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An Empirical Analysis of Market Reactions to the First Solvency and Financial Condition Reports in the European Insurance Industry

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Working Paper

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Version: February 2018

AN EMPIRICAL ANALYSIS OF MARKET REACTIONS TO THE FIRST SOLVENCY AND FINANCIAL CONDITION REPORTS IN THE EUROPEAN INSURANCE INDUSTRY

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This version: February 26, 2018

ABSTRACT

In 2017, insurers in the European Union disclosed their Solvency and Financial Condition Reports (SFCRs) according to the third pillar of Solvency II for the first time. The aim of this paper is to empirically analyze market reactions to the first SFCRs for all publicly listed insurers in the European Union that published an English report based on an event study. We thereby investigate which key figures and textual attributes matter most to investors, using regression analyses and text mining approaches. We also discuss potential areas for improvement concerning SFCR disclosure, which could further enhance the goals of transparency and market discipline in relation to Solvency II's Pillar 3. Our results show that SFCR key figures matter more than textual features. Specifically, we find a significantly positive market impact of the solvency ratio calculated without transitionals or adjustments and a significantly negative one for the solvency capital requirement (SCR).

Keywords: Solvency and Financial Condition Report (SFCR); Solvency II; solvency ratio; risk disclosures; event study; textual analysis

JEL Classification: G14; G22; G28

1. INTRODUCTION

The third pillar of Solvency II requires insurers in the European Union to disclose various reports to increase transparency and market discipline, among them the Solvency and Financial Condition Report (SFCR), which is intended for the public.[1] The first of these reports were to be published in the second quarter of 2017. Since insurers have no experience so far concerning the overall impact of SFCR disclosure, nor the elements of SFCRs that matter most, this paper aims to

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[1] Pillar 1 of Solvency II provides regulatory capital requirements, while Pillar 2 refers to qualitative requirements for governance and risk management, including the Own Risk and Solvency Assessment (ORSA) and the supervisory review process.

empirically investigate how the disclosure of SFCRs, including key figures reported therein, as well as textual features, induce market reactions.

As no SFCRs were previously disclosed, no empirical analyses exist on this topic. However, numerous research studies have considered the impact of different types of disclosures, such as 10-K or 10-Q files (see, e.g., Loughran and McDonald, 2011; 2014; 2015; Griffin, 2003; Jegadeesh and Wu, 2013; Asthana and Balsam, 2001; Bonsall IV et al., 2017; Ertugrul et al., 2017), annual reports (see, e.g., Yekini et al., 2016; Li, 2008; Baumann and Nier, 2004), earnings press releases (see, e.g., Davis et al., 2012; Henry and Leone, 2016; Henry, 2008), ad hoc filings (see, e.g., Palade et al., 2017), initial public offering (IPO) prospectuses (see, e.g., Jegadeesh and Wu, 2013), analyst reports and recommendations (see, e.g., Hsieh et al., 2016) and news from the Dow Jones Newswires or *The Wall Street Journal* (see, e.g., Tetlock, 2007; Tetlock et al., 2008). For instance, Baumann and Nier (2004) observe that more extensive disclosures by banks lead to significantly lower stock price volatility. Establishing a model for the effect of accounting information, Lambert et al. (2007) further show that the quality of accounting information can influence the cost of capital, both directly and indirectly.

A large part of the respective studies also specifically focuses on textual attributes of disclosures, such as tone/sentiment and readability (see Loughran and McDonald, 2016, and Li, 2010, for literature reviews, as well as Kearney and Liu, 2014, specifically for tone). Many researchers find a significant relation between the tone of disclosures and abnormal or excess returns (see, e.g., Loughran and McDonald, 2011; Tetlock et al., 2008; Tetlock, 2007; Henry and Leone, 2016; Henry, 2008; Davis et al., 2012; Palade et al., 2017; Yekini et al., 2016), stock return volatility or trading volume (see, e.g., Loughran and McDonald, 2015; Tetlock, 2007), earnings forecast (see, e.g., Tetlock et al., 2008), return on assets (RoA) (see, e.g., Davis et al., 2012) and IPO underpricing (see, e.g., Jegadeesh and Wu, 2013). In the context of readability, Li (2008) observes more persistent positive earnings for disclosures that are easier to read, and Loughran and McDonald (2014) find stronger announcement effects for better written disclosures. In addition, Hsieh et al. (2016) show that more readable analyst reports decrease uncertainty, such that stock returns are significantly more positive. Conversely, Ertugrul et al. (2017) find that less readable disclosures lead to greater future stock price crash risk and higher loan spreads, while Bonsall IV et al. (2017) observe higher stock market volatility for less readable disclosures.

