The Greek Tragedy - Appendix

Further Analyses and Robustness Checks

Contents

Introduction

This appendix provides several additional analyses for the two steps of our research design. First, our measure of negative-uncertain articles based on future time reference estimation, and dictionary based sentiment analysis. Second, the time series regression analysis for Greece. The goal of presenting these additional analyses is to give confidence in the robustness and plausibility of our results, and to give a better understanding of the complex measures and methods used. The following discussions and analyses are provided in individual subsections.

1. First step: Building our measure

Our measure of top negative-uncertain articles with reference to the future is based on two kinds of indicators. First, the share of sentences in an article referring to the future. Second, high combined negative and uncertain sentiment in relation to the full corpus. We present the two indicators and their measurement in the following. In addition, we provide regression results when determining our measure with an alternative sentiment dictionary, as well as examples of texts excerpts with high values on our measure.

a. Future Time Reference (FTR)

Future time reference (FTR) is a concept from linguistics "encompassing any linguistic statement which refers to future events" (Robertson 2021:3). Since we are not only interested in sentiments in general, but rather in sentiments about expected events and their outcomes in the future, we need to measure in how far an article refers to the future. The language of our corpus is English.

"English does not oblige the future tense for prediction-based FTR. Rather, it obliges the future tense or another modal verb:

[...] a. It will rain. b. It is going to rain. c. It shall rain. d. It could rain. e. It may rain. f. It might rain. g. It should rain. h. It would rain. i. It must rain." (Robertson 2021:32)

On the basis of this characteristic of the English language, Robertson, Carney, and Trudell (2021) train a machine learning model based on a ground truth corpus of hand coded Reddit and Twitter content to predict a probability for a sentence to refer to the future. They achieve an accuracy of 91% with out-of-sample data (Robertson et al. 2021:12). The authors kindly provided their trained model for our work.

Since we are using newspaper articles, one concern is the applicability of their model to our content. Therefore we checked the accuracy of the trained model for

out corpus based on a random sample of 100 sentences from all articles. The sample was hand coded by a single coder, coding very generally whether a sentence referred to something happening in the future or not. 8 of the 100 sampled sentences were coded as referring to the future. We do indeed achieve a lower accuracy of 78%. However, we accept this outcome without further training as a noisy measure but sufficient for our purpose since we also use uncertainty sentiment which also often captures reference to the future.

For every article, we calculate the share of sentences that has a predicted probability $>= 50\%$ to refer to the future. The degree to which articles refer to the future varies over time as presented in the main text and in figure AX. We use this measure combined with sentiments as described in the main text as a main independent variable.
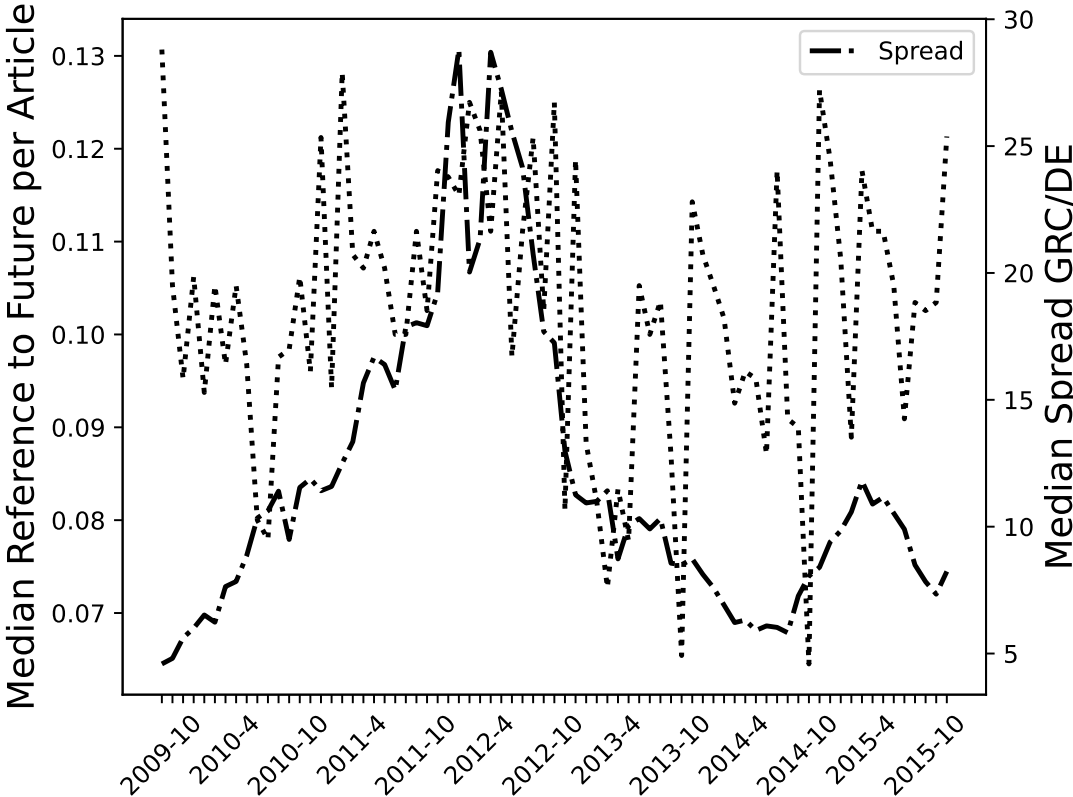

Figure 1: Median share of sentences among all published articles predicted to refer to the future over time.

b. Influential sentiment words

Effectively, sentiment analysis is counting words that are assumed to signal a specific sentiment. In our case, these sentiments stem from a prepared list from Loughran and McDonald (2011). We chose this dictionary for two reasons. First, it was prepared specifically for a financial context and excludes words from standard lists which are not necessarily negative in a finance context. Second, the dictionary includes sentiments in a uncertainty category which is crucial for our theoretical interests, since we suggest that negative sentiment together with high uncertainty proxies negative future narrative construction. The next section presents the most weighted influential sentiment words in the corpus for our period of interest between October 2009 to December 2015. Section 2.b. presents the title of the top 50 negative uncertain articles as an illustration what our measure captures.

In sentiment analysis, it is a common source of bias that words are wrongly classified, counted, or not weighted in a meaningful way. Therefore, this section presents some insights into our sentiment analysis. For each term, a weighting score was calculated as suggested by (Loughran and McDonald 2011:42):

> "Weighting schemes are generically labeled tf.idf, where tf (term frequency) represents the method used to account for the word frequency and normalization, and idf (inverse document frequency) denotes the method used to adjust for impact across the entire collection. We use one of the most common term weighting schemes with a modification that adjusts for document length. If N represents the total number of [documents] in the sample, df_i the number of documents containing at least one occurrence of the ith word, $tf_{i,j}$ the raw count of the $i^t h$ word in the jth document, and a_j the average word count in the document, then we define the weighted measure as

$$w_{i,j} = \begin{cases} \frac{(1+log(tf_{i,j}))}{(1+log(a_j))} log\frac{N}{df_i} & \text{if } tf_i, j \geq 1 \\ 0 & \text{otherwise} \end{cases}$$

Figures 4 and 5 present the most influential sentiment words. The words are presented in descending order according to the sum of their weighting scores in the whole corpus.
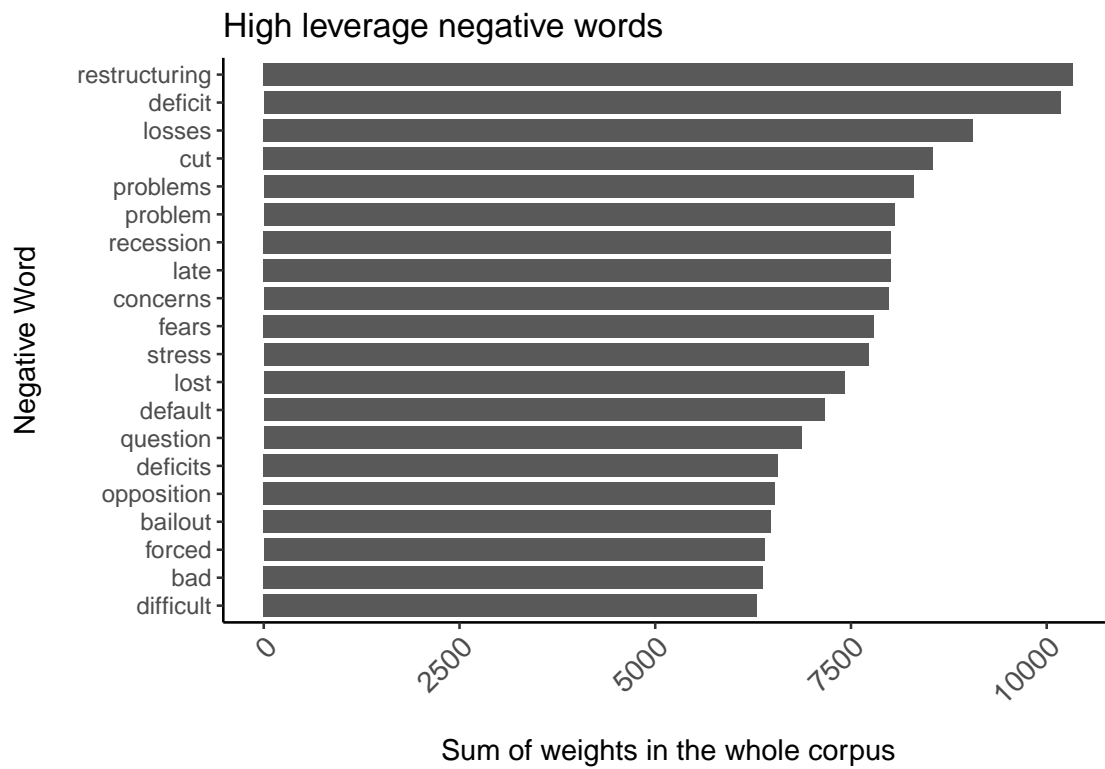
Figure 2: Top 20 negative words in terms of total sum of tf-idf weighting score for the whole corpus.
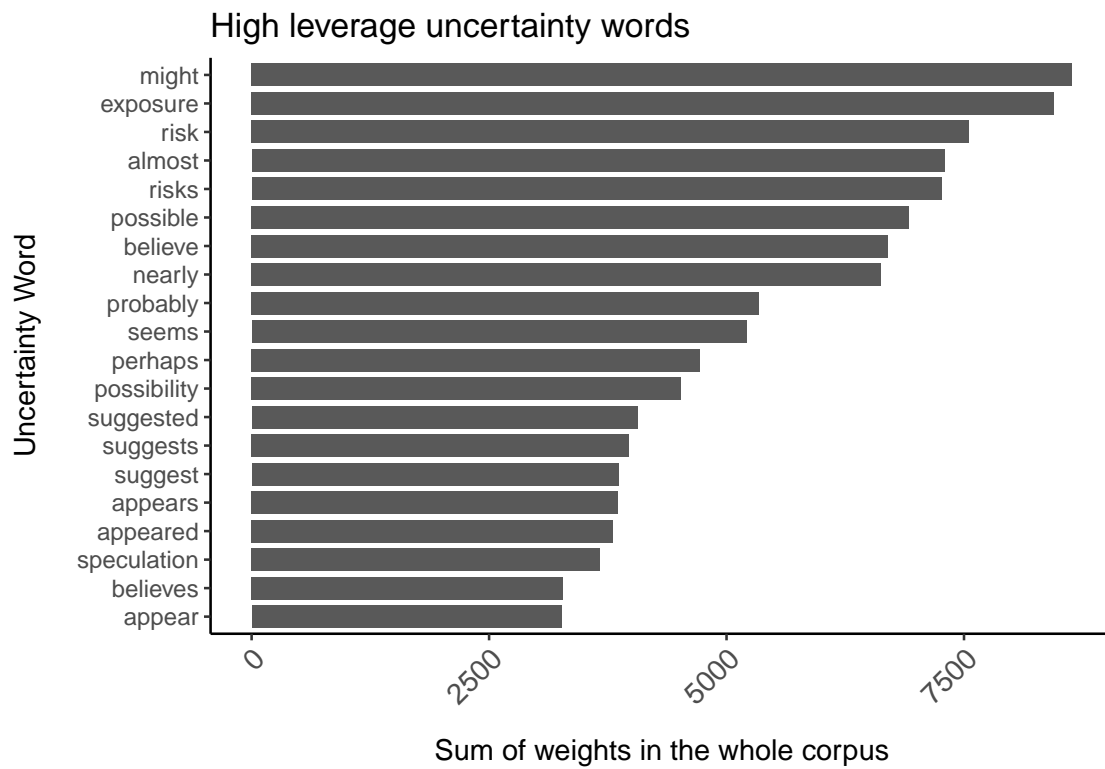
Figure 3: Top 20 uncertainty words in terms of total sum of tf-idf weighting score for the whole corpus.

c. Development of top sentiment and FTR articles over time

Figure 4: Publication of top articles in terms of uncertainty per month and by country.

