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Greece and the media – A qualitative assessment of the media impact on credit conditions in the Greek debt crisis

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To what extent did the global media affect credit conditions in the Greek debt crisis? We study qualitatively the causal link in newspapers between events and interest rates in the Greek debt crisis on dates with strong changes in the Greek interest rate. We relate our results to a quantitative measure of media coverage using topic models and examine days with a high level of the quantitative topic series. We find extensive news coverage on most dates. A causal nexus of news coverage to credit conditions is possible on the majority of dates. The quantitative news measure from topic modeling points to articles relevant to the Greek debt crisis.

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1. Introduction

"Whatever we know about our society, or indeed about the world in which we live, we know through the mass media." (Luhmann, 2000, p. 1)

Niklas Luhmann has shaped our understanding of the mass media as "[…] one of the function systems of modern society […]" (Luhmann, 2000, p. 8). It has become common for the mass media to play an important role in spreading ideas, events and narratives. They diffuse truths and define them. Seemingly, for exactly this role – the harbinger of potential or contested truths – the media have come under fire in recent debates and have been subject to criticisms. The interrelationship between the mass media and the financial markets has been highly discussed in the broad field of the social sciences ever since the global financial crisis in 2008. In particular, it is likely that new information covered in the global mass media has also played a crucial role in the Greek debt crisis. Recent studies point to the fact that the media effectively influenced Greek credit conditions and the credibility of the Greek economy (see Antoniades, 2012; Bickes, Otten, & Weymann, 2014; Juko, 2010).

The Nobel laureate Robert Shiller (1987, 2015, 2017) has highlighted the importance of news and narratives for the economic and financial field. As Shiller states, financial actors frequently refer to reports and events covered in the media when elucidating their investment decisions. Hence, new information as well as narratives about the projected future outlook covered in newspaper articles are quite likely the causes of investment decisions. In that sense, the news media contribute to the creation of expectations that are required for economic and financial activities (Beckert, 2016). For an investor, one advantage of the global media is that the provided news is usually commonly available information and allows one to anticipate the interpretations of other actors (see for instance Jann, 2018). The problem with this theoretically fairly reasonable relationship is that it is empirically difficult to pin down the media as the actual motive of financial actions. The global financial crisis of 2008 sparked new studies on the impact of the media on financial markets or interest rates (Bhanot, Burns, Hunter, & Williams, 2014; Goetzmann, Kim, & Shiller, 2016; Griffin, Hirschey, & Kelly, 2011. For an overview of recent and historical advances in the financial literature see Tetlock, 2014). The results basically suggest, similar to previous research, that the media certainly play a role, although it is difficult to determine the direct link between newspaper articles and stock markets (see Cutler, Poterba, & Summers, 1989; Niederhoffer, 1971). For a single market, Roll (1984) highlighted a link between orange juice and the weather. He revealed empirically the news effect of some changes in weather conditions on the orange juice futures market, while other relevant weather conditions were seemingly neglected by market participants.

Following Luhmann's reasoning of truths constructed by the media, there must be a causal nexus between the system of the mass media and the system of financial markets. However, can we also trace the relationship with respect to the Greek debt crisis for Greece and the media?

In a recent study, Daniel, Neubert, & Orban (2018) apply the novel quantitative method of topic modeling to a large dataset of global newspaper articles, thereby illustrating one of Luhmann´s requirements for research on the function of mass media: "Any more precise analysis and empirical research in particular will surely have to start from that part of the media which provides the most direct portrayal of reality and is indeed declared and perceived in this way: news and in-depth reporting" (Luhmann, 2000, p. 78). Topic models are a way of classifying the content of a large number of articles into topical categories. Although topic models are a complex statistical concept, they aim to reduce the complexity of large text corpora by revealing the hidden structure between words and documents. The study concludes that "events concerning the Greek debt crisis affect financial markets via global news coverage. Events that go along with media coverage affect Greek bond yields on the same day or the days following. This is not the case for events that are not covered" (Daniel et al., 2018, p. 34).

In this paper, we ask two questions. Can we discover a causal nexus between media coverage and Greek credit conditions on specific days in newspaper articles? Can we relate a systematic qualitative study of newspaper articles to the quantitative measure of news coverage of the Greek debt crisis as proposed by Daniel et al. (2018)?

To understand this potential causal nexus, we build on Luhmann´s system theory of mass media. Thus, our study is based on the following theoretical hypothesis: "It is only communication (or in other words, the system of the mass media) that gives facts or events a meaning" (Luhmann, 2000, p. 37). For a sample of articles published in global newspapers on 17 days from 2009 to 2014, we systematically and qualitatively examine this causal link between articles, covered events, and changes in Greek interest rates. We select dates and articles with strong changes in the Greek bond yield and according to the proposed quantitative measure of news coverage of the Greek debt crisis. We then compare our results to the topic modeling approach.

Our results point to a weakly significant effect. In the majority of surveyed dates, news coverage provides an explanation for the stock market reaction and could therefore causally move the Greek interest rate in the expected direction. On some dates, the changes in Greek credit conditions appear to be driven by forces that go beyond the narration in the news reports or a simple “information-reaction” relationship between the media and financial markets. The topic modeling approach reveals relevant articles on each sample date. This study therefore provides evidence for a causal link between the news coverage as measured by topic models and Greek credit conditions that goes beyond statistical correlation.

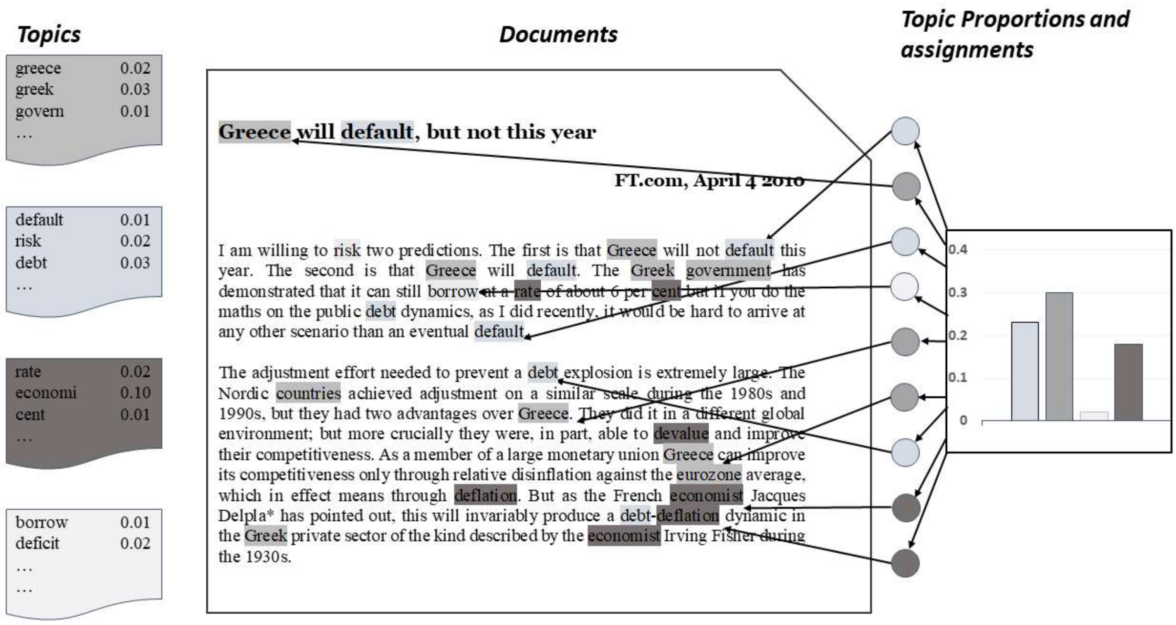
2. Analysis

Before we begin with the qualitative analysis, we present the concept of topic modeling applied in Daniel, Neubert, & Orban (2018) to measure news coverage of the Greek debt crisis. Our intention is to use this measure of news coverage in our selection process of newspaper articles. Subsequently, we relate our qualitative results to the news coverage according to topic modeling.

2.1. Topic models – what they are and how we utilize them

Topic models are a way of classifying large text corpora into topical categories. They reveal thematic connections between words and texts using statistical inference. Following Blei, Ng, & Jordan (2003), a topic is defined as a distribution over words. Some words occur together relatively more often than other words.

Figure 1: The document-generating process: Topic distributions (left), documents with color-coded topics (center) and the topic shares of the text (right)



Left-hand side: exemplary topic distributions of four topics; middle: exemplary document with topics highlighted by gray-tones; right-hand side: exemplary topic shares of the document. Gray dots represent the author's word choices according to topic distributions and proportions. The drawn words are then placed into the text. Source: Münchau (2010), Financial Times, April 4, 2010. Figure taken from Daniel et al. (2018) and related to D. Blei (2012).

Texts are mixtures of topics, with each topic having a positive (or zero) share in each document or newspaper article. The advantage of topic models, compared to qualitative methods, is that they explore large corpora of text articles that would be impossible to read in their entirety – let alone codify manually.

One advantage over other quantitative methods such as word searches taken from a dictionary (or frequency analysis) is that topics contain a variety (or all) words in the texts: We may identify many articles concerning the Greek debt crisis by searching for the terms "Greek", "debt" and "crisis"; however, we may fail to uncover articles that only contain the terms "Athens", "loan" and "bailout".

The topic model reveals such hidden relationships between words. Consequently, we gain a more relevant sample (D. M. Blei & Lafferty, 2009; D. Blei, 2012).[1]

In Figure 1, we provide a hypothetical example of the document-generating process for an article assumed under topic modeling (in the form of the so-called latent dirichlet allocation). On the left-hand side, the topics are lists of words ordered by probability. Assuming that topics exist before an article, an author who writes the article first choses the share of each topic in the article (right-hand side). The topic shares should reflect what the author intends to write about. To create the text, the author then selects words from the topic distribution according to the topic shares in his article and the probabilities of each word in each topic (center) (D. Blei et al., 2003).

In reality, we do not know whether a text was ever created in such a statistical manner. Topic modeling provides a tool for inferring topic distributions and topic shares by comparing a large number of documents and classifying words by their appearances in different texts. That is, we compare the distributions of words over the entire dataset of newspaper articles (see Blei, 2012; Daniel et al., 2018).

Table 1: Top ten words in five exemplified topics ranked by probability in each topic

	Garden	Economy	Greece debt crisis	Syria	Obama
1	garden	economy	greec	syria	obama
2	tree	economi	greek	syrian	presid
3	mountain	Polici	bailout	assad	administr
4	forest	Fiscal	Imf	regim	white
5	anim	govern	countri	rebel	hous
6	dog	growth	fund	opposit	barack
7	plant	country	european	govern	american
8	flower	reform	financ	forc	bush
9	bird	deficit	govern	war	washington
10	natur	crisi	minist	lebanon	polici

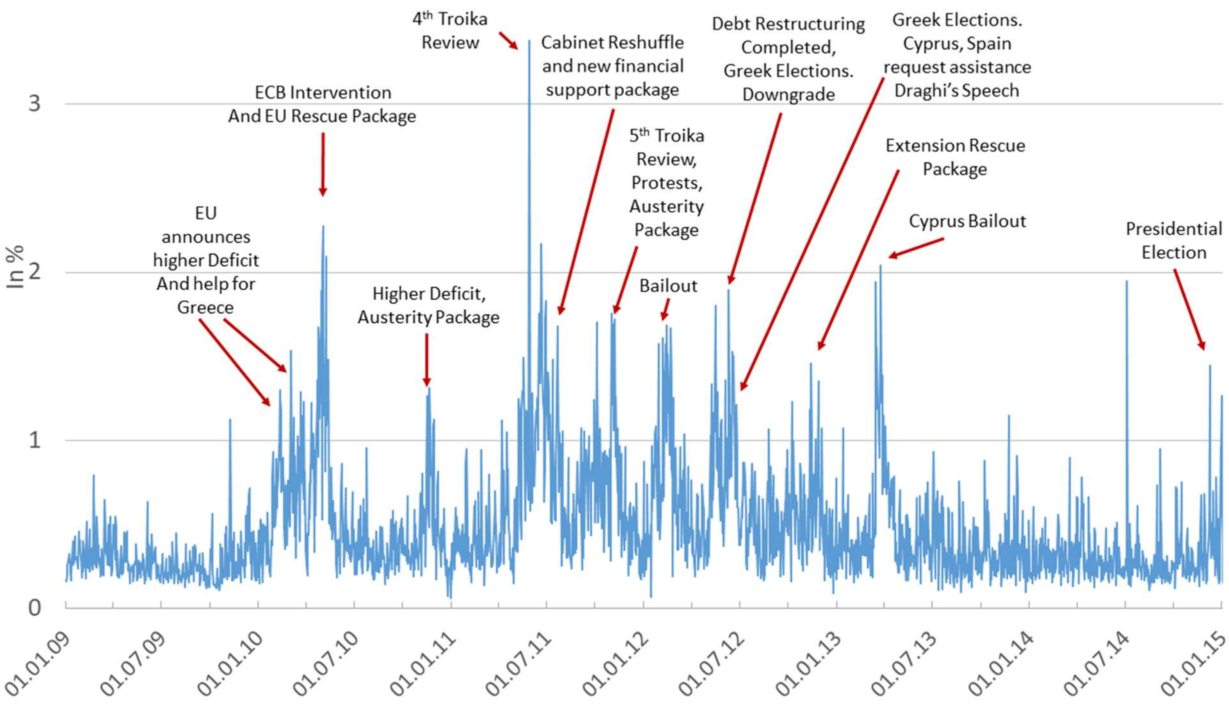
Top ten words in five exemplified topics. We rank the words in each topic by probability. The imperfect forms of the words are due to the stemming process that transforms related words such as "financial", "finance" and "finances" into one term: "financ". In the center, we highlight the topic of interest: the Greek debt crisis topic.