One strand of the literature also deals with risk disclosures in particular, studying the content, determinants and impact of these disclosures. Concerning the factors that contribute to a higher level of risk disclosures, for instance, several studies empirically identify size (Höring and Gründl, 2011; Linsley et al., 2006; Linsley and Shrives, 2006; Kolmatsui et al., 2016), lower profitability (Höring and Gründl, 2011; Helbok and Wagner, 2006), higher riskiness in terms of the book-to-market ratio (Höring and Gründl, 2011), the level of environmental risk (Linsley and Shrives,

2006), a lower equity-assets ratio (Helbok and Wagner, 2006), the existence of an audit committee (Kolmatsui et al., 2016), ownership dispersion (Höring and Gründl, 2011), US cross listings (Höring and Gründl, 2011) and more bancassurance operations of insurers (Höring and Gründl, 2011) as factors that significantly positively influence the risk disclosure level.

A more detailed review regarding the impact of disclosures on various key figures is provided in Section 2 as the basis for developing the hypotheses. Specifically for SFCRs, some industry studies exist that compare the respective figures of different samples, such as those by Deloitte for 61 SFCRs in Ireland (see Regan and Lynch, 2017), PwC for a sample of top-tier non-life insurers (see Skinner and Kaye, 2017), KPMG for the top ten health, life and non-life insurers in the Netherlands (see Lam and Stijnen, 2017a; 2017b; 2017c), Willis Towers Watson and Autonomous for 31 SFCRs (see Crean and Foroughi, 2017), zeb (2017) for the 25 largest German life insurers, and the BaFin (Bundesanstalt für Finanzdienstleistungsaufsicht, Federal Financial Supervisory Authority in Germany) (2017) for German insurers.

As no empirical analysis concerning the impact of SFCRs and respective drivers has been conducted to date, this paper aims to fill this gap, thereby contributing, on the one hand, to Solvency II-related literature and, on the other hand, to the literature on risk-related disclosures and textual analyses, which we extend to this new form of disclosure. In particular, we first conduct an event study to investigate cumulative abnormal returns (CARs) after the SFCR publication as investors receive new relevant information for future cash flows and the risk of the firm due to the disclosure. Our sample consists of all publicly listed insurers of the European Union that published an English SFCR, which resulted in 48 analyzed reports, representing a market share of more than 42% in terms of gross written premiums in Europe at the end of 2015. To investigate which features seem to matter most to investors, we next investigate the drivers of the CARs by analyzing the SFCRs in more detail and examining which features have a positive or negative impact using regression analyses. We thereby assess the impact of five solvency key figures and also use a text mining approach to investigate the effect of three main textual analyses variables according to Li (2010). In addition, we point out several issues that could hamper the aim of transparency and market discipline in a discussion, in particular, on the method of publication, resulting in search and information costs, unstandardized reporting language and currency, as well as reliability issues, because of unharmonized external audit requirements.

Our results imply that key figures in the SFCRs play a bigger role for market reactions than textual elements. In line with our hypotheses, a higher solvency capital requirement (SCR) leads to significantly lower CARs. In addition, the solvency ratio calculated without adjustments or transitionals, i.e., the more ‘accurate’ figure, has a significantly positive influence on the CARs. In a shorter event window of (0;3), the effect of the unadjusted solvency ratio is no longer

significant, possibly because more time is needed to derive the information from the new SFCRs regarding this figure.

The paper is structured as follows. Section 2 reviews the literature on risk disclosures. Section 3 develops hypotheses and presents the data and methodology. Section 4 first provides a descriptive analysis of the SFCRs, then empirically analyzes the drivers for market reactions. Section 5 discusses practical implications against the background of the aim of transparency and market discipline. Section 6 concludes the paper.

2. Literature Review

As no scientific literature specifically exists, to date, on the impact of SFCR disclosure on market reactions, we focus on the related literature on general risk disclosures. The impact of risk disclosures on various key figures is empirically studied in several articles. Pointing out that risk disclosure is one of the most analyzed elements of 10-K files, Bao and Datta (2014) examine which risk types influence stock return volatility after disclosure. Poshakwale and Courtis (2005) find that disclosure about risk management is the part of banks' annual reports which lowers the cost of equity capital the most, thus further emphasizing the relevance of risk disclosures. Similarly, Nahar et al. (2016) observe a significantly negative relationship between the risk disclosure level in the annual reports of banks listed on the Dhaka Stock Exchange and the cost of equity capital. Moreover, Jizi and Dixon (2017) show that risk management disclosures in the annual reports of US commercial banks are associated with higher stock prices and reduced volatility. Campbell et al. (2014) observe that the risk factor section in 10-K files reflects the real risk in terms of pre-disclosure risk proxies. In addition, they find that these risk factors influence the market beta, have a negative relation with abnormal returns and lead to an increase in stock volatility as a proxy for investors' risk perceptions, but to a decrease in bid-ask spreads approximating information asymmetry. Kravet and Muslu (2013) also find an increase in stock return volatility for an increase in risk disclosure in 10-K files, as well as a higher trading volume and more dispersed analyst forecast revisions.