Figure 5: Publication of top articles in terms of negativity per month and by country.
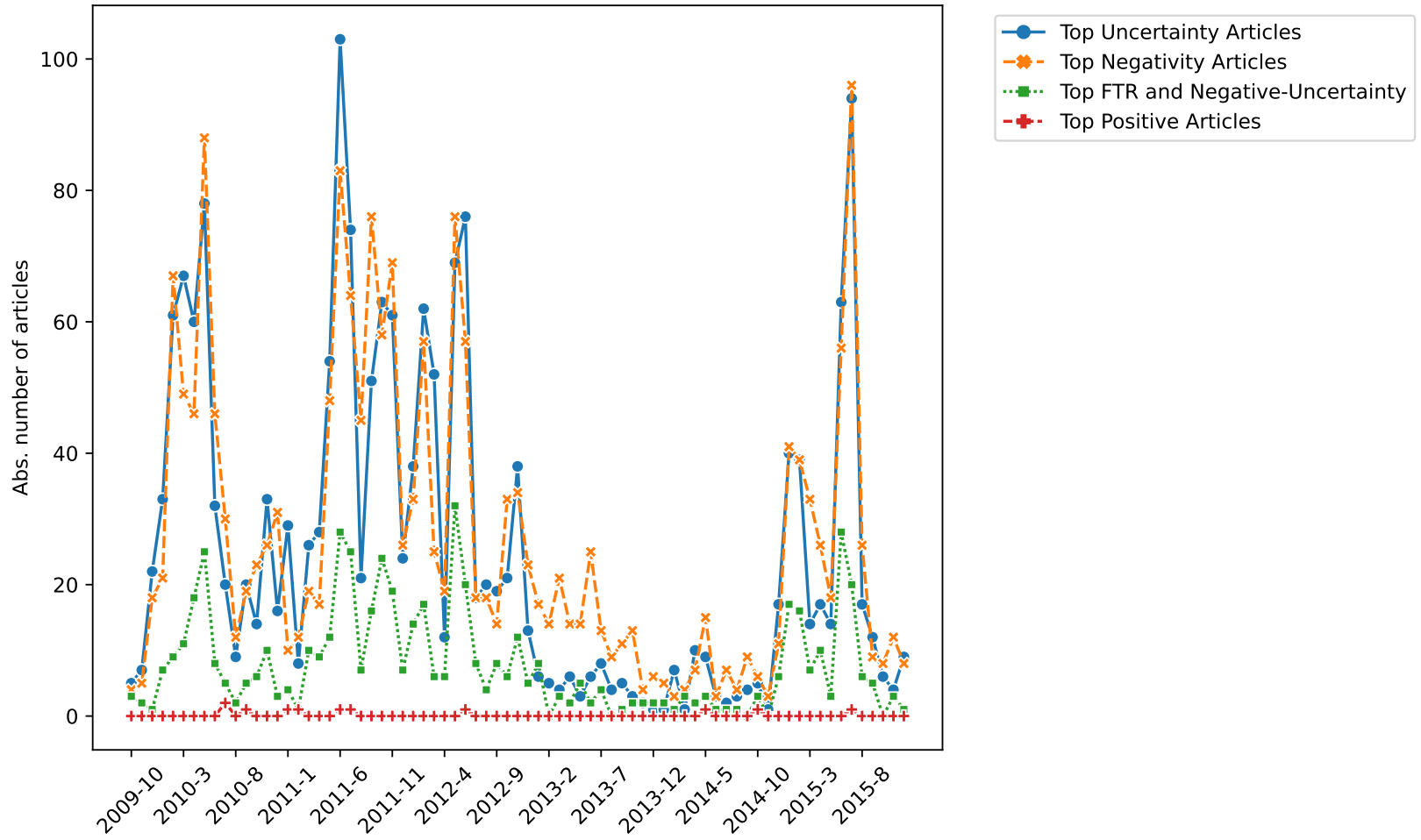
Figure 6: Comparison of top articles in terms of negativity and uncertainty per month.

d. Regression results with alternative sentiment dictionary

Sentiment analysis relies on an association of words to a specific category of sentiment. We draw on the dictionary provided by Loughran and McDonald (2011). The reasons for this are that, first, it was specifically designe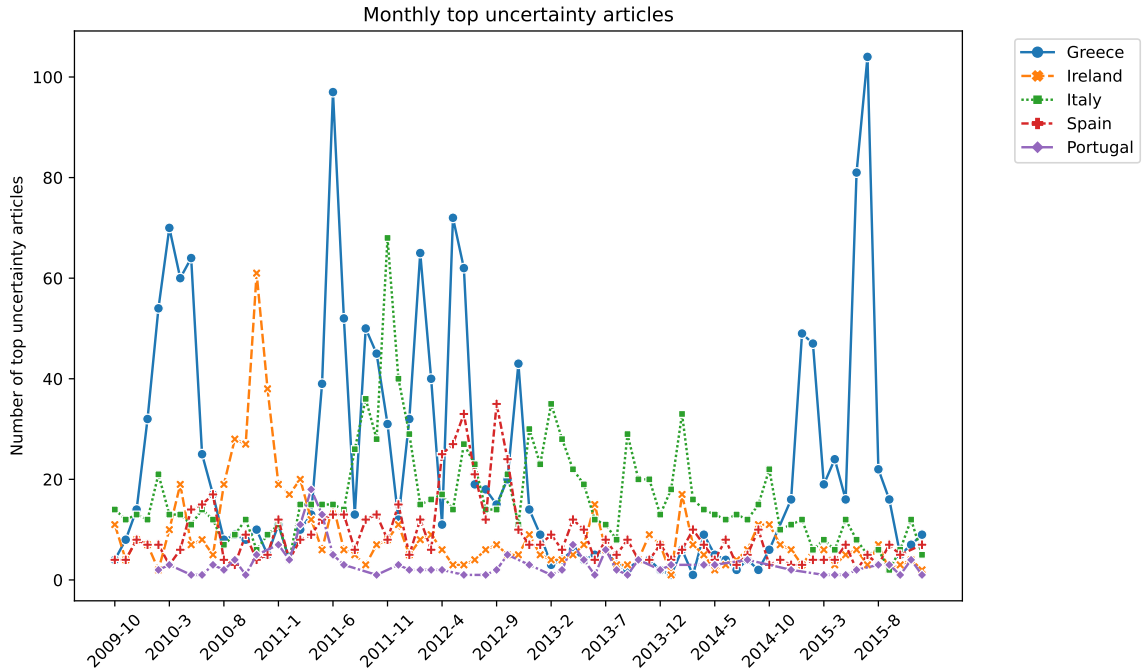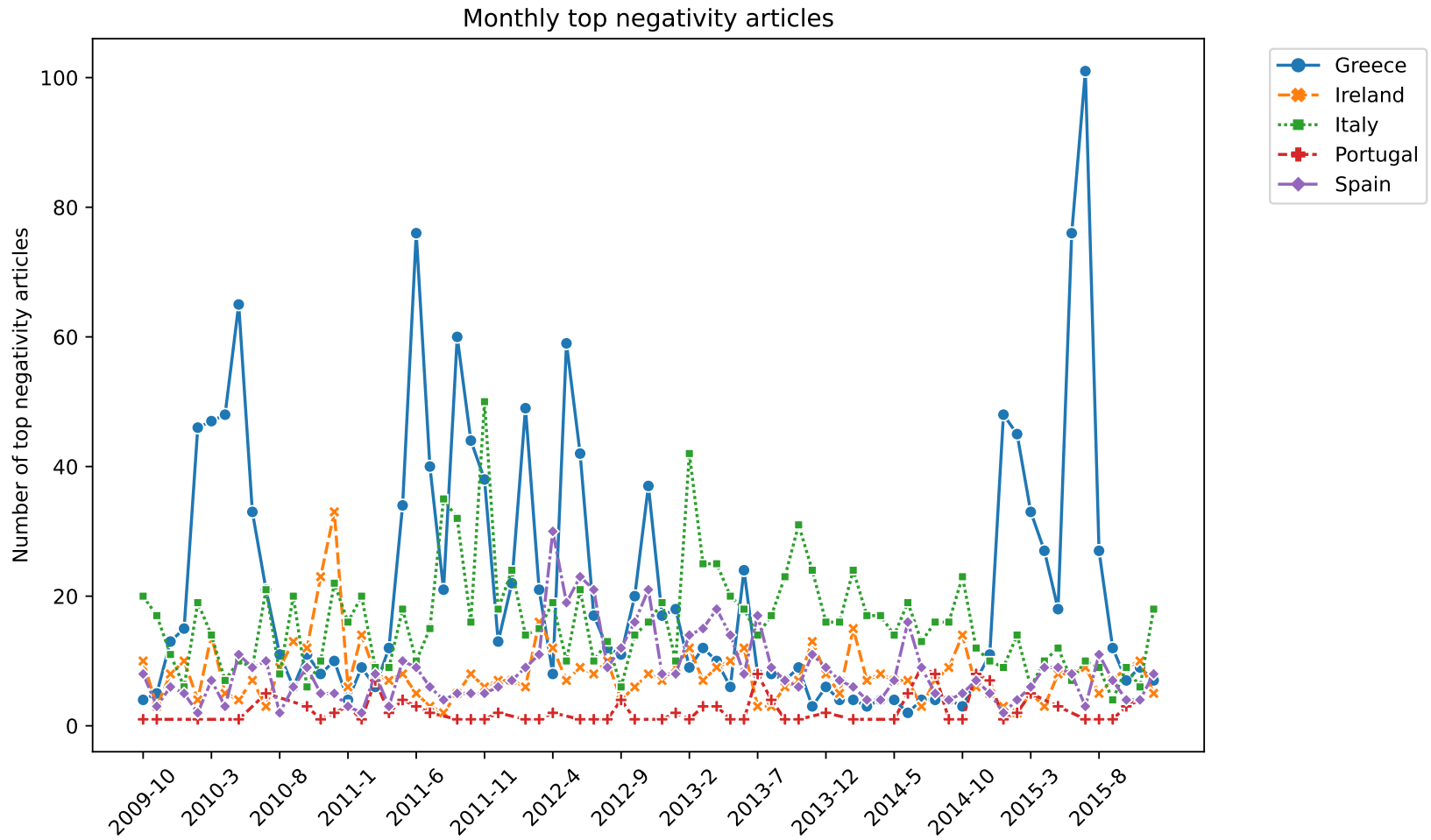d for a finance context. Second, it entails a specific category for uncertainty which is a crucial dimension for our analysis. However, at least for the simple positive-negative distinction used, there are also a lot of other popular dictionaries out there.

We present results from our final regression table using the NRC Word-Emotion Association Lexicon for negativity provided by Mohammad and Turney (2013). Only the negative sentiment is used, since the uncertainty sentiment is - to our knowledge - unique to the Loughran and McDonald (2011) dictionary. Weighting also remains the same, based on the tf-idf weighting scheme.

Table 1 shows that the relevant estimates for our results and conclusions remain the same: our measure shows a significant effect in the ARDL and ECM on the monthly and on the weekly level. Coefficient sizes do not seem to deviate a lot from our main analysis. This gives good confidence that the main results are not driven by our dictionary choice.