[1] Other studies that apply quantitative text analysis in the field of system theory are Roth et al. (2017) and Roth et al. (2018), which make use of the frequency counts of the Google Ngram Viewer. Regarding topic models, Wehrheim (2018) provides an overview of published studies.

Daniel et al. (2018) have applied topic models to a corpus of 431,293 articles from *The International New York Times* / *The International Herald Tribune* (*INYT*) and *Financial Times* (*FT*) over the period 2009 to 2015 and propose one topic in relation to the Greek debt crisis as a measure for news coverage.[2] From the estimated topic model, they compared all estimated topics and identified one topic that contained words with the highest probability related to Greece, financial markets and the debt crisis.

In Table 1, column 3, we show the ten words with the highest probability in this topic. In the other columns, we depict the top terms of topics with different topical content as a comparison. We denote each topic by a meaningful expression as headline. The topic presented in the third column has the top terms "greec" and "greek". These words have the highest probability in the topic. The word list of this topic also contains financial terms, such as "finance" and "fund", stemming from the International Monetary Fund (IMF). It further contains vocabulary related to crises, such as "bailout" as a top term. A newspaper article with a high share of the Greek debt crisis topic will therefore likely contain topical content about the Greek debt crisis. We would expect no such content for articles with a high share of the remaining topics shown in Table 1: "Garden", "Economy", "Syria" or "Obama". By taking the average share of the Greek debt crisis topic over all articles on each day, Daniel et al. (2018) construct a measure of news coverage of the Greek debt crisis over time. By this measure, we are able to compare news coverage over time between days and coverage of other topics.

Figure 2: Greek debt crisis topic – daily average share 2009-2014



Daily average share of the Greek debt crisis topic in The International New York Times and Financial Times, January 1, 2009, to January 1, 2015.

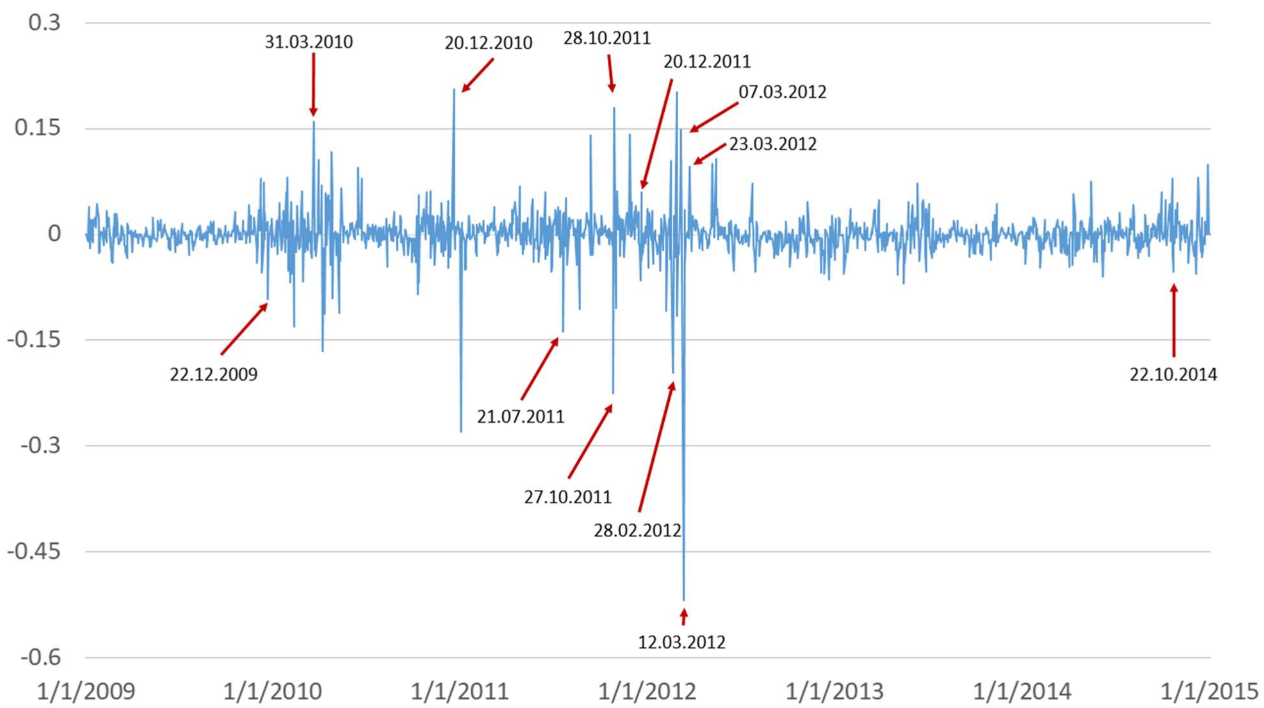
[2] The corpus of documents was collected from the LexisNexis and ProQuest online databases and contains articles from the online and paper editions of both newspapers. The corpus was organized by deleting frequent and rare words and by cutting the word endings (the so-called stemming process).

In Figure 2, we plot the resulting daily media coverage of the Greek debt crisis from 2009 to 2014. We observe some periods and days with more news coverage according to the quantitative news measure. The periods that coincide with extensive news coverage include relevant dates such as, for example, the negotiations with the so-called troika, the bailouts, and elections. In relating the news measure to financial markets, Daniel et al. (2018) indicate a correlation of news coverage and events with Greek credit conditions.

2.2 Choice of Dates

We approach the question of a causal link between media and financial markets by carefully examining 85 articles on 17 days in *The International New York Times* and *Financial Times* with respect to the Greek debt crisis. Our choice of articles relies on two considerations. First, relevant articles should trigger considerable changes in financial markets beyond the daily white noise observed for most traded stocks and bonds. We therefore look at twelve dates with strong changes in the bond yield. We consider the Greek government bond yield as a relevant indicator of how markets assess Greek credit conditions. Second, dates with considerable news coverage may point to important events with respect to the Greek debt crisis that may trigger market reactions. We therefore add to our selection sample articles on five dates with the highest level of the Greek debt crisis topic as a measure for news coverage.

Figure 3: Choice of twelve dates and daily changes in the Greek bond yield, 2009 to 2014



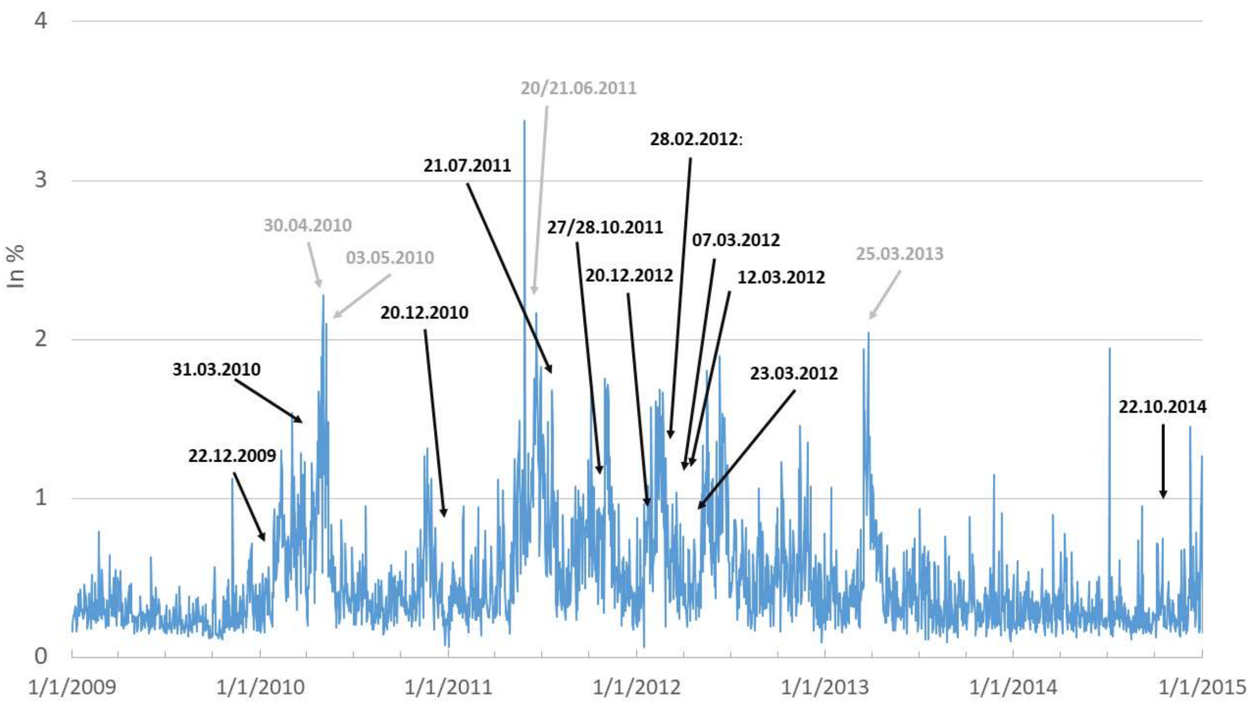
Choice of dates and daily changes in the yield to return of Greek government bonds, January 1, 2009 to January 1, 2015. Twelve dates are denoted in red.

The reasoning behind our selection originates with Niederhoffer (1971) and Cutler, Poterba, & Summers (1989): News should theoretically matter and induce market reactions. This idea can be deduced from Luhmann in that media provides information that – if considered relevant – also results in actions by recipients on financial markets.

In detail, our choice of dates is as follows. We choose six days with strong increases and six days with strong declines in the Greek bond yield on any trading day between 2009 and 2014. The strongest changes from one trading day to the next almost entirely occurred over weekends from Friday to Monday (that is, over a three-day period). Due to this possible bias, we decided to select ten days for our sample of trading days that were not Mondays, and then added the Mondays with the strongest increase and the strongest decline in the bond yield. We denote the daily changes in the bond yield along with our choice of dates in Figure 3. As shown, the selected dates span from 2009 to 2014 almost over the entire evolution of the Greek debt crisis (before the SYRIZA government in 2015).[3]

Next, we chose the five trading days with the highest news coverage according to the Greek debt crisis topic. Since we intended to compare our results with immediate market reactions, we did not include weekends and holidays. In Figure 4, we depict the quantitative measure of news coverage of the Greek debt crisis according to topic modeling and the sample selection of 17 dates from 2009 to 2014.

Figure 4: The Greek debt crisis topic and selected dates



The Greek debt crisis topic and selected dates. We highlight days with strong changes in the bond yield using a black font and arrows, while dates with high levels of the Greek debt crisis topic are in gray. For clarity, we use only one arrow for the pairs October 27/28, 2011 and July 20/21, 2011.

In Table 2, we provide an overview of all dates and the changes in the bond yield, as well as the Greek debt crisis topic measure. We further state the weekday as well as whether the date was chosen due to the bond changes or due to the topic measure. To trace a causal nexus from news coverage to a reaction in the Greek bond yield, we examine five articles on each day. Articles were taken from the dataset collected by Daniel et al. (2018). We read the five articles with the highest

[3] We defined changes in the Greek interest rate as: $\boldsymbol{\Delta X_t = Ln(x_t) - Ln(x_{t-1})}$. On average, daily changes were 0.4%. Our selected dates with respect to bond prices had a daily change in the bond yield higher or lower of at least one standard deviation from the mean (standard deviation: 3.1), which means we considered dates with at least 3.5% increases or -2.7% declines in the bond yield in our sample selection.

degree of news coverage regarding the Greek debt crisis according to the topic model.[4] Subsequently, we will discuss whether topic modeling is a relevant indicator for news coverage regarding the Greek crisis and whether it is also relevant for financial markets.