With regard to textual analyses of reports, studying the frequency of words related to risk and uncertainty in 10-K files, Li (2006) shows that an increase in these terms is associated with lower future earnings and significantly negative returns. For value-at-risk (VaR) disclosures in 10-K and 10-Q files of US commercial banks, Jorion (2002) further finds that a higher VaR-based volatility forecast implies greater variability in subsequent unexpected trading revenues. Concerning credit risk valuation, Tsai et al. (2016) observe a significantly positive impact of risk disclosures in 10-K and 10-Q files on spreads in the credit-default-swap (CDS) market, whereby the subcategory financial risk exhibits the highest impact, and Bonsall IV and Miller (2017) show that, among other aspects, risk-related terms are positively related to credit spreads.

Several studies also deal with the effect of the disclosure of stress test results or announcements of supervisory actions. Alves et al. (2015) conduct an event study to investigate the reaction of stock and CDS markets after the disclosure of stress test results of European banks in 2010 and 2011. While they find no significant reactions in the CDS market, they observe a significantly positive average CAR for the stock market, especially for banks that clearly passed. Morgan et al. (2014) observe, for instance, that banks with larger capital gaps during the stress tests of US bank holdings in 2009 experienced more negative abnormal returns when considering the expected gaps. Studying announcements of supervisory actions of banks, Jordan et al. (2000) find significantly negative CARs following the announcement.

Besides empirical studies on the impact of risk disclosures, several models exist on this topic. Modeling the price effect of risk disclosures, Heinle and Smith (2017) show that risk disclosure reduces the cost of capital and investors' uncertainty with regard to the variance in a firm's cash flows, i.e., the riskiness of a firm, which would otherwise lead to price premiums. In a model for voluntary risk disclosure, Jorgensen and Kirschenheiter (2003) find *inter alia* that disclosure leads to a lower risk premium and beta. Specifically in the context of Basel II, a model by Vauhkonen (2012) shows that the third pillar of Basel II has a positive effect on bank safety because the resulting increased transparency provides incentives to improve risk management capabilities.

Finally, with a focus on market discipline, Eling and Schmit (2012) find significant premium declines and higher life insurance termination rates in the German insurance industry after rating downgrades as a proxy of default risk and after an increase in complaints as a measure of service quality, but less clear evidence for respective positive signals.

3. Methodology and Development of Hypotheses

3.1 Sample and data sources

Our sample consists of all publicly listed insurers in the European Union that published an English SFCR, based on an equity search in Datastream with the following filter options: European Union for the country of issuer, TRBC sector (Thomson Reuters Business Classification) insurance, only primary quotes and active listings. These firms were supplemented with firms from the relevant industry and region-specific Datastream lists (insurance, reinsurance, full line insurance, life insurance, non-life insurance EU), where applicable; listings on large stock exchanges, such as the London Stock Exchange, were additionally checked. Firms for which return data were not available for the necessary period (see Section 3.2 for further details on the estimation period) were not considered. From this set, the companies that do not fall under the scope of Solvency II and thus do not disclose SFCRs had to be excluded. Additional exclusions were necessary because some firms did not publish their SFCR in English, only in their national language.

Hence, our final sample comprises 48 firms from 15 countries as listed in Table A.1. Respective total gross written premiums are approximately EUR 506 billion, which represents a market share of more than 42% in Europe.[2] The first SFCR was published on January 18, 2017 (fiscal year of Hansard Europe DAC differing from the calendar year), followed by the next ordinary fiscal year disclosure on March 31, 2017, by St. James's Place PLC and continuing until the last SFCR disclosure on July 1, 2017, by Just Group PLC.

Market data were obtained from Datastream[3] and solvency-related data were directly taken from SFCRs published on the websites of the examined insurers. For book data, the figures stated in the annual reports of the firms were used. If data were not stated in EUR, they were converted by using the respective exchange rates as of December 30, 2016 (last trading day of SFCR reference period).

3.2 Event study approach

Consistent with findings of the literature review in Section 2, which show that risk disclosures are informative and thus incorporated into the valuation by investors, we expect in general that the disclosure of SFCRs led to CARs that depend on the features of the respective SFCR. The rationale behind this is that, due to the increased transparency resulting from the publication of SFCRs, investors receive new relevant information for future cash flows and the risk of the firm, e.g., anticipating underwriting and surrender behavior for the insurer, and reacting adequately, which should in turn foster market discipline (see, e.g., Eling and Schmit, 2012).

For the calculation of the CARs, we draw on the event study approach as used in the finance and insurance literature. We use continuously compounded (log) returns from total return indices, which consider dividends and splits, and estimate the following one-factor model, which is frequently used (see, e.g., Biell and Muller, 2013; Fiordelisi et al., 2013; Fiordelisi et al., 2014; Gillet et al., 2010; Perry and de Fontnouvelle, 2005):

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t}. \qquad (1)$$

The parameters α_i and β_i are estimated by an ordinary least squares (OLS) regression of the log-return $r_{i,t}$ of the firm i at day t on the log-return of the benchmark index $r_{m,t}$, whereby $\varepsilon_{i,t}$ represents the respective error term of the regression. Cummins et al. (2006), for instance, receive comparable

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[2] See www.insuranceeurope.eu for 2015 (data for 2016 not available); note that the reported gross written premiums in Europe also include countries outside the European Union, e.g., Switzerland, such that the market share of the considered sample with respect to the European Union is even larger.

