Crisis

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Abstract

During the recent European debt crisis, credit rating agencies and the ratings they were producing became a frequent bone of contention. We analyze which factors are considered by credit rating agencies when they judge a state's credibility in implementing an announced austerity program. The results of a fuzzy-set Qualitative Comparative Analysis of credit ratings show that implementation-related factors had a comparatively minor impact while the level of economic competitiveness of the evaluated country displayed high explanatory power. The findings highlight the desolate implications for less competitive countries that emanate from credit ratings and their influence on refinancing costs. While competitive states are deemed better able to generate future growth and therefore get positive evaluations, less competitive states cannot prevent (further) downgrades in the short or middle-term by announcing austerity programs.

Keywords: Austerity Programs, Credit Rating Agencies, European Debt Crisis, fuzzy-set Qualitative Comparative Analysis (fsQCA)

Introduction

This paper studies an important signaling mechanism between countries announcing an austerity program and credit rating agencies (CRAs) subsequently judging the implementation credibility of that program. In several developed economies where the level of debt has risen sharply in recent years states have adopted austerity programs to avoid spiraling debt and to refinance existing debts on the capital markets under acceptable conditions (Blyth 2013). Austerity programs intend to decrease costs and increase state income, thereby reducing debt. In Europe, numerous austerity programs have been put into place over the last few years. Austerity programs have a particularly high relevance for European Union (EU) member states who cannot simply devalue their currency to boost competitiveness. Instead, they are forced to resort to internal devaluation mechanisms – such as austerity programs – to ensure fiscal sustainability and secure access to capital markets (Weisbrot and Ray 2010).

Since sovereign ratings are an “assessment of each government’s ability and willingness to service its debts in full and on time” (Bissoondoyal-Bheenick 2005, 252), announced austerity programs are tested by the markets and reviewed in terms of how and whether they can be implemented successfully with a view to securing solvency. This process of evaluation is dominated by a small number of influential actors, with first and foremost the major US rating agencies Standard & Poor’s, Moody’s and Fitch Ratings. Over the years the significance of their judgments has also increased with regard to Europe, where many bank-based coordinated market economies have substituted former non-market institutions by external rating practices (Trampusch 2013). CRAs have become private regulators of international capital markets. Countries normally have long standing contracts with CRAs and pay to get rated, as they are dependent on the ratings to secure access to capital markets and hold down borrowing costs (Archer, Biglaiser,

and deRouen 2012; Kerwer 2005).

Our aim is to shed empirical light on the reaction function of CRAs during the European debt crisis. We seek to establish whether countries can halt sovereign rating downgrades and secure access to capital markets by announcing an austerity program. To this end, we consider the implementation of an austerity program as the implementation of a public policy. Based on the conceptual framework by Sabatier and Mazmanian (1980; Exadaktylos and Zahariadis 2014; Hinterleitner, Sager, and Thomann 2016), our preliminary assumption is that – besides macroeconomic factors – implementation-related factors should be considered by CRAs when evaluating an announced austerity program and its likely effect on fiscal sustainability. As sovereign ratings assess a state's ability to service its debt and austerity programs are passed in order to maintain this ability, austerity programs and sovereign ratings form a peculiar relationship: Austerity programs are a signal to capital markets that a state is willing to honor its debt obligations (De Haan and Amténbrink 2011), which in turn needs to be verified for its credibility. Accordingly, factors able to impede the successful implementation of the announced austerity program should be considered by CRAs. In this respect, our work differs from other contributions in the field which focus primarily on macroeconomic factors and their influence on ratings (e.g. Cantor and Packer 1996; Monfort and Mulder 2000; Mora 2006). Most of the contributions that have to a certain extent included political factors in the analysis (Archer, Biglaiser, and deRouen 2007; Beaulieu, Cox, and Saiegh 2012; Vaaler, Schrage, and Block 2006), have only done so with regard to developing countries. Studies explicitly considering both macroeconomic and fiscal variables across countries of different level of development have not produced definitive results (Eijffinger 2012; Hill, Brooks, and Faff 2010; Afonso, Gomes, and Rother 2011). A question which has not yet been addressed is how CRAs react to the announcement of austerity programs.

A fuzzy-set Qualitative Comparative Analysis (fsQCA) of 24 austerity programs passed in 16 European countries between January 2009 and May 2012 reveals no combination of implementation-related factors which is fully able to brace itself against an unfavorable economic environment. Instead, it exposes a simple empirical pattern of rating decisions primarily driven by the economic competitiveness of countries. While competitive states are deemed better able to generate future growth and therefore get positive evaluations, less competitive states cannot prevent (further) downgrades in the short or middle-term by announcing austerity programs.

The paper proceeds as follows: The next section outlines the importance of CRAs and their ratings for the scope of policy-making of sovereign states. The third section presents the theoretical framework. The fourth section presents the research strategy for the empirical evaluation of the assumed interrelated effects, the operationalization thereof, case selection and data used. In the fifth section, the results of the fsQCA are presented and interpreted. Finally, implications for a fuller understanding of the political role of CRAs and their ratings during the European debt crisis are formulated.

The Cognitive Authority of Sovereign Ratings and Implications for the Scope of Policy-Making

CRAs have long been criticized for their business model of ‘secret neutrality’: Since more transparency would allow clients to influence rating decisions and thereby damage their reputation for neutrality, CRAs “resist fiercely any attempts to make them more transparent” (Kerwer 2005, 469). Specifically with regards to sovereign bonds, the general ‘Guidelines’¹ as well as explanations of specific rating decisions published by CRAs are very general and allow a great deal of scope for the personal opinions of the

¹ Cf. <http://www.standardandpoors.com/ratings/sovresearch/en/us> (accessed: 06.03.2016).

assessment team (Iyengar 2010; Sinclair 1994). As Sinclair (1994, 140) put it, the “composition of the rating committees and the internal deliberations within the rating agencies on any particular issue are kept strictly confidential”. Most importantly, the CRAs do not state the relative weighting of the factors relevant to the rating, which also cannot always be quantified (Cantor and Packer 1996; Eijffinger 2012; Gaillard 2013). Accordingly, studies that have tried to identify the determinants of sovereign ratings and their weighting have not produced definitive results (Afonso, Gomes, and Rother 2011; Hill, Brooks, and Faff 2010). Although many studies assert that CRAs take political conditions into account, most of them produced insights on rating decisions with regard to developing countries, which may not be readily transferable to developed countries (Gaillard 2013).

For states, the opacity of ratings is problematic since sovereign ratings, especially during times of crisis, influence the cost of borrowing (Aizenmann, Binici, and Hutchison 2013; Alsakka and ap Gwilym 2013; Carruthers and Kim 2011; Kerwer 2005). In complex capital markets, information about creditworthiness can no longer be provided by banks alone. Instead, the latter are flanked by CRAs, which act as informational intermediaries by issuing “a corporate family-level opinion of the relative likelihood that any entity within a corporate family will default on one or more of its long-term debt obligations” (Moody’s 2009, 18). Through the commodification of credit risk, CRAs make the complex economic and financial constitution of sovereigns ‘legible’. The control of this process of commodification constitutes an “indirect exercise of political power over distinct social, economic, and political systems” since it influences the behavior of sovereigns in need of funds (Broome and Seabrooke 2012, 1; Kerwer 2005; Sinclair 1994, 2001). The importance of ratings for the assessment of credit risk is further enhanced by the regulatory use of ratings. Sovereign ratings are used to define investment constraints for institutional investors and determine their

capital reserve requirements (Hinterleitner and Rosser 2015; Pagano and Volpin 2010; White 2010).