Table 1: Regression results with alternative sentiment dictionary NRC

	Dependent variable:		
	Spreads between Interest Rates on Greek and German Sovereign bonds		
	ARDL Weekly	ARDL Monthly	ECM Monthly
	(1)	(2)	(3)
Δ Spread$_{t-1}$	0.084 (0.055)	0.229* (0.106)	
Δ Spread$_{t-2}$	$-0.102^{\dagger}$ (0.052)	-0.364** (0.116)	
Δ Projected Debt/GDP	0.126*** (0.023)		
Δ Projected Government Balance	0.046 (0.048)		
Δ Spread$_{t-3}$		0.307** (0.103)	
Spread$_{t-1}$			-0.120** (0.035)
Δ Spread$_{t-1}$			$0.194^{\dagger}$ (0.108)
Δ Spread$_{t-2}$			-0.323** (0.101)
Δ Spread$_{t-3}$			$0.203^{\dagger}$ (0.102)
Δ Number of Negative-Uncertain Articles	0.085* (0.035)	0.098** (0.031)	0.119*** (0.032)
Δ VIX	0.044 (0.027)		
Δ Projected Debt/GDP$_{t-1}$	-0.075** (0.024)		
Δ Projected Debt/GDP$_{t-5}$	0.051* (0.022)		
Number of Negative-Uncertain Articles$_{t-1}$			0.124** (0.039)
Δ Projected Debt/GDP$_{t-11}$		0.114* (0.054)	0.106* (0.050)
ΔNumber of Negative-Uncertain Articles$_{t-2}$		$0.061^{\dagger}$ (0.033)	
ΔNumber of Negative-Uncertain Articles$_{t-1}$			-0.089* (0.035)
Intercept	-0.006 (0.064)	-0.049 (0.198)	0.191 (0.376)
Breusch-Godfrey Test (AR1)	0.39	0.65	0.68
Breusch-Godfrey Test (AR2)	0.51	0.81	0.92
Breusch-Godfrey Test (AR3)	0.45	0.93	0.9
BIC	1041.86	315.08	311.24
Observations	322	75	75
R^2	0.172	0.363	0.461
Adjusted R^2	0.151	0.307	0.395

Note: Standard errors in brackets. †p<0.1; *p<0.05; **p<0.01; ***p<0.001

e. Text excerpts of top 50 negative-uncertain articles

To get a better qualitative understanding of what the number of articles with high negativity and uncertainty actually measures, the following table presents the original headlines and first-hit keywords-in-context excerpts of the top 50 articles in terms of covariances. To get the rank, we simply multiplied the weighted score of negativity in every article with the weighted score of uncertainty, and sorted in descending order. First-hit keywords-in-context excerpts mean the following: for each text, the first ocurrence of either the word Greece or Greek is searched. The 40 words before and after this occurence are presented here. This of course only gives a very rough idea and might be misleading in some cases, since the whole article can have a very different tonality. However, at least to some extent, the negative and uncertain evaluation becomes clear. By presenting the headings, we intend to give a rough idea of the content and sentiment of an article since it often can be seen as a succinct summary. Since the original records are presented, the headings are not cleaned yet and sometimes include part of the text as in the original raw data.

Rank	Headline	80 KWIC	Date
1	World News: Euro Leaders Move to Dampen Risk to Bloc — Officials Agree to Create Policeman for Biggest, Riskiest Banks, but Delays Direct Bailout of Banks	BRUSSELS – Euro-zone governments capped another tumultuous year on Thursday with deals to more tightly control their biggest banks and keep their bailout of Greece on track , but face a new set of challenges in 2013 . An accord among European Union finance ministers creates a single policeman to oversee the biggest and riskiest banks in the 17-nation currency bloc . That marks a	2012-12-14
2	Raising the curtain on 2013	coalition with Ms Merkel's Christian Democrats , a black-green combination is the likeliest outcome . The result would be a pro-European coalition , but one of the most conservative that Germany has had for decades . Quentin Peel Will the Greek economy stop shrinking in 2013 ? Yes . The International Monetary Fund forecast that Greece would return to growth in 2011 , then 2012 , 2013 , and now 2015 . There are three reasons why this year may be	2012-12-31
3	Ailing Irelan d Accepts Bailout — Nation Asks EU, IMF for Tens of Billions to Boost Banks and Public FinancesB	talks with Ireland are still at an early stage , the people said . The Irish rescue marks the latest escalation in Europe's effort to keep its 16-member common currency from unraveling . The crisis began late last year after Greece acknowledged that its budget deficit figures were inaccurate , triggering ratings downgrades and raising concerns about the creditworthiness of other European countries . Ireland's banking and budget crisis is the first test of the 750 billion euros system of rescue	2010-11-22

Rank	Headline	80 KWIC	Date
4	Raj Verdict, Skype Deal, Toyota Slips to No. 3	mainly reserved for organized-crime , drug and terrorism cases , and vindicated the government's use of wiretap evidence , suggesting more taps and tapes may be used in future prosecutions . – Debt problems threatened European finances anew , as Greece's credit rating was downgraded by Standard and Poor's . The ratings firm cited the risk that Greece will push bondholders to accept delayed payments . Investors are increasingly shunning Greek debt , and other euro-zone countries are facing the prospect	2011-05-14
5	Second thoughts on the euro rescue: Eurozone's latest strategy fails to dispel market doubts	Eurozone leaders ' agreement last week on a new Greek rescue plan marked a big step forward from the previous agonisingly piecemeal approach . The distance to a truly comprehensive solution , however , remains bigger . Although the political deadlock was indeed broken , leaders have glossed over the	2011-07-29
6	A Greek bail-out at last but no real solution	Finally there is a deal . It came late , and only after the financial markets - and a rating agency - forced the European Union to put up or shut up . It will provide Greece with emergency loans at a rate of about 5 per cent , which is lower than present market rates . There is no agreement yet about the overall amount of money to be disbursed . But I hear that the	2010-04-12
7	'From rescue to reform to ensure enduring growth and job creation'	Commission , by the OECD and by every reputable business body in Britain . And for anyone who questions whether this matters in the real world , to real businesses and families , consider this . Market interest rates in Greece are 12.5 per cent , in Ireland they are close to 10 per cent , in Portugal and Spain they are 7 per cent and 5 per cent . Today , our country's market interest rates have fallen to 3.6	2011-03-24

Rank	Headline	80 KWIC	Date
8	Social unrest does violence to hopes of Greek reform	Sunday's explosion of street violence in Athens underlines the danger that political disorder will thwart Greece's attempt to implement the economic reforms required to avert a debt default , according to Greek politicians and economists . " The message is very worrying , " said a senior socialist politician . " As long as the economic	2012-02-14
9	Al Qaeda Figure Killed; Listeria Toll Climbed	from the opposition , a move that headed off a revolt within her ranks . Still , Parliament gave itself veto rights over any future bailouts , tying her hands in future currency-bloc negotiations . The chancellor had earlier reassured Greek Prime Minister Papandreou that " Germany is prepared to provide every assistance that is needed " to Athens , which approved a property tax as it battles a debt crisis and weighs a controversial plan to cut tens of thousands	2011-10-01
10	A new broom	crisis in the banks . Nama is also central to the strategy for economic recovery of a country that has undergone the most precipitate plunge into recession of any eurozone member . As the European Union struggles to prevent the Greek sovereign debt crisis spreading to other economies in the 16-member single currency bloc - and amid fears that the continent's private sector banks could be hard hit in the fallout - Ireland's over-indebted and fragile economy has been thrust back	2010-05-10

Rank	Headline	80 KWIC	Date
11	Draghi's lack of detail disappoints; Analysis: ECB meeting	up more than half the European market , and are often used as collateral in exchange for the ECB's cheap loans . The ECB would also purchase the safer slices of loan bundles from all eurozone member states , including Greece and Cyprus , for which even the senior tranches carry " junk " ratings . To mitigate the risk of investing in Greek and Cypriot bundles , the ECB will insist that both countries remain in EU reform programmes .	2014-10-03
12	Credibility test: ECB	the parameters out of " misguided national pride " . Franco-Belgian lender Dexia was rubber-stamped as financially robust , only to need a third rescue . So was Laiki , a Cypriot bank that was later sunk by its heavy Greek bond holdings . Bankia , the lender whose downfall later helped force Spain into a bailout , sailed through unscathed . Now euroland claims to have learnt the lessons of what one top EU official calls its " howling mistake	2013-12-12
13	Fear of a Greek exit could strengthen Draghi's hand	Would an orderly exit by Greece from the eurozone ever be possible ? The question has become more pertinent for financial markets and investors this week , with a Financial Times / Harris opinion poll showing only a quarter of Germans believed the country should remain	2012-09-06
14	'Britons can walk tall again in a comeback country': THE SPEECH; This is the Chancellor's Budget speech in full	, the OBR have once again revised down the growth of the world economy , revised down the growth of world trade and revised down the prospects for the eurozone . And they warn us that the current stand-off with Greece could be very damaging to the British economy . I agree with that assessment . A disorderly Greek exit from the euro remains the greatest threat to Europe's economic stability . It would be a serious mistake to underestimate its	2015-03-19

Rank	Headline	80 KWIC	Date
15	'Britons can walk tall again in a comeback country'; THE SPEECH; This is the Chancellor's Budget speech in full	, the OBR have once again revised down the growth of the world economy , revised down the growth of world trade and revised down the prospects for the eurozone . And they warn us that the current stand-off with Greece could be very damaging to the British economy . I agree with that assessment . A disorderly Greek exit from the euro remains the greatest threat to Europe's economic stability . It would be a serious mistake to underestimate its	2015-03-19
16	America has good reason to worry about Greece	At the end of last week , the US looked hard at Greece and was scared . So tiny an economy should not be bringing all of Europe low and even threatening to explode the euro , but it is . What started as a US financial crisis plunged Europe into recession ;	2010-05-10
17	Equities suffer hefty losses on fiscal cliff fears	global overview ; Greece budget vote knocks risk appetite ; US and German bonds in demand Global equities came under sustained attack this week as mounting fears about the US fiscal cliff and deteriorating confidence in the outlook for the eurozone undermined recent support	2012-11-10
18	Doubts over Greek support unsettle investors	eurozone economies , and uncertainty about the outlook for global central bank policy made for an uneasy start to the week for financial markets . Optimism that European Union governments would reach agreement over a financial stand-by facility to help Greece was dented at the weekend when Angela Merkel , Germany's chancellor , insisted that no decision had been made on a bail-out package . " Investors , in their eagerness to establish closure on Greek debt as a market theme	2010-03-23

Rank	Headline	80 KWIC	Date
19	Euro hit by confusion over Greece aid	The euro fell to a three-week low against the dollar yesterday as concerns over Greece's fiscal position mounted . Confusion over a potential bail-out for Athens heightened after a meeting of the ruling German coalition over the weekend concluded that financial assistance should not be given to Greece . Furthermore , Angela Merkel , German	2010-03-23
20	Screech from Motown's collapse will be heard in Europe	in Alabama is approaching three years without resolution . European local government restructurings would be even messier : there is no equivalent to US Chapter 9 bankruptcy proceedings . Still , the debt restructuring debate in Europe has changed since Greece's " private sector involvement " last year , which imposed losses on sovereign bond holders . Further sovereign debt restructurings are a step that eurozone policy makers are reluctant to take , yet options for tackling the continent's debt mountains	2013-07-24
21	Debt Deal in House, Mourning in Norway	at least 68 perished . – Sober warnings that the European debt crisis didn't end with last week's summit of EU leaders reignited concerns over contagion , boosting borrowing costs for high-debt governments and pressuring the euro . Moody's pushed Greece's credit rating further into deep junk territory , warning that the bond exchange that is planned would constitute a default . – A top Libyan rebel commander was shot and killed by unknown assailants , threatening to plunge the rebel	2011-07-30

Rank	Headline	80 KWIC	Date
22	The official verdict is that we are not Greece	If there was one message that emerged in capital letters from the new official forecasts produced by the Office for Budget Responsibility it was that Britain is not Greece . Although the projections were underpinned by improvements in forecasting practice , Sir Alan Budd , chairman , found neither that the past figures were fiddled nor that the forecast changes were large , compared with the sort of modifications	2010-06-15
23	A pillar in peril	The second rescue package appears increasingly shaky . By Peter Spiegel and Kerin Hope From the day it was agreed in late July , the EUR109bn bail-out of Greece - the second international package in 15 months - appeared star-crossed . It was by far the most complicated rescue of a eurozone country to date , and even finance ministry officials who signed up to it had a hard	2011-09-13
24	Market In Turmoil: A Shaken Europe Looks for Bolder Fixes	system could seize up , tipping the euro zone into another recession . The soundings on Thursday were bad across the board . Morgan Stanley cut its euro-zone growth forecasts for this year and next . Plans for the second Greek bailout , once thought firm , were jostled by demands from Finland , Austria and others that Athens post collateral for its rescue borrowings . The benchmark indexes in Paris and Frankfurt both fell more than 5 % . The	2011-08-19
25	Spain Back in Cross Hairs — Greek Election Results Fade Quickly as Madrid's Borrowing Costs Set Record	The brief afterglow from Greece's vote Sunday to try to remain in the euro was quickly extinguished by a cascade of bad news out of Spain that again rattled faith in the currency bloc's ability to support its most troubled members . Fresh data from	2012-06-19