[3] The event window for two firms originally included public holidays, with the primary stock exchange being closed, and consequently returns of zero. For this reason, we used total return data from different stock exchanges with no public holidays in the event window for these firms.

results when using a one-factor and a three-factor model in their analysis. For the estimation window, we use the standard period of 250 trading days, ending the day before the SFCR publication. In common with other event studies in the area of finance and insurance, we use FTSEurofirst 100 as the benchmark index (see, e.g., Gillet et al., 2010). Perry and de Fontnouvelle (2005) report similar results when using FTSEurotop 100 and local stock market indices as benchmarks; for our considered period, FTSEurofirst 100 and FTSEurotop 100 have a very high correlation of 0.998.

Abnormal returns $AR_{i,t}$ are then given by subtracting the estimated returns from the observed returns, i.e.,

$$AR_{i,t} = r_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i r_{m,t}). \tag{2}$$

CARs for event windows starting on the day of the SFCR disclosure (day 0) with different lengths T are next obtained by summing up the respective abnormal returns, i.e.,

$$CAR_i(0;T) = \sum_{t=0}^{T} AR_{i,t}. \tag{3}$$

In general, narrow event windows should be chosen so that it is unlikely that the market reaction is influenced by events other than the SFCR disclosure (see, e.g., Yekini et al., 2016). As we observe the highest mean and median concerning the absolute values of the CARs for the event window (0;5), we take this window as the standard one for our subsequent analyses since investors probably need this time span to read the first-time SFCR disclosures and incorporate the information into their valuation. For robustness checks, we further use the standard event window for similar studies of (0;3) (see Griffin, 2003).

In addition to studying CARs for the overall sample, we also divide the sample into two groups, according to the disclosure dates of the SFCRs, in order to investigate whether market reactions are different for the later-disclosed SFCRs when a considerable number of other SFCRs already exists. We therefore split the sample approximately into two halves, such that the first group includes the 25 SFCRs disclosed by May 19 and the second group consists of the 23 SFCRs disclosed afterwards.

3.3 Development of hypotheses and variable description

Our objective is to study which distinct features of the SFCRs give rise to CARs and whether this impact is positive or negative. For this purpose, we use the CARs (see description in the previous section) as the dependent variable in OLS regression analyses and examine the influence of five solvency key figures and three text mining attributes as independent variables, which are described with their respective hypotheses in the following section.

SR: We investigate the impact of the solvency ratio *SR* as reported in the SFCRs, i.e., available own funds divided by the SCR. A lower solvency ratio implies a higher ruin probability. In this regard, Zimmer et al. (2009) find, in an experimental setting, that an increase in default risk negatively affects the policyholders' willingness to pay. As policyholders are debt capital holders, the solvency ratio directly influences product quality (see Lorson et al., 2012). Furthermore, a low solvency ratio may constrain the distribution of dividends (see Skinner and Kaye, 2017). Consequently, we hypothesize:

H_{1a}: Companies with a higher solvency ratio experience higher CARs.

$SR_{unadj.}$: In addition to the solvency ratio as reported, we include the solvency ratio calculated without adjustments or transitionals,[4] and also expect to find a positive relation concerning the CARs. Insurers are required to report on the application and impact of these measures on various positions in their SFCR and in their Quantitative Reporting Template (QRT) S.22.01.22 "Impact of long term guarantees and transitional measures", which enables a calculation of the unadjusted solvency ratio. Our hypothesis is as follows:

H_{1b}: Companies with a higher unadjusted solvency ratio experience higher CARs.

Model: Insurers may choose from among five methods to calculate the SCR: a simplified standard formula, the standard formula, the standard formula with undertaking specific parameters, a partial internal model and a full internal model (labeled with the values of 1 to 5 in accordance with their sophistication for the purpose of the empirical analysis). A more advanced and thus individual model should reflect the risk landscape more accurately, which enables better risk-based business steering and performance measurement. An internal model also implies an improvement in risk management (see Gatzert and Wesker, 2012), which may provide a competitive advantage. Thus, we assume:

H_2: Companies with a more sophisticated model experience higher CARs.

SCR: Eling et al. (2007) refer to the SCR as the "crux" of Solvency II. It indicates how much capital is needed to absorb a loss that only occurs once in 200 years, i.e., it is defined as the VaR for a confidence level of 99.5% and accounts at least for non-life, life and health underwriting,

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[4] Insurers may apply up to four respective measures, which can influence the solvency ratio. For details on these measures, see the following regulatory references: matching adjustment (see Solvency II Directive, 2009, Art. 77b-77c; Commission Delegated Regulation, 2015, Art. 52-54), volatility adjustment (see Solvency II Directive, 2009, Art. 77d; Commission Delegated Regulation, 2015, Art. 49-51), transitional measure on the risk-free interest rate (see Solvency II Directive, 2009, Art. 308c), and transitional measure concerning technical provisions (see Solvency II Directive, 2009, Art. 308d).

market, credit and operational risk (see Solvency II Directive, 2009, Art. 101). A higher capital requirement generally implies a higher cost of capital, which may lead to higher premiums (see Lorson et al., 2012). For these reasons, we expect:

H_3: Companies with a lower SCR experience higher CARs.