The cognitive authority of sovereign ratings, which manifests itself in the influence of ratings on refinancing costs, has important implications for states and their scope of policy-making (Afonso, Furceri, and Gomes 2011; Paudyn 2013; Scott 2002). Through a downgrade, CRAs can trigger self-fulfilling prophecies (Ferri, Liu, and Stieglitz 1999; Gärtner and Griesbach 2012). In the event of a negative rating, refinancing costs rise and the state's ability to service its debt declines. This can trigger a new downgrade and power a self-perpetuating process that forces states to adopt ever stricter austerity measures (Eijffinger 2012).

Against this background, the announcement of an austerity program can be conceived as a signal that states send to capital markets to assert their willingness to honor their debt obligations (De Haan and Amtenbrink 2011). When announcing an austerity program, states usually outline only vague details regarding the total amount of planned savings, the expected duration of the program, and the broad contours of how they aim to achieve their targets. The details states mention when announcing their intended austerity measures must thus (at least theoretically) meet the savings expectations of capital markets. However, CRAs can neither take these signals at face value nor wait for clarification of an austerity program before making a judgement, since slow response rates reduce the informational value of ratings (Löffler 2005; Posch 2011). Hence, it is plausible to assume that the kind and size of an austerity program disclosed by states at the time of announcement is treated by CRAs as a mere 'straw man' that needs to be verified for its implementation credibility.

If CRAs positively evaluate the implementation credibility of an announced austerity program, states may be able to halt the vicious circle of downgrades, rising refinancing costs and ever stricter austerity measures. States thus have a vital interest in knowing

the factors that CRAs take into account when assessing the credibility of an announced austerity program. In a nutshell, while the CRAs decision making constitutes a black box, the consequences emanating from that black box are of crucial importance for rated countries, especially in times when public finances already are in dire straits. This study wants to find out how CRAs react to the announcement of an austerity program and thereby answer the question whether states can prevent (further) downgrades in the short or middle-term by announcing an austerity program.

On what Grounds can CRAs Reasonably Assess Implementation Credibility?

Like Exadaktylos and Zahariadis (2014) in their recent study on bailout reforms in Greece, we draw on Sabatier and Mazmanian's (1980) widely used conceptual framework of the implementation process to assess how CRAs react to the announcement of an austerity program. This framework is particularly well-suited to capture the implementation of austerity measures, which constitute centrally designed top-level policy decisions that are often imposed under external pressure where "compliance is imposed from the top" (Exadaktylos and Zahariadis 2014, 163). Concerning the implementation process, we analyze the degree of centralization to address the question of veto points, the strength of the public administration to grasp adequate resources and the composition of the ruling government to proxy political commitment and set these against macroeconomic variables, namely the level of competitiveness of the economy and the rescue architecture put in place by the European authorities since the outbreak of the crisis.

Sabatier and Mazmanian (1980, 574) see the commitment of officials as crucial for the realization of statutory goals: "[a]ny new program requires implementors who are not merely neutral but sufficiently persistent to develop new regulations and standard

operating procedures, and to enforce them in the face of resistance from target groups”. Following the party difference theory (Hibbs 1977), the party-political constitution of the government during the period when an austerity program is passed and implemented matters. Conservative Centre-Right governments typically support and implement austerity measures to a stronger degree than Centre-Left and Christian-Democratic governments and face less blame for cutting social policy (Giger and Nelson 2010; Hinterleitner 2015; Hinterleitner and Sager 2015; van Kersbergen 1995). Accordingly, as a first condition, the presence of a strong Centre-Right government (CR) should have a positive effect on the reaction of CRAs.

Second, implementation success is determined “by (a) the number of veto/clearance points involved in the attainment of statutory objectives and (b) the extent to which supporters of statutory objectives are provided with inducements and sanctions sufficient to assure acquiescence among those with a potential veto” (Sabatier and Mazmanian 1980, 546). A decentralized political system features a larger number of veto players which can undermine central decisions and block state interventionism (Huber, Ragin, and Stephens 1993; Sager and Rüefli 2005; Tsebelis 1995). Austerity programs in particular tend to entail severe and abrupt cuts that can affect a wide range of players within the political system and give rise to opposition (Exadaktylos and Zahariadis 2014). As a second condition, a high number of veto players in a country (DC) could therefore negatively affect the CRAs’ evaluation of the likelihood that the austerity program will be successfully implemented.

Third, administrative resources are “necessary to hire the staff and to conduct the technical analyses involved in the development of regulations, the administration of permit programs, and the monitoring of compliance” (Sabatier and Mazmanian 1980, 545; Sager 2007a; Sager and Rielle 2013). Established administrative capacities, efficient processes and sufficient financial and personnel resources in state

administrations improve the efficient implementation of austerity programs. As a third condition, the existence of an efficient administration (EFF) should thus positively affect the CRAs' evaluation of implementation credibility.

Like much research on the political determinants of bond ratings, we include macroeconomic factors to establish whether CRAs consider implementation credibility at all or whether implementation-related factors take a backseat when CRAs react to the announcement of an austerity program (Biglaiser and DeRouen 2007).

During times of crisis, when sudden and repeated rating changes become more frequent, CRAs predominantly base sovereign ratings on projected economic development, since retrospective variables such as per capita GDP lose explanatory power (Afonso, Gomes, and Rother 2011). Projected economic development to a large degree depends on economic competitiveness (COM). Compared with other states, those states that are economically competitive at the time of the rating decision, despite intensive cost-saving, will in the future be able to generate economic growth and, thus, will be able to reduce their debt burden and the pressure to reduce costs (Hinterleitner, Sager, and Thomann 2016). The resultant greater likelihood of success when implementing an austerity program should be seen positively by CRAs.

Another macroeconomic variable likely to be considered by CRAs is the safety architecture put in place by the European authorities during the survey period, namely the European Financial Stability Facility (EFSF), the European Stability Mechanism (ESM) or the provision of European Central Bank (ECB) funds to financial markets. CRAs on several occasions have hinted that sovereign ratings may depend on the guarantees provided by the European authorities (Eijffinger 2012). It is therefore plausible to assume that even uncompetitive states are conceded better success estimates by CRAs if they manage to get under the European rescue umbrella. Thus, we assume that both comparably high level of economic competitiveness (COM) as well as the

existence of an established package of rescue mechanisms at the European level (UMB) should have a positive effect on the reaction of CRAs.

Sabatier and Mazmanian's (1980, 554) framework encompasses a "minimum list of crucial conditions", rather than individual factors which independently influence the implementation of a policy (cf. also Sager 2007b). The framework thus allows to discover case-specific configurations of factors that explain how CRAs evaluate the implementation credibility of an austerity program. Specifically, it allows to assess whether specific configurations of implementation-related factors can halt further downgrades in spite of an unfavorable economic environment (comparatively weak competitiveness and/or no support by European authorities) and whether overall 'model' configurations exist that can guarantee positive assessments by CRAs. Taken together, this enables us to shed empirical light on the reaction function of CRAs when states announce an austerity program. Table 1 shows the conditions outlined above, as well as their expected effects on the positive outcome.