Rank	Headline	80 KWIC	Date
26	REVIEW — What the World Will Speak In 2115 — English will still dominate a century from now, but it will no longer share the planet with thousands of other languages; On every continent, expect fewer but simpler modes of oral communication	them , various languages besides English . It is difficult , after all , to interrupt something as intimate and spontaneous as what language people speak to their children . Who truly imagines a Japan with no Japanese or a Greece with no Greek ? The spread of English just means that earthlings will tend to use a local language in their own orbit and English for communication beyond . But the days when English shared the planet with thousands of	2015-01-03
27	Dogmatists raise the costs of eurozone crisis	It is getting harder , politically . Finland and Germany have approved the bail-out of Portugal . But it is not clear whether both will vote in favour of the second Greek loan package , due this autumn . I still think they might , but it is not hard to imagine some political accident , in Berlin , in Athens , in Helsinki , in all three or somewhere else .	2011-05-16
28	A bail-out for Greece is just the beginning	Desperate times ; desperate measures . After months of costly delay , the eurozone has come up with an enormous package of support for Greece . By bringing in the International Monetary Fund , at Germany's behest , it has obtained some additional resources and a better programme . But is it going to work ? Alas , I have huge doubts . So what	2010-05-05

Rank	Headline	80 KWIC	Date
29	Merkel struggles with 'lose-lose' dilemma; GREECE TURMOIL; Germany: Rocky road	In five years of managing the Greek crisis , German chancellor Angela Merkel has maintained and even enhanced her reputation as Europe's most successful political leader - both at home and around the world . Not any more . As EU leaders this weekend make a last-ditch	2015-07-11
30	A Better Grecian Bailout	A Better Grecian Bailout . With Tuesday's vote , the finance ministers of the European Union have agreed to a second giant Greek bailout , just two years after the May 2010 bailout that was supposed to be all that was needed . While the day-to-day machinations of this long saga seem monotonous from afar , a closer look reveals several changes that	2012-02-22
31	Europe's choice is to integrate or disintegrate	The aim of the rescue package agreed for Greece cannot conceivably have been to prevent a default . For all the daunting austerity and structural reform it requires , the numbers do not add up . The main purpose I can detect is to reverse the rise in Greek	2010-05-03
32	Borrowing Costs Hurt Greece's Budget Plans — Recent Brisk Bond Issue Threatens to Derail Athens's Ambitions to Cut Deficit as Investors Demand Higher Premiums	Borrowing Costs Hurt Greece's Budget Plans — Recent Brisk Bond Issue Threatens to Derail Athens's Ambitions to Cut Deficit as Investors Demand Higher Premiums . The high interest rates Greece must pay to borrow money are threatening the county's ambitions to cut its deficit	2010-03-11

Rank	Headline	80 KWIC	Date
33	Greece needs a deal before midnight	What is going to happen with Greece ? Nobody knows . That does not mean nobody cares . On the contrary people care passionately , in directly conflicting directions . On both sides are participants determined not to concede . This impasse illustrates the folly of creating	2015-06-03
34	Companies must find their voice in the eurozone debate	the prospect is that the old order could shatter . Companies will face massive uncertainty about currency values and politics . This will affect day-to-day trading , employment and investment . If the crisis is limited to the departure of Greece , most corporates can easily absorb the losses . Existing supply contracts can be renegotiated , and new terms agreed with resident staff and those holding corporate pensions . Some brave companies may even see some Greek assets as undervalued	2012-07-09
35	Bail-out fails to halt escalation of eurozone debt crisis fears	News analysis ; Many investors now believe the chances of a restructuring of Greek , Spanish and Portuguese debt are increasing , writes David Oakley This weekend's EUR110bn bail-out for Greece was supposed to have stopped the rot in markets . Instead the reverse has happened . Financial markets are convinced the sovereign debt	2010-05-05
36	Hard slog to reach sunlit uplands	is double the European Union average - by ensuring that the anaemic economy continues to grow . At the same time , however , Spain needs to convince the sovereign bond markets that it will not go the way of Greece , Ireland and Portugal in seeking a multibillion-euro bail-out from the EU and the International Monetary Fund . Even if it can convince investors , who are concerned about its high level of private sector debt and its exposure to	2011-06-17

Rank	Headline	80 KWIC	Date
37	Greeks Default On Bailout Ahead of Vote	Greeks Default On Bailout Ahead of Vote . Greece became the first developed country to default on the International Monetary Fund , as the rescue program that has sustained it for five years expired and its creditors rejected last-ditch efforts to	2015-07-01
38	Third time lucky? The latest plan to rescue Greece	Greece may have lost the ability to throw international financial markets into a tailspin but events over the summer have illustrated that it can still convulse European politics . Greece's coalition government , led by Antonis Samaras , the centre-right prime	2013-09-17
39	The euro crisis is all about breaking the rules	a confusing adage . If you do not want a rule followed , why make it ? Yet it is clearly a popular idea among the European politicians who are managing the sovereign debt crisis . When they bailed out Greece , Ireland and Portugal they did not merely do something that exceeded their powers , they violated an explicit prohibition on such bail-outs . Now there is talk of the European Central Bank accepting Greek government bonds as collateral even	2011-06-09
40	Doubts Reign as Stocks Head Into the Holidays	challenge making sense of the stock market lately . After weeks of losses , the market soared in October amid Herculean efforts by European political leaders to stem their debt crisis . Last week came new volatility , however . Greek politicians squabbled and new doubts arose over the future of the euro currency , even as data on Friday showed a bit more strength in the U.S . labor market than expected . It all sowed more confusion . There	2011-11-06

Rank	Headline	80 KWIC	Date
41	World Braces For Test Of Euro	World Braces For Test Of Euro . Europe , facing a momentous Greek election after a week of mounting financial stresses , is preparing for what some financial analysts are calling its " Lehman moment " : the prospect that Greece could leave the euro currency union following Sunday's vote . Yet	2012-06-16
42	National actions threaten regional ratings	, to rein back mounting debt levels , which continue to undermine the finances of municipalities , rating agency Moody's warned yesterday . Many downgrades are also likely because of the knock-on effect of actions taken by sovereigns , such as Greece , Moody's said in a report that covers the world , except the US . In addition , local authorities may suffer from a crowding-out effect - which will force up their interest rate costs - in the capital markets	2010-01-15
43	'Picts' stand at sharp end of any rate rise fallout; Analysis: Emerging markets	Never mind the Brics or the Fragile Five - the Picts is the new emerging market group investors should worry about as they look ahead to US interest rate rises . Analysts are divided on whether the Greek crisis will have much lasting impact on EM assets , though few doubt it has racked up the tension . What they do agree on is that the overriding focus for markets in the second half of the year will	2015-06-30
44	On their heads be it	Europe reached the US ? One , two or three years , or never ? " Under 10 per cent said never , " says a banker involved in the polling . Last year brought the eurozone debt crisis . Greece and Ireland had to be bailed out and big question marks still hang over Portugal and Spain . But the focus is now likely to widen . The question for 2011 is how much of the western world could be	2011-01-04

Rank	Headline	80 KWIC	Date
45	That elusive spark	in the west is still far below pre-2008 trends . Stubbornly high US unemployment is blighting lives and souring politics . Europe narrowly avoided sparking a second worldwide crisis in May when its big economies agreed a bail-out fund for Greece and other highly indebted countries at risk of sovereign default . Japan has intervened in currency markets for the first time in six years to stop an appreciation of the yen hurting its exports . This has sparked dark talk	2010-10-06
46	Vultures in view: Investors in search of distressed assets are descending on the crisis-hit continent. Though often reviled, they can aid a recovery by stripping out the private sector's burdensome borrowings. But some say they have arrived too soon. By Robin Wigglesworth	periphery , and simmering fears over the strength of the global recovery , culminated in market convulsions in the past few months . Eurozone policymakers recently thrashed out an-other rescue package but , even before this week's renewed anxieties over Greece , distressed debt investors were scenting blood . The sector , sometimes maligned as a flock of " vultures " by aggrieved politicians and owners of target companies , seeks to take advantage of stressed and dislocated financial markets .	2011-11-03

Rank	Headline	80 KWIC	Date
47	Fear drives Irish towards Yes vote on treaty: EU referendum	Polls show 37 % in favour although for many it is due to concerns they could be the next Greece , writes Jamie Smyth In a hard-fought battle to persuade Irish voters to back Europe's unpopular fiscal discipline treaty , Ireland's deputy finance minister has the task of convincing the leafy Dublin suburb of Templeogue . The middle-class area appears	2012-05-21
48	Saving the dream of centuries	Confronted with turbulence in the provinces , the eurozone has sent in new governors . In place of the wayward George Papandreou , Greece now has Lucas Papademos , former vice-president of the European Central Bank . Instead of the unruly Silvio Berlusconi , Italy has Mario Monti , former head of competition policy at the European Commission . Europe is putting in place	2011-11-16
49	Soft options are no longer viable options	this been the first policy shift since the arrest of Dominique Strauss-Kahn ? A lingering dispute between the International Monetary Fund and the European Union has come out in the open . It is about the EU's hesitance in supporting Greece all the way through next year . The IMF is saying to the EU : unless you agree to new loans for 2012 , we are not going to risk our shareholders ' funds and pay the next tranche of	2011-05-30

Rank	Headline	80 KWIC	Date
50	International Finance: New Doubts on EU Bank Stress Tests — Skeptics Wonder Why There's So Much Optimism in Official Circles; Friday Is Day of Reckoning	LONDON – Greece's economy is in tatters and its financial system is under pressure . But its banks appear poised to glide through Europe's " stress tests . " A similar paradox is playing out across Europe . As regulators prepare to release	2010-07-20

2. Second step: Time series regression

The second part of our analysis is based on time series regression analysis of the data for Greece. In this section we provide additional descriptive statistics and time series characteristics. Since the data is analyzed in differences due to non-stationarity, the presented descriptives are for the differences if not stated otherwise. We provide correlations of the differenced data in section a. Second, autocorrelations of the differenced data, i.e. how changes of the individual variables correlate with their past changes are presented in section b. Section c presents time series plots of original and differenced variables. Next, section d presents regression results on the daily level. Section e shows the output of the applied cointegration test for the Greek ECM model. Section f shows results when using the heteroscedasticity and autocorrelation (HAC) robust estimator. And finally, section g presents estimates without control variables.

a. Correlations of differenced data

To get a better understanding of how the variables used relate to each other, Figures 3 to 5 present correlations for the differenced data on the daily, weekly and monthly level. Overall, there is no evidence for relevant correlation between the variables used that should cause multicollinearity issues. The most relevant correlation is between the measures of negative and uncertainty sentiment which we combined by looking only at the most negative *and* uncertain articles.
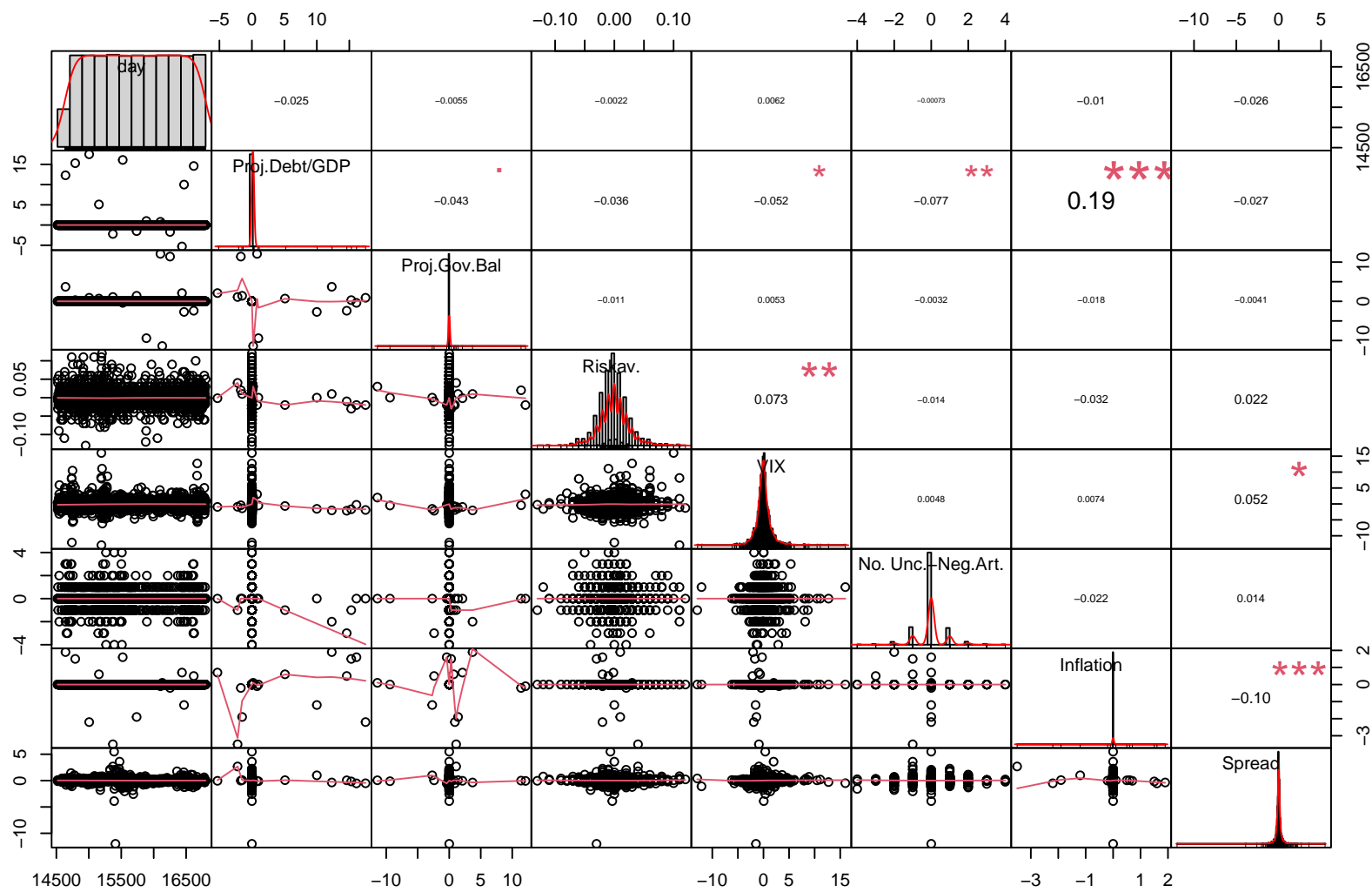
Figure 7: Distributions and correlations of the differenced variables used - daily level. Size of font and stars are proportional to the value of the correlation coefficient.

