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Davor Kunovac and Rafael Ravnik

Are Sovereign Credit Ratings Overrated?

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Are sovereign credit ratings overrated?

Davor Kunovac* Rafael Ravnik†

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Abstract

In this paper we examine the relevance of changes in sovereign credit rating for the borrowing cost of Croatia and other EU countries. Our results indicate that discretionary credit rating announcements are only of limited economic importance for the borrowing cost of the countries under analysis. It seems that rating agencies do not reveal any new information to financial markets, in addition to that already contained in the underlying macroeconomic and fiscal fundamentals. Hence, given the sentiment in financial markets, the government's borrowing cost can only be reduced by improving macroeconomic and fiscal fundamentals. Any increase in the credit rating may then follow only as a consequence of these improvements.

Keywords: Sovereign credit ratings, borrowing cost, macroeconomic and fiscal fundamentals

JEL classification: G14, G24, H63, E62

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†email: dkunovac@hnb.hr, rravnik@hnb.hr

1 Introduction and motivation

Frequent sovereign rating downgrades received a huge amount of public attention during the recent European sovereign debt crisis. The news media as well as policymakers have routinely suggested that credit rating announcements strongly affect the borrowing cost of a country. This is mainly based on the assumption that credit rating agencies may reveal to financial markets important information about creditworthiness of a debt issuer, beside that already contained in macroeconomic fundamentals. In this paper we challenge that presumption and examine the relevance of changes in sovereign credit rating for the borrowing cost of Croatia and other EU countries. In other words, we examine whether possible positive assessments of rating agencies could have a positive impact on the price of Croatia's external borrowing. We also analyse whether financial markets ground their decisions on the same information set as rating agencies, implying that their announcements have only limited importance for financial markets. The answers to the questions asked may help to inform the discussion on the importance of sovereign credit ratings for the borrowing cost of Croatia and other countries of the European Union. Moreover, we try to quantify the importance of rating agencies for the borrowing cost of the Croatian economy and the EU in general applying various methodological frameworks, and in this sense this paper represents a contribution to related literature.

The analysis conducted in this paper works out the thesis that it is *a priori* unclear whether the improvement of the credit rating automatically causes a decline in government bond yields of a country. Usually we expect that financial markets and rating agencies largely base their decision on the same set of publicly available macroeconomic and fiscal indicators, such as public debt and deficit, GDP growth or unemployment rate. In such a case a change in the credit rating does not provide any new information to financial markets, pointing to the absence of *asymmetric information* between the state as the debt issuer and investors. Moreover, in case the information set on which the agencies base their decision is exactly equal to that of market participants, rating changes would not affect government bond yields at all because efficient markets would have already absorbed (priced in) such information in the price of the debt. The credit rating *per se* in such a case does not have a dominant influence on the borrowing cost - it is the underlying economic fundamentals that determine the borrowing cost in the long run. Therefore, given the sentiment in financial markets, the government's borrowing cost can only be reduced by improving macroeconomic and fiscal fundamentals. Any increase in the credit rating may then follow only as a natural consequence of these improvements. However, if, on the other hand, information sets of rating agencies and market participants differ significantly, changes of credit ratings may surprise the financial markets and in this way directly affect the government bond yields. In such a case credit ratings are truly informative and rating announcements now reveal *new information* to financial markets, in addition to that already contained in economic fundamentals. Only for such a case of the presence of substantial asymmetric information it makes sense to consider the increase in the credit rating

as a precondition for lower government bond yields. In order to gain a better insight into the mechanism according to which the main rating agencies can affect the borrowing cost of Croatia and other European countries we conduct an analysis based on the four steps we summarise below.

In the first step we estimate the direct impact of sovereign credit rating changes on the borrowing cost of European countries. For this purpose we conduct an *event study* analysis in order to estimate the reaction of EU members CDS (*Credit Default Swap*) spreads to changes in credit ratings. Our focus is on the announcements of the *big three* rating agencies: *Standard & Poor's*, *Moody's* and *Fitch*. The analysis suggests that the reaction of CDS spreads on rating downgrades is statistically significant but rather mild (around 10 basis points over the first two days), while the reaction to rating upgrades is not significant at all. Moreover, the total new information is completely absorbed in the price within the first two days following the rating announcement. However, it turned out that the reaction largely depends on the current level of the respective country's rating at the day when the rating change is announced. The reaction is the strongest following downgrades from the investment into the junk category (around 29 basis points). In addition, the market reaction is somewhat stronger for the first downgrade into the junk category (approximately 36 basis points), while subsequent rating downgrade announcements by other agencies normally do not lead to a significant reaction by the financial markets. The stronger reaction of sovereign spreads to the downgrade into the junk category may, at least partially, be explained by administrative and regulatory restrictions. For instance, institutional investors that are prevented by regulatory constrains from investing into securities of certain rating categories only may decrease their demand for junk-rated government bonds and can thus directly affect their yield.

The results of the first part of the analysis suggest that agencies do not reveal any important new information on the credibility of the debt issuer to the market participants. They base their decisions, to a large extent, on the information that is already absorbed in the borrowing cost. In order to carry out a formal verification of this preliminary conclusion further analysis was conducted in order to examine the way in which the main rating agencies determine the rating of EU member states. After that we also analyse the information set of the bond market participants.

The second step of this paper studies how the three leading rating agencies determine the credit ratings of EU member states. In other words, here we try to approximate the information set used by credit rating agencies when deciding on the credit rating of a country. For this purpose we project credit ratings of EU countries onto the usual set of publicly available macroeconomic and fiscal indicators. Based on the estimated relationships we decompose the credit ratings into two parts: *i)* a systematic part labelled as *credit rating implied by fundamentals* (i.e. the estimated regression fit) and *ii)* a discretional part that is unexplained by fundamentals (residual of the estimated regression). The unexplained part approximates discretionary actions of rating agencies - specific information on the rating of a country that does not follow the dynamics of fundamentals in a systematic way. The main findings of this step of the analysis suggest that the estimated

systematic part is able to capture the dynamics of the true credit rating very well. Around 90% of ratings implied by fundamentals were equal or one notch different from the actual ratings. As for specific results for Croatia, the *rating overestimation/ underestimation indicator* points to a conclusion that rating agencies have underestimated Croatia's rating prior 2010, while results for the last two to three years indicate that its credit rating was overestimated by one notch.

In the third step we analyze whether rating agencies reveal any new information to financial markets that has not yet been absorbed (priced in) in the borrowing cost of a country. In other words, our objective here is to isolate the informational contribution of the credit ratings to CDS market in addition to that already contained in the economic fundamentals. For that purpose we decompose the CDS spreads into three components: *i)* the contribution of economic fundamentals captured by the previously estimated systematic part of the credit rating, *ii)* contribution of the discretional part (contribution of the residual) and *iii)* contribution of global risk aversion. The mentioned decomposition allows us to assess the relative importance of discretionary rating agency actions for the borrowing cost of the analysed countries. Our results suggest that fundamentals, along with the global risk aversion, are the most important determinants of CDS spreads of European countries. On the other hand, the discretional part of the credit rating explains only a small portion of the variation in CDS spreads. Discretionary reactions of rating agencies can only in specific periods and for specific countries have temporary effects on CDS spreads. For instance, the earlier mentioned *overestimation* of Croatia's rating in the recent period lowered Croatia's spreads by 5 to 25 basis points compared to those implied by fundamentals. On the other hand, during the European sovereign debt crisis of 2011-2012 discretionary measures of rating agencies were not relevant at all for determining Croatian spreads. During this period external factors were the dominant driving forces of Croatia's borrowing cost.[1]

In the final step of our analysis we estimate so-called *market implied ratings* and compare them with the corresponding observed credit ratings. It is important to note that the ranking of a set of countries by their credit rating is not necessary in line with their ranking by CDS spreads. One explanation of this inconsistency could be attributed to the fact that rating agencies are prudent in their approach to rating revisions which means that they neglect short-term fluctuations in economic fundamentals to a large extend. On the other hand, market participants tend to react immediately to changes in the underlying economic fundamentals. The described difference in behaviour between the rating agencies and the market participants is noticeably confirmed by our results. More precisely, the estimated market implied ratings are able to anticipate almost all observed rating changes well in advance. For example, the financial markets placed Croatian spreads into the junk category two years prior to the actual rating downgrade so that the announcement of the rating downgrade from the investment into the junk category (14 December 2012 - S&P) was not considered as important news for market participants. Similar results were obtained for

[1] The impact of external factors on the domestic borrowing cost is analysed in more detail in Kunovac (2013).

the majority of other Southern and South-eastern European Countries. These findings additionally confirm earlier results about the limited relevance of the information content of credit ratings.

The analysis clearly points to the conclusion that the autonomous, discretional impact of rating announcements on the borrowing cost for EU member states is significant in the statistical sense. However, the economic importance of this impact is rather limited. On the other hand, our results, in line with the related literature suggest that macroeconomic fundamentals, in addition to global risk aversion, are the dominant determinants of the borrowing cost of European countries. The analysis thus leads to the conclusion that the importance of rating agencies for the borrowing cost is probably *overrated* by the Croatian public and that, under current financial market conditions, only an improvement in the underlying macroeconomic fundamentals can substantially lower the borrowing cost of the Republic of Croatia.

1.1 Selected related literature

The existing empirical literature on sovereign credit ratings and government's borrowing cost that is relevant for our paper is quite extensive and analyses a wide array of specific questions. This paper, formally, by employing multiple methodological approaches, aims to quantify the importance of rating agencies for the borrowing cost of the Croatian economy and the EU in general, and in this sense represents a contribution to the relevant literature. The literature available thus far relies heavily on the event study analysis and uses daily frequency data in order to answer this question. The event study analysis to test the reaction of spreads of different countries to changes in their credit ratings was, for instance, carried out in Afonso et al (2012) and Aizeman et al (2013) for European countries and Rowland, Torres (2004) and Özmen, Yaşar (2015) for developed countries, and as the first paper of this kind in Cantor and Parker (1996) for a wide set of developed and undeveloped countries. The results differ in terms of intensity and significance of the reaction, as well as in terms of the time of absorption. However, consensus was achieved regarding the asymmetry of the estimated reactions, which means that rating downgrades are on average followed by a stronger market reaction in comparison to rating upgrades. Additionally, the majority of research shows a stronger market reaction when a country's rating is downgraded from investment into the speculative (junk) category.

On the other hand, the present paper is related to research on determinants of credit ratings using various panel data models. Some of these papers include Cantor and Parker (1996), Feri, et al (1999), Afonso (2003), Bissoondoyal-Bheenick (2004), Afonso, et al (2009) and Gärtner et al (2011). These papers generally deal with the issue of finding appropriate rating determinants and the accuracy of rating forecasts, while the results are not put into the context of their impact on the borrowing cost. The only exception is Gärtner et al (2011), where similarly as in this paper, a decomposition of spreads into two basic factors was made: the part explained by fundamentals and unexplained part which the authors interpret as the discretionary actions of rating agencies.

This was also done in two steps: estimate of regression with rating determinants and after that a decomposition of spreads into the explained and unexplained part. However, the mentioned paper shows some shortcomings in the aspect of result interpretation. In the first part of the analysis the authors include government bond yields in the set of regressors for explaining the rating, which means that the obtained fit cannot be interpreted as rating implied exclusively by fundamentals. The results of the said paper may be interpreted as ratings implied by fundamentals and market so that it becomes impossible to disentangle what part of the information is common to the market and rating agencies and what part represents the discretionary actions of the rating agency. An additional deficiency of the mentioned paper is related to the exclusion of the external factors from the estimated model in the second step, which may consequently lead to substantial overestimations of the contribution of discretionary actions of rating agencies. Afonso et al (2015) also examined to what extant rating agencies influence the spread of countries, in addition to information already contained in the fundamentals. For that purpose the authors used a panel data model which, in addition to the fundamentals, included the credit rating as an additional regressor, while their sample consisted of only ten euro area countries. The main finding of their analysis was that rating agencies may have a statistically significant impact on spreads but also that the contribution of the credit rating after controlling for the fundamentals is almost negligible. Jaramillo and Tejada (2011) conducted a similar analysis for a sample of 35 developing countries where they also concluded that ratings are not of decisive importance for the borrowing cost, which is, to a largest extent, determined by global financial conditions and economic fundamentals.

The determinants of borrowing of Croatia have been analysed in several papers, among other in Žigman and Cota (2011), Dumičić and Ridzak (2011), Bobetko et al (2013), and Kunovac (2013). The focus of the first three mentioned papers was on the impact of macroeconomic fundamentals on the borrowing cost, while Kunovac (2013) stressed the importance of external factors such as spillover, contagion and global risk aversion. To our knowledge, the impact of credit rating on the borrowing cost of Croatia has so far not been analysed. Papers on credit ratings by domestic authors, as for example Bach (2014), Pavković and Vedriš (2011) are exclusively qualitative in nature. For this reason, a quantitative analysis of credit rating on the price of borrowing of the Republic of Croatia is the main contribution of this paper to domestic literature.