Condition	Expected direction of influence on positive assessment (POS)
Existence of a strong Centre-Right government (CR)	+
High degree of decentralization of the political system (DC)	-
High quality/efficiency of state administration (EFF)	+
High level of economic competitiveness of the country (COM)	+
Existence of an extensive package of European rescue measures (UMB)	+

Table 1: Conditions and directional expectations for the positive outcome

Data and Methods

For the question of which factors affected the CRAs' reaction to announced austerity programs, cases are austerity programs passed by state governments.² We thus assess 24 austerity programs introduced in 16 countries within the Eurozone or the EU since the crisis began during the period from January 2009–May 2012 (see Table 5 in the Appendix). To focus on the five conditions presented above, we employ a Most Similar Systems Design which holds important economic contextual factors constant (Przeworski and Teune 1970). Since the countries concerned have the same currency or their national currency is tied with the Euro, they cannot devalue their currency without restriction as a means of avoiding consolidation measures. This enhances the importance of austerity programs. The countries also share an internal market and have

² As there is no official document by any international or supranational body that lists austerity programs passed in the EU, cases were identified using internet-based research. For every case several sources (national and international news services) were consulted in order to secure that the announced austerity program had actually been adopted by state authorities and its announcement not just used for party political purposes.

been undergoing a process of fiscal-political harmonization since the crisis began.³

We employ Fuzzy Set Qualitative Comparative Analysis (fsQCA) (Ragin 2000; Rihoux and Ragin 2008) to identify complex explanations in terms of necessary and/or sufficient conditions for positive and negative assessments of implementation credibility by CRAs.

fsQCA, which is based on the assumption of complex causality, allows for the study of interrelated and substitutable, rather than isolated net effects of different conditions on CRAs' assessments of implementation credibility (Befani and Sager 2006; Sager and Ledermann 2006; Sager and Andereggen 2012). Complex causality has three key characteristics (Schneider and Wagemann 2012, 89): (1) *Equifinality* means that various combinations of existing conditions can lead to the same outcome. (2) *Conjunctural Causation* refers to the fact that any interactions between the influencing factors are taken into account and the influence of a condition does not have to be viewed in isolation. (3) *Asymmetrical Causation* means that the occurrence of an outcome can have different causes than the non-occurrence. As states are particularly interested in combinations of factors that are eventually able to halt further downgrades, our predominant interest lies in the analysis of the positive outcome. fsQCA is specifically suitable for a mid-range number of cases, which accommodates the limited number of austerity programs passed recently in Europe (Schneider and Wagemann 2012, 295-305). The fundamental case-orientedness of QCA as an approach and the employment of post-QCA case analysis allow to control for potential measurement errors in the data (Schneider and Wagemann 2012, 307-312).

fsQCA takes into account the fact “that most social science concepts establish qualitative differences between cases in principle, but that cases manifest adherence to

³ This includes countries such as the UK or Denmark, since they cannot avoid internal devaluation at the expense of currency devaluation.

these criteria in various degrees” (Schneider and Wagemann 2012, 16). To this end, qualitative anchors are set, which determine the stage at which the condition is deemed fully present (‘fully in’; fuzzy value ≥ 0.95) and fully absent (‘fully-out’; fuzzy value ≤ 0.05). The indifference point is set at 0.5 and establishes difference in kind. For instance, fuzzy values above 0.5 indicate that the assessment of implementation credibility was rather or fully positive, while values below 0.5 mean that an assessment is rather or fully negative. The presence of a set is indicated by capital letters (POS), the absence of a set by lower case letters (pos).

fsQCA is based on fuzzy algebra. It uses the logical operators ‘or’ (+) and ‘and’ (*) to depict the combinations of conditions observed in the individual cases (austerity programs passed in European countries). A ‘truth table’ is built, which shows all possible combinations of conditions (configurations, paths) and attributes the cases to them. During the logical minimization process, the shortest possible expression depicting the combinations of factors that imply (\rightarrow) the outcome is derived – the solution term. For example, where the two paths (combination of conditions in a country that has passed an austerity program) $COM*CR*UMB \rightarrow POS$ and $COM*cr*UMB \rightarrow POS$ exist it is assumed that the party-political composition of the ruling government (CR) obviously has no influence on the reaction of CRAs.

fsQCA results are evaluated using two parameters of fit that range from 0-1, which allow to evaluate the results obtained in terms of their explanatory power. *Consistency* shows the extent to which there are contradictions in the outcome, that is, whether there are cases in which the specific form of outcome contradicts the prognosis of the solution formula (Schneider and Wagemann 2012, 128). Consistency is indicated for single truth table rows (raw consistency), single paths of, or the whole solution term. *Coverage* states how well the available empirical information can be explained by the solution formula (Ragin 2006, 291; Schneider and Wagemann 2012, 139). Raw coverage

indicates how much of the outcome a single path covers, and unique coverage, how much it uniquely covers. For both parameters of fit, the “appropriate levels for consistency and coverage are research-specific” (Schneider and Wagemann 2010, 406) but are better, the closer to 1. Consistency should not be below 0.75 for sufficient conditions, and not below 0.9 for necessary conditions (Ragin 2008, 46). Low coverage values indicate that in reality there are evidently other factors that explain the outcome and which were not taken into account in the QCA (Schneider and Wagemann 2012, 139).

We apply the Enhanced Standard Analysis procedure and interpret the intermediate solution. This means that we make theoretically informed assumptions (outlined in Table 1) about empirically unobserved truth table rows (logical remainders). We also make sure that these assumptions do not contradict prior findings of necessity or sufficiency (Schneider and Wagemann 2012, 198-211). Raw data and fuzzy set scores, truth tables, directional expectations, complex and parsimonious solution terms and simplifying assumptions can be found in the Appendix.

Operationalization and Calibration

We now turn to the measurement and calibration of the condition and outcome sets, as summarized in Table 2. Calibration is based both on theoretical knowledge and with an eye on the distribution of raw data in the cases. For some variables, no clear a priori theoretical criterion exists for determining membership in a set (e.g., a country’s economic competitiveness is per definition a feature relative to other countries’ competitiveness). In these cases, we apply well-grounded empirical criteria with an eye on the cases’ value distributions (Schneider and Wagemann 2012, 32-35). For the calibration of fuzzy values we used the direct method of calibration, which applies a logistic function to assign the raw data to the different qualitative categories partitioned

by the qualitative anchors 0.95 (fully membership), 0.5 (point of indifference) and 0.05 (full nonmembership) (Schneider and Wagemann 2012, 35-39).

Outcome: Positive reaction of CRAs (POS)

Operationalization. The data foundation for the outcome consists of the ‘Sovereign Rating History’ by Fitch Ratings (2012). Corresponding data from the other two major CRAs, Standard & Poor’s and Moody’s, is not publicly available. This should not, however, limit the meaningfulness of the analysis since a significant herd mentality can be observed among these market leaders, as manifested in an extremely high correlation between the three.⁴

To capture the reaction of CRAs to the announcement of an austerity program, changes in the rating of a country within 4-6 weeks following the announcement were recorded. This time span covers the duration of a standard rating process (cf. Standard and Poor’s 2012, 6) and takes into account that the agencies occasionally require quite some time to include new relevant information in the rating of a country (Löffler 2005; Posch 2011). An indicator was constructed that integrates changes in the rating and outlook and awards points accordingly. Whole points were awarded for changes in the absolute rating of a country; for changes in outlook only half and quarter points, whereby positive changes are shown with plus points and negative changes with minus points. This distinction expresses the fact that a change in outlook represents a less severe change in assessment than an actual up- or downgrade. Greece, for, instance, when it announced its first austerity program in March 2010, had a rating of BBB+, which was downgraded on 9 April 2010 to BBB- (outlook unchanged negative). This was a

⁴ Gaillard (2011) determines correlation coefficients for the three CRAs of more than 0.97 for the period from 2000 – 2010. Hill, Brooks, and Faff (2010) find that disagreements about rating quality among the agencies are usually confined to one or two notches on the finer scale (which considers both changes in rating and outlook).

downgrade of two rating stages (BBB+ → BBB → BBB-), so it was evaluated with the points -2. Obviously, the announced austerity program was not able to prevent a downgrade in this instance. This method of allocating points results in a distribution scale ranging from +0.25 to -2.75.