Figure 8: Distributions and correlations of the differenced variables used - weekly level. Size of font and stars are proportional to the value of the correlation coefficient.
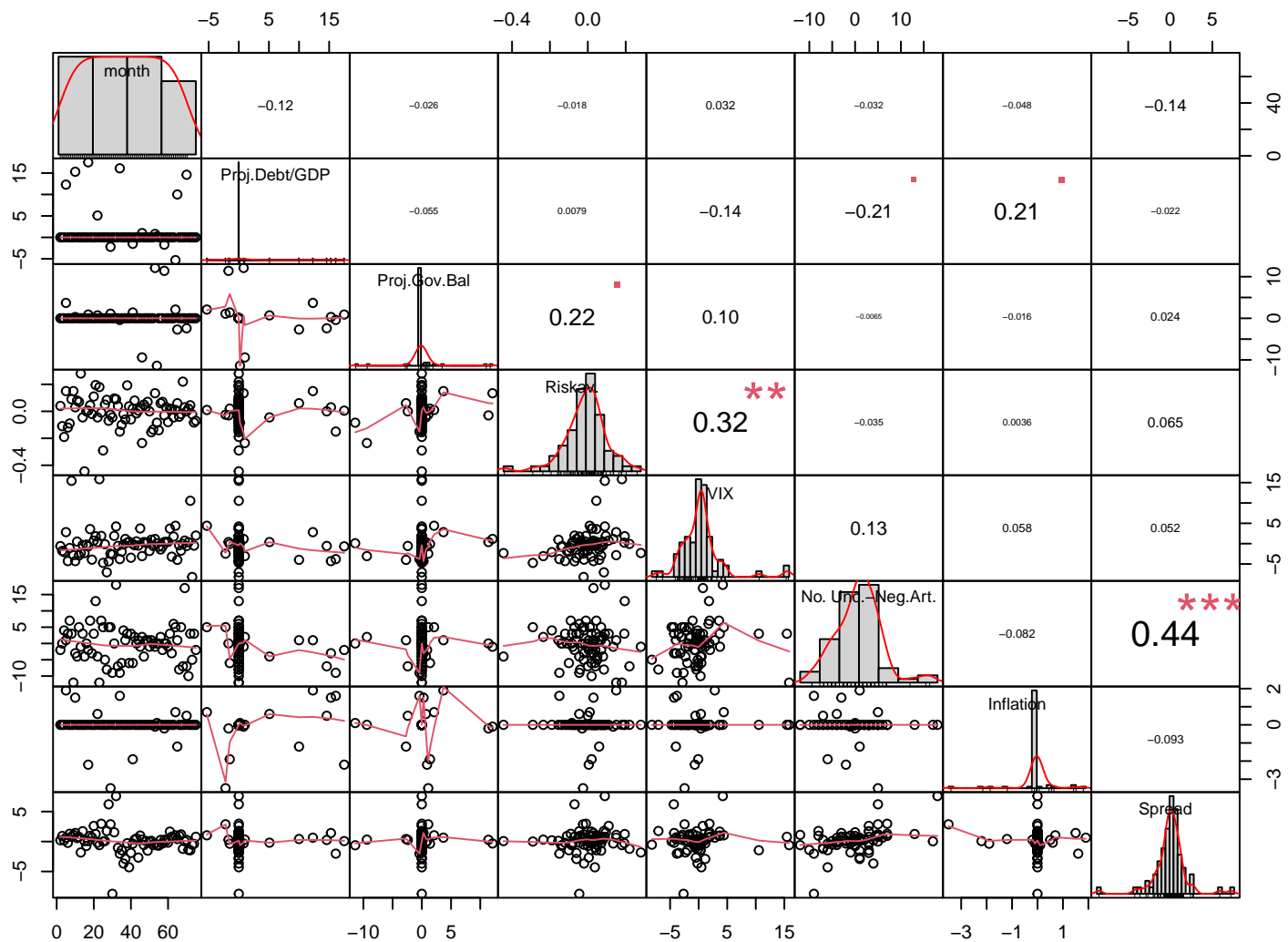
Figure 9: Distributions and correlations of the differenced variables used - monthly level. Size of font and stars are proportional to the value of the correlation coefficient.
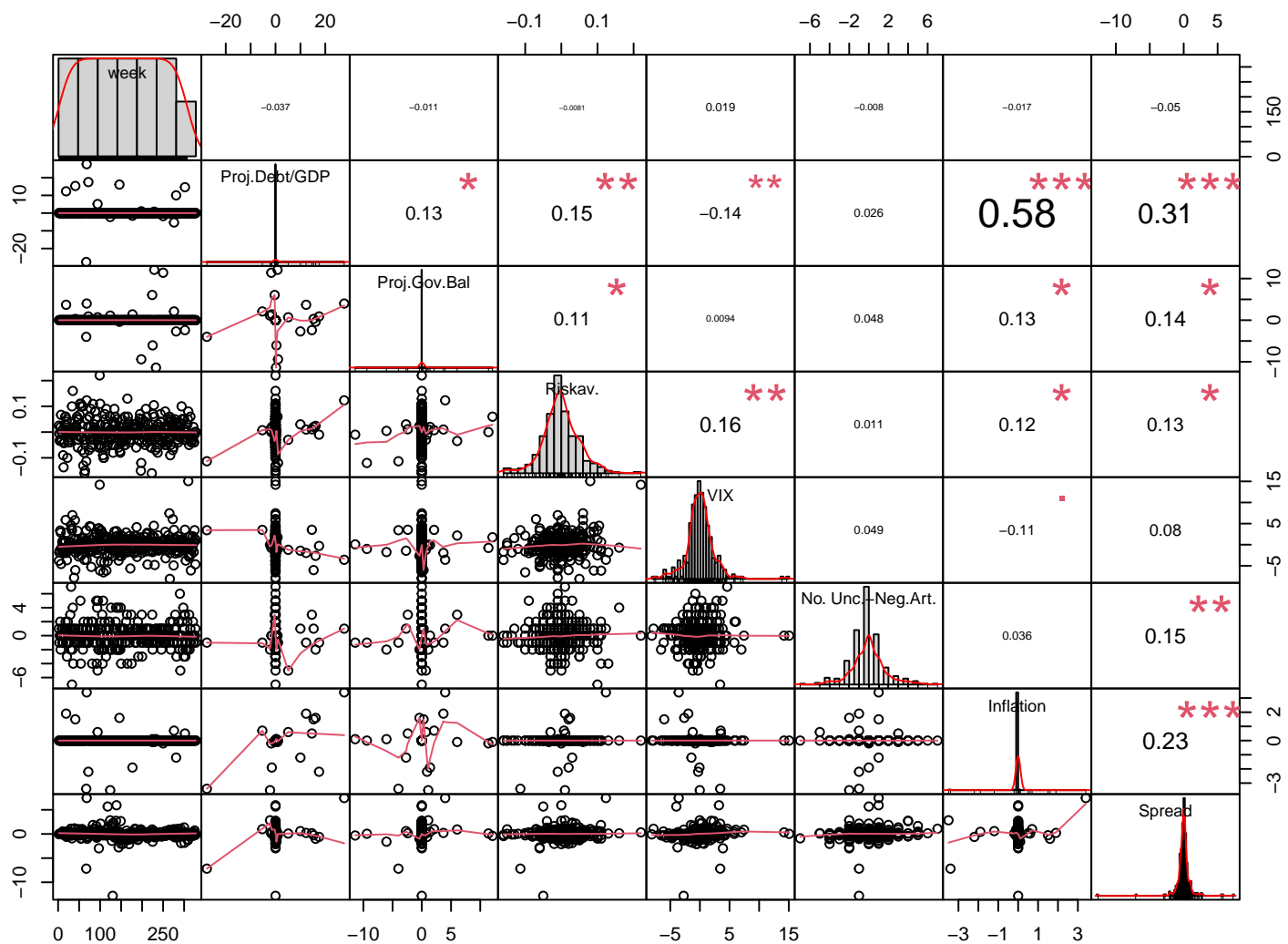
b. Autocorrelations of differenced data

To get a better understanding of how the variables used relate to their past observations, this section presents correlations between the differenced data and their past observations on the daily, weekly and monthly level.
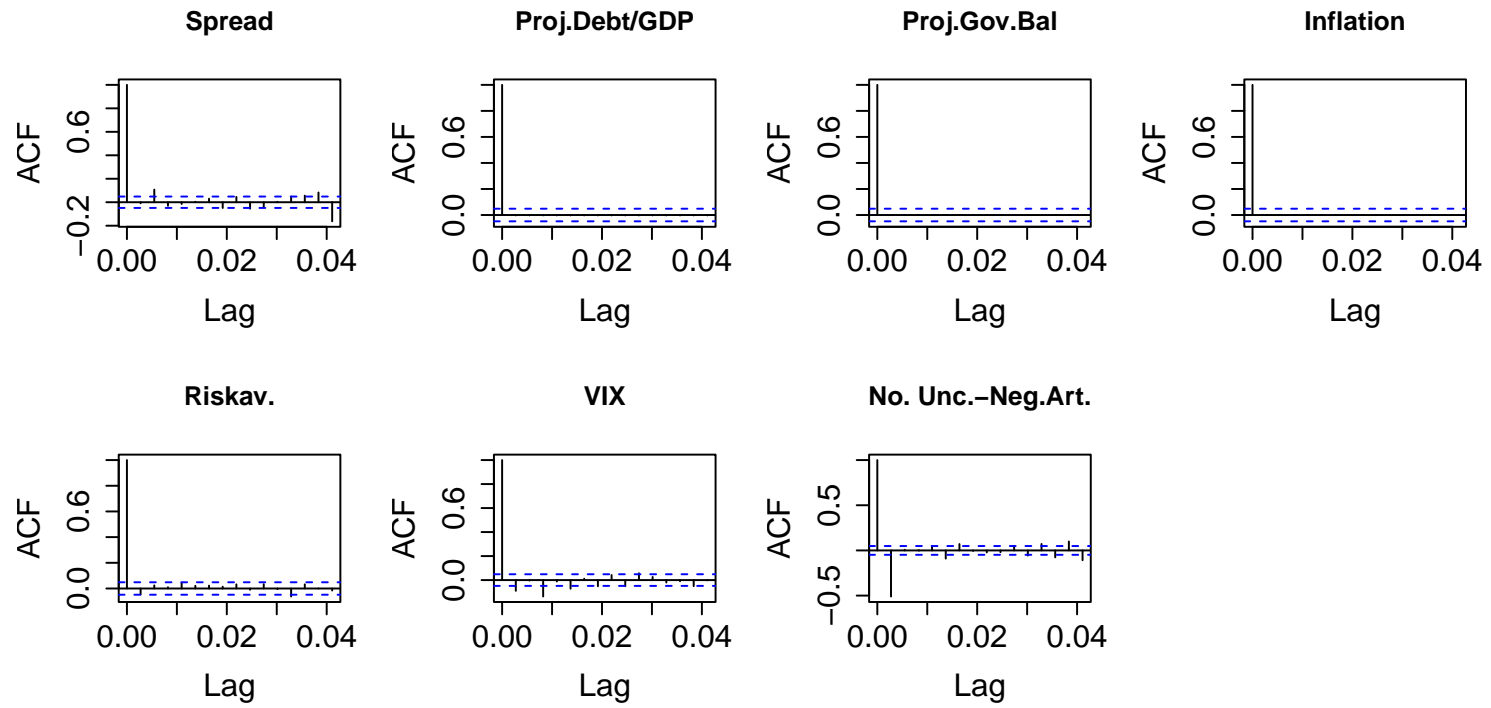
Figure 10: Autocorrelation functions for 20 lags - daily level

Spread

Proj.Debt/GDP

Proj.Gov.Bal

Inflation

Riskav.