2 What is the role of rating agencies?

Prior to the empirical analysis itself it is useful to explain what rating agencies are and to describe their main tasks. Rating agencies assign credit ratings to issuers of debt securities – individual countries or enterprises. Estimating a country's rating (sovereign rating) means estimating the capacity, the ability and the willingness of the government of the country under review to timely and fully repay its debts. Rating agencies assign different countries into different categories according to risk perception by using a predefined discrete rating scale. For instance, S&P uses a scale of 24

levels (notches), where the lowest level, marked with *SD*, denotes a high risk country with great likelihood of default, while the highest level is marked by AAA and denotes the least risky countries. It is noteworthy, that this is a relative ranking of countries, which means that ordinal measurement scales are used and they do not represent an accurately determined likelihood of default. Decisions on rating changes are adopted and published occasionally without a predetermined schedule as a reaction to changes in some factors that determine the riskiness of the analysed country. In addition to the rating level, agencies also publish their outlooks, that is, warnings related to potential changes in ratings during the upcoming two years. These outlooks may be negative, positive or stable.

Rating agencies fulfil three main tasks: provision of information, monitoring and certification service (IMF, 2010). Their task of providing information to financial market participants is of special interest for the topic of this paper. The key purpose of this task is to resolve the potential problem of asymmetric information between bond issuers and investors in the financial market. For this reason, rating agencies as the third independent party evaluate the capability of timely settlement of existing debt by the issuer and publicly announces its evaluation. The purpose of monitoring is to warn and to put pressure on the debt issuers to undertake appropriate measures to reduce the risk of future rating downgrades. Finally, the certification service is related to regulatory requirements for different market participants. For instance some institutional investors may be faced with regulatory restrictions such that they can invest only into securities with a particular rating category. This task makes it crucial for rating agencies to assess the risk of bond issuers in an unbiased manner in order not to impact financial markets and thereby start a self-fulfilling process of underestimated (overestimated) ratings and too high (too low) yields.

All three big rating agencies, according to own information, take into account a wide array of macroeconomic, fiscal, monetary and also institutional indicators when assessing the credit rating of a country under review. S&P, for instance, estimates the political and institutional efficiency, the level of economic developed, economic growth outlook, fiscal performance laying particular importance on the sustainability of public debt and potential limitations in the implementation of fiscal and monetary policy (S&P, 2014). For that purpose S&P monitors and analyses an entire array of indicators such as: GDP per capita, current and expected GDP growth, unemployment rate, public debt, trends in government deficit, current and expected future growth of public debt, budget interest expenses, liquidity of state-owned assets, current taxation burden and space for future tax rate increase, external debt by all sectors, balance of payments current and capital account balances, convertibility of domestic currency, access to international financial markets, degree of development of the domestic financial market, various demographic indicators, monetary policy credibility, inflation and stability of the real and nominal exchange rate, percentage of currency substitution of loans and deposits, banking sector stability, bankruptcy history of the country under review, political stability and security situation, institutional framework, degree of economic freedom, institutional transparency and corruption level and other similar indicators (S&P, 2014).

It is also important to stress that agencies put substantial weight on medium-term trends of all the mentioned series, while short-term cyclical fluctuations are, to a large extent, ignored. For instance, S&P states in its official documents that their assessments of public finance stance of a country is primarily based on public debt as the key indicator, while government deficit is usually of much lower interest. S&P has also stressed that when analysing inflation, GDP and labour market indicators they mostly pay attention to smoothed variables in order to eliminate the effects of the business cycle.

3 Are credit rating announcements affecting financial markets?

In this chapter we quantify the direct impact of credit rating announcements on the borrowing cost of EU countries.[2] When the information set on which rating agencies base their decision is equivalent to the information set of the market participants, the market will not react significantly to credit rating announcements. On the other hand, if the rating announcement comes as a surprise to the market participants, they will react to the mentioned announcement and absorb this new information into the respective government bond yield. In order to examine the mentioned surprise effect, we estimate the reaction (and time of absorption) of CDS spreads to sovereign rating announcements by conducting an event study analysis on a set of European countries.[3] The analysis uses a panel of daily data for the period from January 2007 to September 2015 for 23 EU member states.[4]

We construct two dummy variables, one identifying the days when upgrades were observed while the other identifies the days when rating downgrades were observed.[5] The estimated parameters corresponding to these dummy variables measure the impact of rating changes on the CDS spreads. In order to estimate the time needed for absorption of rating changes into spreads, we also add the lagged dummies to our specification. Additionally, we include three control variables: the volatility index as an indicator of global risk aversion,[6] the common factor of European CDS spreads

[2] The analysis carried out in this chapter largely follows Kunovac (2012) and CNB (2012).

[3] In this paper CDS spreads have been used as a proxy variable of the country risk premium due to the unavailability of a comparable series of bond yield spreads for all analysed countries. However, the correlation between CDS spreads and bond spreads is very high both at daily frequency as well as at lower frequencies. In addition, Kunovac (2013) has shown that results on the determinants of CDS spreads and spreads of generic bond yields are equal to a great extent. Moreover, in theory CDS and bond spreads should have very similar dynamics. Indeed, suppose that i is the yield of a one-year bond, r is the yield of an equivalent non-risky instrument and cds is the pertaining credit risk insurance premium for the bond. Then the purchase of the insured portfolio that consists of this bond and insurance in the form of CDS is approximately equal to the purchase of a non-risk bond and the following holds: $i - cds = r$. From this it follows that $cds = i - r$, which means that CDS and bond spreads are in theory equivalent. In practice there are a number of reasons why CDS and bond spreads diverge (De Wit, 2006) but generally there is a high correlation between them.

[4] This includes the following countries: Croatia, Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Italy, Latvia, Lithuania, Hungary, Germany, Netherlands, Poland, Romania, Slovenia, Slovakia, Sweden, Spain and the United Kingdom.

[5] There are currently 76 rating agencies in the world (Bach, 2014). However, the focus is on the largest three agencies (Standard & Poor's, Fitch i Moody's) that cover the widest spectrum of debt securities. Therefore, this paper analyses only the three mentioned rating agencies.

[6] The measure of risk aversion included in this analysis is the volatility index on European stock exchanges (*Euro*

(estimated by the principal components method) as the indicator of common dynamics in the market of European government bonds and stock indices for each of the analysed countries as a measure of the business cycle at daily frequency which controls for the possible pro-cyclicality of rating announcements. The spreads and all three control variables are included in the equation in first differences, and fixed effects are additionally assumed in order to control for unobserved heterogeneity among countries included in the sample. The specification of the equation is given below, where $D_{i,t-j}$ represents the dummy variable for rating upgrades (downgrades) of a country i, in period $t-j$, $\eta_{i,t}$ the fixed effects, $\log(STOCK_{i,t})$ the logarithm of the stock index, PC_t the common factor of CDS spreads, VX_t represents the measure of risk aversion, and $\epsilon_{i,t}$ the normally distributed error with zero expectation.

$$\begin{aligned} \Delta CDS_{i,t} &= \alpha_0 + \eta_{i,t} + \sum_{j=0}^{2} \beta_j D_{i,t-j} + \alpha_1 \Delta \log(STOCK_{i,t}) + \\ &\quad + \alpha_2 \Delta PC_t + \alpha_3 \Delta VX_t + \epsilon_{i,t} \end{aligned} \tag{1}$$

Two models have been estimated where the variable $D_{i,t-j}$ represents two different events – a rating *upgrade* and a rating *downgrade*. The results in Table 1 show that CDS premia indeed responded to sovereign rating downgrades in the period under review. Although this reaction was statistically significant, its magnitude was rather low. On average, on the day of the rating downgrade spreads rose by about 6 basis points and by additional 5 basis points the next day. It is noteworthy that markets absorb the overall impact of the rating downgrade within two days which additionally confirms that the price of borrowing in the long run is not determined by actions of rating agencies.[7] The second column in Table 1 shows the result of the market reaction to rating upgrades. The estimated parameters related to the dummy variables are not statistically significant, suggesting that CDS spreads in our sample did not exhibit systemic reactions to positive rating news.

The results given in Table 1 quantify the impact of agency announcements on spreads for a relatively large and heterogeneous group of countries. Therefore, we have to be cautious when using these results in order to draw conclusions about the expected impact of a downgrade for individual countries. In other words, it is not *a priori* clear whether the impact of a rating change on borrowing costs is linear, i.e. whether it affects all countries in the same way regardless of their current rating. The reaction of the financial markets might be stronger following downgrades into the *junk* category in comparison to the average reaction estimated above. Such a potentially stronger reaction can be explained by regulatory restrictions for some of the market participants. For instance, institutional investors that are prevented by regulatory constrains from investing into securities of certain rating

Stox 50 Volatility Index).

[7] For clarity, only the results for the change in the rating on the day of the announcement and for the first two days after the announcement are shown. We also estimated a model with a greater number of lags but further lags were not statistically significant.

Table 1: The impact of rating downgrades/upgrades on the change of CDS spreads

	CDS	
	Rating downgrade	Rating upgrade
Risk aversion	0.05*	0.05*
	(0.03)	(0.03)
CDS common factor	18.73***	18.75***
	(0.29)	(0.29)
Stock prices	-18.43***	-18.73***
	(5.60)	(5.61)
D	6.11**	-1.01
	(2.92)	(1.18)
D(-1)	4.74**	0.15
	(2.05)	(1.01)
D(-2)	0.92	-2.16
	(1.38)	(1.61)
C	-0.05	-0.01
	(0.04)	(0.04)
Adjusted R^2	0.31	0.31
S.E. of regression	9.64	9.65
F-statistic	825.2***	820.6***

Note: Dependent variables are daily changes in CDS spreads. White robust standard errors are shown in parenthesis. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

categories may decrease their demand for low-rated government bonds and can thus directly affect their yield.

In order to estimate such non-linear effects we constructed a dummy variable which identifies only those rating changes that lead to rating downgrades from the investment into the speculative category. The first column of Table 2 shows the results of the model that includes the mentioned dummy variable. These results suggest that the reaction of CDS spreads on rating downgrades in this category is greater compared to the aggregate results in Table 1. CDS spreads reacted on average 29 basis points on the day of the downgrade, which is almost three times stronger than the average reaction. Such a strong reaction can, at least partially, be explained by the earlier mentioned mechanism of the decrease in demand for bonds in the speculative category.

We constructed an additional equation in order to estimate the reaction of CDS spreads to rating downgrades only for those countries that already are in the junk category. The results are shown in the second column in Table 2. The estimated parameters suggest that the average reaction of CDS spreads for these countries amounts around 25 basis points within two days from the rating downgrade, which is only slightly less than the average reaction to downgrades from the investment into the junk category. On the other hand, the reaction of CDS spreads to rating downgrades for countries that are in the investment category (Table 2, third column) is much weaker (only 5 basis points within two days).

The results above have shown that the strongest CDS reaction is related to the entry into the junk category, while the next step is to examine the difference in CDS reactions with respect to the chronological order of the junk entry. Being more precise, the aim is to analyse whether the

Table 2: The impact of rating downgrades on the change of CDS spreads for different rating categories

	CDS		
	Junk entry	Junk ratings	Investment ratings
Risk aversion	0.04	-0.02	0.06*
	(0.03)	(0.15)	(0.03)
CDS common factor	19.00***	33.57***	17.51***
	(0.28)	(1.44)	(0.30)
Stock Prices	-24.24***	-93.17***	-17.20***
	(4.91)	(16.66)	(5.09)
D	0.38	1.55	3.51
	(6.82)	(4.82)	(2.72)
D(-1)	28.60**	16.62**	4.61**
	(11.62)	(8.37)	(2.02)
D(-2)	3.18	8.33**	-0.42
	(5.44)	(3.81)	(1.39)
C	-0.01	-0.40**	0.02
	(0.02)	(0.15)	(0.02)
Adjusted R^2	0.33	0.34	0.34
S.E. of regression	6.61	11.23	5.88
F-Statistic	907.2***	255.8***	847.2***

Note: Dependent variables are daily changes in CDS spreads. White robust standard errors are shown in parenthesis. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

reaction to the first downgrade from the investment into the junk category is different in comparison to the following downgrades. For that purpose we constructed three dummy variables, where the first identifies the day on which a country's rating was downgraded to speculative category for the first time, while the second and the third variable identify the days on which the remaining two rating agencies placed this country in the speculative category. The estimated parameters for this model are shown in Table 3. The strongest market reaction is found for the first downgrade into the junk category (36 basis points). The reaction to the second downgrade is much weaker (13 basis points), while the reaction of the market to the third downgrade is not significant at all.