Calibration. When determining the cutoffs, the question to be answered is whether the absence of a change in rating or outlook (0 points) should be interpreted as more of a positive or negative sign on the part of the CRAs. In view of the criticism that CRAs are too pessimistic rather than overly optimistic in their evaluations in times of crisis (Ferri, Liu, and Stiglitz 1999), here, the absence of any change in rating is interpreted as a positive reaction and, accordingly, the cutoffs are set at -0.1, -0.26 (point of indifference) and -1.75. For mostly previously top-rated countries this means that slight upgrades or the absence of any downgrade are considered fully-in, while any deterioration in outlook (-0.25 points) can be taken into consideration in the analysis as a caution or ‘warning shot’, and accordingly is still slightly above the point of indifference. Only the downgrades observed in the aftermath of the announcements of Greek austerity programs, which “placed Greece, from September 2009 onwards, in a sovereign risk class of its own” (Panagiotarea 2013, 1), are considered fully-out.

Strong Centre-Right government (CR)

Operationalization. This condition is measured through the Comparative Political Data Set III 1990-2010 of Armingeon *et al.* (2012). The percentage share of (ministerial) posts held by Centre-Right parties in the government ranges from zero to 100% in the cases studied (table 5).

Calibration. The distribution selected for calibration expresses the idea of a ‘blocking minority’ of Centre-Right parties in a government. In cases where the latter have at least 50% of government posts, one can assume that they exercise significant control on the

implementation of austerity policies. Hence, we choose 49% as the crucial point of indifference that establishes differences in kind. The anchor for full membership was set at 89% to make sure that only cases are considered fully-in where there exists not a single (potentially influential) ministerial post held by a Christian- or Social-Democrat. The anchor for full nonmembership was set at 3%, where the presumed influence of the Centre-Right on the implementation of austerity policies can be considered negligible.

Strongly decentralized political system (DC)

Operationalization. A decentralization index developed by the Assembly of European Regions (AER 2009) is used to operationalize this condition. This is an aggregated index, which determines and shows autonomy in decision-making and implementation in various areas by means of qualitative and quantitative data on a scale from 0 to 100.

Calibration. Since ideal-typical situations of “full” or “absent” autonomy are never observed in reality, the distribution observed in the cases – which ranges from 63 (Belgium) to 31 (Greece) – is relevant when determining the cutoff. The individual anchors were set at 57 (full membership), 48 (crossover point) and 35 (full nonmembership) respectively. The chosen anchors account for larger gaps in the observed distribution and achieve an allocation which can also be found more or less in this form in similar indices. The anchor at 57, for instance, makes sure that only Belgium, Germany, and Spain, widely considered to be the only real federalist countries in the present study, are considered fully-in.

High quality/efficiency of state administration (EFF)

Operationalization. The Governance Indicator developed by Kaufmann, Kraay, and Mastruzzi (2011) both records and evaluates various aspects of governance in the period from 1996 to 2010. ‘Government Effectiveness’ reflects the quality of the Public

Service, the political independence of the administration, the quality of policy formulation and implementation as well as other administration-related aspects measured on a scale from -2.5 to +2.5.

Calibration. The qualitative anchors are set at 1.6 (full-membership), 1.1 (point of indifference) and 0.55 (full nonmembership). With this calibration, 11 cases are above and 13 cases are below the point of indifference. With the cutoff at 1.6 only countries with very strong and efficient administrations such as Denmark, Finland, Luxembourg and Austria are considered fully-in. The cutoff at 0.55 considers the two countries that have by far the lowest score – Greece and Italy. Countries with considerably stronger and more efficient administrations such as Slovakia, Spain or the Czech Republic are still treated more out than in compared to countries such as Germany, France or the United Kingdom, yet to a lesser degree.

High economic competitiveness (COM)

Operationalization. The Global Competitiveness Index of the World Economic Forum evaluates and aggregates a large range of data concerning basic conditions for growth, efficiency-boosting factors and innovation-boosting factors on a scale from approximately 2.7 to 5.8. This index is widely recognized as the most comprehensive of its kind in the media and financial industry.

Calibration. Since the scores can only be interpreted relative to other countries' scores, comparably large gaps in the existing distribution dictate where the cutoffs are set, which is at 5.25 (full membership), 5 (crossover point) and 4.1 (full nonmembership). The resultant distribution differentiates between the highly competitive countries Denmark, Finland and Germany, relatively more competitive countries such as Belgium, France, Austria, and the United Kingdom, and comparatively less competitive countries such as Latvia, Italy, Spain, or the Czech Republic. Finally, only the cases

situated in Greece, which has by far the lowest competitiveness scores of the cases examined, are considered fully-out.

Existence of a comprehensive package of European rescue measures (UMB)

Operationalization. The European package of rescue measures took on a concrete form in the EFSF and the ESM following several EU summits at the end of 2011, when the ECB underwent a change in policy under its new chairman Mario Draghi and began to provide money to the financial markets to avert a ‘credit crunch’.

Calibration. Austerity programs where the reaction of the CRAs was made prior to this point⁵ are coded with 0; austerity programs evaluated after this time are coded with 1 (crisp set; indirect calibration method).

<i>Set</i>	<i>Measurement</i>	<i>Calibration</i>		
		<i>Full member-ship</i>	<i>Cross-over point</i>	<i>Full non-member-ship</i>
Positive reaction of CRAs (POS)	Self-created index based on the ‘Sovereign Rating History’ of Fitch Ratings	- 0.1	- 0.26	- 1.75
Existence of a strong Centre-Right government (CR)	Percentage share of Centre-Right parties in government (Comparative Political Data Set III 1990-2010 by Armingeon <i>et al.</i> (2012))	89	49	3
High level of decentralization of the political system (DC)	AER Decentralization Index (2009)	57	48	35
High quality/level of efficiency of state administration (EFF)	Government Effectiveness partial index of the Governance Indicator of Kaufmann, Kraay, and Mastruzzi (2011)	1.6	1.1	0.55
High economic competitiveness of the country (COM)	WEF Global Competitiveness Index	5.25	5	4.1
Existence of a developed European package of rescue measures (UMB)	Dichotomous variable (Relevant Date: 9.12.2012)	1	-	0

Table 2: Measurement and calibration

⁵ The specific date is December 9 2011, when the decision to resolve the state debt crisis in the Eurozone and to consolidate eight other EU-states (The European Economic and Monetary Union (EMU)) into a factual fiscal union was taken at the Brussels summit.

Results

In this section, we present the findings of the analysis of sufficient conditions. The results of the analysis of necessity did not reveal any necessary conditions. It can be found in the Appendix.

Sufficient conditions for a positive reaction of CRAs (POS)

<i>Outcome: POS</i>	<i>consistency</i>	<i>raw coverage</i>	<i>unique coverage</i>	<i>cases covered</i>
DC*cr +	0.89	0.24	0.07	E, CS1, CS2
UMB*DC +	1.00	0.28	0.11	B1, B2, A2, I3, CS2
COM*EFF*CR	0.89	0.46	0.26	FIN, DK, GER, UK, F, B1, B2, A1, A2
<i>solution consistency:</i>	0.89			
<i>consistency cutoff:</i>	0.832 (next 0.827)			
<i>solution coverage:</i>	0.67			

Table 3: Sufficient conditions for a positive reaction of CRAs (POS)

The solution presented in Table 3 reads as follows: In the cases observed the CRAs showed a positive reaction in cases where:

the austerity program was passed in a comparably decentralized country (DC) without a ruling Centre-Right government (cr)

or (+)

the austerity program was passed in a comparably decentralized country (DC) after the end of 2011 (UMB)

or (+)

the austerity program was passed in a country with a comparably high level of economic competitiveness (COM), a strong administration (EFF) and a Centre-Right government (CR).