VIX

No. Unc.–Neg.Art.
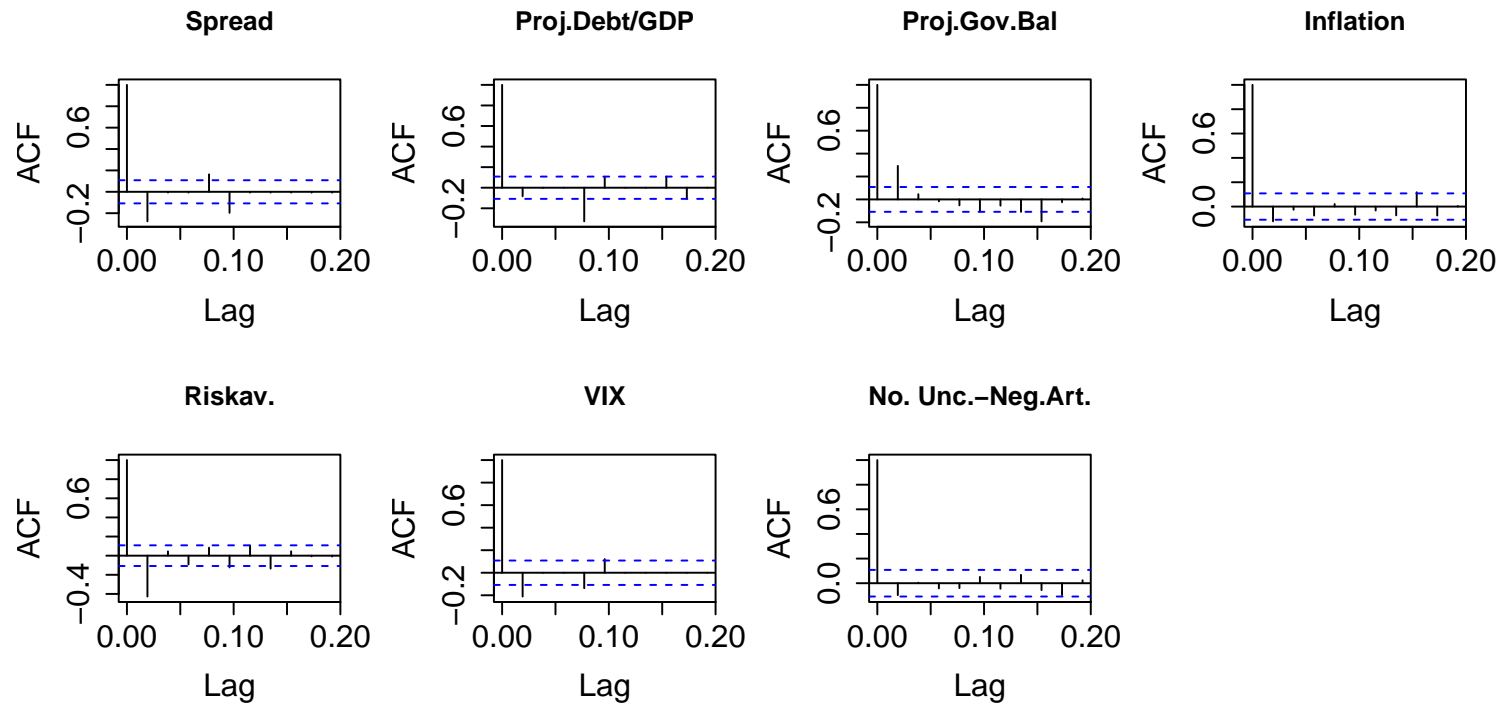
Figure 11: Autocorrelation functions for 10 lags - weekly level
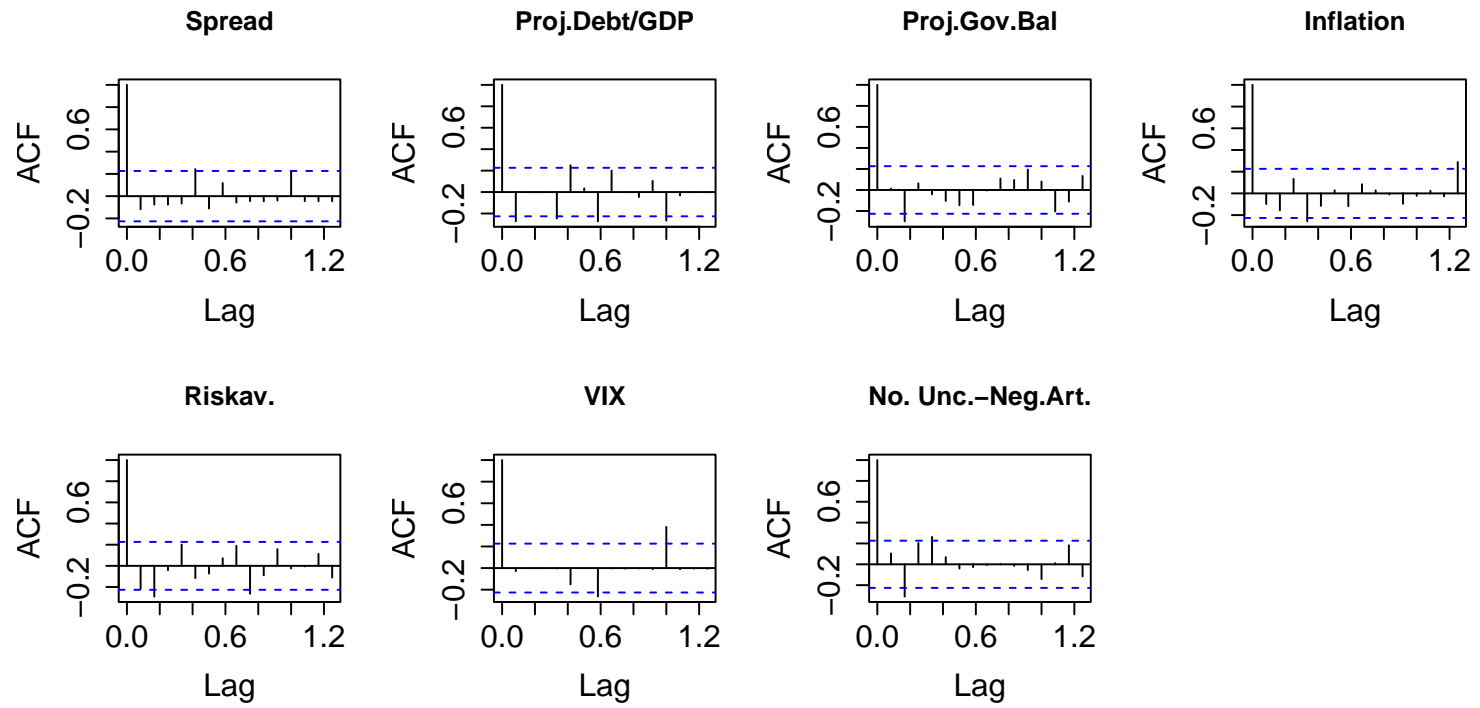
Figure 12: Autocorrelation functions for 15 lags - monthly level

c. Time series plots

The following figures plot the development of the time series used from October 2009 until the end of 2015. The first figure shows the original, undifferenced variables which show some obvious signs of non-stationarity. The second figure shows the variables, as mostly used, in their differenced form which give more confidence in their stationarity as also confirmed by stationarity tests.
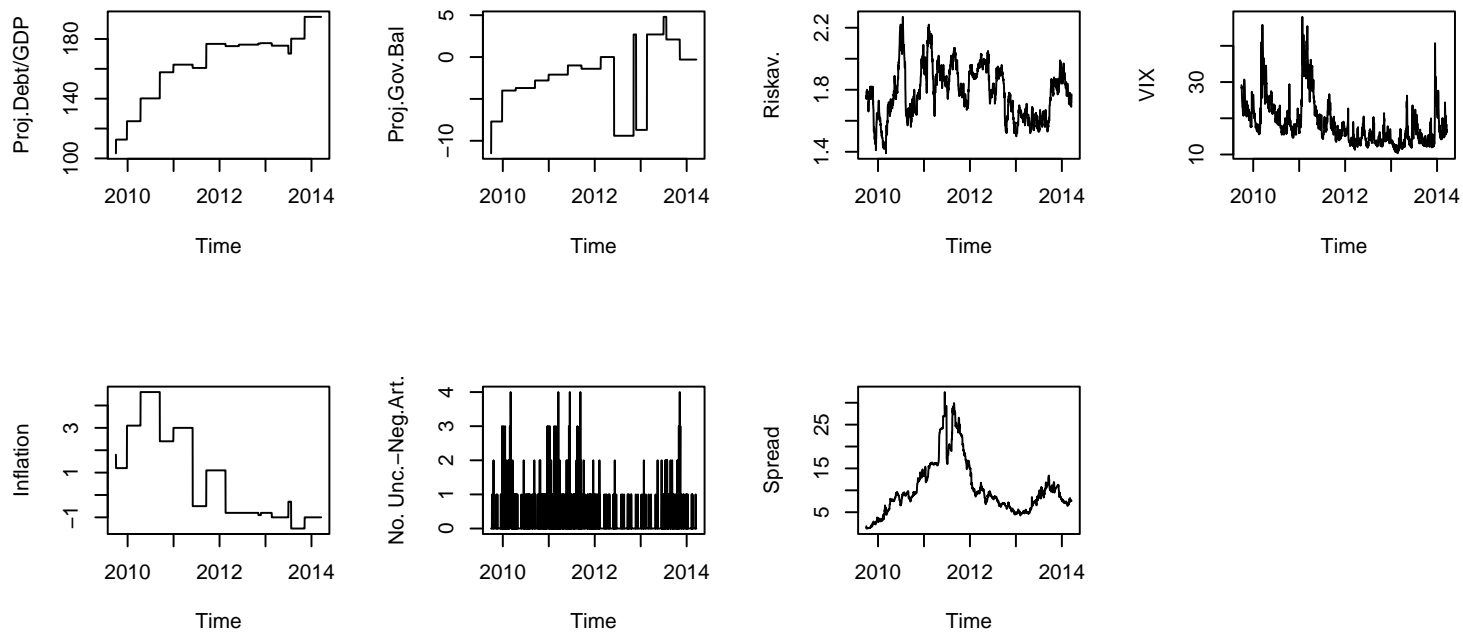
Figure 13: Time series plots of the variables used in their undifferenced form (daily level)