Hidden: We further examine the hidden reserves or liabilities of the Solvency II balance sheet, i.e., the difference between the total assets according to the (market) valuation for solvency purposes and the valuation of the total assets on the balance sheet of the annual report. In the context of the transition from UK GAAP to IFRS, Horton and Serafeim (2010) find significant negative abnormal returns for a negative earnings reconciliation. As the market valuation of Solvency II ought to reflect the economic reality and is therefore relevant for investors, we expect:

H_4: Companies with higher hidden reserves experience higher CARs.

In addition to the key figures, we use a text mining approach for investigating the effect of qualitative information associated with the SFCRs. A literature review by Loughran and McDonald (2016) shows that investors incorporate more than quantitative data in their valuation. In addition, based on a literature review concerning textual analyses, Li (2010) identifies tone/sentiment, the amount of the disclosure and readability as the three main variables of interest, which are thus discussed in the following.

Tone: Several researchers have been able to show that textual sentiment has a market impact, even after controlling for financial figures (see, e.g., Yekini et al., 2016; Kearney and Liu, 2014, offer a survey of the sentiment literature). Tone is most frequently measured by examining the frequency of the occurrence of specific words (see, e.g., Henry and Leone, 2016, for a respective review). We only consider the count for negative words (logarithmized), instead of a net measure of positive and negative words, as positive words are often negated and thus may be noisy, whereas the inverse case only rarely occurs (see Loughran and McDonald, 2011). In addition, empirical evidence exists that investors do not react to positive news in the same way as to negative news. For instance, Loughran and McDonald (2015) find a significant relation between their negative word list and stock return volatility, while the positive word list only provides insignificant results. Similarly, Tetlock et al. (2008) and Palade et al. (2017) observe that the size of the reaction to negative messages is larger than to positive ones. The word list predominantly used in recent studies in this context and the one we use is by Loughran and McDonald (2011), which was specifically created for a business context and consists of 2,355 negative words after continuous updates. General word lists, such as the Harvard University's General Inquirer IV-4, have the disadvantage that they also include words with a different meaning in a business context, such as liabilities, which is not necessarily negative in this context (see Loughran and McDonald, 2011). Since, for instance,

Loughran and McDonald (2011) find that negative words lead to significantly lower excess returns, we assume:

H_5: Companies with a lower number of negative words in their SFCRs experience higher CARs.

Length: We further investigate the impact of the length of the SFCR disclosure in terms of the total number of words (logarithmized). If more information is disclosed, we expect to find stronger market reactions, i.e., more extreme CARs (measuring approach is laid out below) (see, e.g., Loughran and McDonald, 2014):

H_6: Companies with a higher number of words in their SFCRs experience a stronger market reaction.

Readability: Readability functions as a measure of transparency. Hsieh et al. (2016) observe significantly more positive stock returns for more readable analyst reports, as they reduce uncertainty. In addition, Loughran and McDonald (2014) find higher announcement effects for better-written disclosures. Most studies use the Fog Index (see, e.g., Bonsall IV et al., 2017) as a measure for readability, which considers the proportion of complex words, i.e., words with more than three syllables, and the average sentence length, i.e., the average words per sentence. However, in a business context, words with more than three syllables are very common; consequently, Loughran and McDonald (2014), decomposing the two elements of the Fog Index, were able to show that only the second component leads to significant market reactions. In the context of loan spreads and stock price crash risk, Ertugral et al. (2017) also observe that only the 'average words per sentence' component of the Fog Index has explanatory power. Thus, we only use the average words per sentence to reduce noise. We expect to find more extreme CARs, i.e., stronger announcement effects, for SFCRs that are easier to read and consequently more informative and easier to comprehend (see, e.g., Loughran and McDonald, 2014):

H_7: Companies with a lower number of average words per sentence in their SFCRs experience a stronger market reaction.

In addition to our independent variables of primary interest, we include four commonly used firm-specific control variables: as a measure of size, the natural logarithm of the book value of total assets; leverage as defined as the book value of total liabilities, divided by the book value of total assets; RoA as a measure of profitability; and, to further include a market value measure, the market-to-book ratio (MB).