The third path, which has a considerably higher level of empirical relevance than the first two paths, as shown by the much higher ‘raw coverage’ score, describes the ‘prototype’ of a highly competitive country with Centre-Right government and a strong administration, which is obviously the most successful in fending off downgrades by CRAs. The cases covered by this path are without exception highly-developed economies, namely Finland, Germany, Denmark, the UK, Belgium, France and Austria. The raw data (Table 5 in the Appendix) show that these countries are all considered highly competitive and display marked differences from all of the other countries in which austerity programs were passed. With respect to the two other conditions in this path – a strong administration (EFF) and a strong Centre-Right government (CR) – this difference – although present – is far less pronounced. This path and the cases it explains correspond to the theoretical expectations.

This is not the case for the first path, in which the two conditions are diametrically opposed to the theoretical expectations. However, with a raw coverage of 0.24, the empirical significance of this path is limited; it explains only a few cases – the austerity programs announced in Spain (E) and the Czech Republic (CS1, CS2). A look at the cases shows that the austerity program passed in the Czech Republic in 2009 displays the highest set-membership-values for this path. Possible reasons for a positive outcome in this case lie in the early passing of the austerity program and the comparably good economic situation in the Czech Republic at that time. In 2009, the debt crisis verifiably had not yet reached its highpoint and the Czech Republic was one of the first countries in Europe to pass an austerity program in the wake of 2008 (OECD 2013). The second path covers comparatively decentralized countries potentially able to resort to an existing European rescue architecture. With regard to the condition of a European rescue architecture (UMB), this path corresponds to the theoretical expectations. In path 1 and 2, however, the degree of decentralization (DC) does not occur in the form

expected from the theoretical framework. Taken together, the explanatory power of the third path is highest and, as such, should be afforded more weight in the cross-path interpretation of the solution.

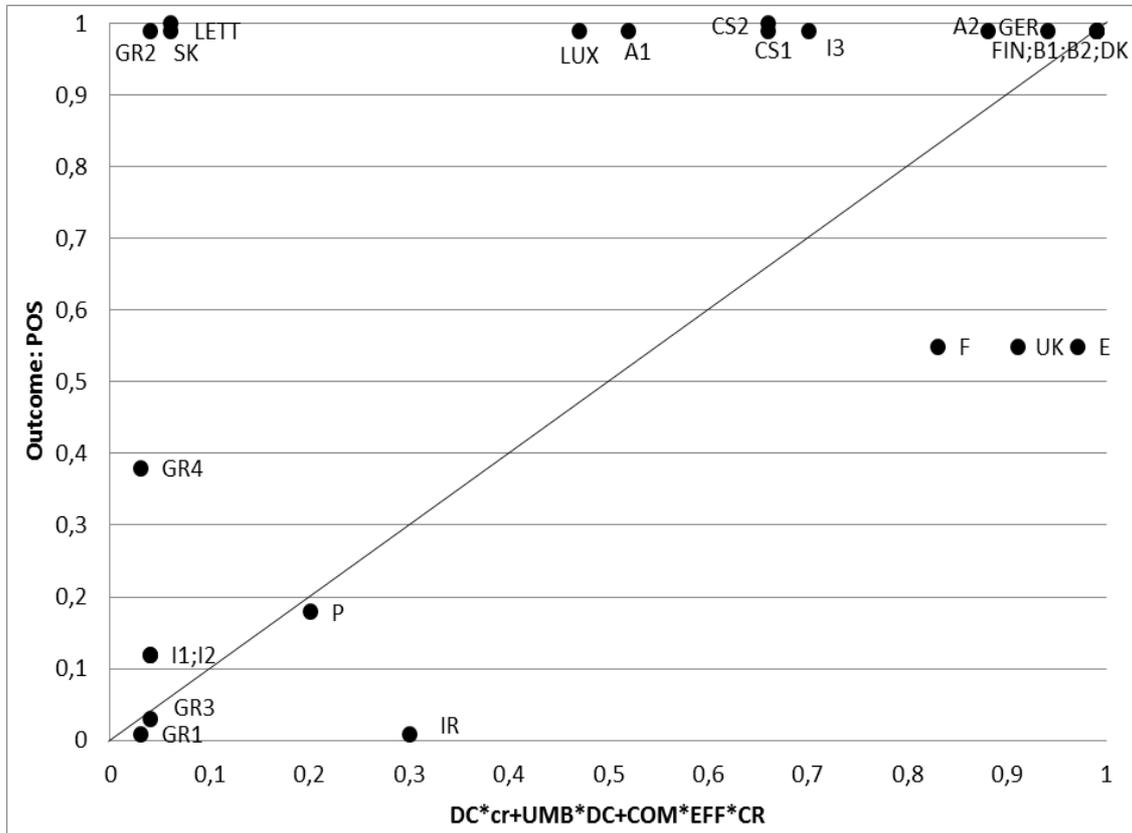


Figure 1: Sufficient conditions for the outcome ,POS'

The quality criteria (consistency = .89 and coverage = .67) and Figure 1 show that the solution has relatively high explanatory power since it displays a fairly high level of consistency and furthermore covers a good proportion of the cases examined. While the cases of Spain (E), France (F), and the United Kingdom (UK) are clearly below the diagonal, contradicting the statement of sufficiency (since $x < y$ does not apply), none of these three cases is actually a true contradictory case, which shows one path of the solution but not the outcome. The inconsistency can therefore be tolerated in these cases (Schneider and Wagemann 2012, 69). For the positive outcome, finally, post-QCA case-

analysis (Schneider and Wagemann 2012, 305-312) needs to consider the programs announced in Latvia (LETT), Slovakia (SK), and the second program announced in Greece (GR2), which are situated in the upper left quadrant of Figure 1. These cases are left unexplained by our cross-case model since they display the positive outcome (POS) but are not covered by the solution term. Thus, we compare a case with a high membership in the outcome but a low membership in the solution to a case with similar solution membership but low outcome membership to identify the causes for the difference in outcome. Figure 1 shows that the second Greek austerity program (GR2) is the only out of a total of four devised programs that were announced in Greece during the survey period that was able to temporarily halt further downgrades (POS). A reason for this could be the fact that GR2 was the first austerity program in Greece devised under close collaboration with the European authorities and the IMF. A closer grip on implementation by these actors might have been interpreted positively by CRAs.

Sufficient conditions for the negative outcome (pos)

Table 4 shows the solution for a negative assessment of implementation credibility by CRAs.

<i>Outcome: pos</i>	<i>consistency</i>	<i>raw coverage</i>	<i>unique coverage</i>	<i>cases covered</i>
<i>umb*com*eff*DC*CR</i>	0.9	0.25	0.25	I1, I2
<i>solution consistency:</i>	0.9			
<i>consistency cutoff:</i>	0.9 (next 0.63)			
<i>solution coverage:</i>	0.25			

Table 4: Sufficient conditions for a negative reaction of CRAs (pos)