Figure 14: Time series plots of the variables used in their differenced form (daily level)

d. Regression results for daily data

As discussed in the main text, we do not assume that our measure is precise enough to measure relevant sentiment and negative narrative construction on the daily level. This is because we assume the newspaper articles from *The Financial Times* and *The Wall Street Journal* to be a proxy of the discourse, and *not* that the exact articles we analyze are the cause for inve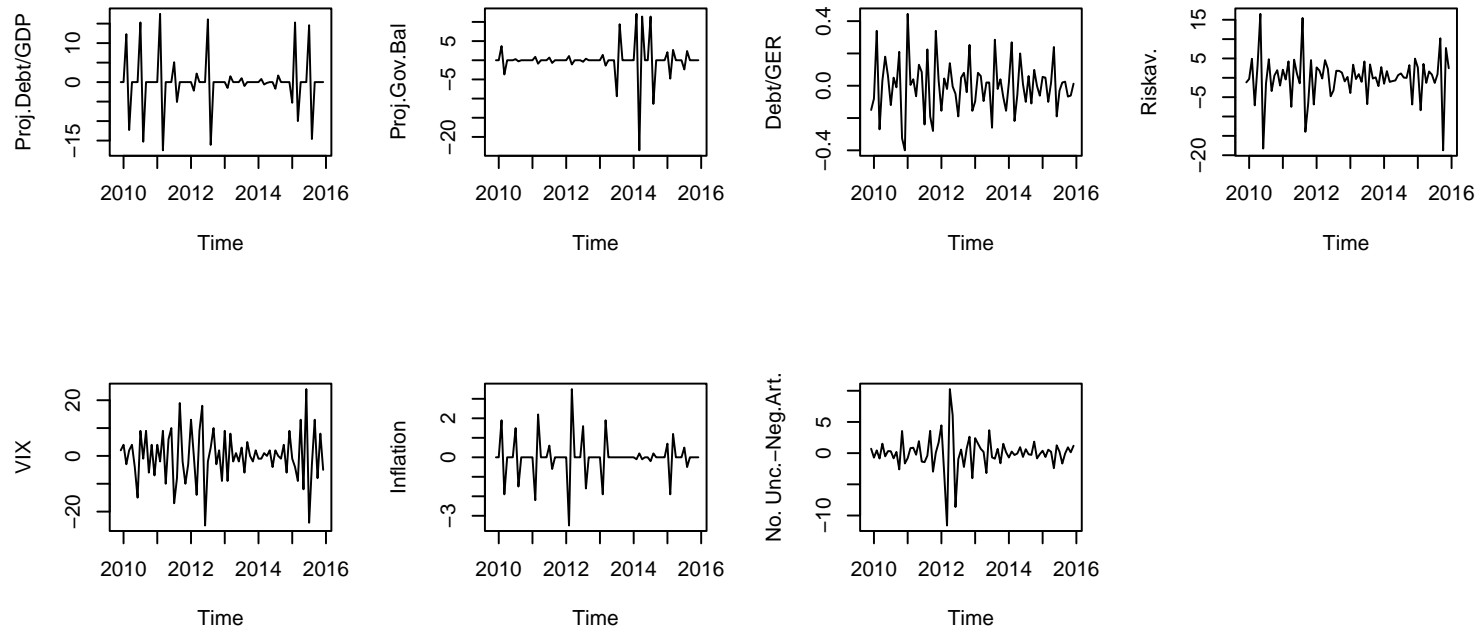stors' behavior. In fact, on the daily level, only the volatility index VIX and changes in the harmonized consumer price index seem to show some explanatory power. However, articles do not only relate to news from the last four days. They can also be seen over a longer period as negotiating a general sentiment and construct more general and long-term narratives, e.g. on the future. Therefore we expect that with our approach we are only able to capture signals for increasing negative narrative construction in the overall discourse over more long-term periods such as the weekly and monthly level.

Table 3: Regression results for daily data

	Dependent variable:	
	Spreads between Interest Rates on Greek and German Sovereign bonds	
	M1 Daily	M2 Daily
	(1)	(2)
Δ Spread$_{t-1}$	-0.013 (0.025)	-0.012 (0.025)
Δ Spread$_{t-2}$	0.106^{***} (0.025)	0.105^{***} (0.025)
Δ Spread$_{t-3}$	-0.024 (0.025)	-0.024 (0.025)
Δ Spread$_{t-4}$	-0.023 (0.025)	-0.023 (0.025)
Δ VIX	0.019^{**} (0.007)	0.019^{**} (0.007)
Δ Inflation	-0.351^{***} (0.085)	-0.351^{***} (0.085)
Δ Number of Negative-Uncertain Articles		0.006 (0.015)
Δ VIX$_{t-1}$	0.032^{***} (0.007)	0.032^{***} (0.007)
Δ VIX$_{t-2}$	-0.002 (0.007)	-0.002 (0.007)
Intercept		0.027 (0.086)
Constant	0.003 (0.012)	0.003 (0.012)
Breusch-Godfrey Test (AR1)	0.65	0.94
Breusch-Godfrey Test (AR2)	0.89	0.98
Breusch-Godfrey Test (AR3)	0.96	0.99
BIC	2285.05	2299.62
Observations	1,625	1,625
R^2	0.038	0.038
Adjusted R^2	0.033	0.032

Note: Standard errors in brackets. †p<0.1; *p<0.05; **p<0.01; ***p<0.001

e. Cointegration test for ECM

Here we present the detailed results and output of the cointegration test for the monthly level of our data. The output stems from the R package Dynamac based on Philips (2018) with small sample critical values provided by Narayan (2005). The test delivers some robust evidence for a cointegration relationship between the most negative and uncertain articles and spread development. We think it also seems theoretically plausible and interesting to think of negative narrative construction and the spread level to be in a long-term equilibrium. How robust such a finding is should be analyzed in future studies and could easily be transferred to comparable cases.

```
PESARAN, SHIN AND SMITH (2001) COINTEGRATION TEST

Observations: 75
Number of Lagged Regressors (not including LDV) (k): 1
Case: 3 (Unrestricted intercept; no trend)


-------------------------------------------------------
-                       F-test                        -
-------------------------------------------------------
                <------- I(0) ------------ I(1) ----->
10% critical value       4.15               4.88
5% critical value        5.14               5.92
1% critical value        7.22               8.30


F-statistic = 6.847
-------------------------------------------------------
-                       t-test                        -
-------------------------------------------------------
                <------- I(0) ------------ I(1) ----->
10% critical value      -2.57              -2.91
5% critical value       -2.86              -3.22
1% critical value       -3.43              -3.82


t statistic = -3.32
-------------------------------------------------------
```

f. Results with robust HAC estimator

We chose lag lengths by simply adding lagged differences until there is no auto-correlation in the residuals anymore. However, in some cases the probability with which the Null Hypothesis of no autocorrelation of a Breusch-Pagan Test is close to being rejected. In addition, there might be heteroscedasticity in our residuals, and standard errors could therefore be biased. The following output therefore shows our results with Newey-West heteroscedasticity- and autocorrelation-consistent (HAC) estimators as a further check of robustness. The results are presented in the following. The main results are robust to heteroscedasticity and autocorrelation, though significance levels vary and confidence levels are lower for some of the coefficients. It must be noted that in Model M6 our measure for negative narrative construction only shows a weakly significant effect at the 10% confidence level. However, we still find a more significant effect in the ECM Model M7. Since there is no evidence for autocorrelation in model M6, we see this as due to unecessarily inflated SEs.

Table 4: Regression results with heteroscedasticity and autocorrelation robust (HAC) estimator

	Dependent variable:		
	Spreads between Interest Rates on Greek and German Sovereign bonds		
	ARDL Weekly	ARDL Monthly	ECM Monthly
	(1)	(2)	(3)
Δ Spread$_{t-1}$	0.008 (0.055)	0.235* (0.106)	
Δ Spread$_{t-5}$	0.076 (0.055)		
Δ Projected Debt/GDP	0.127*** (0.024)		
Δ Projected Government Balance	0.074 (0.047)		
Δ Spread$_{t-2}$		−0.363** (0.117)	
Δ Spread$_{t-3}$		0.310** (0.104)	
Spread$_{t-1}$			−0.117** (0.035)
Δ Spread$_{t-1}$			0.202† (0.109)
Δ Spread$_{t-2}$			−0.343** (0.102)
Δ Spread$_{t-3}$			0.217* (0.101)
Δ Number of Negative-Uncertain Articles	0.091* (0.037)	0.115** (0.038)	0.146*** (0.040)
Δ VIX	0.060* (0.027)		
Δ Projected Government Balance$_{t-1}$	−0.052* (0.024)		
Δ Projected Government Balance$_{t-5}$	0.032 (0.024)		
Number of Negative-Uncertain Articles$_{t-1}$			0.164** (0.053)
Δ Projected Government Balance$_{t-11}$		0.111* (0.051)	0.110* (0.048)
Δ Number of Negative-Uncertain Articles$_{t-2}$	−0.0005 (0.037)	0.060 (0.040)	
Δ Number of Negative-Uncertain Articles$_{t-1}$			−0.105* (0.044)
Intercept	−0.009 (0.066)	−0.050 (0.199)	0.216 (0.376)
Breusch-Godfrey Test (AR1)	0.62	0.65	0.55
Breusch-Godfrey Test (AR2)	0.86	0.78	0.84
Breusch-Godfrey Test (AR3)	0.69	0.89	0.91
BIC	1062.24	316.07	312.12
Observations	322	75	75
R^2	0.162	0.371	0.468
Adjusted R^2	0.138	0.316	0.404

Note: Standard errors in brackets. $\dagger$ p<0.1; *p<0.05; **p<0.01; ***p<0.001

g. Regression results without controls

There is a possibility that the identified correlations could only be conditional on other included control variables, possibly accentuated by small sample sizes at the monthly level. While the presented correlation plots in Appendix 2a. already gives some evidence that this is unlikely the only reason, the following table presents regression results for the individual independent variables without controls. ARDL models are estimated again and lag lengths extended until there is no strong evidence for autocorrelation in the residuals anymore according to Breusch-Godfrey tests.

Table 5: Regression results without control variables

	Dependent variable:	
	Spreads between Interest Rates on Greek and German Sovereign bonds	
	M1 Weekly	M6 Monthly
	(1)	(2)
Δ Spread$_{t-1}$	-0.115^* (0.056)	0.251^* (0.115)
Δ Spread$_{t-2}$	-0.016 (0.056)	-0.271^* (0.119)
Δ Spread$_{t-4}$	-0.054 (0.055)	
Δ Spread$_{t-3}$		0.183 (0.119)
Δ Number of Negative-Uncertain Articles	0.144^{**} (0.044)	0.149^{***} (0.041)
Δ Number of Negative-Uncertain Articles$_{t-1}$	$0.087^{\dagger}$ (0.049)	0.003 (0.045)
Δ Number of Negative-Uncertain Articles$_{t-2}$	0.046 (0.045)	0.069 (0.044)
Δ Number of Negative-Uncertain Articles$_{t-3}$		0.089^* (0.043)
Intercept	0.023 (0.068)	0.072 (0.196)
Breusch-Godfrey Test (AR1)	0.49	0.35
Breusch-Godfrey Test (AR2)	0.4	0.53
Breusch-Godfrey Test (AR3)	0.55	0.6
BIC	1091.92	317.31
Observations	324	74
R^2	0.044	0.372
Adjusted R^2	0.026	0.306

Note: Standard errors in brackets. †p<0.1; *p<0.05; **p<0.01; ***p<0.001

3. Third step: Credit ratings as alternative explanation

In many contributions analyzing and estimating determinants of spreads between Greece and Germany, the role of credit ratings from the big agencies is emphasized. Theoretically, we believe that these ratings are closely related to future narratives. Credit rating agencies are merely contributing to an imagined future by taking past data and experience - in a somewhat intransparant way - to give an evaluation of the future. They strongly "rely on the assumption that ontological indeterminacy does not exist" (Besedovsky 2018:253). Their practices are based on this assumption and they offer institutionalized suggestions for future developments (cf. Besedovsky 2018). However, economists argue that the announcements of downgrades and changes in credit ratings by the big agencies matter as new information available to investors that is accordingly priced in by markets. Therefore, we checked whether this alternative explanation diminishes the explanatory power of our main measure for negative narrative construction, by including a quantitative scale of credit ratings into our models.

The data we used to control for the impact of credit ratings stems from a publicly available collection (TradingEconomics 2019b, 2019a). As a first step we transformed the credit rating scheme of the three most important rating agencies Moody's, Standard & Poors, and Fitch into a simple metric scale counting from 1 to 24.

However, as for example Wolfinger et al. (2018:11) argue, it makes intuitive sense to use the spreads between credit ratings of Germany and Greece, since our dependent variable is also the spreads. It is a problem that Germany was rated with the highest rating AAA throughout the whole period, except that the outlook - and not the rating - was lowered twice in our period of observation: a negative outlook was given first on 5 December 2011, and then on 23 July 2012. Therefore, we include a scale for the outlook of rating agencies. Outlooks are not a change of the credit rating but indicates that a downgrade or upgrade might happen in the near future. This can be assumed to also affect investors' behavior and assessment of the future. We therefore added the following scores depending on the outlook for both Germany and Greece.