Table 2: Selected Dates

No	Date	Weekday	Topic	Bond Change	High Topic Date
1.	December 22, 2009	Tuesday	0.37%	-9.20%	
2.	March 31, 2010	Wednesday	0.40%	10.57%	
3.	April 30, 2010	Friday	1.89%	-0.60%	yes
4.	May 3, 2010	Monday	2.28%	0.42%	yes
5.	December 20, 2010	Monday	0.26%	20.64%	
6.	June 20, 2011	Monday	1.90%	1.24%	yes
7.	June 21, 2011	Tuesday	2.17%	-2.93%	yes
8.	July 21, 2011	Thursday	1.68%	-13.74%	
9.	October 27, 2011	Thursday	0.89%	-22.58%	
10.	October 28, 2011	Friday	0.56%	17.96%	
11.	December 20, 2011	Tuesday	0.37%	5.91%	
12.	February 28, 2012	Tuesday	0.57%	-11.53%	
13.	March 7, 2012	Wednesday	0.68%	14.91%	
14.	March 12, 2012	Monday	0.77%	-51.81%	
15.	March 23, 2012	Friday	0.24%	9.58%	
16.	March 25, 2013	Monday	2.04%	-2.54%	yes
17.	October 22, 2014	Wednesday	0.21%	-5.27%	

Selected dates with the percentage share of the Greek debt crisis topic measure and the changes in the bond yield. For each date, we denote the weekday and whether the day was selected due to a high share of Greek debt crisis topic.

2.3 Qualitative analysis

In this chapter, we present the results of our content analysis aligning roughly with Mayring (1985, 1992, 1999, 2000) and Scheufele and Engelmann (2009). Remember, we intend to examine whether there is a causal nexus between media coverage and Greek bond yields, thereby testing the hypothesis that it is communication via mass media that gives facts or events meaning (see Luhmann 2000, p. 37).

Our analysis of the sample of articles based on a set of categories. Table 3 states the questions we pose for each category. By the first category, we verify whether an article is relevant in our context by asking whether there is a relationship to the Greek debt crisis. We verify the relevance if the article covers Greece and either financial markets or the debt crisis. By the first category, we are able to verify the validity of the topic modeling approach for each article.

As a second category, we check whether relevant events in relation to the Greek debt crisis are covered in each article. As part of this category, we further test, if the mentioned events occurred on the same day, in the previous days or at a future date. This category provides evidence for the

[4] In a few cases, we database contains two versions of an article that are almost similar. In that case, we chose the one with the higher topic level. We further checked the new coverage and bond changes on the previous and next two trading days, as well as news coverage over the weekends in the case of Mondays or Fridays.

transmission of events via the media as well as the timing of events. Third, we ask for the attitude of the article towards the developments in Greece. We do so because the stance of the news article towards Greece could matter for financial markets and could differ from expected interpretations of certain events. We then test for possible relationships between news coverage and market reaction. As a fourth category we ask whether the market reaction of Greek government bonds matches the event covered in the news, and fifth, whether the market reaction matches the attitude towards Greece. From the content analysis, we then discuss possible causal links. We infer types of days for which a causal link is likely or not.

Table 3: Categories incorporated in the qualitative analysis

	Category
1.	**Is there a relationship to the Greek debt crisis?** *1.a Does the article relate to Greece?* *1.b Does the article relate to the debt crisis?* *1.c Does the article relate to financial markets?*
2.	**Are there relevant events covered in relation to the Greek debt crisis?** *2.a Is there a relevant event covered?* *2.b Is the event covered occurring today?* *2.c Is there an indication of a relevant event in the future?* *2.d Is there a relevant event covered that occurred on previous days?*
3.	**What is the attitude of the article towards the developments in Greece? (positive, neutral, negative)**
4.	**Does the market reaction match the event?**
5.	**Does the market reaction match the attitude of coverage?**

To make our analysis traceable, we provide our coding results for each article in the Appendix (see Table A.2 for the coding results, for references of selected articles see Table A.3). This structured analysis focusses exclusively on the five articles on each day. In some situations, influential media coverage could have occurred not exactly on those days. To back our results and for their interpretation, we therefore further consider media coverage and changes in bond yield up to two trading days (including weekends) before and after our sample days. We do so if the sample days alone cannot deliver coherent results, although hidden triggers of media coverage seem at work around the sample days (especially over the weekends), but are not reflected on the single day. In those few cases, the structured qualitative results focusing exclusively on the five articles with the highest topic share on each sample day can arrive at different conclusions than our final interpretation.

We start with the days for which we argue that an impact of media coverage on Greek interest rates is possible. Referring to Table 2 (No. 1), the first day is December 22, 2009, with a 9.20 percent decline in the bond yield. In the newspaper articles on that day, we recognize that the rating agency

Moody's downgraded Greece from A1 to A2 (A. Raval, 2009, *FT*: "Banks lead European equity rally").[5] This is remarkable and appears to be a contradictory indication, since from a downgrade, we would expect an increase in the bond yield instead. The five articles with the highest Greek debt crisis topic share all address the Greek debt crisis, and they reveal the likely reason for the seemingly contradictory market reaction: "Greek banking stocks gained after Moody's, the rating agency, downgraded the country's sovereign debt to A2 from A1 – not as bad as feared, after the two other main rating agencies S&P and Fitch both downgraded Greece below A earlier in the month" (A. Raval, 2009). In covering this aspect, the media gave the event a positive meaning, which deviated from the per se negative downgrade decision. Surely, the media could have influenced financial markets by reflecting the medium-term development of market expectations in contrast to the single daily event.

The next sample day of interest is May 3, 2010 (No. 4 in Table 2), a day with a high topic level. After Greece, the Eurozone and the IMF reached an agreement on a €110 billion aid package on Sunday, May 2, the ECB announced on the next day that it would accept Greek sovereign bonds as collateral to hedge liquidity supply. Considering this substantial measure, it is remarkable that there was only a slight 0.42 percent decline in the interest rate. For instance, we can compare this date with July 21, 2011, another day in our sample selection (see Table 2, No. 8). On this day, the so-called troika and Greece agreed on another program worth €109 billion, and the bond rate declined by 13.74 percent. Comparing the two dates, the small decline on May 3 is not the expected reaction. Both days show a high Greek debt crisis topic measure – 2.28 percent on May 3, 2010, and 1.68 percent on July 21, 2011. What can the articles in global newspapers tell us about the different market reactions and a causal nexus after the seemingly similar events?

We find substantial differences in media coverage. On July 21, 2011, articles addressed the abovementioned agreement. Media coverage conveyed the impression of a common agreement among the Eurozone, the IMF and – for the first time – private-sector investors facing the crisis: "European leaders have agreed a new EUR109bn bail-out of Greece under which private bondholders will be called on to participate for the first time, contributing a target of a further EUR37bn" (P. Spiegel, 2010, *FT*: "EU leaders agree EUR109bn Greek bail-out"). Another article quoted Josef Ackermann, then CEO of Deutsche Bank, saying, "We believe that taken together with the intention of the EU to improve the terms of its financial assistance to Greece, the recently strengthened economic reform program of the Greek government and the additional support of the IMF, this offer can contribute substantially to improving the competitiveness of the Greek economy" (Q. Peel, 2011, *FT*: "Bond swap plan is for Greece and Greece only").

On May 3, 2010, the media also addressed the previous day's agreement, but we observe considerable differences in coverage as compared to July 21. Neither the agreement and its potentially positive effects for Greece nor Greece's creditworthiness on financial markets were the focus; rather, it was the remaining uncertainty on several issues regarding Greece. First, the media questioned the fundamental enforceability of reforms: "While the economic lifeline for Greece is expected to reassure jittery markets, doubts remain as to whether Greece will be able to follow through on what amounts to a cultural revolution in the social contract between state and citizen. The shakeup of longstanding aspects of Greek life, from endemic tax evasion to overstaffed offices of idle employees,

[5] We refer to each newspaper article in the following analysis by the stated author, year and title. We denote the publication by either *FT* (*Financial Times*) or *INYT* (*International New York Times / International Herald Tribune*) if not stated already in the text.

has prompted fears that widespread social unrest could unhinge a Greek recovery" (Bilefsky and Thomas, 2010, *INYT:* "Greece to get bailout after agreeing to big cutbacks"; "I.M.F. and Europe to send as much as €120 billion to fight regional decline"). Second, the media addressed criticism of the austerity-oriented strategy. *The International New York Times* used a martial tone: "But some influential economists fear that such harsh measures risk killing the patient" (Bilefsky and Thomas, 2010, *INYT*: "Pain of austerity may stunt growth for years to come; Athens gets help but is it enough?"). Third, the media discussed the critical situation and position in German politics with respect to Greece (G. Wiesmann & J. Wilson, 2010, *FT*: "Germany seeks private sector support for Greek aid").

Therefore, the media coverage on the two days was seemingly important for the magnitude of the market reaction, as the events on those dates were relatively similar. Following Luhmann, one can argue that the media attributed a different meaning to fairly similar events. In reflecting similar events in different ways, the media's influence likely evoked different market reactions. On July 21, 2011, articles focused on the successful agreement on a rescue package, and a reasonable market reaction to a decreasing Greek bond yield occurred. On May 3, 2010, a comparably successful agreement on a rescue package did not induce a substantial decrease in the bond yield. The relevance of the media coverage thus provides a meaningful explanation for the reaction of financial markets.

This result is backed by another argument. We find no evidence that the media covered the second event that occurred on May 3, 2010. On that day, the ECB announced that it would accept Greek sovereign bonds as collateral. This announcement was of particular interest to financial markets because it provided a guarantee to Greek bond-holders – irrespective of current prices – to secure liquidity and therefore likely had a positive impact on Greek bonds, resulting in a reduction of interest rates. Since we know that the ECB announcement was not addressed by the daily global media, we see it as a counterfactual indication for the assumption that events transmitted via the media affect bond interest rates.

We find a quite similar case in our sample selection only a few days before May 3, 2010. On Friday, April 30, 2010, the only event covered by the media was the forthcoming round of emergency negotiations that were expected to come to a head over the weekend. Consequentially, the articles addressed different issues of uncertainty about the outcome (T. Barber, 2010: "Eurozone to hold emergency talks on Greece"; K. Hope, 2010, *FT*, "Papandreou says Greek survival at stake"; *Financial Times*, 2010: "Germans consider private bail-out"). The media coverage on this day was considerable, and the market reaction was in the expected positive direction although it was small (-0.60 percent, see Table 2, No. 3). There appears to be no new information, but the media credited the recent event with a different meaning.

December 20, 2010, was the day with the strongest increase in the bond yield in the period of observation (20.64 percent, see Table 2, No. 5). On this day, we find neither an event relevant to the Greek debt crisis nor substantial news coverage. Only one article addresses the Greek debt crisis by reflecting an expected downgrade: "Greek stocks also faced heavy selling as investors worried about a possible credit rating downgrade" (M. Stothard, 2010, *FT*: "Banco Popolare leads gains"). This article reflected the situation on bond markets towards Greece but above that had a general focus on European equity markets. It is therefore unlikely that this article alone could have provoked a substantial increase of more than 20 percent in the bond yield. Therefore, our qualitative analysis of new articles on the day alone would suggest that the market reaction does not match the media coverage on Greece (and as we indicate in Table A.2). Importantly, however, we observe the bond change from the previous trading day over the whole weekend since Friday, December 17. Taking into account the news articles over the weekend, media coverage can indeed explain the strong market reaction on Monday. The articles covered the results of the European Council summit on December 16, when the EU endorsed the establishment of the European Stability Mechanism (P. Spiegel, 2010, *FT*: "EU leaders signal commitment to bail-out fund"). On Saturday, December 18, the media addressed a lack of short-term measures (S. Castle & M. Saltmarsh, 2010, *INYT*: "E.U. pledges unity but avoids action"). In doubting the effectiveness of the established measures in the short-term and critically interpreting the results of the summit, the media possibly provoked the increase in the Greek bond yield and the market reaction certainly matches the media coverage over the whole weekend.