3.4 Regression analyses

As the hypotheses concerning the last two variables refer to the size of the CARs without a specific direction, i.e., to the absolute values of the CARs, we establish two separate OLS regression models. The first one examines the relation between the five key solvency ratios, as well as the first text mining attribute and the CARs, and is given by:

$$CAR(0;5) = \alpha + \beta_1 SR + \beta_2 SR_{unadj.} + \beta_3 Model + \beta_4 SCR + \beta_5 Hidden + \beta_6 Tone + \beta_7 Size + \beta_8 Leverage + \beta_9 RoA + \beta_{10} MB + \varepsilon. \quad (4)$$

The second regression model includes the absolute values of the CARs as the dependent variable (see, e.g., Loughran and McDonald, 2014) in order to investigate the influence of the remaining two text mining attributes:

$$|CAR(0;5)| = \alpha + \beta_1 Length + \beta_2 Readability + \beta_3 SR + \beta_4 SR_{unadj.} + \beta_5 Model + \beta_6 SCR + \beta_7 Hidden + \beta_8 Tone + \beta_9 Size + \beta_{10} Leverage + \beta_{11} RoA + \beta_{12} MB + \varepsilon. \quad (5)$$

In this case, the other independent variables are adjusted to resemble ‘extreme’ values as well, i.e., we calculated the absolute deviation from the median for each variable and observation (indicated by the subscript *dev.* for the empirical analysis in Section 4.2).

4. Empirical Results

4.1 Descriptive analysis of SFCR elements and further examined variables

Table 1 gives an overview of descriptive statistics of the sample. One can observe that the publication of the first SFCRs led to a slightly positive CARs on average, with a mean of 0.27% (0.40%) and a median of 0.46% (0.71%) for the event window (0;5) ((0;3)). When dividing the sample into two groups according to the disclosure dates of the SFCRs, as described in Section 3.2, we find no significant differences in the means and medians of the CARs between the first and second group, implying similar market reactions in general. The mean of the reported solvency ratios is 198%, ranging from 66% to 390%.[5] Calculated without adjustments and transitionals, the mean solvency ratio is 176%, which is more than 20 percentage points lower on average, with a range from -56% to 390%.[6]

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[5] In an analysis of 31 SFCRs of European insurers, Crean and Foroughi (2017) find an average solvency ratio of 187%, and Lam and Stijnen (2017a; 2017b; 2017c) state a figure of 156% for the top ten health, 165% for the top ten life and 150% for the top ten non-life insurers in the Netherlands.

[6] zeb (2017) also observes considerable differences in the unadjusted solvency ratio for the 25 largest German life insurers, which, for some firms, is below 100% in this case.

Table 1: Summary statistics

	Mean	Median	Standard deviation	Min.	Max.
CAR (0;5)	0.27%	0.46%	3.28%	-9.31%	6.98%
CAR (0;3)	0.40%	0.71%	2.74%	-9.40%	5.44%
SR	198.15%	177.00%	66.34%	66.00%	390.00%
$SR_{unadj.}$	176.43%	164.00%	83.40%	-56.00%	390.00%
Model	3.04	3.00	1.27	1.00	5.00
SCR	5,244.08	1,682.00	7,833.65	6.00	34,580.00
Hidden	-25,964.52	-127.50	67,550.10	-260,895.00	20,849.00
Tone (ln)	6.47	6.59	0.64	4.06	7.62
Length (ln)	10.56	10.57	0.63	8.63	12.05
Readability (words per sentence)	34.78	31.70	18.13	15.09	136.22[7]
Size (ln)	9.39	9.19	2.89	3.33	13.70
Leverage	0.78	0.82	0.20	0.01	0.99
RoA	3.57%	1.28%	6.36%	-0.12%	38.61%[8]
MB	1.63	1.20	1.50	0.16	9.10

The investigated companies use all five methods for calculating the SCR, from a simplified standard formula to a full internal model. Resulting SCRs range from EUR six to 34,580 million. The valuation for solvency purposes rather leads to hidden liabilities than hidden reserves in terms of the difference in total assets between the Solvency II balance sheet and the statuary accounts for the firms in the sample. The investigated SFCRs include between 58 ($\approx e^{4.06}$) and 2,045 ($\approx e^{7.623}$) negative words of the respective Loughran and McDonald (2011) word list and are composed of between 5,577 ($\approx e^{8.626}$) and 171,067 ($\approx e^{12.05}$) words. As the mean of 34.78 average words per sentence even exceeds the one reported by Loughran and McDonald (2014) for 10-K files with 27.37, the examined SFCRs are, in general, complex and difficult to read, which is consistent with the findings of Linsley and Lawrence (2007) for risk disclosures in annual reports of UK firms.

4.2 Determinants of the market reaction to SFCR disclosure

To investigate which factors drive the direction and magnitude of the market reaction after the SFCR disclosure, we first examine whether there are significant differences between firms that

[7] The high maximum value occurs for the SFCR of Ecclesiastical Insurance Office PLC, which is driven by long bullet point lists without full stops at the end of the bullet points. Without this outlier, the maximum is 74.80 words per sentence. As a robustness check, we additionally performed the subsequent regression analyses without this outlier, but found similar results.