It is important to note that the interpretation of the above results for individual countries require a certain degree of caution. For example, the reaction of CDS spreads to rating downgrades into the junk category may be weaker for a country that is already perceived by financial markets as a country that belongs into the junk category. On the other hand, countries that the markets place in the investment category until the very moment of the downgrade will face a stronger reaction. Thus, for example, the CDS spread for Croatia reacted by only 13 basis points within two days from the S&P's downgrade, 16 basis points after the Moody's downgrade and 11 basis points after the downgrade by Fitch. The reactions of CDS spreads for all three downgrades were weaker than the earlier estimated average reaction.

All results presented in this chapter indicate that the reaction of CDS spreads to the credit rating downgrade is mild and, depending on the rating, ranges between 5 and 30 basis points.

Table 3: The impact of rating downgrades on the change of CDS spreads with respect to the downgrading order

Risk	CDS common factor	Stock prices	D_1	D_1(-1)	D_1(-2)	D_2	D_2(-1)	D_2(-2)	D_3	D_3(-1)	D_3(-2)	C
2.17**	18.70***	-16.61***	-6.74	36.03**	6.89	13.52**	7.22	-2.46	1.28	21.02	4.05	-0.02
(1.01)	(0.30)	(6.18)	(8.81)	(16.63)	(7.96)	(5.69)	(12.80)	(4.91)	(13.54)	(19.30)	(6.29)	(0.04)
Adjusted R^2 = 0.31, S.E. of regression = 9.64, F-statistic = 694.1***												

Note: The dependent variable is the daily change in CDS spreads. White robust standard errors are shown in parenthesis. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

4 Determinants of credit ratings

The results of the previous chapter suggest a relatively weak market reaction to rating changes which indicates that there is no significant information asymmetry between governments as debt issuers on one side and investors in the financial market on the other side. In other words, it seems that agencies do not reveal any new information about the creditworthiness of a debt issuer to the financial markets and that the agencies base their decisions, to a large extent, upon the information that is already absorbed in the borrowing cost. In order for this to be checked effectively, in this chapter we explore how the three leading rating agencies determine the ratings of EU countries. Afterwards in the following two chapters we analyse the information set of the bond market participants.

4.1 Empirical estimation of credit rating determinants

4.1.1 Selection of the best model for determining credit ratings

In this chapter, the analysis is based on simple linear panel data models used to estimate the impact of a series of key macroeconomic and fiscal indicators on credit ratings of EU member states for the three leading rating agencies. As already explained, rating agencies base their risk assessment of a country on a wide spectrum of economic, fiscal and political factors, but also on additional qualitative evaluations (IMF 2010). In order to estimate the relationship between the credit ratings of EU member states and their potential determinants we project credit ratings of EU countries onto the usual set of publicly available macroeconomic and fiscal indicators. Similar to Gärtner et al (2011), and Cantor and Parker (1996) the following rating determinants were used in this chapter:[8]

- Real GDP growth rate (annual rate of change)
- Public debt (general government debt-to-GDP ratio)
- Budget surplus (overall budget balance of the general government, expressed as a ratio to GDP)

[8] The data source for the index of economic freedom is the *Heritage Foundation* web site, while all other data has been downloaded from the *Eurostat* database. All regressors enter the equations as one-year moving averages

- Interest payments (general government interest payments, expressed as a ratio to GDP)
- Inflation rate (annual rate of change in the HICP)
- Unemployment rate (ILO methodology)
- Economic freedom index

In order to estimate the relationship between the determinants listed above and the credit ratings of EU countries we use four different linear models: one model for each of the three rating agencies and one model for the average rating. The ratings are transformed into a numerical scale from the lowest rating marked by number 1 (below *CCC+* for S&P and Fitch, and below *Caa1* for Moody's) up to the highest rating marked by number 17 (*AAA* for S&P and Fitch and *Aaa* for Moody's) while the lowest rating in the investment category is marked by number 8. We use quarterly data on the sample 2007Q1-2015Q3 for the same set of countries as in the previous chapter. We estimate the following linear panel regression for each agency as well as for the average rating:[9]

$$R_{i,t} = c + \eta_{i,t} + \beta_1' X_{i,t} + \varepsilon_{i,t} \tag{2}$$

where $R_{i,t}$ is the credit rating assigned by the respective agency for period t and country i, $X_{i,t}$ represents the determinants listed earlier for country i and period t, c represents the common intercept, $\eta_{i,t}$ potential fixed effect, β_1' is the vector of unknown parameters, and $\varepsilon_{i,t}$ represents a normally distributed residual with zero expectation. Besides the mentioned baseline specification, we estimated an additional specification, expanded by the term $\beta_2' D_{80} X_{i,t}$, that is, an interaction dummy variable D_{80} which equals 1 if the respective country had a public debt above 80% of GDP in the given period. This interaction dummy variable allows us to estimate potential non-linearities in the reaction function of rating agencies. The debt level of 80% has been chosen because at the time when this paper was written Croatia's public debt exceeded the mentioned threshold. This threshold is also interesting because several European countries have exceeded it during the sovereign debt crisis so one can expect that investors and rating agencies will analyse the risk of these countries more carefully.

It should be noted that is not *a priori* clear how to model the heterogeneity among the EU member states - by using *fixed effects* or *random effects*? For this purpose we estimated several alternative specifications of equation 2 with selective inclusion of fixed and random effects. The main conclusion of the conducted analysis is that models with random effects that include the average GDP per capita as an additional regressor, can successfully replicate the results of the fixed

[9] It is noteworthy that rating agencies base their decisions, to some extent, on the basis of expectations (forecasts) of macroeconomic fundamentals. In order to verify whether the link between a country's rating and fundamentals is different for the case of observed fundamentals in comparison to the case of forecasted fundamentals, we estimated these relationships for both cases on a narrower set of European countries. In doing this, we used the macroeconomic projections of the European Commission. The results obtained for the model with forecasted fundamentals is in line with the results obtained for the model with observed fundamentals.

effects model. The estimated parameters, in-sample-fit and respective residuals are thus to a large extent in line with those obtained from the fixed effects model.[10] The results obtained, as has been expected, suggest that the level of economic development (GDP per capita) largely determines the differences between rating levels among the analysed countries.[11] For this reason, it is not crucial for the objective of this paper whether the basic specification linking the ratings of EU member states and fundamentals will include fixed effects or, similarly, whether the heterogeneity between countries will be represented by GDP per capita in a random effect model. Nevertheless, bellow we carried out an analysis with fixed effects because likelihood ratio tests indicated the presence of fixed effects for all estimated models.

4.1.2 Estimated parameters

The results of the estimated specifications with fixed effects are shown in Table 4, where each column represents the estimated parameters for the corresponding rating agency and for the average rating. The first four columns refer to the baseline specification, while the last four columns are related to the non-linear specification which includes the interaction dummy variable described earlier. When interpreting our results one should bear in mind that the main objective of this analysis was not to estimate and interpret individual model elasticities. Therefore the estimated specification contains a relatively large number of correlated regressors which raises the issue of multicollinearity. However, the primary objective of our analysis is the aggregate influence of fundamentals on rating levels which was the reason we chose such a wider set of regressors.

The estimated parameters for the *baseline* specification suggest that the credit ratings are well described by the used fundamentals. More precisely, the majority of parameter estimates is statistically significant, with expected signs, a relatively good fit and with standard errors of regressions not exceeding one notch. For instance, the parameter related to public debt is negative, as expected, which means that higher levels of public debt are, on average, related to lower credit ratings. The

[10] The estimated parameters for the said alternative specifications for the average rating are shown in Table 8 of the appendix to the paper. The residuals and the model fit are not shown due to space constraints but they are available on request.

[11] Columns V and VI of Table 8 show the estimated parameters of the specification which, in addition to the level of the average GDP per capita, include the square of this variable. The purpose of these specifications is to analyse the potential non-linear relationship between the GDP per capita and the credit rating. The estimated fit and the respective residuals for this specification is to a large extent equivalent to those from the fixed effects model, while the heterogeneity among countries is almost fully described by the quadratic specification used. In addition, the estimated values of other parameters are in line with those obtained from the fixed effects model. Figure 4 in the appendix is constructed on the basis of the estimated model by using GDP per capita in the described way. The figure illustrates the non-linear relationship between the GDP per capita and the rating category. The Figure clearly suggests that the relationship between credit rating and GDP per capita is stronger for lower levels of GDP per capita and monotonically declines as the GDP per capital level increases. Thus, for example, the estimated contribution of GDP per capita for explaining credit rating is almost equal for countries like Italy and the Netherlands, despite the fact that the Dutch quarterly GDP averages some EUR 8200 per capita, which is as much as EUR 1700 more than the Italian. On the other hand, the function shown suggests that the rating of countries with GDP per capita like Slovakia's (about EUR 4000) will be by as much as four notches higher than the rating for a country like Bulgaria whose GDP per capita is also lower by about EUR 1700.

Table 4: Determinants of sovereign credit ratings

	Baseline Model				Nonlinear Model			
	SP	Moody's	Fitch	Average	SP	Moody's	Fitch	Average
Intercept	16.26***	9.68***	13.88***	12.06***	16.41***	10.12***	14.08***	12.12***
	(1.26)	(1.18)	(1.15)	(1.26)	(1.15)	(1.00)	(0.93)	(0.95)
Gov. debt	-0.05***	-0.07***	-0.05***	-0.05***	-0.01*	-0.04***	0.00	-0.01***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Budget balance	-0.06***	-0.10***	-0.06***	-0.06***	0.02	-0.03	0.01	0.01
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Unemployment	-0.22***	-0.13***	-0.16***	-0.17***	-0.17***	-0.08***	-0.13***	-0.12***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
GDP growth	0.05**	0.04***	0.06***	0.05***	0.02**	0.01	0.04***	0.02**
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Interest payments	-0.49***	-1.05***	-0.79***	-0.84***	-0.75***	-1.08***	-0.95***	-0.99***
	(0.12)	(0.15)	(0.12)	(0.13)	(0.11)	(0.13)	(0.09)	(0.09)
Inflation	-0.14***	-0.09***	-0.12***	-0.11***	-0.07***	-0.02	-0.06***	-0.04*
	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
Econ. freedom	0.04**	0.15***	0.07***	0.11***	0.01	0.12***	0.04***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Gov. debt*D80					-0.08***	-0.09***	-0.08***	-0.08***
					(0.00)	(0.01)	(0.00)	(0.00)
Budget balance*D80					-0.08*	-0.06	-0.04	-0.07**
					(0.04)	(0.04)	(0.03)	(0.03)
Unemployment*D80					-0.13***	-0.1***	-0.08**	-0.13***
					(0.03)	(0.04)	(0.03)	(0.03)
GDP growth*D80					0.03	0.11**	0.04	0.06*
					(0.03)	(0.05)	(0.03)	(0.03)
Interest payments*D80					0.36**	0.23	0.00	0.17
					(0.17)	(0.31)	(0.18)	(0.23)
inflation*D80					-0.02	-0.31***	0.03	-0.08
					(0.05)	(0.08)	(0.05)	(0.06)
Econ. freedom*D80					0.08***	0.12***	0.09***	0.09***
					(0.01)	(0.01)	(0.01)	(0.01)
Adjusted R^2	0.94	0.92	0.94	0.94	0.96	0.94	0.96	0.95
S.E. of regression	0.91	1.04	0.89	0.92	0.78	0.92	0.75	0.79
F-statististic	438.72***	317.85***	446.19***	416.4***	491.72***	339.12***	506.7***	466.44***

Note: Dependent variables are the respective credit rating levels. Fixed effects are included in all equations. White robust standard errors are shown in parenthesis. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

estimated values of this parameter lie within the range of -0.07 to -0.05, suggesting that rating upgrades by one notch are, on average, associated with the reduction of debt-to-GDP ratio by 14 to 19 percentage points, everything else being equal. On the other hand, the sign of the estimate corresponding to the budget balance is rather unexpected - results suggest that higher surpluses or lower deficits are associated with lower credit ratings. However, one should take into account that the two mentioned variables (public debt and deficit) contain related information on the state of public finances and are therefore strongly correlated, which can be one of the explanations for this unexpected sign.