The next days of interest are June 20, 2011, and June 21, 2011 (see Table 2, Nos. 6 and 7). On June 20, the Eurogroup delayed a decision about another financial support package until the Greek parliament passed the next austerity program. On June 21, Greek Prime Minister Giorgos Papandreou faced a no-confidence vote in parliament as a result of new austerity measures. On June 20, the media covered the forthcoming no-confidence vote (S. Castle & N. Kitsantonis, 2011, *INYT*: "Euro zone officials weigh new bailout for Greece", P. Spiegel, 2011, *FT:* "EU delays EUR12bn loan for Greece") and shortcomings in Greek public administration (R. Donadio, 2011, *INYT*: "Greeks focus on tax cheating to put muscle into austerity measures"). As expected from the uncertain outcome of the coming no-confidence vote covered in the news, we find a moderate increase in the interest rate on June 20 (1.24 percent). The media impact on changes in the Greek bond yield is certainly reasonable on June 20, although it may be difficult to discriminate between the effect of the event and the effect of media coverage on financial markets unambiguously. On June 21, the news coverage highlighted Papandreou's success in the vote as an important outcome to ending uncertainty in Greek politics (R. Donadio & N. Kitsantonis, 2011a, *INYT*: "Papandreou vows to stay and untangle finance knot"; K. Hope, 2011, *FT*: "Papandreou survives confidence vote"). As expected, and possibly as a reaction to Papandreou's success or the extensive news coverage, we also find a strong decline in the interest rate on June 21 (-2.93 percent).

This reaction, however, appears minor when compared to the change in bond yields two trading days earlier. On June 17, 2011, the previous Friday, bond yields declined even more strongly, by 3.48 percent.[6] On that day, Prime Minister Papandreou announced the latest cabinet reshuffle and replaced his finance minister. Both events seem to be of particular interest to financial markets, but why did the market react more strongly to the government reshuffle than to the failed no-confidence vote?

The media articles on these two days reveal substantially different news coverage. On June 17, there is a clear focus on a strong-willed Prime Minister facing a difficult political situation after turbulent weeks. *The International New York Times* quoted him as saying, "You can rely on me and I will support the national effort to extract Greece from the crisis" (R. Donadio & N. Kitsantonis, 2011, *INYT*: "Papandreou vows to stay and untangle finance knot"). The article argued that Papandreou´s "announcement appeared to put to rest speculation that he would call early elections". The *Financial Times* reported that the Prime Minister had "replaced his finance minister in a broad cabinet

[6] Note that this day (June 17th, 2011) is not part of the list. We consider it here because we also checked the two trading days before and after each sample date.

reshuffle to counter widespread anger over tough new austerity measures essential to prevent Greece from a disastrous default" (K. Hope, 2011, *FT*: "Greece replaces finance minister").

On June 21, despite the positive turn in the no-confidence vote, the focus in the media shifted forward and the articles foreshadowed that the hardest part was yet to come: "European finance ministers failed to agree Monday on the expected disbursement of (EURO)12 billion in immediate aid to debt-laden Greece, delaying the decision until July and demanding that the Greek Parliament first approve spending cuts and financial changes that include a large-scale privatization program." (R. Donadio & N. Kitsantonis, 2011a, *INYT*: "European leaders put off Greece decision; Prime Minister issues call for autumn referendum to alter political system"). The *Financial Times* cited José Manuel Barroso, then president of the European Commission, as declaring, "If anyone thinks, 'Well, without the program agreed with the EU and the IMF [International Monetary Fund], we can still get by somehow, there's an alternative program', that's not true" (P. Spiegel, 2011, *FT*: "Barroso offers Athens austerity incentive").

Relating the changes in the bond yield on both days and the different content of news articles on June 17 and June 21, one can argue that different areas of emphasis in media coverage could have affected financial markets differently. It is possible that the smaller change in the bond yield on June 21 was – among other factors – influenced by media coverage that interpreted the success in the no-confidence vote as being less important than some relevant decisions in the future.

On October 27, 2011 (Table 2, No. 9), in the early morning, the Euro area summit agreed on a €130 billion rescue package and a haircut with private sector involvement. The news articles covered this event (J. Chaffin & K Hope, 2011, *FT*: "Bigger haircuts put strain on Greek banks"; P. Spiegel, S. Pignal & A. Barker, 2011, *FT*: "EU reaches agreement on Greek bonds"). It is therefore quite possible that media coverage had an influence on the strong market reaction to a 22 percent decrease in the bond rate on the same day. As both event and media coverage corresponded positively with respect to the Greek situation, the unique impact of media coverage on financial markets is difficult to discriminate unambiguously.

In the case of March 31, 2010, Moody´s downgraded five important Greek banks, and the bond yield increased by 10.57 percent (Table 2, No. 2). The increasing interest rate appears to be a market reaction to the downgrade of Greek banks. The only article with a focus on Moody´s decision reflected on the downgrade as being "not unexpected" and referred to a forecast by the Bank of Greece one week earlier, which revised the growth prognosis from -1.2 to -2.0 percent (K. Hope, 2010, *FT*: "Moody's cuts five Greek banks' ratings"). Similar to October 27, 2011, the event and the attitude of the media coverage corresponded with each other. Hence, a media effect on financial markets is likely but difficult to discriminate from the covered event.

The next day of interest is December 20, 2011 (Table 2, No. 11). On this Tuesday, the interest rate increased by 5.91 percent. Considering that there is neither an event related to Greece nor considerable media coverage with respect to the Greek debt crisis, there appears to be no direct influence on the bond yield via the media. However, the one article with a relationship to the Eurozone on that day addressed the critical situation in Italy and Ireland (D. C. Unger, 2011, *INYT*: "Inside the Eurozone, bracing for austerity, it is easy for Europe's political leaders to glibly prescribe fiscal austerity as an all-purpose cure for the debt crisis"; A. Beattie, 2011, *FT*: "Eurozone turmoil poses 'serious threat' to Irish economy"). Potentially, the media coverage of the critical state of the European debt crisis influenced the credit conditions of European countries with financial problems, including Greece.

For March 25, 2013, at first glance, the extensive media coverage (as indicated by the high share of the Greek debt crisis topic) does not indicate an impact on the change in the Greek bond yield (-2,54 percent, Table 2, No. 16), as we find no direct mention of Greece. The Eurogroup reached an agreement with Cyprus to stabilize Cypriot banks. There is no immediate link to the Greek debt crisis, except for the fact that Cypriot banks also held Greek sovereign bonds. Consequentially, we find news articles addressing the agreement with Cyprus among the articles with the highest Greek debt crisis topic share on that day (L. Alderman & J. Kanter, 2013, *INYT*: "Cyprus struggles to defuse its crisis"; L. Alderman & J. Kanter, 2013, *INYT*: "Small savers spared in latest plan to rescue Cyprus banks"; P. Spiegel, 2013, *FT*: "Eurozone wounded by Cyprus imbroglio. Reason prevails but the damage is done"). Two articles reflect potential positive side effects on Greece's situation (L. Alderman & J. Kanter, 2013, *INYT*: "Small savers spared in latest plan to rescue Cyprus banks; T. Buck, 2013, *FT*: "Relief and concern on eurozone periphery"). Quite possibly, the Cypriot crisis put pressure on the bond yields of most crisis countries within the Euro area, and it questioned the stability and strength of the euro as a currency. In turn, by reflecting the positive side effects of the solution of the crisis on Greece, media likely attributed a new meaning to the agreement between the Eurogroup and Cyprus.

On Monday, March 12, 2012, we find the strongest decline in bond prices from the previous trading day (51.81 percent, Table 2, No. 15) in our sample. The media had covered the successful restructuring of Greek sovereign debt from Friday, March 9 and over the weekend (L. J. Thomas, 2012, *INYT*: "Optimism as Athens closes in on debt swap; Sealing deal would lift the final obstacle to crucial rescue assistance"; K. Hope, 2012, *FT*: "Athens pushes bondholders to take losses"). Focusing on March 12 alone, news articles had already shifted their focus to other issues (P. Spiegel, 2012, *FT*: "Eurozone calls for new Spanish budget cuts"; N. Kulish & A. Lowrey, 2012, *INYT*: "For Lagarde and Merkel, warmth transcends differences") and therefore refuted a substantial direct impact of daily news coverage on this day. One could, however, argue that the remarkable decrease in interest rates on March 12 – the first trading day after the restructuring – was caused in part by this media coverage on the previous days regarding the debt restructuring, although the magnitude of the bond price change can be surely attributed to the nature of the event.

On Friday March 23, 2012 (Table 2, No. 14), the Greek bond interest rate increased by 9.58 percent. The news coverage included Greece, though only with a minor and positive focus on the debt crisis (R. Wigglesworth, N. Bullock & R. Cookson, 2012, *FT* "Once risky assets rise on the rally"). The news coverage on that day could therefore not be the reason for the strong bond increase. We find one potentially relevant event one day earlier: the looming increase of the European Stability Mechanism (P. Spiegel, 2012, *FT*: "EU urged to raise firewall to EUR940bn"). While this event would be good news for European-crisis countries such as Greece, the article also provides a possible explanation that would also allow for a negative market reaction: "The markets could consider the new lending capacity to be insufficient in the event that one or several large member states would need to be taken out of the market".

For the following days, we find no coherent causal links between media coverage and changes in the bond yield.

Having identified a likely impact of media coverage on credit conditions on October 27, 2011 (-22.58 percent), on October 28, news articles discussed the future aid package and the successful decision on a Greek haircut of October 26 rather optimistically (S. Erlanger & S. Castle, 2011, *INYT*: "Banks accept deal on Greek debts"; S. Erlanger & S. Castle, 2011a, *INYT* "Lenders agree to take 50% loss; focus turns to Italy"; J. Ewing, 2011: "A good bank plan for Europe, but is it good enough?"). However, the market reaction on October 28 seems contradictory. The interest rate increase of 17.96 percent (Table 2, No. 10) may presumably be considered a counterreaction to the extensive decrease one day previously and cannot be explained by the news.

On February 28, 2012, we find a drop in the bond yield comparable to October 28, 2011 (Table 2, No. 12). After a Standard & Poor´s downgrade of Greece and a bond interest rate increase by 20.18 percent on the previous day (i.e., February 27, which is not part of our sample), the interest rate decreased by -11.53 percent on the 28th. We identify one event relevant to the Greek debt crisis on February 28: the ECB announced the suspension of its acceptance of Greek bonds as collateral (J. Wilson, 2012, *FT*: "ECB suspends use of Greek bonds as collateral"). Further, an opinion article criticized Europe´s focus on austerity measures in general (P. Rayment, 2012, *FT*: "Let Marshall plan inform current EU attitudes to Greece"). The ECB announcement could not be positively received by financial markets, and the latter article was only a single affirmation of a well-known criticism of the European rescue policy. Therefore, we cannot confirm an impact of media coverage on the bond yield decline on this day. Rather, there may have been a counterreaction in response to the extensive increase in the bond yield the previous day.

March 7, 2012, came with a remarkable increase of 14.91 percent in the bond yield (Table 2, row 13). Articles relating to the debt crisis discussed the projected private sector involvement in the forthcoming Greek haircut. However, we argue that the potential effect of media coverage on March 7 should have been quite positive given the tone in the articles (P. Spiegel, 2012, *FT*: "Investors help Athens over bailout hurdle"). The economist Nouriel Roubini commented in the *Financial Times*, "The new bonds will also be subject to English law, where the old bonds fell under Greek jurisdiction. So if Greece were to leave the Eurozone, it could no longer pass legislation to convert euro-denominated debt into new drachma debt. This is an amazing sweetener for creditors" (N. Roubini, 2012, *FT*: "Greece's private creditors are the lucky ones"). Consequently, our sample of news articles shows no indication that media coverage had an impact on the increasing bond interest rate on March 7, 2012.

Lastly, for October 22, 2014, neither an event related to the Greek debt crisis nor substantial media coverage could explain the sharp decline in bond prices (-5.27 percent, Table 2, No. 17). The news account focused on other issues.

3. Discussion and comparison with quantitative topic modeling

Our qualitative analysis indicates that on many days, a link between news coverage and changes in the Greek bond yield is plausible. Remember, the analysis is built on the hypothesis that "It is only communication (or in other words, the system of the mass media) that gives facts or events a meaning" (Luhmann 2000, p. 37). As indicated in Table 5, for ten days, our analysis appears to confirm this assumption. Especially for December 22, 2009, April 30, 2010, May 3, 2010, December 20, 2011, June 21, 2011, and July 21, 2011, we find strong evidence of an influence of the media on changes in the Greek bond yield by attributing a particular meaning to an ongoing event (as indicated by a "++"). On four days, we find a fairly likely effect of the media on Greek interest rates, however the actual events, the attitude of media coverage towards Greece and the direction of change in the Greek bond yield corresponded with each other (as indicated by a "+" on March 31, 2010; June 20, 2011; March 25th 2013, October 27, 2011). Hence, on those days an effect of the mass media on Greek interest rates is possible, but it is difficult to discriminate media-induced effects from the actual event. The media certainly played a role in informing the general public about the events on those dates.