The most salient information in table 4 is the very low solution coverage of .25 what basically means that the assessed conditions are not apt to explain the negative outcome. This suggests that the positive and the negative rating decision are two distinct

phenomena which require separate explanations. In the two covered cases, the reaction of CRAs were negative when the austerity program was passed in a comparably decentralized (DC) and economically uncompetitive (com) country with a Centre-Right government (CR) and weak administration (eff) before the end of 2011 (umb). This path corresponds with the theoretical expectations in that the explained cases include Italy (I1, I2), with its uncompetitive economy, weak administration and comparably decentralized structure, which is not yet able to rely on a functioning European rescue architecture. The only condition that contradicts the theoretical expectations is the existence of a Centre-Right government (CR). However, in both cases the government concerned is that of Silvio Berlusconi, which was never known for fiscal rectitude. While these cases confirm the tendency to be more critical of the austerity programs of less competitive countries, the explanatory power of this path must not be overrated, since with I1 and I2 it explains only two cases of a total of seven that were evaluated negatively. As for the positive outcome, post-QCA case-analysis (Schneider and Wagemann 2012, 305-312) is thus needed to understand negative rating decisions. We therefor compare a case with a high membership in the outcome but a low membership in the solution (most deviant case coverage) to a case with similar solution membership but low outcome membership in order to identify the causes for the difference in outcome. In Figure 2, this is the case for Greece: cases G1, G3, and to a lesser degree G4 are deviant cases, G2 is not. Consequently, there must have been other factors or conditions taken into account by CRAs when assessing Greece's implementation credibility. One factor can be assumed to lie in the unprecedented ambition and swift succession of the austerity programs passed in Greece, which involved a great deal of social upheaval and protest (Panagiotarea 2013), and which are likely to have made it noticeably more difficult to implement the costs-saving measures. The comparatively high level of corruption with its negative impact on political trust (Exadaktylos and

Zahariadis 2014) is a second factor that may be accountable for the outcome, as austerity measures in Greece need to “break thirty year old practices of corruption, cronyism, and clientelism” (Panagiotarea 2013, 155; Transparency International 2012), a situation that is unique among the cases considered. These explanations however need to be confirmed in further qualitative case study research.

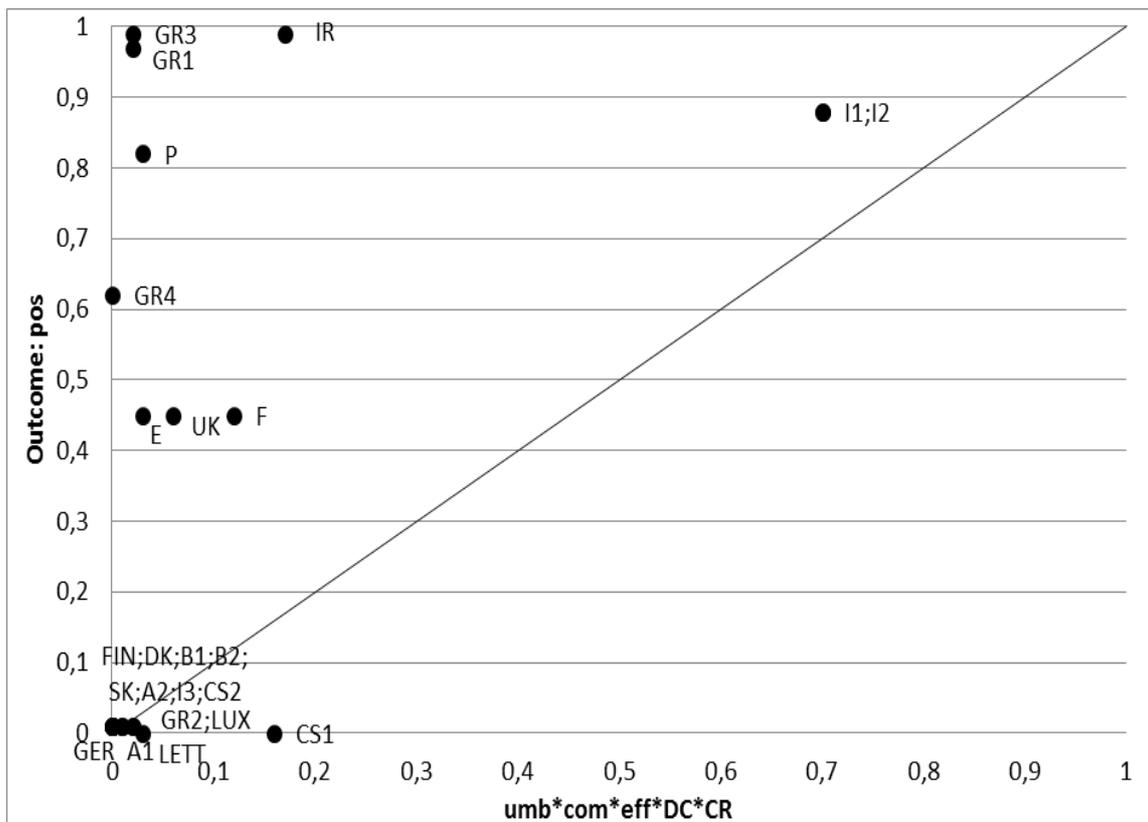


Figure 2: Sufficient conditions for the outcome ‘pos’

Discussion

With regard to the directional expectations discussed at the outset, the analysis of the ratings provides a mixed picture. The most distinct finding is that CRAs evaluated the implementation credibility of austerity programs passed in economically competitive states comparably more positively. In contrast, sweeping statements regarding implementation-related factors cannot be made without question since the conditions

Existence of a strong Centre-Right government (CR) and High degree of decentralization of the political system (DC) appear in sometimes ambivalent forms in the solution paths. The importance of a strong administration (EFF) appears greater, but this finding must also be qualified, since it cannot be determined unequivocally whether this variable must explicitly be viewed in addition to the (in most cases also present) economic competitiveness (COM). This underlines the context dependency of the effect of implementation-related factors, which, although often present in the expected forms in the solution paths, take a back seat where there are *simultaneous* macroeconomic factors with greater explanatory power. It can also be concluded that the European package of rescue measures (UMB) was by no means viewed by the CRAs as a panacea – the individual rescue mechanisms provided by the EU constitute plausible assistance first and foremost for smaller economies. The condition of economic competitiveness (COM) plays a comparatively greater role in the individual solution paths and has a clear influence on the reaction of CRAs. It usually represents the ‘stronger’ condition in the individual solutions. In various combinations of conditions, it is decisive for the occurrence of the outcome even if implementation-related factors do not occur in the form expected from theory. The fact that the solution has greater explanatory power for the positive outcome (POS) than the solution for the negative outcome (pos) corresponds with the theoretical considerations. The study design is specifically tailored to identify conditions or combinations of conditions which must be present for that the announcement of an austerity program can halt further downgrades.

With regard to the questions posed in the theory section, two important inferences can be drawn. First, there seems to be no combination of implementation-related factors which is fully able to brace itself against an unfavorable economic environment, be it in the form of an uncompetitive economy or the absence of European rescue commitments. The cases of the first Czech and the Spanish austerity programs do not

contradict these findings as shown in the explanations for the first path of the positive outcome. Second, an overall ‘model’ configuration of factors that can increase the chances of getting positive ratings (or manage to avoid downgrades) can be identified. In the cases considered, the highly-developed economies Finland, Germany, Denmark, the UK, Belgium, France, and Austria with their comparably very high economic competitiveness (and also higher, but less pronounced membership-values in the conditions strong Center-right government and strong administration) all avoided severe downgrades. For these states, announcing an austerity program is a worthwhile strategy, since the latter is taken by CRAs as a credible signal for future fiscal sustainability. For uncompetitive states, on the contrary, this signaling mechanism does not work. They cannot halt sovereign rating downgrades and secure access to capital markets by announcing an austerity program.