The parameters corresponding to the unemployment rate and GDP growth have expected signs and are statistically significant for all three agencies, as well as for the average rating. The parameter related to interest payments has the expected sign and is also statistically significant for all agencies. Negative values estimated for parameters related to inflation for all four models suggest that a higher inflation rate is associated with a lower rating. The sign of the parameter corresponding to the economic freedom index is positive for all four baseline models. This is in line with our expectations because countries with a greater degree of economic freedom have, on average, higher ratings. In order to check robustness of the estimated models, we tested specifications with various measures of institutional quality (different components of the World Bank's Doing Business Indicator and the Corruption Perception Index). However, we were not able to find any statistically significant relationship between these indicators and the credit ratings of the European countries under analysis.

The results obtained for the *alternative non-linear* specification are, in terms of the direction of the reaction, largely in line with those from the baseline model. For instance, the signs related to public debt are negative, as expected. Still, the estimated parameter values are much lower, if we consider only those countries with public debt levels below 80% of GDP. However, if a country exceeds the public debt threshold of 80%, rating agencies will penalise all further public debt increases more strongly. On the other hand, the surplus parameter, after controlling for non-linearity, becomes statistically insignificant for the majority of analysed agencies. The estimated parameters related to the unemployment rate are very similar to those from the linear specification, where we have to note that rating agencies will penalise higher unemployment rates more strictly if the analysed country exceeds the 80% public debt threshold. The results in table 4 additionally suggest a statistically significant positive relationship between real economic activities (GDP growth) and credit rating, whiteout any statistically significant difference with respect to the debt level. The signs and values of parameters related to interest payments are in line with those obtained in the baseline specification. Again, no significant non-linearity was found. A similar conclusion can be drawn about the inflation rate. Parameters connected with the index of economic freedom are also in line with those obtained from the baseline model, with a slightly stronger relationship for countries with public debt above 80% of GDP.

The results shown for the model that includes the interaction dummy variable are of special

Table 5: Precision of the estimated credit rating models

	Baseline Model				**Non-linear Model**			
	SP	Moody's	Fitch	Average	SP	Moody's	Fitch	Average
Correct prediction	0.49	0.48	0.53	0.48	0.55	0.59	0.60	0.60
Within 1 notch	0.86	0.85	0.89	0.88	0.89	0.89	0.91	0.91
Within 2 notches	0.97	0.95	0.97	0.97	0.97	0.96	0.98	0.97

interest for countries like Croatia which has just exceeded the public debt level of 80%. The obtained results suggest that all three agencies will be more prone to downgrade the rating of such countries, if the public debt continues to grow, as well as in case of deterioration in the real economic activity (unemployment growth and/or decrease in real GDP).

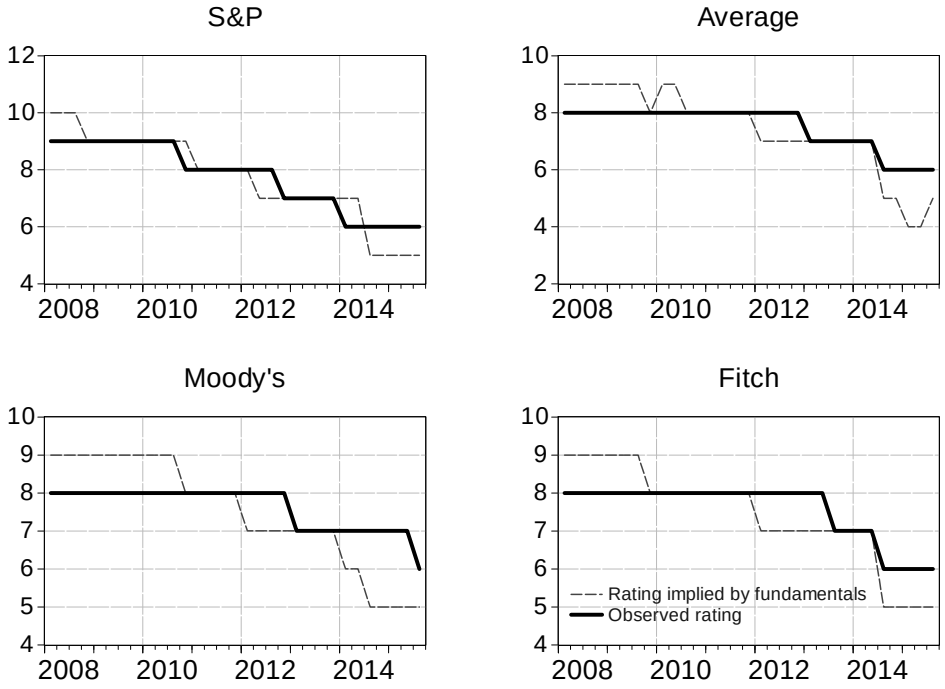
4.2 Rating implied by fundamentals and rating over/under estimation

In order to estimate the ratings implied by fundamentals we rounded the obtained regression fit (in-sample forecast $\hat{c}+\hat{\eta}_{i,t}+\hat{\beta}_1'X_{i,t}+\hat{\beta}_2'D_{80}X_{i,t}$) from the previous subsection to the nearest integer number. This indicator then represents the expected (predicted) rating based exclusively on the information available from macroeconomic fundamentals. In order to better understand to which extent the observed actions of rating agencies can really be reconstructed from the movements of macroeconomic fundamentals, we compared the earlier estimated implied ratings with the corresponding observed ratings. Table 5 shows the results of the accuracy evaluation of the estimated models. This table presents the percentage of accurately predicted ratings (*zero error*) and the percentage of ratings that were predicted within at most one or two notches. The results shown suggest that the estimated systematic part is able to capture the dynamics of the true credit rating very well. Between 48% and 60% of ratings are accurately predicted. The non-linear models for Fitch and for the average rating predicted the ratings with a high degree of accuracy within one notch (91%), while the model for Moody's is slightly less precise (85% for the linear and 89% for the non-linear specification). Models for all agencies are able to predict ratings within two notches with a very high degree of accuracy, exceeding 95%. These results suggest that by using the standard set of macroeconomic and fiscal fundamentals one may very precisely replicate the ratings of European countries.

Figure 1 shows the estimated implied ratings for Croatia for all three rating agencies and for the average rating, together with the corresponding observed (actual) ratings. This Figure suggests that Croatia's current credit rating is *overestimated by one notch* by all three agencies, as well as for the average rating. This finding points to potential future downgrades of Croatia's credit rating in case those economic and fiscal fundamentals remain unchanged.[12] Moreover, all four versions of the

[12] At the moment of writing this paper, Moody's downgraded Croatia's rating by one more notch to Ba2 (level 5 at the numerical scale used in here).

Figure 1: Rating implied by fundamentals and observed rating for Croatia



implied rating placed Croatia in the junk category already in late 2011, one year before the actual rating downgrade into the junk category by S&P (14 December 2012). The Figure also illustrates that Croatia's rating was underestimated in the period before 2010, by one notch. The degree to which the mentioned differences between implied and actual ratings really affected Croatia's borrowing cost will be analysed in the next chapter.

Implicit ratings, together with the actual ratings for all analysed countries and each rating agency are shown in Figures 5 to 8 of the Appendix to this paper. These Figures suggest that the majority of changes in credit ratings of EU countries are accompanied by changes in respective implicit ratings. For example, the majority of downgrades during the European sovereign debt crisis of 2011 – 2012 were predicted by the implied ratings estimated here. We can also conclude that the majority of AAA rated countries (level 17 at the numerical scale used here) well deserved to be in this category according to the underlying economic fundamentals. A country showing slightly greater divergence of the rating implied by fundamentals from the actual rating is Hungary. Its rating has recently, depending on the agency, been underestimated by two to three categories. However, it would be wrong to fully interpret this difference between the true and the implied ratings as a rating underestimation, because a part of these differences could, for instance, be attributed to political factors that are not covered by our analysis.

5 Decomposition of CDS spreads

In this chapter we analyse whether rating agencies reveal important new information to financial markets that has not yet been absorbed in the borrowing cost of a country. For this purpose we use *ratings implied by fundamentals* and the *indicators of credit rating overestimation* from the previous chapter. The mentioned overestimation indicator, that is, the unexplained component of the credit rating (the residual in equation 2) approximates the discretionary actions of credit agencies. This component contains specific information on the rating of a country which does not follow the dynamics of economic fundamentals - it is independent (orthogonal) from the credit rating implied by fundamentals. Using the dynamics of discretionary actions of credit agencies it is possible to estimate the market power of rating agencies, i.e. the influence of their autonomous actions on financial markets. For that purpose, it is necessary to differentiate the degree to which credit ratings and the borrowing cost are correlated due to macroeconomic fundamentals that simultaneously determine both the credit rating and the borrowing cost, and the degree to which the credit rating by itself is informative for financial markets, independently from the information obtained from macro fundamentals.

In order to disentangle the influence of rating on the borrowing cost via the two channels we first estimated the linear panel data model in which CDS spreads of EU countries are regressed on the rating implied by fundamentals and the rating overestimation indicators, while controlling for external factors. More precisely, the following equation is estimated:

$$CDS_{i,t} = \alpha_0 + \eta_{i,t} + \alpha_1 \hat{R}_{i,t} + \alpha_2 \widehat{\varepsilon}_{i,t} + \alpha_3 VX_{i,t} + \epsilon_{i,t} \tag{3}$$

where α_0, α_1, α_2 and α_3 represent the unknown parameters, $\eta_{i,t}$ fixed effects, $\hat{R}_{i,t} = \widehat{c} + \widehat{\eta}_{i,t} + \widehat{\beta}_1' X_{i,t} + \hat{\beta}_2' D_{80} X_{i,t}$ the rating implied by fundamentals, $\widehat{\varepsilon}_{i,t}$ the residual from the previous chapter, i.e the rating overestimation indicator, $VX_{i,t}$ is the global risk aversion, while $\epsilon_{i,t}$ is a normally distributed error with zero expectation.[13] It is important to stress that the included residual from the credit rating equation, $\widehat{\varepsilon}_{i,t}$, is not a perfect measure of rating overestimation. The main issue is that it includes all other omitted credit rating determinants, such as the indicators of political or legal insecurities and other omitted regressors.

The estimated parameters of the equation 3 are given in Table 6.[14] The obtained results suggest

[13] We have also tried specification expanded by the common factor of European CDS spreads as an additional control variable which approximates the spillover index. However, the problem is that the mentioned variable also contains information on the common fundamentals of analysed countries leading to a significant correlation between the said index and the rating implied by fundamentals used here. It is also noteworthy that the objective of this paper is to examine the relative importance of the discretionary actions of rating agencies and fundamentals, while the impact of spillover and contagion on the borrowing cost is analysed in more detail in Kunovac (2013). Therefore, in this paper we will use the volatility index as the only control variable.

[14] It is necessary to point to the fact that two regressors from equation 3 (rating overestimation indicator and rating implied by fundamentals) are not observed variables but estimates of unobserved variables - i.e. *generated regressors*. For such regressors usual OLS estimates of standard errors are generally biased. These estimates do not take into account the uncertainty arising from the estimation of these unobserved regressors. Consequently, the respective

Table 6: The effect of the rating overestimation indicator, rating implied by fundamentals and risk aversion index on CDS spreads

	S&P	Moody's	Fitch	Average
Intercept	757.79**	494.19**	789.79***	665.23**
	(148.03)	(98.60)	(136.90)	(120.49)
Fundamentals	-52.73***	-36.09***	-52.38***	-46.20***
	(8.86)	(5.76)	(8.03)	(7.05)
Overestimation indicator	-27.01***	-34.90***	-33.28***	-34.69***
	(4.33)	(3.83)	(4.34)	(4.25)
Risk aversion	7.02***	7.14***	6.87***	7.01***
	(0.47)	(0.44)	(0.46)	(0.45)
Adjusted R^2	0.58	0.57	0.59	0.59
S.E. of regression	99.45	100.87	98.24	99.07

Note: Dependent variables are quarterly averages of CDS spreads. Bootstrap standard errors are shown in parenthesis. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

that all variables used are statistically significant in explaining the dynamics of CDS spreads. The signs of all three parameters are also in line with expectations. Thus, the parameters related to risk aversion are positive, which means that higher global risk aversion will materialise in higher spreads. Further, the fundamental rating component is negatively correlated to the borrowing cost. Finally, the rating overestimation indicator is, on average, related to lower spreads.