For seven days, we find no evidence that media played a relevant role (on October 28, 2011; December 20, 2011, February 28, 2012; March 7, 2012; March 12, 2012; March 23, 2012; October 22, 2014). On two of those dates (indicated by a "-" on March 7, 2012, and March 23, 2012), we even arrive at *contradictory results:* While the attitude towards the situation in Greece in the articles is positive, bond interest rates increased considerably.

Table 5: Theoretical Implications

No	Date	Weekday	Topic	Bond Change	Result
1.	December 22, 2009	Tuesday	0.37%	-9.20%	++
2.	March 31, 2010	Wednesday	0.40%	10.57%	+
3.	April 30, 2010	Friday	1.89%	-0.60%	++
4.	May 3, 2010	Monday	2.28%	0.42%	++
5.	December 20, 2010	Monday	0.26%	20.64%	++
6.	June 20, 2011	Monday	1.90%	1.24%	+
7.	June 21, 2011	Tuesday	2.17%	-2.93%	++
8.	July 21, 2011	Thursday	1.68%	-13.74%	++
9.	October 27, 2011	Thursday	0.89%	-22.58%	+
10.	October 28, 2011	Friday	0.56%	17.96%	-
11.	December 20, 2011	Tuesday	0.37%	5.91%	~
12.	February 28, 2012	Tuesday	0.57%	-11.53%	-
13.	March 7, 2012	Wednesday	0.68%	14.91%	-
14.	March 12, 2012	Monday	0.77%	-51.81%	~
15.	March 23, 2012	Friday	0.24%	9.58%	~
16.	March 25, 2013	Monday	2.04%	-2.54%	+
17.	October 22, 2014	Wednesday	0.21%	-5.27%	-

Selected dates and the results of the analysis. Column 6 explains whether our results confirm the theoretical hypothesis (++ indicates "result confirms hypothesis", + indicates "hypothesis possible, but strong correlation between event and news coverage", ~ indicates "result with ambiguous implication", - indicates "result contradicts hypothesis".)

What do these findings imply for our theoretical hypothesis? The indication of a causal link supports Luhmann's assumption of the media as a functional system of society. Although we cannot trace a direct immediate effect on many days, it is entirely plausible that investors take the new information into account to form decisions, immediately or over time at a later stage. One reason may be that actions on financial markets are costly in terms of both fees and time, as decisions may be carefully weighted under an array of considerations and expectations. It is therefore remarkable that we still find a possible causal link within the news coverage for about half of our sample dates.

An interesting finding is the timing of relevant dates. We find more relevant causal links for the first dates in our sample than for the later dates in 2013 and 2014. One interpretation of this observation is that financial actors have seemingly familiarized themselves with the situation in Greece over time and have begun to form expectations before news coverage occurs. Following Luhmann, the lower relevance of the media in later stages may point to less new information. Potentially, after a series of rescue operations, investors have adapted to the Greek turmoil and uncertainty has faded. Market conditions froze up and expectations with respect to Greece became more manageable. In this sense, information lost its value as soon as it became an event. The media transformed new information about an event, such as the rescue packages, into non-information by reporting it (Luhmann 2000, pp. 19f).

With respect to the economic and financial literature, in some situations, we find an actual media effect if the news coverage interprets previous events (a downgrade in the case of December 22, 2009) or provides information about future events, while there is no market reaction on the dates of the events. This would point to the reasoning of Cutler et al. (1989) and Niederhoffer (1971) that relevant events induce no immediate market reaction. Or as R. J. Shiller, Kon-Ya, & Tsutsui (1991) have noted, that market reactions may only realize after weeks.

With respect to topic models, our analysis provides evidence for the validity of this novel approach. On the days with the highest level of the Greek debt crisis topic in our sample, we find articles that precisely address this topic. According to our analysis presented in Table A.2, four of five days in the high-topic sample exhibit a distinct focus on the Greek sovereign debt crisis (April 4, 2010, May 3, 2011, June 20 and 21, 2011). Only for March 25, 2013, do we find – at first glance – a seemingly incorrect indication. One of the highest shares of the topic measure on that day indicates that media coverage should focus on the Greek debt crisis. However, as our qualitative analysis has shown, the daily articles did not cover the Greek debt crisis but instead the debt crisis in Cyprus. Apparently, the reason for the incorrect indication is that those articles used terminology similar to the case of Greece. We could argue that the Cypriot crisis is geographically and thematically closely related to the Greek debt crisis and is somewhat a result and further development of the latter. Certainly, the financial reaction on that day indicates that the events in Cyprus also mattered for Greece. In that case, the topic model may yield an even better measure for market sentiment than a simple word search for “Greece” in the database.

While the topic model approach appears relevant, our study reveals that strong bond market changes do not go along with a high level of the Greek debt crisis topic. The sample days with the strongest changes in the bond market are also those with low levels of news coverage. Nevertheless, we find indications of relevant but often less prominent news in our article selection. Again, we can relate this finding to Cutler et al. (1989) and Niederhoffer's (1971) notion that it is often not the headlines that move the markets.

The sample days with a high topic share appear to point to the expected bond market reaction and on those days the content is in line with the movement of the interest rates. However, the level of the topic measure does not predict the magnitude of the bond market changes. The highest levels of the Greek debt crisis topic do not induce exceptionally strong bond changes. We therefore refute a linear relationship between the quantitative news coverage measure and the stock market reaction. The news coverage appears relevant, but this relevance may depend on the particular circumstances and changes over time. For instance, comparable downgrades or rescue packages induce different market reactions. One possible explanation is that news coverage biases seemingly similar events and provides interpretations that affected market reactions (as, for instance, in December 2009, when the downgrade was not as bad as expected). Another explanation is that new information crucially depends on what is already known: The fifth rescue package may have induced a different market reaction because actors had considerable knowledge of the event from their experience with the first four rescue packages. Comparable to Roll's (1984) study, seemingly similar news may have different values to financial markets.

At the article level, the Greek debt crisis topic measure points to a relevant context with respect to the Greek debt crisis. The topic model provides a valid indication as to which articles stress the contents of interest. For the days in our sample, the ranking of articles on the Greek debt crisis topic persistently allocates the relevant articles on top of the lists. In Table A.1 in the Appendix, we list the starting words of the top six articles of these lists for each day in our selection. As mentioned earlier, in our qualitative analysis, we incorporated the top five articles from these lists. We highlight articles we categorized as covering the Greek debt crisis by a dark gray background. As becomes clear, aside from the articles about the Cypriot debt crisis, articles with a very high share of 15 percent or more of the Greek debt crisis topic almost all address this topic. On days with important events, at least five articles address Greece, and those articles also have a high topic share. Most articles with a topic share of ten percent or more have a relationship with the Greek debt crisis, although we do find several articles in this group that do not cover the Greek debt crisis. In contrast, on days with low levels of the Greek debt crisis topic, we also find few indications for events in Greece. Articles with a low share of the topic in our sample mostly have no relation to the Greek debt crisis. We checked more articles on each day to verify that indeed, the top five articles do reveal crucial information about Greece in the news of each day and we missed no relevant information.

Our analysis indicates a clear relationship between topics and topical content. However, we must take certain care in assuming that this relationship always holds. High shares of the Greek debt crisis topic as a measure of news coverage are not proof that articles concern the Greek debt crisis. Higher levels of the topic do not necessarily correlate with more, or more important, coverage. As Daniel et al. (2018, p. 18) have stated, the topic measure shows which texts likely relate to the Greek debt crisis topic. It therefore provides a probability of the topic in the news. Our study can verify this assumption in some cases and challenge it in others. For example, on October 28, 2011, we find an article with a topic measure of 13.02 percent with a clear focus on the haircut decision two days earlier (S. Erlanger & S. Castle, 2011, *INYT*: "Banks accept deal on Greek debts"). By contrast, on March 25, 2013, more than five articles have a very high share of the Greek debt crisis topic. However, all articles address the Cypriot debt crisis instead of the Greek one. To underline this fact, in Table A.1, we highlight the Cypriot articles on that day in light gray. All articles certainly use a similar vocabulary with a high share of words from the Greek debt crisis topic. Here, we crucially depend on qualitative analysis to disentangle the differences and similarities and how carefully interpret them. In the case of March 25, we would argue that none of the articles is truly about the Greek debt crisis, although one article has a minor link to the past Greek rescue package (P. Spiegel, 2013, *FT*: "Eurozone wounded by Cyprus imbroglio. Reason prevails but the damage is done"; topic measure of 24,75 percent). Nevertheless, the market reaction regarding Greek bond yields provides evidence for the relevance of media coverage on that day.

4. Conclusion

We have qualitatively examined the extent to which events covered by the media affected Greek bond interest rates by searching for a traceable effect of global newspaper articles on bond prices. For a sample of 85 articles on 17 days, on eleven days an effect of media coverage is quite plausible. We identify six days with no substantial impact or even with a seemingly contradictory relationship. On those days, factors other than the media likely had an impact on the Greek bond yield.

Our result is that media appears to be one likely direct source of markets fluctuations, although it is certainly not the only one. For some days, we could show that media attributed meaning and interpretation to events, thereby affecting changes in the Greek bond yield. Although we find many days on which the media may have had a potential effect, it may however be difficult to prove this effect. As Shiller (2015; 1987) has stressed, one is unlikely to determine a direct and immediate impact of media on entire financial markets, although this impact is likely to exist. Moreover, the media may have longer-lasting effects, which we do not consider here, by providing all information necessary over a long time horizon. Therefore, Luhmann´s assumption that it is only communication that provides a meaning for facts or events may be valid.

In terms of quantitative methods, we ascertain that topic models are a viable tool for selecting samples for qualitative text analysis. Topic models are exceedingly useful in finding and selecting articles related to our topic – the Greek debt crisis – from a large body of newspaper articles. They provide a useful expansion and alternative for qualitative research that should be considered in other fields of study. Importantly, we also find that the results from a statistical approach such as topic modeling provide truths only with a certain probability. Qualitative investigations, on the other hand, can therefore complement quantitative analysis by going into more textual detail and identifying in each case the unique considerations and the possible false indications of the statistical and complex output. This study provides a way of employing the advantages of both approaches.

In terms of limitations, our study focused exclusively on two globally acknowledged newspapers. Analyzing a sample of articles from these newspapers implies to focus on a – relatively – small sample of all potentially relevant mass media in the world. It would be valuable to further consider the perspective of the receiver by conducting and qualitatively analyzing in-depth interviews with markets participants.

Further research may focus on more country-specific differences in media coverage (see Antoniades, 2012; Bickes et al., 2014; Mylonas, 2012) by applying both quantitative and qualitative text analysis. It certainly makes sense to combine both approaches in analyzing phenomena such as discourse, framing and tone in large text corpora. With respect to longer-term effects, further research may examine whether media coverage affects public opinion and whether those shifts have influenced the sovereign debt crisis.