The sometimes low coverage of individual paths indicates that the five conditions in selected cases have difficulty in explaining in full the outcome in each case. Following our exploratory study, post-QCA case-analysis can point towards other explanatory conditions. One such condition, potentially taken into account by the CRAs, is the degree of political trust – irrespective of its political color – a government enjoys in supporting the announced austerity measures and actively encouraging their implementation (Exadaktylos and Zahariadis 2014). This could be the case for Italy and Greece in particular. Especially with regard to the negative outcome, further research should examine other political and macro-economic factors that eventually play a role in the rating decisions of CRAs. In any case, our findings for the CRAs have to be qualified in that they are solely based on the rating decisions of Fitch Ratings. However, due to the exceptionally high correlation coefficients between the three agencies (Gaillard 2011) and given that disagreements about rating quality among the agencies are usually confined to one or two notches on the finer scale (Hill, Brooks, and Faff

2010), we are confident that our results contribute to the understanding of the CRAs' behavior as a whole and that the pursued research approach based on fsQCA encourages further inquiry into the role and significance of CRAs' decision-making during specific historical periods.

Conclusion

Since the outbreak of the European debt crisis, CRAs have been increasingly accused of triggering self-fulfilling prophecies through their severe downgrades, which let refinancing costs rise and a state's ability to service its debt decline (Carruthers and Kim 2011; Ferri, Liu and Stieglitz 1999; Gärtner and Griesbach 2012; Kerwer 2005;). This leads to a new downgrade and powers a self-perpetuating process that, in the absence of possibilities to externally devalue, forces countries to adopt ever stricter austerity measures (Eijffinger 2012). Obviously, it is of crucial importance for states to know the factors that may eventually help to break this 'vicious circle'. The aim of this study was to establish which factors are considered by CRAs when they judge a state's credibility in implementing an announced austerity program and thereby answer the question whether countries can successfully signal their will for fiscal sustainability by announcing such a program (see also Hinterleitner, Sager, and Thomann 2016).

With regard to rating decisions, we have found no combination of implementation-related factors which is fully able to brace itself against an unfavorable economic environment and that, instead, only highly competitive states secure better ratings through the announcement of an austerity program. Given the complexity of implementation processes, our framework sheds light on a simple empirical pattern of rating decisions during the European debt crisis. Economically competitive states can use the outlined signaling mechanism for their own benefit, while for less competitive

states this strategy cannot halt rating downgrades. For less competitive states, the negative consequences that emanate from CRAs' reaction to announced programs and their influence on the cost of borrowing set particular incentives. Since they can neither devalue nor buy time through the announcement of an austerity program, uncompetitive countries can only opt for further European integration. There is a certain irony to this finding as CRAs do not further competitiveness but on the contrary force uncompetitive states into rescue solutions that constrain national economic sovereignty instead of fostering it. In the end, the practice of separately rating countries that are tied together through a currency union could well render sovereign ratings superfluous over time as long as CRAs show as little trust in the autonomous problem-solving capabilities of uncompetitive members states as they do in our findings.

Appendix

Table 5: Raw data

CASE	Case ID	Date of announcement	Time span (last year)	POS	CR	DC	EFF	COM	UMB
Belgium1	B1	14.02.2012	2012	0.00	54.54	63.00	1.59	5.2	1.00
Belgium2	B2	11.03.2012	2012	0.00	54.54	63.00	1.59	5.2	1.00
Denmark	DK	25.05.2010	2013	0.00	100.00	42.00	2.29	5.46	0.00
Germany	GER	07.06.2010	2014	0.00	100.00	60.00	1.55	5.37	0.00
Finland	FIN	24.03.2012	2016	0.00	100.00	45.00	2.24	5.47	1.00
France	F	25.08.2011	2012	-0.25	88.41	42.00	1.44	5.13	0.00
Greece1	GR1	03.03.2010	2012	-2.00	73.73	31.00	0.52	4.04	0.00
Greece2	GR2	06.05.2010	2014	0.00	73.73	31.00	0.52	4.04	0.00
Greece3	GR3	29.06.2011	2015	-2.75	73.73	31.00	0.52	3.99	0.00
Greece4	GR4	13.02.2012	2015	-0.50	36.84	31.00	0.52	3.92	1.00
United Kingdom	UK	22.06.2010	2014	-0.25	100.00	49.00	1.56	5.19	0.00
Ireland	IR	07.12.2010	2014	-2.75	86.28	41.00	1.31	4.74	0.00
Italy1	I1	25.10.2010	2012	-1.25	100.00	50.60	0.52	4.37	0.00
Italy2	I2	23.08.2011	2013	-1.25	100.00	50.60	0.52	4.37	0.00
Italy3	I3	04.12.2011	2013	0.00	100.00	50.60	0.52	4.43	1.00
Latvia	LETT	16.06.2009	2012	0.25	73.40	33.00	0.61	4.26	0.00
Luxembourg	LUX	12.04.2010	2014	0.00	60.00	31.00	1.71	4.96	0.00
Austria1	A1	26.01.2010	2013	0.00	50.00	54.00	1.89	5.13	0.00
Austria2	A2	10.02.2012	2016	0.00	50.00	54.00	1.89	5.14	1.00
Portugal	P	26.11.2010	2011	-1.00	0.00	42.00	1.04	4.38	0.00
Slovakia	SK	15.05.2012	2013	0.00	0.00	36.00	0.88	4.19	1.00
Spain	E	27.05.2010	2011	-0.25	0.00	58.00	0.98	4.59	0.00
CzechRepublic1	CS1	25.09.2009	2010	0.25	25.13	50.00	0.98	4.67	0.00
CzechRepublic2	CS2	12.04.2012	2016	0.00	45.45	50.00	1.01	4.52	1.00

Note: Survey period: July/August 2012

Table 6: Fuzzy data

<i>CASE ID</i>	<i>POS</i>	<i>CR</i>	<i>DC</i>	<i>EFF</i>	<i>COM</i>	<i>UMB</i>
B1	0.99	0.61	0.99	0.95	0.92	1.00
B2	0.99	0.61	0.99	0.95	0.92	1.00
DK	0.99	0.99	0.20	1.00	1.00	0.00
GER	0.99	0.99	0.98	0.94	0.99	0.00
FIN	0.99	0.99	0.33	1.00	1.00	1.00
F	0.55	0.96	0.20	0.88	0.83	0.00
GR1	0.03	0.89	0.02	0.04	0.04	0.00
GR2	0.99	0.89	0.02	0.04	0.04	0.00
GR3	0.01	0.89	0.02	0.04	0.03	0.00
GR4	0.38	0.30	0.02	0.04	0.03	1.00
UK	0.55	0.99	0.58	0.94	0.91	0.00
IR	0.01	0.96	0.17	0.78	0.30	0.00
I1	0.12	0.99	0.70	0.04	0.11	0.00
I2	0.12	0.99	0.70	0.04	0.11	0.00
I3	0.99	0.99	0.70	0.04	0.13	1.00
LETT	1.00	0.88	0.03	0.06	0.08	0.00
LUX	0.99	0.71	0.02	0.97	0.47	0.00
A1	0.99	0.52	0.88	0.99	0.83	0.00
A2	0.99	0.52	0.88	0.99	0.84	1.00
P	0.18	0.03	0.20	0.42	0.11	0.00
SK	0.99	0.03	0.06	0.23	0.06	1.00
E	0.55	0.03	0.97	0.34	0.20	0.00
CS1	1.00	0.16	0.66	0.34	0.25	0.00
CS2	0.99	0.44	0.66	0.38	0.17	1.00

Table 7: Necessary conditions for ‘POS’ and ‘pos’

	outcome ‘POS’		outcome ‘pos’	
	consistency	coverage	consistency	coverage
CR	0.68	0.68	0.77	0.36
DC	0.56	0.84	0.40	0.28
EFF	0.65	0.86	0.36	0.22
COM	0.57	0.91	0.26	0.19
UMB	0.45	0.91	0.09	0.09
cr	0.36	0.77	0.31	0.31
dc	0.52	0.65	0.76	0.45
eff	0.41	0.58	0.77	0.50
com	0.49	0.58	0.87	0.49
umb	0.55	0.57	0.91	0.43

The consideration of the individual consistency values shows that no single condition (both in the positive and in the negative form) is absolutely necessary for the occurrence of the outcome or, as the case may be, for the non-occurrence thereof, since the majority of the consistency values are nowhere near 1. The closest is the absence of a package of European rescue measures (umb) with the value of 0.91. However, the case GR4 makes clear (cf. Figure 3) that ‘umb’ is not a necessary condition for a negative outcome, since in GR4 the negative outcome ‘pos’ (negative reaction of CRAs) exists, but ‘umb’ is not present. In other words: there was a downgrade in GR4 despite the existing package of rescue measures.