The interpretation of these results warrants caution. Namely, the statistical significance of the respective parameter could point to a conclusion that discretionary credit rating actions really can affect the borrowing cost of European countries. However, the mentioned statistical significance is not sufficient to conclude about the relative importance of rating agencies for CDS spreads in comparison to the relative importance of economic fundamentals and other factors. The relative importance of individual variables in the model may be analysed in the context of the importance of the variable for describing the *variability* of spreads and the importance of the variable for describing the *level* of spreads. For the purpose of examining the relative importance of a regressor for describing the variability of the dependent variable in a regression, it is necessary to analyse the marginal effect of each of the used regressors on the R^2 statistic. In order to carry out the said decomposition, we apply the method described in Lindeman, Merenda and Gold (1980), which was previously used to decompose European spreads in Kunovac (2013). For each possible variable ranking and each variable in the model this method calculates the marginal influence its inclusion has on the R^2 statistic. The final estimate of the contribution of the variance of a given variable is calculated as the average of these marginal contributions over all possible orders of the variables in

standard errors will be underestimated (Pagan, 1984, and Murphy and Topel, 1985). In this paper we addressed the problem of generated regressors by using the *two-step bootstrap* method so that we choose random samples from the estimated residuals for both steps, i.e. for both regressions used (equation 2 and 3). The estimated bootstrap standard errors, based on 30000 random draws, are shown in Table 6

Table 7: CDS spreads variance decomposition

	S&P	Moody's	Fitch	Average
Fundamentals	0.36	0.27	0.36	0.33
Overestimation indicator	0.04	0.07	0.05	0.06
Risk aversion	0.60	0.66	0.59	0.61

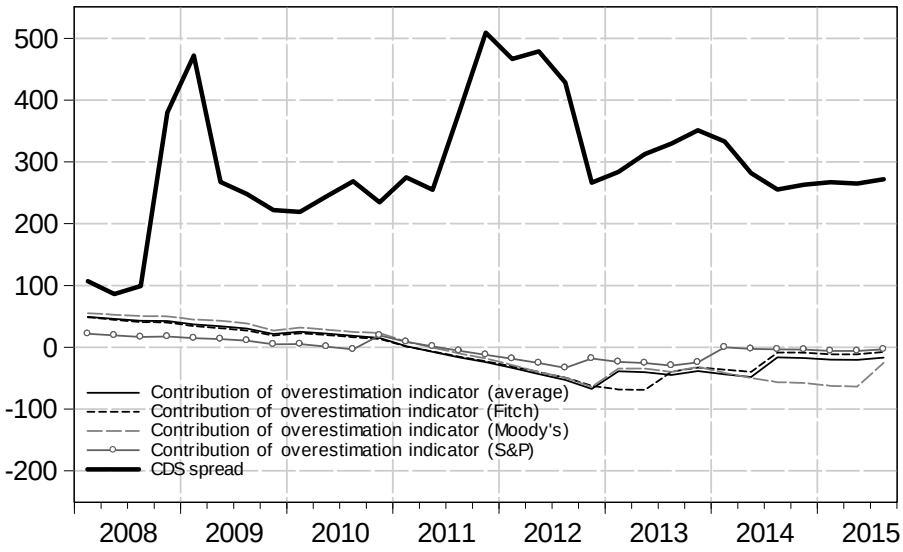
Note: The values are representing contributions of the respective variable to the R^2 of equation 3.

the model.

Table 7 shows the results of the mentioned *variance decomposition* of CDS spreads to relative contributions of rating overestimation indicator, rating implied by fundamentals and risk aversion for each rating agency and average rating. The figures suggest that the greatest contribution to the variance of CDS spreads of European countries result from risk aversion (between 59% and 66%), which is in line with results in Kunovac (2013). The contribution of ratings implied by fundamentals is slightly lower (between 27% and 36%). On the other hand, the contribution of the overestimation indicator is the lowest in all four equations (between 4% and 7%). These results point to the conclusion that rating agencies can partly affect CDS spreads, that is, that rating actually contributes to the information set of the participants in the market in addition to information provided by fundamentals. However, the said influence was relatively weak compared to the influence that fundamentals and external factors have on CDS spreads. It is worth noting that the used overestimation indicator does not only measure discretionary actions of rating agencies but includes all other unexplained variations in credit ratings, not covered by the used fundamentals. Therefore, the presented contribution of the overestimation indicator may be considered as an estimate of the *upper bound* of the contribution of discretionary rating agency actions to the variation in CDS spreads.

A decomposition of the CDS spread *level* of EU countries to the relative contributions of the said indicators is carried out below. The contributions are obtained by multiplying each of the variables and the respective parameter estimate. Figures 9 to 12 of the Appendix show the relative contribution of the rating overestimation indicators together with the CDS spreads for analysed European countries. The positive (negative) values of the contribution by this indicator imply underestimated (overestimated) credit rating. This means that for such a country the CDS is higher (lower) than implied by the underlying fundamentals and risk aversion indicator. The mentioned figures suggest that the contribution of the overestimation indicator for the most part of the analysed period represents only a negligible part of the spread level and totals less than 60 basis points, while the average absolute contribution totals merely 20 basis points. The limited relevance of rating agency's discretionary actions is clearly illustrated by comparing the mentioned 20 basis points with the usual spread variation. For instance, during the great recession of 2008 to 2009 and the European sovereign debt crisis, CDS spreads for most European countries quickly exceeded

Figure 2: Contribution of rating overestimation indicators to the level of Croatian CDS spreads



400 basis points, while for countries that were hit harder by the crises they exceeded levels of as much as 800 points. During this time, strong influence came from external factors whose influence on spreads is several times stronger than the influence of discretionary actions of rating agencies (Kunovac, 2013). All the results indicate that fundamentals, along with the global risk aversion, are the most important determinants of CDS spreads of European countries. On the other hand, the discretional part of the credit rating explains only a negligible part of the variation in CDS spreads. We can therefore conclude that the credit rating itself does not contain much valuable information in addition to that already contained in the economic fundamentals.

Due to the special emphasis of this paper on Croatian rating, Figure 2 shows contributions exclusively for Croatia, broken down by all analysed rating agencies. The Figure suggests that the contribution of the overestimation indicator, i.e. of the discretionary action of rating agencies, during the analysed period does not exceed 50 basis points. As a consequence of the Croatia's underestimated rating mentioned earlier, in the period before 2010 observed CDS spreads were by 20 to 50 basis points higher, depending on the agency. On the other hand, CDS spreads during the most recent period are 5 to 25 basis points lower than those implied by fundamentals and risk aversion. In other words, Croatia's government currently pays lower interest rates on public debt than those implied by fundamentals and external factors due to the overestimation of its rating. Such results may be interpreted as a warning that CDS spreads may grow, up to a maximum of 25 basis points, should there come to a rating downgrade in the future. However, due to the earlier mentioned interpretation of the contribution of the overestimation indicator as the upper limit, the market reaction could ultimately be weaker than the mentioned 25 basis points.

6 Market implied rating

Rating agencies mostly refrain from reacting to economic fluctuations they deem short-term only. On the other hand, financial market participants tend to react immediately to news about the fundamentals for which they assess that might affect the creditworthiness of a country as a debt issuer. In this regard, markets can informally assign ratings to individual countries (or companies) - *market implied ratings* - that need not always be equivalent to the actual credit rating assigned by rating agencies. More precisely, countries with higher credit ratings need not always enjoy lower cost of borrowing than countries with lower credit ratings. Markets can, for instance, downgrade a debt issuer from the investment into the junk category much before rating agencies decide to do so. A comparison of actual ratings assigned by rating agencies and informal, market implied ratings may provide further insight into the causal relationship between rating agencies and financial markets.

For the purpose of determining boundaries (thresholds) between informal, market implied rating categories, we applied a method used in Berger et al (2002), and Kou and Varotto (2005). This method establishes the borders between rating categories by minimising a simple penalty function. As stressed earlier, the ranking of a set of countries by their credit rating is not necessary in line with their ranking by CDS spreads. The used method thus searches for the optimum threshold between rating categories so as to penalise this inconsistency. In short, the ratings of a group of countries are first divided into k categories. Then, for each period t and each rating category a penalty function is defined, which depends on the assumed threshold between the respective and the bordering category. The objective of the algorithm is to find the value of the threshold which will minimise the penalty function shown below, that is, minimise the inconsistency between rating rankings and risk premiums:

$$P(g) = \frac{1}{m}\sum_{i=1}^{m}\max(S_{i,R_1} - g, 0) + \frac{1}{n}\sum_{j=1}^{n}\max(g - S_{j,R_2}, 0) \tag{4}$$

where g represents the assumed threshold, S_{i,R_1} the spread of i-th country with rating R_1, S_{j,R_2} represents the spread of the j-th country with rating R_2 (i.e. one category below R_1), m is the number of countries had rating R_1 in the observed period, while n is the number of countries that had rating R_2 in the observed period. The equation clearly shows that the value of the function will increase due to an increase in the first term, when the selected g is bellow the optimum level, while the second term increases, when the selected g is above the optimum level.

In this paper ratings are divided into four categories. The first category comprises only countries with the highest possible rating (AAA). Next to follow is the category that comprises countries which at a given moment had some of other rating from the investment category. The third category comprises countries with ratings in the speculative category $BB+$ and B-, while the fourth category includes all other speculative ratings below B-.[15] In order to carry out such an analysis it is necessary

[15] Other specifications of rating categories have been estimated as well, and the estimated boundaries between the

to have at least one country in each of the rating category at all times. For this reason, the group of countries was expanded by twenty non-European countries with available comparable data on CDS spreads and credit ratings, which did not default over the last twenty years.[16] Only S&P provides data on credit ratings for all countries listed for a sufficiently long period. Therefore, the analysis was conducted only for the said agency. However, the results obtained above indicate similar behaviour of all three rating agencies. Therefore, the results obtained here for S&P can be considered representative for all other rating agencies.

A strong common component in CDS spreads may contaminate the results of such analysis due to occasional strong spread jumps caused by common global shocks. For this reason, we extract these common factors from CDS spreads in such a way that the respective spread for each country was regressed on the estimated common factor of the spreads of all countries. The resulting residuals obtained by this regression are used for further analysis and they represent CDS spreads cleaned of common factors. Therefore, this chapter will seek to find the representative boundary between CDS spread residuals constructed in this way. In order for the obtained result to be as clear as possible, only the boundary between the speculative and the investment category will be shown, which is of special interest for Croatia for the analysed period.

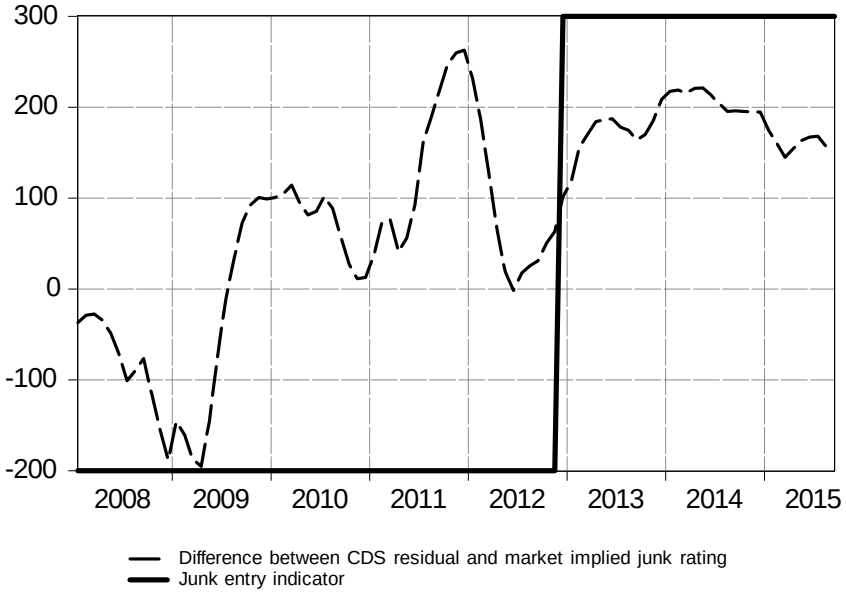
Figure 13 in the Appendix, shows the difference between CDS residuals and the estimated boundary between the junk and the investment category. Positive numbers indicate countries which are placed in the junk category according to the financial market. In order for these results to be compared to actual ratings, we added thick lines to the Figure which indicate periods during which respective countries were actually placed in the junk category, according to S&P.

These results suggest that financial markets have almost always anticipated downgrades to the speculative category. Thus, CDS residuals crossed over to the positive territory prior to the actual downgrade for all five countries for which the actual rating was downgraded from investment to speculative category. For instance for Croatia, markets had anticipated S&P's decision almost two years before the actual downgrade to the junk category. Moreover, recent data on CDS residuals suggest that the decision to rate Croatia within the junk category is justified. According to the results obtained, Croatia's return to investment category is associated with a CDS spread reduction of some 150 basis points. An additional interesting finding is related to Hungary, for which the markets also anticipated the downgrade to the junk category well in advance and which is recently held in this category for justified reasons. If we compare such results with the results on under-estimated rating it becomes clear that investors in the bond market have the same perception of Hungary's risk as rating agencies. This points to the fact that markets and rating agencies value political factors, which are not fully covered by this paper, in a similar way.

speculative and investment categories are almost unchanged in relation to the division suggested here.