[8] Euler Hermes Group SA received an exceptional dividend from Euler Hermes SA (EUR 620 million) in 2016, resulting in a RoA of 38.61%. Without this dividend payment, the RoA would be 7.8%. The regression analyses show similar results when excluding this outlier. Without this number, the maximum RoA is 18.14% (esure Group PLC).

experience negative and positive CARs. We compare the means and medians for the group of firms with negative CARs versus the group of firms with non-negative CARs (more than 58% of the firms in the sample), as depicted in Table 2.

Table 2: Univariate differences across groups with negative and non-negative CARs

	Non-negative CAR (0;5) (n=28)		Negative CAR (0;5) (n=20)		Differences	
	Mean	Median	Mean	Median	Difference in means	Difference in medians
SR	209.50%	201.50%	182.25%	164.00%	27.25%	37.50%**
$SR_{unadj.}$	197.39%	190.00%	147.10%	147.00%	50.29%**	43.00%**
Model	3.18	3.50	2.85	2.00	0.33	1.50
SCR	5,662.43	1,526.00	4,658.40	1,875.00	1,004.03	-349.00
Hidden	-34,316.18	-22.50	-14,272.20	-255.50	-20,043.98	233.00
Tone	6.45	6.53	6.50	6.69	-0.05	-0.16
Length	10.45	10.52	10.71	10.71	-0.26	-0.19
Readability	31.14	31.39	39.88	32.49	-8.74	-1.10
Size	9.32	8.87	9.49	10.18	-0.17	-1.31
Leverage	0.74	0.80	0.83	0.85	-0.09	-0.05
RoA	4.47%	2.50%	2.32%	0.73%	2.15%	1.77%
MB	1.75	1.17	1.47	1.35	0.27	-0.18

Notes: Differences in means are based on a t-test. Differences in medians are based on a non-parametric median test. ** denotes statistical significance at the 5% level.

We find significant differences in means and medians for the solvency ratio calculated without any adjustments or transitionals, as well as a significant difference in medians for the solvency ratio as reported. Firms that experience non-negative CARs have an unadjusted solvency ratio that is 50.29 percentage points higher than firms with negative CARs on average. Furthermore, the median of the solvency ratio as reported is 37.5 percentage points higher for firms with non-negative CARs. While this univariate analysis does not yield further significant differences between the groups of firms with negative and non-negative CARs for the variables of interest, the tendency of the differences in medians of the other variables is in line with our hypotheses. That is, firms in the sample with non-negative CARs rather use more sophisticated models, have a lower SCR, possess more (less) hidden assets (liabilities) and use fewer negative words in their SFCR disclosure.

Conducting the group tests separately for the first half of disclosures leads to similar results as for the overall sample with firms of the first half with non-negative CARs having significantly higher mean and median values of the solvency ratio as reported and the unadjusted solvency ratio. For the second half, the group of firms with non-negative CARs also has a higher solvency ratio as reported and a higher unadjusted solvency ratio, but the differences (on average 19 percentage

points for the solvency ratio as reported, and 38 percentage points for the unadjusted solvency ratio) are not significant.

We next conduct a multivariate OLS regression with *CAR (0;5)* as the dependent variable, as well as the five SFCR key figures, the first of the three text mining attributes and the four control variables as independent variables (see Equation (4)). Table 3 shows the resulting (standardized) regression coefficients and significance levels.[9]

Table 3: Results of the OLS regression (Equation (4))

	Regression coefficient	P-value	Standardized regression coefficient
SR	-0.022820	0.145470	-0.461365
SRunadj.	0.023073*	0.067641	0.586430
Model	0.004242	0.393682	0.164305
SCR	-0.000002*	0.094036	-0.427363
Hidden	-0.000000	0.231004	-0.251641
Tone	0.002680	0.754120	0.052028
Size	0.006265**	0.037978	0.552203
Leverage	-0.026636	0.500891	-0.163866
RoA	0.108875	0.288378	0.211014
MB	0.000810	0.804928	0.037210
Intercept	-0.060282	0.280452	
R^2=0.293			

Notes: The dependent variable is *CAR (0;5)*. ** and * denote statistical significance at the 5% and 10% level, respectively.

We find that firms with a higher solvency ratio calculated without adjustments or transitionals *ceteris paribus* have significantly higher CARs in line with our hypothesis H_{1b}, as also shown by the univariate analysis of group differences in Table 2. Meanwhile, the solvency ratio as reported has no significant effect. Furthermore, in line with our hypothesis H_3, we observe that firms with a higher SCR *ceteris paribus* experience significantly lower CARs. The magnitude of the effect sizes as implied by the standardized regression coefficients shows that the unadjusted (and thus - in theory - economically more realistic) solvency ratio has a higher effect on the CARs in absolute terms than the SCR. An increase in the unadjusted solvency ratio by 10 percentage points implies an increase in the CAR by 0.23 percentage points, while an increase in the SCR by EUR 1 billion leads to a (low but significant) decrease in the CAR by 0.2 percentage points, for instance. This is consistent with the statement by zeb (2017) that the solvency ratio is the most important piece of information in the SFCRs due to the limited experience of the market participants and an information overload.