Figure 3: X-Y-Plot for condition umb

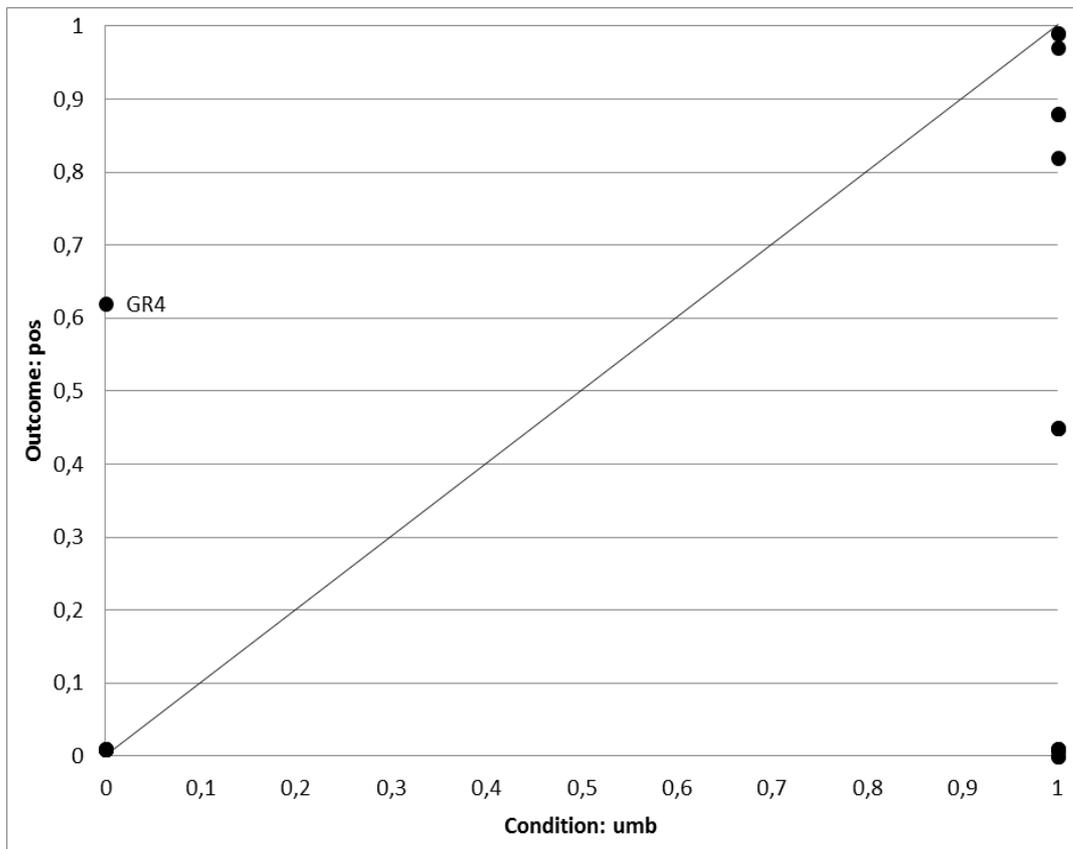


Table 8: Truth table for outcome 'POS'

CR	DC	EFF	COM	UMB	number	POS	consistency
1	1	0	0	1	1	1	1.00
0	1	0	0	1	1	1	1.00
1	1	1	1	1	3	1	1.00
1	0	1	1	1	1	1	1.00
1	1	1	1	0	3	1	0.93
0	1	0	0	0	2	1	0.90
1	0	1	1	0	2	1	0.83
0	0	0	0	1	2	0	0.827(*)
1	0	1	0	0	2	0	0.65
0	0	0	0	0	1	0	0.61
1	0	0	0	0	4	0	0.52
1	1	0	0	0	2	0	0.37

Notes: - Prime implicant: DC*UMB
 - Directional expectations: CR → POS; dc → POS; EFF → POS; UMB → POS; COM → POS
 - 15 logical remainders included in minimization:
 $cr\{0\}eff\{1\}com\{1\}+cr\{0\}dc\{1\}eff\{1\}+eff\{0\}com\{1\}+dc\{1\}eff\{1\}com\{0\}umb\{1\}$

(*) In order to establish a raw consistency threshold, we first state that a pronounced gap in the raw consistency values exists between rows 8 (0.827) and 9 (0.65) of our truth table. However, a closer examination of row 8 then reveals that the only case with a membership above 0.5 in this configuration is contradictory in a qualitative sense, since its membership in the outcome set is below 0.5 (Schneider and Wagemann 2012: 127, 143 ff). We hence exclude row 8 from minimization and set the raw consistency threshold at 0.83 to include row 7.

Table 9: Complex and most parsimonious solution for outcome ,POS'

complex solution	raw coverage	unique coverage	consistency
CR*EFF*COM +	0.46	0.41	0.89
cr*DC*eff*com +	0.14	0.07	0.93
DC*eff*com*UMB	0.09	0.04	1.00
<i>solution consistency:</i>	0.90		
<i>solution coverage:</i>	0.60		
most parsimonious solution	raw coverage	unique coverage	consistency
COM +	0.57	0.29	0.91
cr*DC +	0.24	0.05	0.89
DC*UMB	0.28	0.05	1.00
<i>solution consistency:</i>	0.89		
<i>solution coverage:</i>	0.70		

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Table 10: Truth table for outcome 'pos'

<i>CR</i>	<i>DC</i>	<i>EFF</i>	<i>COM</i>	<i>UMB</i>	<i>number</i>	<i>pos</i>	<i>consistency</i>
1	1	0	0	0	2	1	0.99
0	0	0	0	0	1	0	0.63
1	0	0	0	0	4	0	0.60
1	0	1	0	0	2	0	0.58
0	1	0	0	0	2	0	0.48
1	0	1	1	0	2	0	0.42
0	0	0	0	1	2	0	0.37
1	1	1	1	0	3	0	0.35
0	1	0	0	1	1	0	0.11
1	0	1	1	1	1	0	0.09
1	1	0	0	1	1	0	0.06
1	1	1	1	1	3	0	0.04

Notes: - Prime implicant: $CR*DC*com*umb$
 - Directional expectations: $umb \rightarrow pos$; $com \rightarrow pos$
 - 1 logical remainder included in minimization: $cr\{1\}dc\{1\}eff\{1\}com\{0\}umb\{0\}$

Table 11: Complex and most parsimonious solution for outcome ,pos'

<i>complex solution</i>	<i>raw coverage</i>	<i>unique coverage</i>	<i>consistency</i>
$CR*DC*eff*com*umb$	0.25	0.25	0.90
<i>solution consistency:</i>	0.90		
<i>solution coverage:</i>	0.25		
<i>most parsimonious solution</i>	<i>raw coverage</i>	<i>unique coverage</i>	<i>consistency</i>
$CR*DC*com*umb$	0.26	0.26	0.84
<i>solution consistency:</i>	0.84		
<i>solution coverage:</i>	0.26		

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