[16] In addition to EU member states, the following countries were included: Australia, Brazil, Chile, Canada, Indonesia, Israel, Japan, South Korea, Kazakhstan, Mexico, Malaysia, Norway, Panama, Peru, the Philippines, Qatar, Russia, Thailand, Turkey and South African Republic.

Figure 3: Market implied rating for Croatia



In the period under analysis only two countries were upgraded from the junk category into the investment category: Latvia and Romania. Similarly as for the downgrades mentioned earlier, the markets had relatively early anticipated the mentioned upgrades. However, it should also be noted that due to high spread variability it often comes to false signals of downgrades to junk category. Thus, even for countries with highest credit ratings potential downgrades to speculative category are observed within a very short period of only a several months. These findings point to the fact that rating agencies are cautious when revising ratings which means that they neglect short-term cyclical fluctuations in economic fundamentals to a large extend and base their decisions on long-term trends in fundamentals. On the other hand, market participants tend to react immediately to changes in the underlying economic fundamentals and therefore the used method often shows such false signals in the short run,

The results presented in this chapter confirm the thesis that rating agencies do not have a significant impact on the borrowing cost and that investors in the financial markets largely anticipate future rating changes.

7 Conclusion

This analysis clearly leads to the conclusion that the autonomous impact of credit rating announcements on the borrowing cost is of limited economic importance. It seems that rating agencies do not provide financial markets with significant information in addition to those already contained in

macroeconomic fundamentals. Hence, given the sentiment in financial markets, the government's borrowing cost can only be reduced by improving macroeconomic and fiscal fundamentals. Any increase in the credit rating may then follow only as a consequence of these improvements.

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A Appendix

Table 8: Determinants of sovereign credit ratings for different alternative specifications

	I	II	III	IV	V	VI	VII
Intercept	-6.31***	10.71***	2.62***	8.54***	-1.06**	3.87**	12.12***
	(1.06)	(1.2)	(0.37)	(0.89)	(0.5)	(1.56)	(0.95)
Gov. debt	0.1***	0.00	0.01***	-0.04***	0	-0.03***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Budget balance	0.11***	0.01	0.03**	-0.01	-0.01	-0.04*	0.01
	(0.03)	(0.02)	(0.01)	(0.02)	(0.01)	(0.03)	(0.02)
Unemployment	-0.33***	-0.16***	-0.06***	-0.14***	-0.09***	-0.15***	-0.12***
	(0.02)	(0.03)	(0.01)	(0.03)	(0.02)	(0.03)	(0.02)
GDP growth	-0.01	0.02	0.04***	0.04***	0.05***	0.05***	0.02**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Interest payments	-1.23***	-0.89***	-0.58***	-0.37**	-0.74***	-0.65***	-0.99***
	(0.11)	(0.16)	(0.07)	(0.11)	(0.04)	(0.14)	(0.09)
Inflation	-0.1*	-0.05	0.06***	-0.03	0.06**	0.02	-0.04*
	(0.05)	(0.04)	(0.02)	(0.03)	(0.02)	(0.04)	(0.03)
Econ freedom	0.3***	0.09***	0.05***	0.01	0.01**	0.03***	0.08***
	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Gov. debt*D80	-0.07***	-0.08***	-0.05***	-0.07***	-0.04***	-0.07***	-0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Budget balance*D80	-0.06	-0.06*	-0.17***	-0.07**	-0.03	-0.01	-0.07**
	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Unemployment*D80	-0.15***	-0.13***	-0.26***	-0.14***	-0.27***	-0.14***	-0.13***
	(0.04)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
GDP growth*D80	0.01	0.04	0.04	0.05	0.01	0.02	0.06*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.03)
Interest payments*D80	0.28	0.11	0.62*	0.12	0.18	0.15**	0.17
	(0.22)	(0.22)	(0.16)	(0.22)	(0.13)	(0.22)	(0.23)
Inflaction*D80	0.24**	-0.04	-0.08	-0.14*	-0.06	-0.17**	-0.08
	(0.10)	(0.09)	(0.11)	(0.09)	(0.1)	(0.09)	(0.06)
Econ freedom*D80	0.05***	0.10***	0.05***	0.09***	0.08***	0.1***	0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
GDP/pc			1.64***	1.74***	5.03***	4.83***	
			(0.02)	(0.08)	(0.11)	(0.57)	
GDP/pc					-0.33***	-0.3***	
					(0.01)	(0.05)	
Effects	Pooled	Random	Pooled	Random	Pooled	Random	Fixed
Adjusted R^2	0.83	0.67	0.92	0.72	0.96	0.74	0.98
S.E. of regression	1.98	0.87	1.31	0.83	1.15	0.84	0.71
F-statistic	273***	119.91***	661.12***	136.01***	1306.14***	143.51***	1258.83***

Note: The dependent variable in all equations is the average credit rating. White robust standard errors are shown in parenthesis. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% level.

Figure 4: Estimated partial contribution of GDP *per capita* to the credit rating level