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Appendix

Table A.1: Article selection and first words on each day of our sample

1. Date: 22.12.09		Daily Topic: 0,37%	Bondyield: -9,20%
No.	Topic	Paper	Start of the arcticle text
1	9,59%	fit	Gazprom gives Ukraine more time to pay Russia's Gazprom announced on Tuesday that it would grant
2	5,37%	fit	Recession damps sweetness and light in Latvia In the cobbled squares of old Riga, the festive season
3	4,38%	fit	Sterling hits two-month low versus dollar Sterling fell below the $1.60 level against the dollar for
4	4,11%	fit	Banks lead European equity rally European shares rallied on Tuesday, as banking, energy and pharmace
5	3,87%	fit	Positive US housing figures add to confidence Equity indices on both sides of the Atlantic struck fr
6	1,98%	fit	Climate change alliance crumbling The tabular content relating to this article is not available to v

2. Date: 31.3.10		Daily Topic: 0,40%	Bondyield: 10,57%
No.	Topic	Paper	Start of the arcticle text
1	14,33%	fit	Moody's cuts five Greek banks' ratings Moody's, the credit ratings agency, on Wednesday downgraded G
2	9,80%	fit	Berlin and Paris eye bank levy to fund bail-outs Germany and France on Wednesday called for an inter
3	5,00%	fit	Ireland asks how bank shock was missed Any air left in the Irish property bubble was unceremoniously
4	4,25%	fit	Brussels presses Berlin to ease imbalances The European Commission on Wednesday signalled sympathy w
5	4,15%	fit	Discord persists over bank global tax The idea of a global levy on banks has gained momentum in inte
6	3,42%	fit	Moody's adds to pressure on Greek banks European equities posted their fourth consecutive quarterly

3. Date: 30.4.10		Daily Topic: 1,89%	Bondyield: -0,60%
No.	Topic	Paper	Start of the arcticle text
1	29,80%	fit	Eurozone to hold emergency talks on Greece Eurozone finance ministers will hold emergency discussion
2	29,13%	fit	Papandreou says Greek survival at stake George Papandreou, Greek prime minister, told parliament on
3	25,92%	fit	Asia sees double standards in IMF Greek rescue The International Monetary Fund's proposed bail-out f
4	24,52%	fit	Germans consider private bail-out A group of German banks and other companies is considering a priva
5	23,93%	fit	Papandreou braced for fresh fury George Papandreou stands at the centre of a storm that could soon t
6	21,82%	nyt	I.M.F. promises to increase aid to Greece; Spain emerges as next possible problem as its debt rating

4. Date: 3.5.10		Daily Topic: 2,28%	Bondyield: 0,42%
No.	Topic	Paper	Start of the arcticle text
1	36,58%	nyt	Greece to get bailout after agreeing to big cutbacks; I.M.F. and Europe to send as much as (EURO)120
2	28,45%	nyt	Bailout no cure-all for threats to other E.U. countries; Athens gets help but is it enough? Greece a
3	27,57%	fit	Eurozone ditches doubt to back IMF role European governments that once wanted to keep the Inter-nati
4	26,16%	fit	Germany seeks private sector support for Greek aid German banks and insurers will meet Wolfgang Scha
5	24,81%	nyt	Pain of austerity may stunt growth for years to come; Athens gets help but is it enough? Greece, eff
6	21,28%	nyt	Bailout of Greece is back in Germany's hands The ball is back in Germany's court. Now that Greece h

5. Date: 20.12.10		Daily Topic: 0,26%	Bondyield: 20,64%
No.	Topic	Paper	Start of the arcticle text
1	6,90%	fit	Migrant crisis in Greece strains EU open borders Concern over the fate of asylum seekers in Greece h
2	3,23%	fit	Banco Popolare leads gains European equities gained ground in a low-volume session as the December r
3	2,30%	fit	OECD urges Spain to liberalise markets Spain should not only reform its labour market and keep cutti
4	2,05%	fit	UralKali seals $24bn potash deal Russia is preparing to create the world's largest potash producer b
5	1,72%	fit	Competition is not the only priority From Ms Ann Cairns. Sir, Paul Myners' call for big banks to be
6	1,58%	fit	Further eurozone expansion is some time away Estonia may be about to join the eurozone - but further

Article selection on each day of our sample. We carefully read the five articles with the highest level of the Greek debt crisis topic on each date. Here, we show the start of each of those articles. For comparison, we also show the next article not chosen (No. 6 on each date). For each day, we denote the sample number (for comparison to the other tables), the bond change and the daily average topic share. For each article, we denote the topic share and the rank (No.) of the article's topic share on that day. We highlight the selection of days with a high Greek debt crisis topic in gray in the top row. We further highlight articles related to the Greek debt crisis in dark gray. On March 25, 2013, we highlight the articles concerning the Cypriot debt crisis in light gray.

Table A.1 continued

6. Date: 20.6.11	Daily Topic: 1,90%	Bondyield: 1,24%	
No.	Topic	Paper	Start of the arcticle text
1	42,74%	fit	EU delays EUR12bn loan for Greece Eurozone finance ministers on Monday failed to commit to a critica
2	35,49%	nyt	Euro zone officials weigh new bailout for Greece; Talks aim at averting further damage from sovereig
3	28,79%	nyt	Greeks focus on tax cheating to put muscle into austerity measures In the year since Greece received
4	27,03%	fit	Fresh Greek debt concerns weigh on euro The euro retreated on Monday as investors continued to focus
5	25,96%	nyt	Correction Appended Greeks focus on tax cheating to put muscle into austerity measures In the year
6	25,60%	nyt	Greeks look to put teeth into austerity moves; Rampant tax cheating heads list of problems adding to

7. Date: 21.6.11	Daily Topic: 2,17%	Bondyield: -2,93%	
No.	Topic	Paper	Start of the arcticle text
1	48,15%	nyt	European leaders put off Greece decision; Prime minister issues call for autumn referendum to alter
2	36,43%	fit	Papandreou survives confidence vote Greece's embattled government won a vote of confidence in parlia
3	34,60%	fit	Barroso offers Athens austerity incentive , Greece's embattled politicians have been offered a fres
4	34,19%	nyt	E.U. holds back on aid to Greece; Pressure on Papandreou builds to secure passage of austerity measu
5	32,16%	nyt	I.M.F. gets tough with Europe; aid to Greece withheld, for now Billed as a meeting that would help t
6	31,38%	fit	Papandreou prepares for vote of confidence Greece held a successful auction of three-month treasury

8. Date: 21.7.11	Daily Topic: 1,68%	Bondyield: -13,74%	
No.	Topic	Paper	Start of the arcticle text
1	31,80%	fit	EU leaders agree EUR109bn Greek bail-out European leaders have agreed a new EUR109bn bail-out of Gre
2	24,82%	fit	Greece observes from the sidelines Greece is observing from the sidelines as European politicians an
3	22,19%	fit	Cyprus bank chief sounds warning The prospect of a selective default for Greece has raised fears tha
4	20,18%	fit	Europe's bail-out fund given new powers The EUR440bn temporary bail-out fund that eurozone governmen
5	17,80%	fit	Bond swap plan is for Greece and Greece only Private creditor participation in Greece's latest rescu
6	16,68%	nyt	Talk of Greek default builds before conference; Bond-swap plan pushed by E.U., despite warning of ri

9. Date: 27.10.11	Daily Topic: 0,89%	Bondyield: -22,58%	
No.	Topic	Paper	Start of the arcticle text
1	26,71%	fit	EU reaches agreement on Greek bonds European leaders reached a deal with Greek debtholders on Thursd
2	23,02%	fit	Bigger haircuts put strain on Greek banks A plan to impose bigger losses on private holders of Greek
3	19,55%	fit	The devil in the details and the data For many analysts combing over the three-part deal to restore
4	14,94%	fit	Osborne calls for renewed momentum on eurozone Eurozone leaders have put their economy on "the right
5	11,28%	fit	Bric nations cautious on rescue fund As Klaus Regling, head of the eurozone rescue fund, sets off fo
6	8,51%	fit	Banks rush to reassure on capital positions Europe's leading banks rushed to reassure the market tha

10. Date: 28.10.11	Daily Topic: 0,56%	Bondyield: 17,96%	
No.	Topic	Paper	Start of the arcticle text
1	14,31%	nyt	Berlusconi's credibility is Europe's issue; Pledges of big changes to bolster economy have rickety s
2	13,02%	nyt	Banks accept deal on Greek debts; European leaders take a major step toward restoring euro credibili
3	11,03%	nyt	Lenders agree to take 50% loss; focus turns to Italy Nicolas Sarkozy and Angela Merkel desperately n
4	10,50%	fit	Italy gives EU a post-party hangover Italy's borrowing costs have climbed to euro-era highs just a d
5	8,10%	nyt	A good bank plan for Europe, but is it good enough? European banks may win back a measure of confide
6	5,20%	fit	Strong week for Euro as leaders plan rescue A strong week for the euro crossed over into other risk

11. Date: 20.12.11	Daily Topic: 0,37%	Bondyield: 5,91%	
No.	Topic	Paper	Start of the arcticle text
1	11,86%	fit	Eurozone turmoil poses 'serious threat' to Irish economy The turmoil in the eurozone is posing a ser
2	8,19%	fit	IMF and EU warn Hungary on credit facility The International Monetary Fund and European Union have w
3	4,80%	nyt	Inside the euro zone, bracing for austerity It is easy for Europe's political leaders to glibly pres
4	2,30%	fit	Dexia sells off Luxembourg division The dismantling of Dexia, the twice bailed-out Franco-Belgian le
5	2,16%	fit	Debit card fees on foreign cash dropped British holidaymakers are in line to save about pound(s)20m
6	1,32%	fit	Olympic legacy 'not dependent on football' The Olympic stadium can be economically viable even witho

Table A.1 continued

12. Date: 28.2.12		Daily Topic: 0,57%	Bondyield: -11,53%
No.	**Topic**	**Paper**	**Start of the arcticle text**
1	19,54%	fit	ECB suspends use of Greek bonds as collateral The European Central Bank on Tuesday reacted to Standa
2	16,86%	fit	Portugal on right track, say lenders Portugal is on track to meet the terms of its EUR78bn bail-out
3	15,54%	fit	Let Marshall plan inform current EU attitudes to Greece From Mr Paul Rayment. Sir, The continuing p
4	9,11%	fit	CDS payouts on Greek bond deal on agenda A group of banks and investors in the credit derivatives ma
5	6,02%	fit	On-air race clash mars Dutch political contest The contest for leadership of the Dutch Labour party
6	2,66%	fit	Ireland calls vote on European fiscal pact Dublin will hold a referendum on the eurozone fiscal pact

13. Date: 7.3.12		Daily Topic: 0,68%	Bondyield: 14,91%
No.	**Topic**	**Paper**	**Start of the arcticle text**
1	27,05%	fit	Q&A: Greek bond swap Private investors holding more than EUR100bn in Greek bonds have declared publi
2	16,40%	fit	Greece's private creditors are the lucky ones Amyth is developing that private creditors have accept
3	15,80%	fit	Top woman politician takes key Athens job Greece's leading female politician took over on Wednesday
4	13,30%	nyt	Bond swap eases fear of Greek default Greece moved a step closer to avoiding default on its debt, wh
5	11,67%	fit	Bondholders in stand-off with Athens In the end, it was always going to come down to a game of chick
6	11,26%	fit	Investors struggle to make sense of Greek deal richard.milne@ft.com, It is as complex as it is big.

14. Date: 12.3.12		Daily Topic: 0,77%	Bondyield: -51,81%
No.	**Topic**	**Paper**	**Start of the arcticle text**
1	19,52%	nyt	Post-bailout, Greece set for political makeover; Implosion of Socialists opens door to new forces re
2	15,73%	fit	Eurozone calls for new Spanish budget cuts Eurozone finance ministers called on Spain to make new cu
3	15,10%	nyt	For Lagarde and Merkel, warmth transcends differences With a deal on Greek debt finally done, Europe
4	13,52%	fit	Clinton calls for bilateral aid on Egypt economy Hillary Clinton, US secretary of state, has urged t
5	13,10%	fit	New Greek bonds trade at distressed levels Greece's new bonds, issued after its 206bn debt exchange,
6	11,53%	fit	Germans seek lawsuits over Greek debt swap A German law firm is preparing lawsuits against banks and

15. Date: 23.3.12		Daily Topic: 0,24%	Bondyield: 9,58%
No.	**Topic**	**Paper**	**Start of the arcticle text**
1	6,82%	fit	Greek food: potential to shake off fetters Lob Greek debt into a dinner party conversation and it is
2	5,39%	fit	Carstens calls for open World Bank selection Mexico's top central banker on Thursday said that it wa
3	3,26%	fit	Once risky assets rise on the rally A rising tide lifts all ships, even those with slightly leaky hu
4	2,17%	nyt	For U.S., euro crisis moves to back burner; Top policy makers cite 'significant progress' by Europea
5	2,08%	fit	Keep a low profile when you meet the PM, Mr Chairman Dear Chairman, I promised to brief you about ou
6	1,70%	nyt	Dividend will follow strong year at HermÃ¨s HermÃ¨s International, the French luxury goods maker, sa

16. Date: 25.3.13		Daily Topic: 2,04%	Bondyield: -2,54%
No.	**Topic**	**Paper**	**Start of the arcticle text**
1	32,52%	nyt	Cyprus struggles to defuse its crisis; European officials gather as president arrives with new plan
2	32,28%	nyt	Small savers spared in latest plan to rescue Cyprus banks As Cyprus faced a Monday deadline to avoid
3	26,73%	fit	Eurozone wounded by Cyprus imbroglio Reason prevails but the damage is done. With their 11th-hour a
4	24,75%	fit	Relief and concern on eurozone periphery Political leaders in Spain and other troubled economies on
5	21,07%	fit	Nicosia pledges 'temporary' capital curb The Cypriot government said it was imposing "very temporary
6	20,51%	fit	Cyprus: crossing the green line Overnight, Cyprus has become an offshore banking centre without a ba