We summed up these two scales for every rating agency to take into account that they announce and grade independently. This way, we arrive at a theoretical scale ranging from 3 (Aaa from Moody's and AAA from S&P and Fitch) to 70 (C from Moody's and D from S&P and Fitch). Positive and negative outlooks are treated as equivalent to a downgrade as steps between the ratings. This is a somewhat abstract measure but takes into account different timing of the grading and outlook announcements, as well as that when three rating agencies lower their rating this is probably more meaningful than only one. We then take the difference of this

Table 6: Transformed scale of credit ratings

Moody.s	S.P	Fitch	Value
Aaa	AAA	AAA	1
Aa1	AA+	AA+	2
Aa2	AA	AA	3
Aa3	AA-	AA-	4
A1	A+	A+	5
A2	A	A	6
A3	A-	A-	7
Baa1	BBB+	BBB+	8
Baa2	BBB	BBB	9
Baa3	BBB-	BBB-	10
Ba1	BB+	BB+	11
Ba2	BB	BB	12
Ba3	BB-	BB-	13
B1	B+	B+	14
B2	B	B	15
B3	B-	B-	16
Caa1	CCC+	CCC+	17
Caa2	CCC	CCC	18
Caa3	CCC-	CCC-	19
Ca	CC	CC	20
/	C	C	21
C	RD	DDD	22
/	SD	DD	23
/	D	D	24

Table 7: Transformed scale of credit ratings

Outlook	Value
positive	-2
positive watch	-1
stable	0
n/a	0
under review	0
negative watch	1
negative	2

scale for Greece subtracted by that for Germany. This way we have a credit rating spread measure.
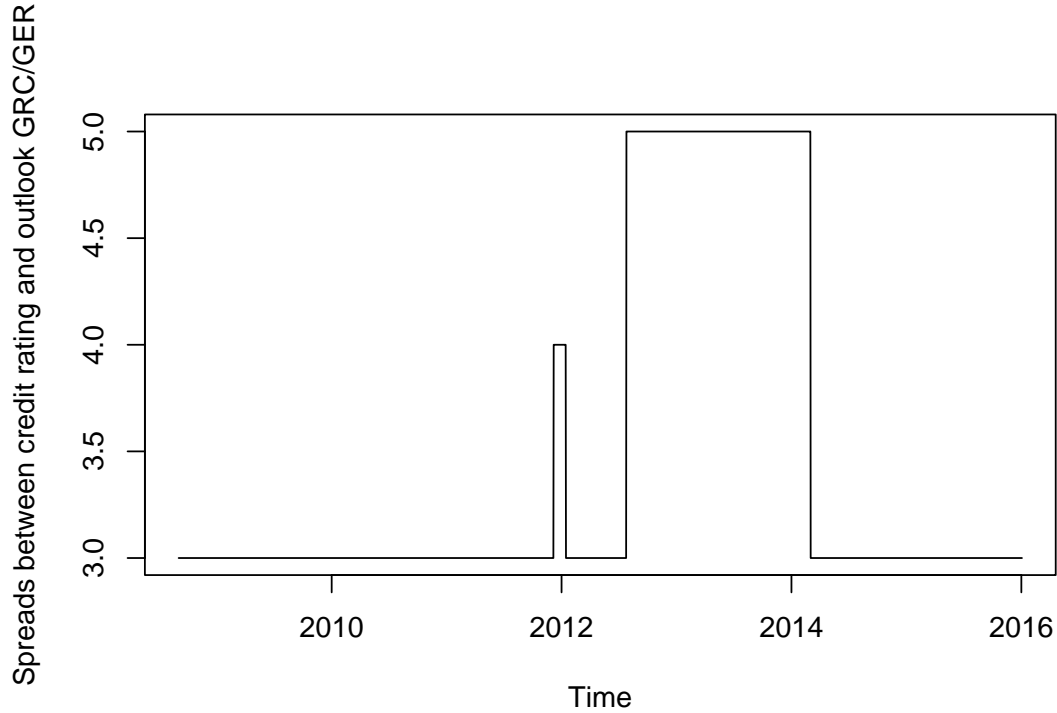
Finally, however, KPSS and Dickey-Fuller tests suggest that this measure is not stationary even at first differences and therefore I(2). One could just take the second difference although this would make the measure even more abstract. In addition to that, Gibson, Hall, and Tavlas (2015:123–24) suggest using credit ratings only net of the endogenous macroeconomic fundamentals. In their modelling of Greek spreads in the sovereign debt crisis, they want to evaluate the impact of credit rating announcements disregarding the development of macroeconomic fundamentals which they depend on. To achieve this, they regress their credit rating scale on their measures for macroeconomic fundamentals and use the residuals as an indicator for the effect of credit ratings controlling for changes in macroeconomic fundamentals. We follow this procedure and use OLS regression to estimate our just described credit rating spread scale with projected Debt/GDP ratio, projected government balance, as well as debt relative to Germany - our measures for fundamentals which we already used in the main analysis.
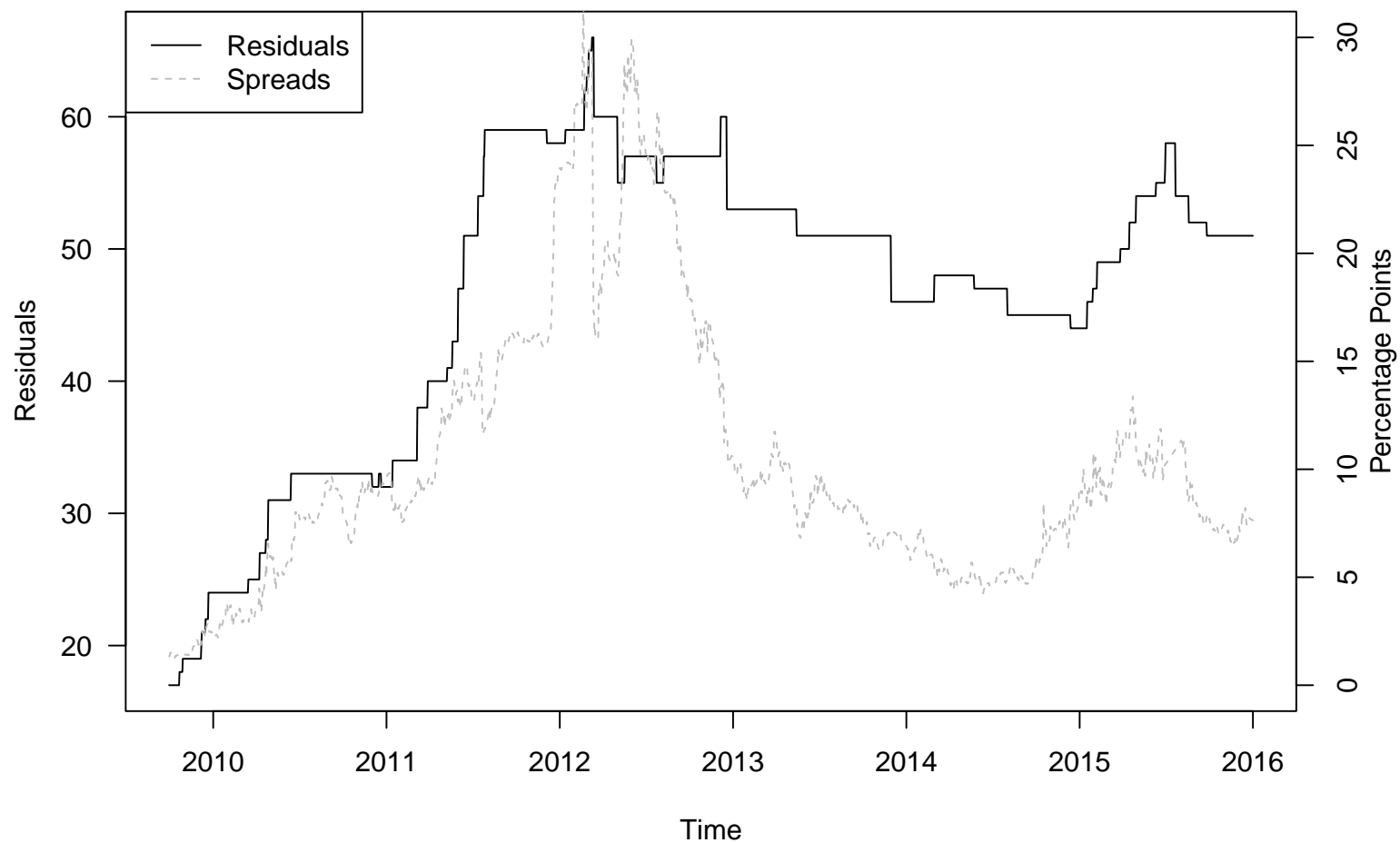
Figure 15: Residuals from an OLS model estimating the credit rating and outlook spreads (see above) on the basis of proj. Debt/GDP ratio and projected government debt, and the debt relative to Germany. The result is the development of credit ratings net of the development of (projected) macroeconomic fundamentals. Sovereign bond spreads between Germany and Greece are also included as a reference.

The residuals are then non-stationary, as suggested by KPSS and Dickey-Fuller tests and also theoretically more interesting for our purpose. We include the residuals as a measure of credit ratings into our models from the main analysis. The results give even more confidence in our measure of negative narrative construction. When looking closely, Figure 14 already suggests that credit rating spreads (net of fundamentals) rather seem to follow the bond spread development than the other way around. However, an exception is the beginning of the crisis where they also seemed to play a role and possibly contributed to the initiation of the crisis by giving a shock to investors' assessment of the Greek future credibility. But how does this affect the explanatory power of our measures for negative narrative construction in the expert discourse? Table 4 presents the results for our models including our measure for negative narrative construction when controlling for credit rating spreads (as residuals).

Table 8: Regression results including credit ratings as alternative explanation

	Dependent variable:		
	Spreads between Interest Rates on Greek and German Sovereign bonds		
	M1 Weekly	M6 Monthly	M7 ECM Monthly
	(1)	(2)	(3)
Δ Spread$_{t-1}$	0.108† (0.055)	0.240* (0.108)	
Δ Spread$_{t-5}$	0.045 (0.052)		
Δ Projected Debt/GDP	0.249*** (0.032)		
Δ Projected Government Balance	0.079† (0.047)		
Δ Spread$_{t-2}$		−0.360** (0.119)	
Δ Spread$_{t-3}$		0.304** (0.104)	
Spread$_{t-1}$			−0.119** (0.035)
Δ Spread$_{t-1}$			0.190† (0.110)
Δ Spread$_{t-2}$			−0.330** (0.102)
Δ Spread$_{t-3}$			0.205† (0.103)
Δ Number of Negative-Uncertain Articles	0.053† (0.030)	0.085** (0.027)	0.109*** (0.029)
Δ VIX	0.050† (0.026)		
Δ Credit Rating Residuals	0.291*** (0.055)	−0.034 (0.067)	−0.033 (0.064)
Δ Projected Debt/GDP$_{t-1}$	−0.127*** (0.035)		
Δ Projected Debt/GDP$_{t-5}$	0.038† (0.022)		
Δ Credit Rating Residuals$_{t-1}$	−0.137* (0.057)		
Number of Negative-Uncertain Articles$_{t-1}$			0.121** (0.038)
Δ Projected Debt/GDP$_{t-11}$		0.124* (0.054)	0.117* (0.051)
Δ Number of Negative-Uncertain Articles$_{t-2}$		0.049† (0.029)	
Δ Number of Negative-Uncertain Articles$_{t-1}$			−0.073* (0.032)
Intercept	−0.021 (0.062)	−0.065 (0.200)	0.202 (0.375)
Breusch-Godfrey Test (AR1)	0.55	0.45	0.54
Breusch-Godfrey Test (AR2)	0.16	0.75	0.78
Breusch-Godfrey Test (AR3)	0.29	0.9	0.82
BIC	1023.67	318.77	314.97
Observations	322	75	75
R^2	0.247	0.369	0.465
Adjusted R^2	0.223	0.303	0.391

Note: Standard errors in brackets. †p<0.1; *p<0.05; **p<0.01; ***p<0.001

The results show that, on the weekly level, credit ratings clearly seem to have an independent effect which underlines the relevance of credit ratings on the weekly level where they are more relevant than what we can measure as negative narrative

construction. When looking at the monthly level the story is different. Credit rating residuals do not show significant effects anymore but negative uncertain articles do. The measure for negative narrative construction continues to be an important explanatory factor on the monthly level while credit rating spreads do not seem to explain much. Since the credit rating variable does not seem to add much on the monthly level, one could exclude it and arrive back at the model from our main analysis.

To sum up, we have strong theoretical reasons to believe that credit ratings are to some degree an independent factor influencing future narratives - and therefore measure another, institutionalized dimension of negative narrative construction. On top of that, we can also show empirically that negative narrative construction in the expert discourse remains significant when including a measure for credit rating and outlook spreads in two out of three of our models. Credit ratings therefore do seem to matter as an independent explanatory factor. Nevertheless, we believe that it is only another factor measuring how investors' perception of the future is influenced, by institutionalized forecasts of credibility which then fuels the expert discourse on Greece's future credibility and possible default.

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