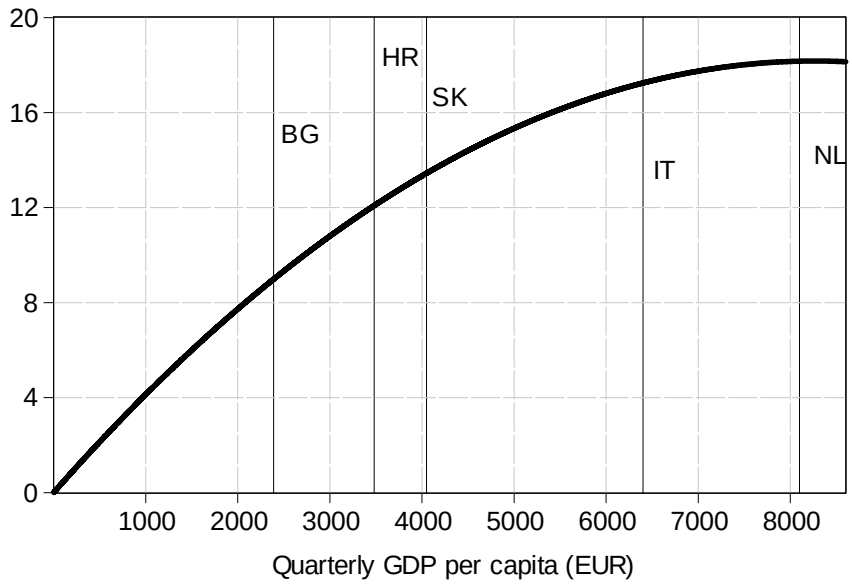

Figure 5: Rating implied by fundamentals and observed rating for S&P

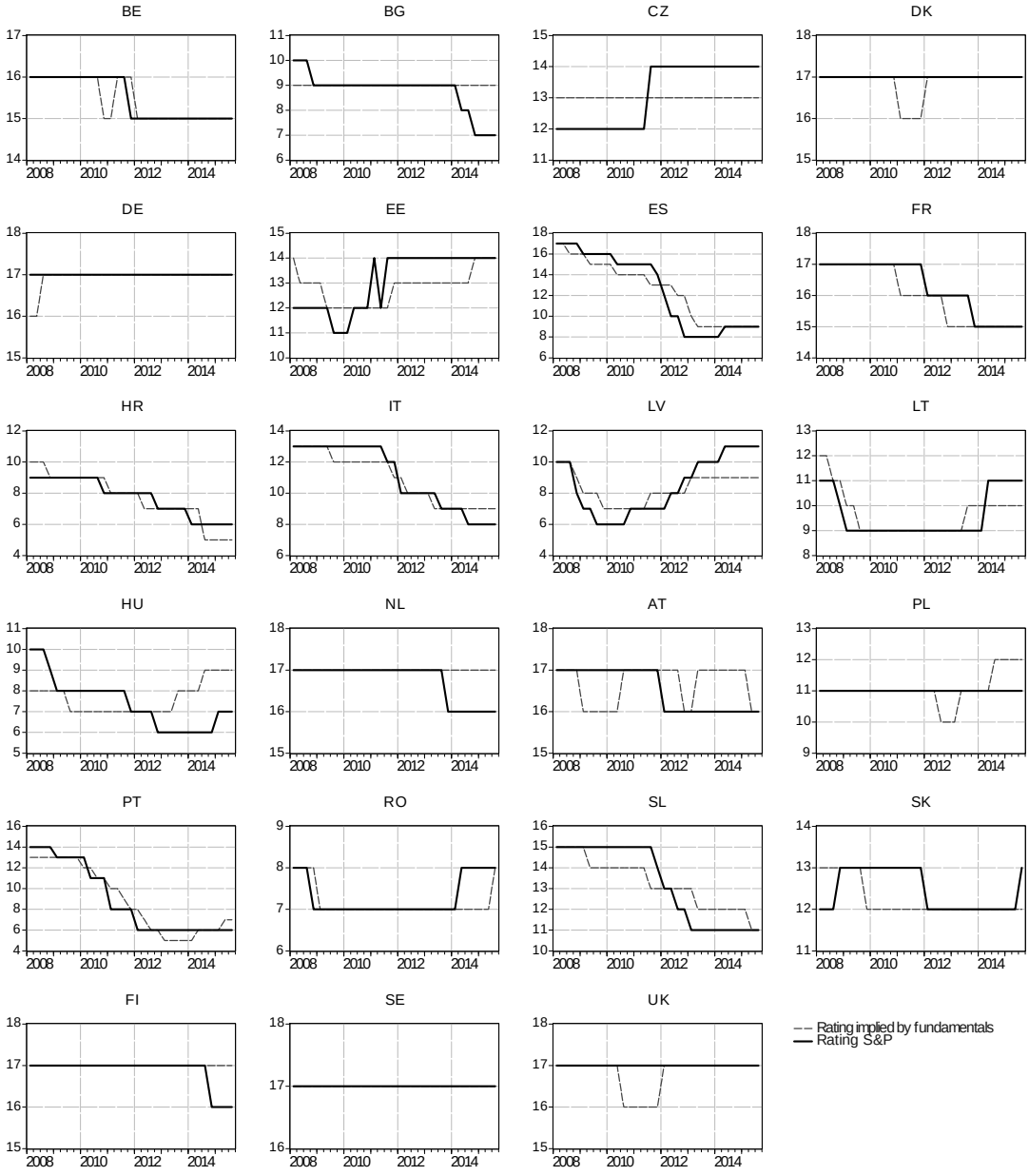

Figure 6: Rating implied by fundamentals and observed rating for Moody's

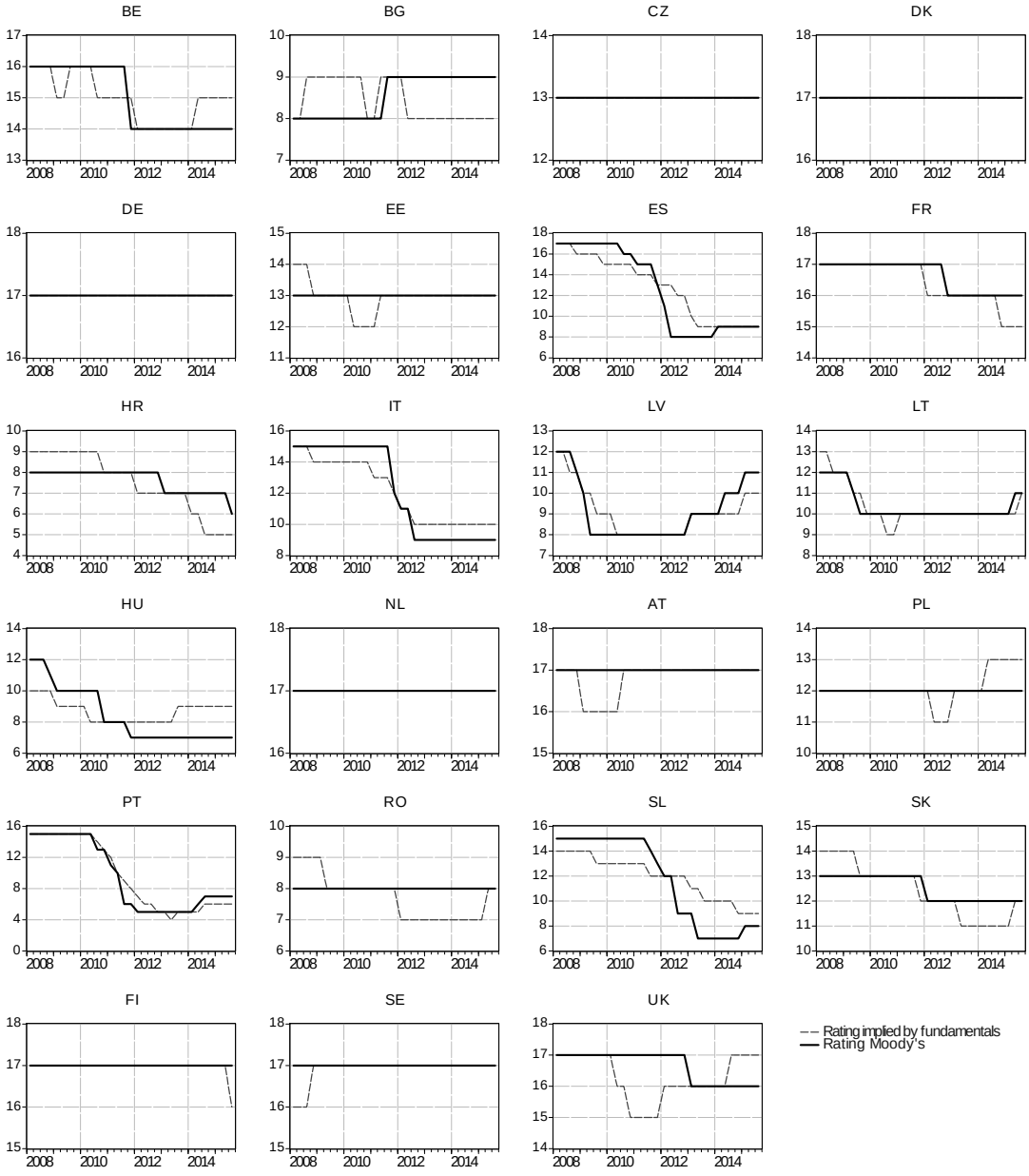

Figure 7: Rating implied by fundamentals and observed rating for Fitch

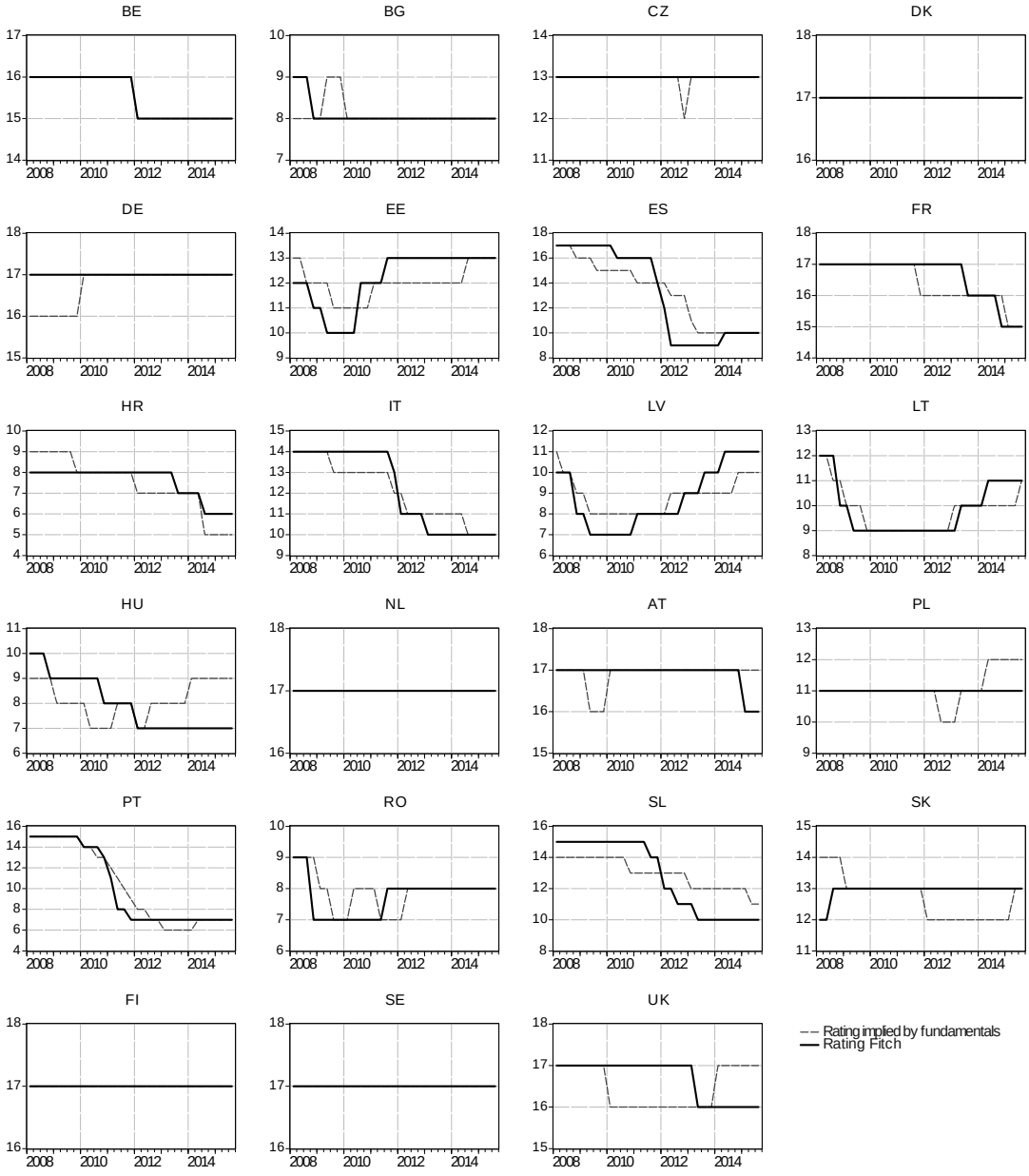

Figure 8: Rating implied by fundamentals and observed average rating

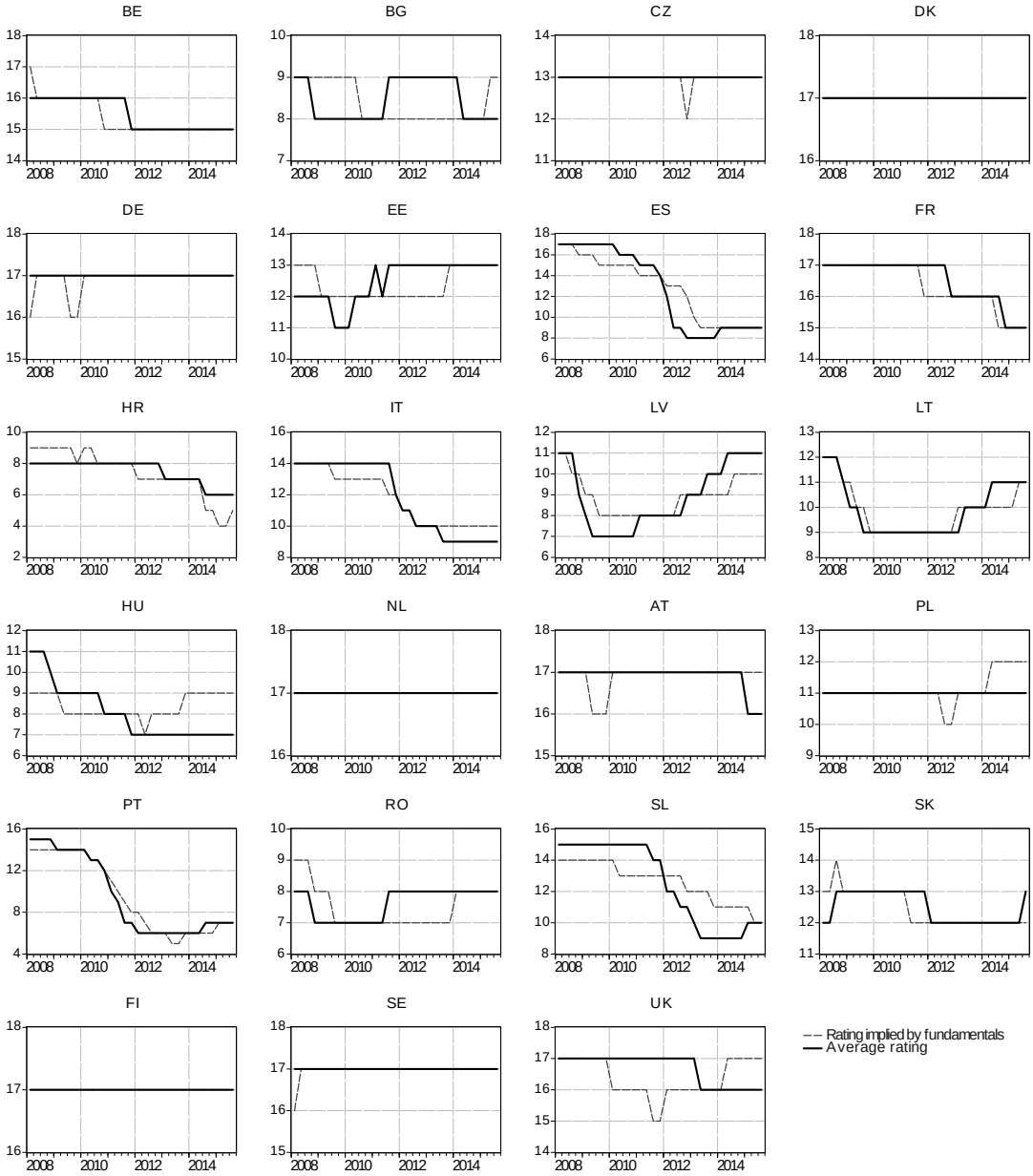

Figure 9: Contribution of the rating overestimation indicator (S&P) to the level of CDS spreads

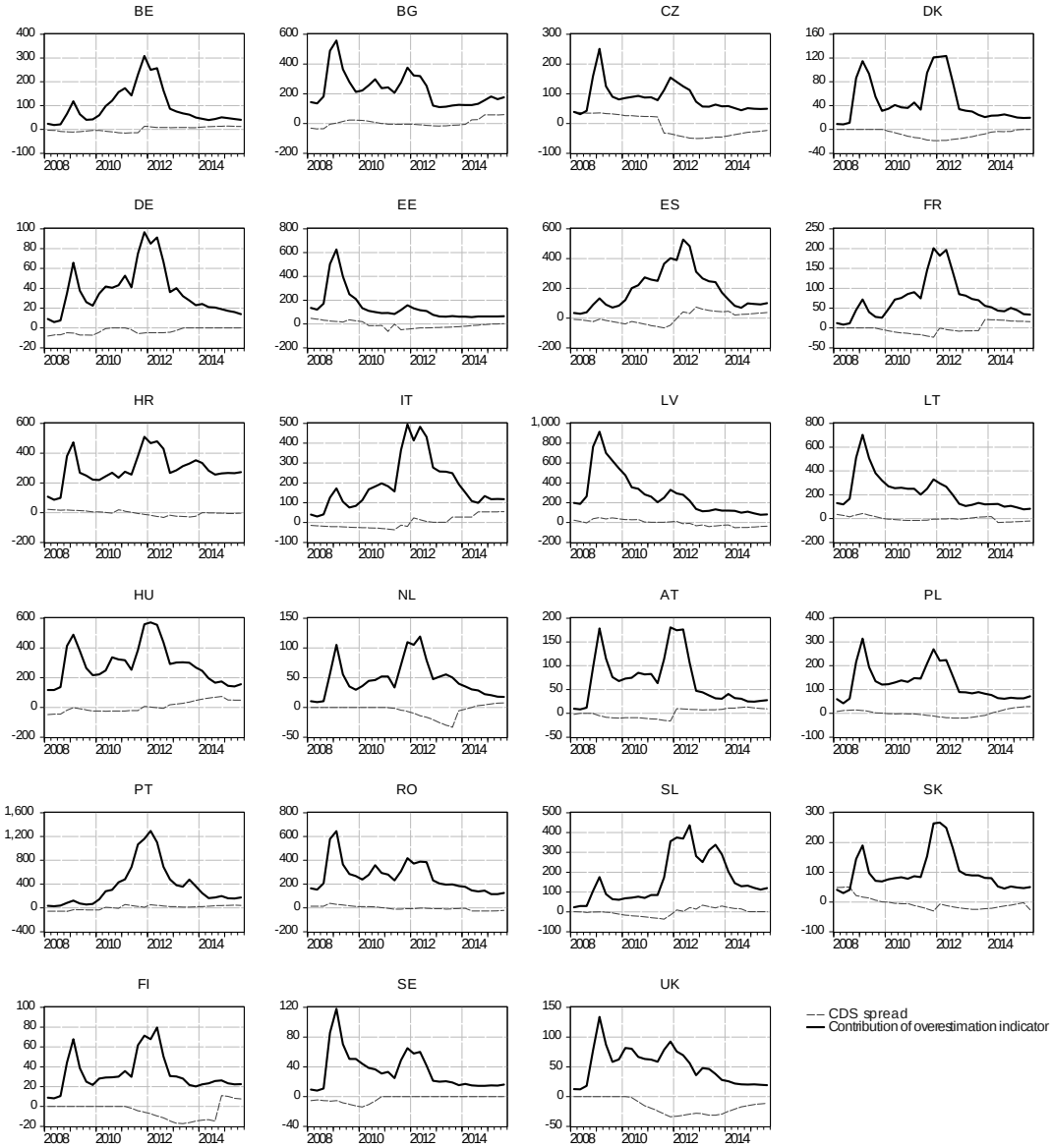

Figure 10: Contribution of the rating overestimation indicator (Moody's) to the level of CDS spreads