17. Date: 22.10.14		Daily Topic: 0,21%	Bondyield: -5,27%
No.	**Topic**	**Paper**	**Start of the arcticle text**
1	2,52%	fit	Paris defends budget amid EU irritation As the clock ticks down to a potential - and humiliating - r
2	2,15%	fit	Marshall's postwar logic holds true in Ukraine today Ukraine is ravaged by war, aggravating its econ
3	2,00%	fit	Africa bond rally halts amid Ebola fear The rally in African debt markets has come to an abrupt halt
4	1,68%	fit	Colonialism, culture and the Catalan language Sir, In his article "Catalans have as much in common w
5	1,28%	nyt	Gary Martin on his least favorite airport Q. How often do you fly for business? A. About twice
6	1,20%	fit	MPC votes 7-2 to keep UK interest rates on hold Expectations UK interest rates will not rise in the

Table A.2. Results Qualitative Analysis

	1. Relevance	1.a	1.b	1.c	2. Event	2.a	2.b	2.c	2.d	3	4. Market	5. Market
Date Information	Greek Debt Crisis	Greece	Debt Crisis	Financial		Relevant	Today	Future	yesterday	Attitude	Reaction Event	Reaction Attitude
1. Date: 22.12.09	n	n	n	n	n	n	n	n	n		n	
Daily Topic: 0.37%	n	n	n	y	n	n	n	n	n		n	
Bondyield: -9.20%	y	y	y	y	y	n	n	n	n	0	n	n
	y	y	y	y	y	y	y	n	n	1	n	y
	y	y	y	y	y	y	y	n	n	0	y	n
2. Date: 31.3.10	y	y	y	y	y	y	y	n	n	-1	y	y
Daily Topic: 0.40%	n	n	y	y	n	n	n	n	n		n	
Bondyield: 10.57%	n	n	y	y	n	n	n	n	n		n	
	y	y	y	n	n	n	n	n	n		n	
	n	n	n	y	n	n	n	n	n		n	
3. Date: 30.4.10	y	y	y	y	y	y	n	y	n	0	n	y
Daily Topic: 1.89%	y	y	y	y	y	n	n	y	n	-1	n	n
Bondyield: -0.60%	y	y	y	y	n	n	n	n	n		n	
	y	y	y	y	y	y	n	y	n	0	y	y
	y	y	y	n	y	y	n	y	n	-1	y	n
4. Date: 3.5.10	y	y	y	y	y	y	n	n	y	0	y	y
Daily Topic: 2.28%	y	y	y	y	y	y	n	n	y	-1	n	y
Bondyield: 0.42%	y	y	y	y	n	n	n	n	n		n	
	y	y	y	y	y	y	n	y	n	0	y	y
	y	y	y	y	n	n	n	n	n	-1	n	y

This Figure shows the findings of the qualitative analysis by date. For each date, we highlight the relevance and uncovered relationship of news coverage and market reaction by different shades of grey. Days on which relevant media coverage matches with the market reaction is highlighted in light grey. Days with no clear relationship are highlighted in medium grey. Days with a seemingly contradictory result are highlighted in dark grey. The qualitative analysis does not indicate our interpretation regarding a possible causal link, but focusses on the correlation of news coverage and market reaction on each day. From the analysis, we discuss possible causal links of media coverage in detail in the text. In the text, we further discuss a possible correlation and relevance of news articles and events on previous days that were not incorporated in this qualitative analysis.

Table A.2 continued

	1. Relevance	1.a	1.b	1.c	2. Event	2.a	2.b	2.c	2.d	3	4. Market	5. Market
Date Information	Greek Debt Crisis	Greece	Debt Crisis	Financial		Relevant	Today	Future	yesterday	Attitude	Reaction Event	Reaction Attitude
5. Date: 20.12.10	n	y	n	n	n	n	n	n	n		n	
Daily Topic: 0.26%	y	y	y	y	n	n	n	n	n	-1	n	y
Bondyield: 20.64%	n	n	y	y	n	n	n	n	n		n	
	n	n	n	y	n	n	n	n	n		n	
	n	n	y	n	n	n	n	n	n		n	
6. Date: 20.6.11	y	y	y	y	y	y	y	y	n	-1	y	y
Daily Topic: 1.90%	y	y	y	y	y	y	n	y	n	0	y	n
Bondyield: 1.24%	y	y	y	y	n	n	n	n	n	-1	n	y
	y	y	y	y	y	y	y	n	y	-1	y	y
	y	y	y	y	n	n	n	n	n	0	n	n
7. Date: 21.6.11	y	y	y	y	y	y	n	n	y	0	n	n
Daily Topic: 2.17%	y	y	y	y	y	y	y	n	n	1	y	y
Bondyield: -2.93%	y	y	y	y	y	n	n	y	n	1	n	y
	y	y	y	y	y	y	n	y	n	0	y	n
	y	y	y	y	n	n	n	n	n		n	
8. Date: 21.7.11	y	y	y	y	y	y	y	n	n	1	y	y
Daily Topic: 1.68%	y	y	y	y	y	y	y	n	n	0	y	n
Bondyield: -13.74%	y	y	y	y	y	y	y	n	n		n	n
	y	y	y	y	y	y	y	n	n	1	y	y
	y	y	y	y	y	y	y	n	n	1	y	y

Table A.2 continued

	1. Relevance	1.a	1.b	1.c	2. Event	2.a	2.b	2.c	2.d	3	4. Market	5. Market
Date Information	Greek Debt Crisis	Greece	Debt Crisis	Financial		Relevant	Today	Future	yesterday	Attitude	Reaction Event	Reaction Attitude
9. Date: 27.10.11	y	y	y	y	y	y	n	n	y	0	y	
Daily Topic: 0.89%	y	y	y	y	y	y	n	n	y	1	y	y
Bondyield: ######	y	y	y	y	y	y	n	n	y	-1	y	n
	y	y	y	y	y	y	n	n	y	1	y	y
	y	n	y	y	y	y	n	n	y	0	n	
10. Date: 28.10.11	y	y	y	y	n	n	n	n	n	-1	n	y
Daily Topic: 0.56%	y	y	y	y	y	y	n	n	y	1	n	n
Bondyield: 17.96%	y	y	y	y	y	y	n	n	y	1	n	n
	n	n	y	y	n	n	n	n	n		n	
	y	y	y	y	y	y	n	n	y	0	n	n
11. Date: 20.12.11	n	n	y	y	n	n	n	n	n		n	
Daily Topic: 0.37%	n	n	y	y	n	n	n	n	n		n	
Bondyield: 5.91%	y	y	y	y	n	n	n	n	n	-1	n	y
	n	n	n	y	n	n	n	n	n			
	n	n	n	n	n	n	n	n	n			
12. Date: 28.2.12	y	y	y	y	y	y	y	n	n	-1	n	n
Daily Topic: 0.57%	n	n	y	y	n	n	n	n	n		n	
Bondyield: -11.53%	y	y	y	y	n	n	n	n	n	-1	n	n
	y	y	y	y	y	y	n	y	n		n	
	y	y	y	y	n	n	n	n	n		n	

Table A.2 continued

	1. Relevance	1.a	1.b	1.c	2. Event	2.a	2.b	2.c	2.d	3	4. Market	5. Market
Date Information	Greek Debt Crisis	Greece	Debt Crisis	Financial		Relevant	Today	Future	yesterday	Attitude	Reaction Event	Reaction Attitude
13. Date: 7.3.12	y	y	y	y	y	y	n	y	n	1	y	n
Daily Topic: 0.68%	y	y	y	y	y	y	n	y	n	0	y	n
Bondyield: 14.91%	y	y	y	n	n	n	n	n	n		n	
	y	y	y	y	y	y	n	y	n	0	y	n
	y	y	y	y	y	y	n	y	n	0	y	n
14. Date: 12.3.12	y	y	y	n	y	y	n	y	n	0	y	n
Daily Topic: 0.77%	n	n	y	y	n	n	n	n	n		n	
Bondyield: -51.81%	n	y	y	y	n	n	n	n	n		n	
	n	n	n	n	n	n	n	n	n		n	
	y	y	y	y	y	y	n	n	y	1	y	y
15. Date: 23.3.12	y	y	y	y	n	n	n	n	n	1	n	n
Daily Topic: 0.24%	n	n	n	n	n	n	n	n	n		n	
Bondyield: 9.58%	y	y	y	y	n	n	n	n	n	1	n	n
	y	y	y	y	n	n	n	n	n	1	n	n
	n	n	y	y	n	n	n	n	n		n	
16. Date: 25.3.13	n	n	y	y	n	n	n	n	n		n	
Daily Topic: 2.04%	n	n	y	y	n	n	n	n	n	1	n	y
Bondyield: -2.54%	n	n	y	y	n	n	n	n	n		n	
	n	n	y	y	n	n	n	n	n	1	n	y
	n	n	n	y	n	n	n	n	n		n	
17. Date: 22.10.14	n	n	n	n	n	n	n	n	n		n	
Daily Topic: 0.21%	n	n	n	y	n	n	n	n	n		n	
Bondyield: -5.27%	n	n	y	y	n	n	n	n	n		n	
	n	n	n	n	n	n	n	n	n		n	
	n	n	n	n	n	n	n	n	n		n	

Table A.3: References of selected articles by date

1. Date:	22.12.09	Daily Topic: 0.37%	Bondyield: -9.20%
No.	Topic	Article reference	
1	9.59%	Olearchyk, Roman. Gazprom gives Ukraine more time to pay. The Financial Times. ProQuest. 2009	
2	5.37%	Ward, Andrew. Recession damps sweetness and light in Latvia. The Financial Times. ProQuest. 2009	
3	4.38%	Dennis, Neil. Sterling hits two-month low versus dollar. The Financial Times. ProQuest. 2009	
4	4.11%	Raval, Anjli. Banks lead European equity rally. The Financial Times. ProQuest. 2009	
5	3.87%	Harvey, Fiona. Positive US housing figures add to confidence. The Financial Times. ProQuest	
6	1.98%	Harvey, Fiona. Climate change alliance crumbling. The Financial Times. ProQuest. 2009	

2. Date:	31.3.10	Daily Topic: 0.40%	Bondyield: 10.57%
No.	Topic	Article reference	
1	14.33%	Kerin Hope . Moody's cuts five Greek banks' ratings. The Financial Times. ProQuest. 2010	
2	9.80%	Wiesmann, Gerrit . Berlin and Paris eye bank levy to fund bail-outs. The Financial Times. ProQuest. 2010	
3	5.00%	Brown, John Murray . Ireland asks how bank shock was missed. The Financial Times. ProQuest. 2010	
4	4.25%	Barber, Tony . Brussels presses Berlin to ease imbalances. The Financial Times. ProQuest. 2010	
5	4.15%	Giles, Chris . Discord persists over bank global tax. The Financial Times. ProQuest. 2010	
6	3.42%	Raval, Anjli . Moody's adds to pressure on Greek banks. The Financial Times. ProQuest. 2010	

3. Date:	30.4.10	Daily Topic: 1.89%	Bondyield: -0.60%
No.	Topic	Article reference	
1	29.80%	Barber, Tony . Eurozone to hold emergency talks on Greece. The Financial Times. ProQuest. 2010	
2	29.13%	Kerin Hope . Papandreou says Greek survival at stake. The Financial Times. ProQuest. 2010	
3	25.92%	Brown, Kevin . Asia sees double standards in IMF Greek rescue. The Financial Times. ProQuest. 2010	
4	24.52%	Financial Times . Germans consider private bail-out. The Financial Times. ProQuest. 2010	
5	23.93%	Hope, Kerin . Papandreou braced for fresh fury. The Financial Times. ProQuest. 2010	
6	21.82%	Hope, Kerin . I.M.F. promises to increase aid to Greece. The International Herald Tribune. LexisNexis. 2010	

4. Date:	3.5.10	Daily Topic: 2.28%	Bondyield: 0.42%
No.	Topic	Article reference	
1	36.58%	Bilefsky, Dan and Thomas, Landon . Greece to get bailout after agreeing to big cutbacks. The International Herald Tribune. LexisNexis. 2010	
2	28.45%	Bilefsky, Dan and Thomas, Landon . Bailout no cure-all for threats to other E.U. countries. The International Herald Tribune. LexisNexis. 2010	
3	27.57%	Barber, Tony . Eurozone ditches doubt to back IMF role. The Financial Times. ProQuest. 2010	
4	26.16%	Wiesmann, Gerrit and Wilson, James . Germany seeks private sector support for Greek aid. The Financial Times. ProQuest. 2010	
5	24.81%	Bilefsky, Dan and Thomas, Landon . Pain of austerity may stunt growth for years to come. The International Herald Tribune. LexisNexis. 2010	
6	21.28%	Kulish, Nicholas . Bailout of Greece is back in Germany's hands. The International Herald Tribune. LexisNexis. 2010	

5. Date:	20.12.10	Daily Topic: 0.26%	Bondyield: 20.64%
No.	Topic	Article reference	
1	6.90%	Pignal, Stanley . Migrant crisis in Greece strains EU open borders. The Financial Times. ProQuest. 2010	
2	3.23%	Stothard, Michael . Banco Popolare leads gains. The Financial Times. ProQuest. 2010	
3	2.30%	Mallet, Victor . OECD urges Spain to liberalise markets. The Financial Times. ProQuest. 2010	
4	2.05%	Gorst, Isabel and Belton, Catherine . UralKali seals $24bn potash deal. The Financial Times. ProQuest. 2010	
5	1.72%	Cairns, Ann . Competition is not the only priority. The Financial Times. ProQuest. 2010	
6	1.58%	Cluse, Reinhard . Further eurozone expansion is some time away. The Financial Times. ProQuest. 2010	

References of articles considered in the analysis by day. To compare with Tables A.1 and A.2, we denote the sample number, the bond change and the daily average topic share. For each article, we denote the topic share and the rank (No.) of the article's topic share on that day. We highlight the selection of days with a high Greek debt crisis topic in gray in the top row. We further highlight articles related to the Greek debt crisis in dark gray. On March 25, 2013, we highlight the articles concerning the Cypriot debt crisis in light gray. We also show the next article not considered (No. 6 on each date).

Table A.3 continued

6. Date: 20.6.11	Daily Topic: 1.90%	Bondyield: 1.24%
No.	**Topic**	**Article reference**
1	42.74%	Spiegel, Peter . EU delays EUR12bn loan for Greece. The Financial Times. ProQuest. 2011
2	35.49%	Castle, Stephen and Kitsantonis, Niki . Euro zone officials weigh new bailout for Greece. The International Herald Tribune. LexisNexis. 2011
3	28.79%	Rachel Donadio . Greeks focus on tax cheating to put muscle into austerity measures. The International Herald Tribune. LexisNexis. 2011
4	27.03%	Garnham, Peter . Fresh Greek debt concerns weigh on euro. The Financial Times. ProQuest. 2011
5	25.96%	Rachel Donadio . Correction Appended. Greeks focus on tax cheating to put muscle into austerity measures. The International Herald Tribune. LexisNexis. 2011
6	25.60%	Rachel Donadio . Greeks look to put teeth into austerity moves. The International Herald Tribune. LexisNexis. 2011

7. Date: 21.6.11	Daily Topic: 2.17%	Bondyield: -2.93%
No.	**Topic**	**Article reference**
1	48.15%	Donadio, Rachel and Kitsantonis, Niki . European leaders put off Greece decision. The International Herald Tribune. LexisNexis. 2011
2	36.43%	Hope, Kerin . Papandreou survives confidence vote. The Financial Times. ProQuest. 2011
3	34.60%	Spiegel, Peter . Barroso offers Athens austerity incentive. The Financial Times. ProQuest. 2011
4	34.19%	Donadio, Rachel and Kitsantonis, Niki. E.U. holds back on aid to Greece. The International Herald Tribune. LexisNexis. 2011
5	32.16%	Castle, Stephen . I.M.F. gets tough with Europe. The International Herald Tribune. LexisNexis. 2011
6	31.38%	Hope, Kerin . Papandreou prepares for vote of confidence. The Financial Times. ProQuest. 2011

8. Date: 21.7.11	Daily Topic: 1.68%	Bondyield: -13.74%
No.	**Topic**	**Article reference**
1	31.80%	Spiegel, Peter and Peel, Quentin . EU leaders agree EUR109bn Greek bail-out. The Financial Times. ProQuest. 2011
2	24.82%	Hope, Kerin . Greece observes from the sidelines. The Financial Times. ProQuest. 2011
3	22.19%	Hope, Kerin . Cyprus bank chief sounds warning. The Financial Times. ProQuest. 2011
4	20.18%	Chaffin, Joshua . Europe's bail-out fund given new powers. The Financial Times. ProQuest. 2011
5	17.80%	Peel, Quentin . Bond swap plan is for Greece and Greece only. The Financial Times. ProQuest. 2011
6	16.68%	Castle, Stephen and Dempsey, Judy . Talk of Greek default builds before conference. The International Herald Tribune. LexisNexis. 2011

9. Date: 27.10.11	Daily Topic: 0.89%	Bondyield: -22.58%
No.	**Topic**	**Article reference**
1	26.71%	Spiegel, Peter and Pignal, Stanley and Barker, Alex . EU reaches agreement on Greek bonds. The Financial Times. ProQuest. 2011
2	23.02%	Chaffin, Joshua and Hope, Kerin . Bigger haircuts put strain on Greek banks. The Financial Times. ProQuest. 2011
3	19.55%	Spiegel, Peter . The devil in the details and the data. The Financial Times. ProQuest. 2011
4	14.94%	Warrell, Helen . Osborne calls for renewed momentum on eurozone. The Financial Times. ProQuest. 2011
5	11.28%	Beattie, Alan . Bric nations cautious on rescue fund. The Financial Times. ProQuest. 2011
6	8.51%	The Financial Times . Banks rush to reassure on capital positions. The Financial Times. ProQuest. 2011

10. Date: 28.10.11	Daily Topic: 0.56%	Bondyield: 17.96%
No.	**Topic**	**Article reference**
1	14.31%	Povoledo, Elisabetta and Kitsantonis, Nikki . Berlusconi's credibility is Europe's issue. The International Herald Tribune. LexisNexis. 2011
2	13.02%	Erlanger, Steven and Castle, Stephen . Banks accept deal on Greek debts. The International Herald Tribune. LexisNexis. 2011
3	11.03%	Erlanger, Steven and Castle, Stephen . Lenders agree to take 50% loss. The International Herald Tribune. LexisNexis. 2011
4	10.50%	The Financial Times . Italy gives EU a post-party hangover. The Financial Times. ProQuest. 2011
5	8.10%	Ewing, Jack . A good bank plan for Europe, but is it good enough? The International Herald Tribune. LexisNexis. 2011
6	5.20%	Strong week for Euro as leaders plan rescue. The Financial Times. ProQuest. 2011

11. Date: 20.12.11	Daily Topic: 0.37%	Bondyield: 5.91%
No.	**Topic**	**Article reference**
1	11.86%	Beattie, Alan . Eurozone turmoil poses 'serious threat' to Irish economy. The Financial Times. ProQuest. 2011
2	8.19%	Kester Eddy . IMF and EU warn Hungary on credit facility. The Financial Times. ProQuest. 2011
3	4.80%	Inside the euro zone, bracing for austerity. The International Herald Tribune. LexisNexis. 2011
4	2.30%	Pignal, Stanley . Dexia sells off Luxembourg division. The Financial Times. ProQuest. 2011
5	2.16%	Goff, Sharlene . Debit card fees on foreign cash dropped. The Financial Times. ProQuest. 2011
6	1.32%	Blitz, Roger . Olympic legacy 'not dependent on football'. The Financial Times. ProQuest. 2011

Table A.3 continued

12. Date: 28.2.12	Daily Topic: 0.57%	Bondyield: -11.53%
No.	**Topic**	**Article reference**
1	19.54%	Wilson, James . ECB suspends use of Greek bonds as collateral. The Financial Times. ProQuest. 2012
2	16.86%	Wise, Peter . Portugal on right track, say lenders. The Financial Times. ProQuest. 2012
3	15.54%	Rayment, Paul . Let Marshall plan inform current EU attitudes to Greece. The Financial Times. ProQuest. 2012
4	9.11%	Mackenzie, Michael . CDS payouts on Greek bond deal on agenda. The Financial Times. ProQuest. 2012
5	6.02%	Steinglass, Matt . On-air race clash mars Dutch political contest. The Financial Times. ProQuest. 2012
6	2.66%	Smyth, Jamie . Ireland calls vote on European fiscal pact. The Financial Times. ProQuest. 2012

13. Date: 7.3.12	Daily Topic: 0.68%	Bondyield: 14.91%
No.	**Topic**	**Article reference**
1	27.05%	Spiegel, Peter . Q&A: Greek bond swap. The Financial Times. ProQuest. 2012
2	16.40%	Nouriel Roubini . Greece's private creditors are the lucky ones. The Financial Times. ProQuest. 2012
3	15.80%	Hope, Kerin . Top woman politician takes key Athens job. The Financial Times. ProQuest. 2012
4	13.30%	Thomas, Landon J. . Bond swap eases fear of Greek default. The International Herald Tribune. LexisNexis. 2012
5	11.67%	Jones, Sam . Bondholders in stand-off with Athens. The Financial Times. ProQuest. 2012
6	11.26%	Milne, Richard . Investors struggle to make sense of Greek deal. The Financial Times. ProQuest. 2012

14. Date: 12.3.12	Daily Topic: 0.77%	Bondyield: -51.81%
No.	**Topic**	**Article reference**
1	19.52%	Kitsantonis, Niki and Donadio, Rachel . Post-bailout, Greece set for political makeover. The International Herald Tribune. LexisNexis. 2012
2	15.73%	Spiegel, Peter . Eurozone calls for new Spanish budget cuts. The Financial Times. ProQuest. 2012
3	15.10%	Kulish, Nicholas and Lowrey, Annie . For Lagarde and Merkel, warmth transcends differences. The International Herald Tribune. LexisNexis. 2012
4	13.52%	Saleh, Heba . Clinton calls for bilateral aid on Egypt economy. The Financial Times. ProQuest. 2012
5	13.10%	Milne, Richard . New Greek bonds trade at distressed levels. The Financial Times. ProQuest. 2012
6	11.53%	Wilson, James . Germans seek lawsuits over Greek debt swap. The Financial Times. ProQuest. 2012

15. Date: 23.3.12	Daily Topic: 0.24%	Bondyield: 9.58%
No.	**Topic**	**Article reference**
1	6.82%	The Financial Times . Greek food: potential to shake off fetters. The Financial Times. ProQuest. 2012
2	5.39%	Lambert, Richard . Carstens calls for open World Bank selection. The Financial Times. ProQuest. 2012
3	3.26%	Wigglesworth, Robin and Bullock, Nicole and Cookson, Robert . Once risky assets rise on the rally. The Financial Times. ProQuest. 2012
4	2.17%	Lowrey, Annie . For U.S., euro crisis moves to back burner. The International Herald Tribune. LexisNexis. 2012
5	2.08%	Milne, Richard . Keep a low profile when you meet the PM. The Financial Times. ProQuest. 2012
6	1.70%	Jolly, David . Dividend will follow strong year at Hermes. The International Herald Tribune. LexisNexis. 2012

16. Date: 25.3.13	Daily Topic: 2.04%	Bondyield: -2.54%
No.	**Topic**	**Article reference**
1	32.52%	Kanter, James and Alderman, Liz . Cyprus struggles to defuse its crisis. The International Herald Tribune. LexisNexis. 2013
2	32.28%	Alderman, Liz and Kanter, James . Small savers spared in latest plan to rescue Cyprus banks. The International Herald Tribune. LexisNexis. 2013
3	26.73%	Spiegel, Peter . Eurozone wounded by Cyprus imbroglio. The Financial Times. ProQuest. 2013
4	24.75%	Buck, Tobias . Relief and concern on eurozone periphery. The Financial Times. ProQuest. 2013
5	21.07%	Chaffin, Joshua . Nicosia pledges 'temporary' capital curb. The Financial Times. ProQuest. 2013
6	20.51%	The Financial Times . Cyprus: crossing the green line. The Financial Times. ProQuest. 2013

17. Date: 22.10.14	Daily Topic: 0.21%	Bondyield: -5.27%
No.	**Topic**	**Article reference**
1	2.52%	Carnegy, Hugh . Paris defends budget amid EU irritation. The Financial Times. ProQuest. 2014
2	2.15%	Aslund, Anders . Marshall's postwar logic holds true. The Financial Times. ProQuest. 2014
3	2.00%	Moore, Elaine . Africa bond rally halts amid Ebola fear. The Financial Times. ProQuest. 2014
4	1.68%	Punt, Jordi . Colonialism, culture and the Catalan language. The Financial Times. ProQuest. 2014
5	1.28%	Alderman, Liz and Kanter, James . Gary Martin on his least favorite airport. The International New York Times. LexisNexis. 2014
6	1.20%	Cadman, Emily . MPC votes 7-2 to keep UK interest rates on hold. The Financial Times. ProQuest. 2014