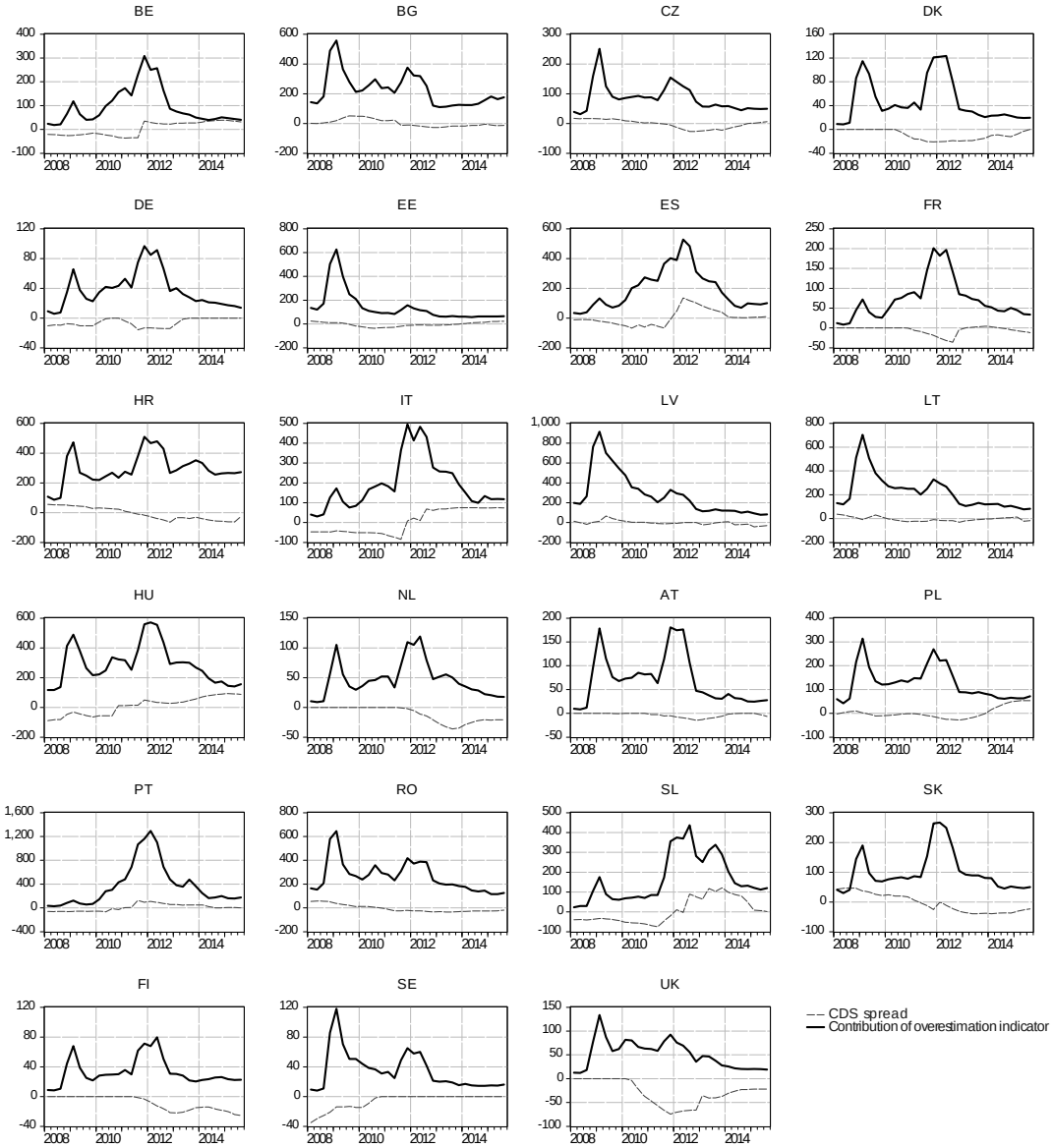

Figure 11: Contribution of the rating overestimation indicator (Fitch) to the level of CDS spreads

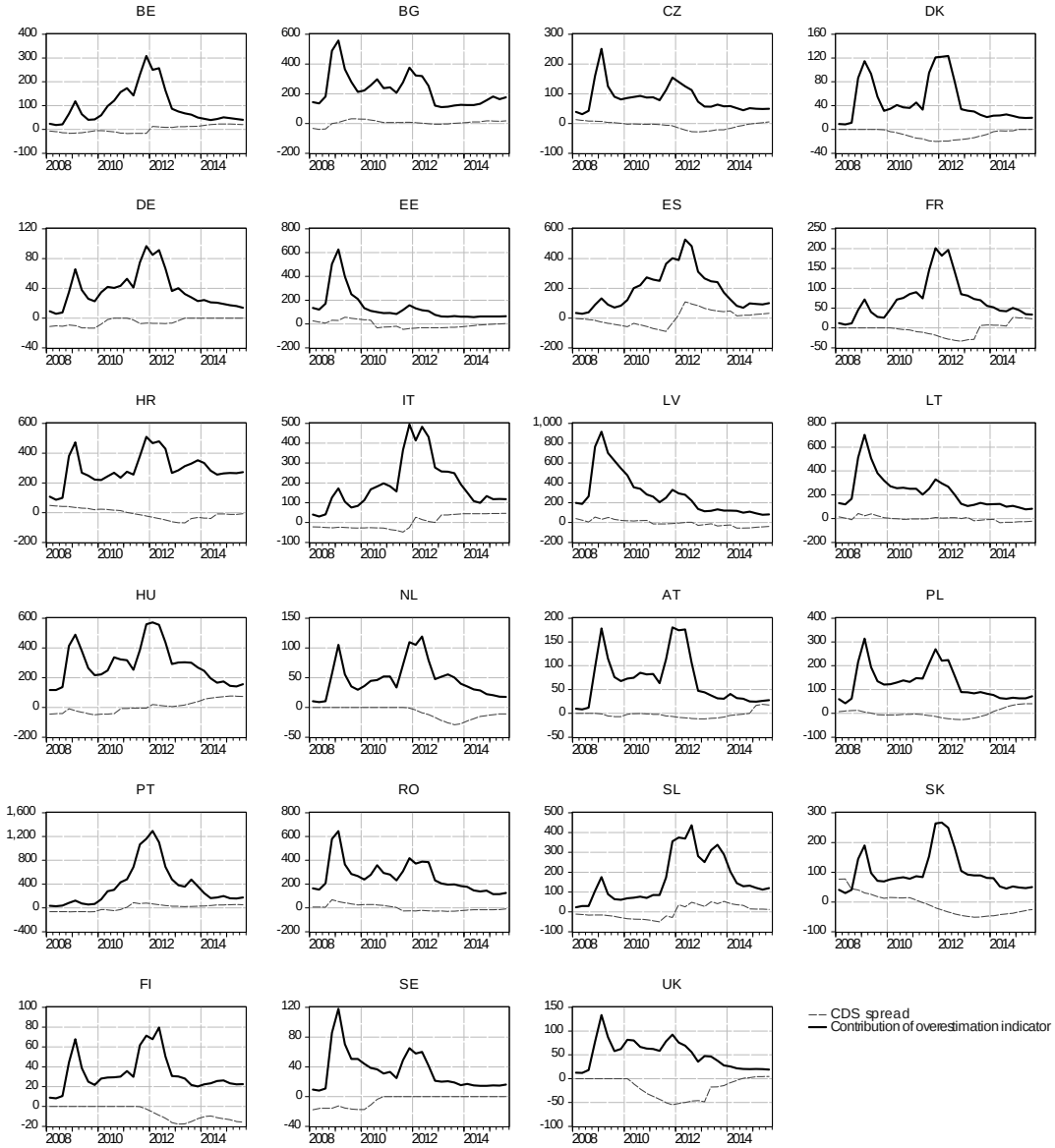

Figure 12: Contribution of the rating overestimation indicator (average rating) to the level of CDS spreads

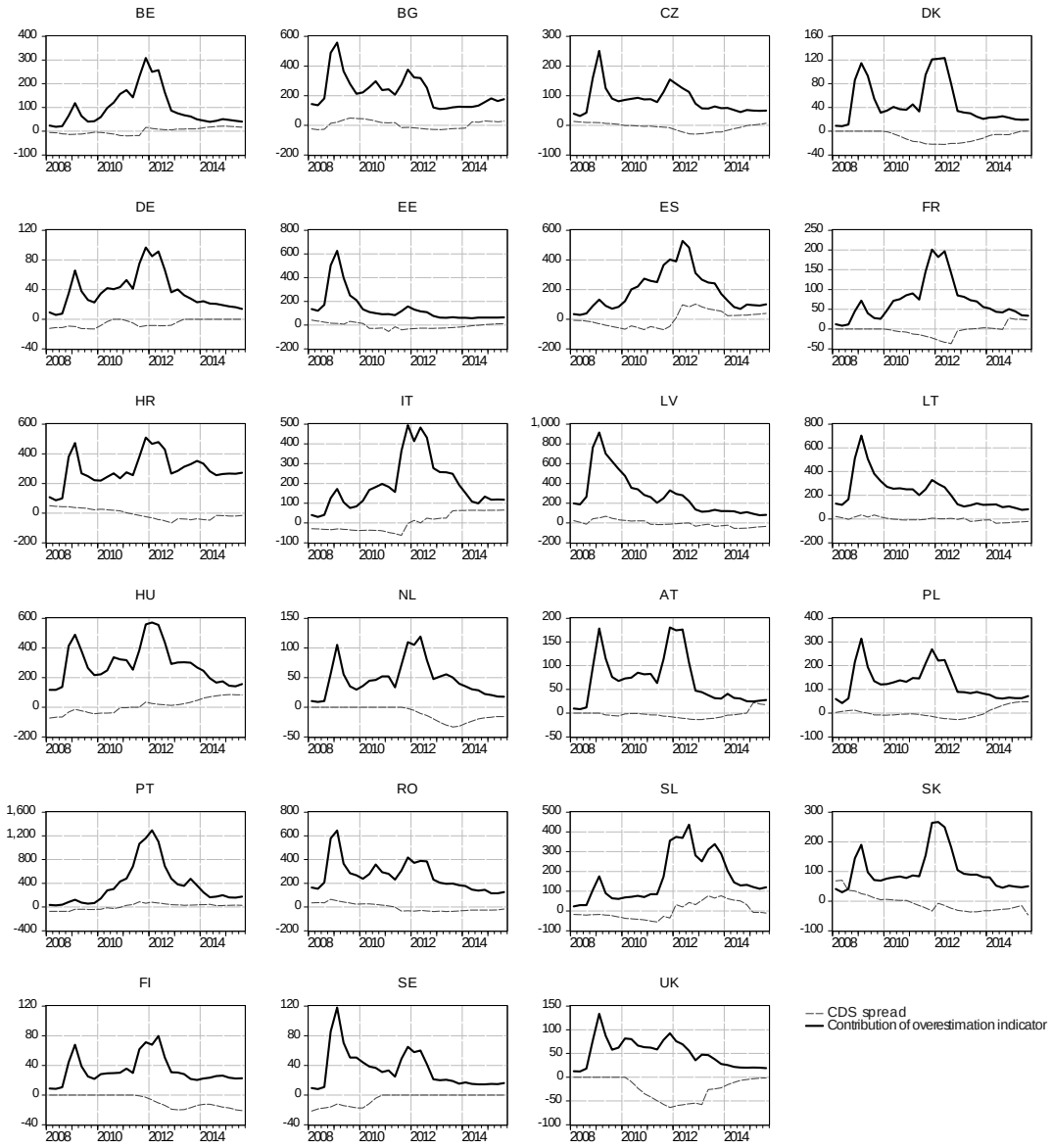

Figure 13: Market implied ratings