[9] As a multicollinearity check, we analyzed variance inflation factors, which clearly fall below the conventionally cited critical value of 10 (see Marquardt, 1970), with the highest one being 5.076.

We also find a significantly positive influence of the control variable *Size* on the CARs. The other examined variables have no significant impact on the CARs. The reason for the insignificant effect of *Model* could be that a more individual internal model also leads to less comparability between firms (see, e.g., Gatzert and Wesker, 2012; Eling et al., 2007). Moreover, investors do not seem to value the difference in balance sheets between Solvency II and accounting standards.

One reason why the tone of the disclosure does not seem to play a role could be that the narratives in the SFCRs are rather neutral by nature and do not contain as many forward-looking statements as complete annual reports, for instance. For risk disclosures contained in annual reports, Kolmatsui et al. (2016) also find that they rather focus on the present and the past, than contain forward-looking statements (also observed by Linsley et al., 2006, for instance), and have a neutral meaning in general.

Using a shorter event window (0;3) for the CAR as the dependent variable, in terms of a robustness check, the significant effects of *SCR* and *Size* are confirmed, and we again observe a positive but no longer significant influence of the unadjusted solvency ratio (p-value 0.355). A possible explanation is that more time, i.e., a longer event window, is needed to calculate the (mostly not explicitly reported) unadjusted solvency ratios, especially for the first-time SFCR disclosure. The other variables of interest are not significant for the shorter event window either, but have the same signs as for the longer event window, apart from the tone, which has, in this case, a negative sign, as hypothesized.

Furthermore, we perform additional robustness checks on our results. We conduct the regression analysis with fewer control variables, specifically only with the six variables of interest and excluding the four control variables. This analysis confirms the signs of all variables as well as the significantly positive effect of the unadjusted solvency ratio. The negative impact of the SCR is no longer significant (p-value 0.241) without control variables. However, we observe another significant effect at the 10% level for *Model* in line with our hypothesis. The more advanced the model used to calculate the SCR, the higher the CAR *ceteris paribus*. Including the one significant control variable, *Size*, our original results are robust, i.e., the solvency ratio without adjustments or transitionals exhibits a significantly positive and the SCR a significantly negative effect on the CARs.

Moreover, we conduct another OLS regression with the absolute value of the CARs as the dependent variable (see Equation (5)) in order to investigate our hypotheses concerning the remaining two text mining variables, in which more extreme CARs in absolute terms are observed for longer, along with more readable SFCRs, with the results shown in Table 4. For this purpose, we transformed the ten variables included in the prior regression analysis to depict ‘extreme’

values as well, as explained in Section 3.4.[10] While we observe, in our sample, that longer and more easily readable SFCRs lead to more extreme CARs, these effects are not significant (p-values 0.162 and 0.407, respectively). These findings are the same when conducting the regression analysis with only the two variables of interest. For a shorter event window of (0;3), we do not observe significant effects either. These findings, together with the insignificant effect of *Tone* in the previous regression analysis, imply that textual features do not seem to play an important role in SFCRs in terms of market reactions, in contrast to the results of the majority of studies concerning 10-K files (see, e.g., Kearney and Liu, 2014, for a survey of the sentiment literature), at least for the first-time SFCR disclosure. In a review of the textual analysis literature, Li (2010) finds indications that the market may not fully understand the implications of textual disclosure elements.

Table 4: Results of the OLS regression concerning the absolute value of the CARs (Equation (5))

	Regression coefficient	P-value	Standardized regression coefficient
Length	0.011026	0.162284	0.316470
Readability	-0.000252	0.406553	-0.207144
$SR_{dev.}$	0.005007	0.642022	0.108140
$SR_{unadj.dev.}$	-0.003372	0.711572	-0.087192
$Model_{dev.}$	-0.008393	0.298611	-0.180993
$SCR_{dev.}$	-0.000001*	0.086012	-0.455040
$Hidden_{dev.}$	0.000000	0.649616	0.110039
$Tone_{dev.}$	0.009888	0.407594	0.210659
$Size_{dev.}$	0.002929	0.239712	0.221494
$Leverage_{dev.}$	0.000670	0.982000	0.004497
$RoA_{dev.}$	0.030996	0.674548	0.083944
$MB_{dev.}$	-0.002426	0.405128	-0.143552
Intercept	-0.078690	0.327551	
R^2=0.172			

Notes: The dependent variable is the absolute value of *CAR (0;5)*. * denotes statistical significance at the 10% level; *dev.:* variables were adjusted to measure the absolute deviation to the median.

Finally, we again conduct the regression analyses separately for the first and second half of the disclosed SFCRs to check for differences. Concerning the first regression (Equation (4)), we find no significant effects for the first group for event windows (0;5) and (0;3), which is also due to the smaller sample size, while we obtain similar results compared to the overall sample for the second group with a significantly positive influence of the unadjusted solvency ratio (regression coefficient 0.034, p-value 0.080) and size (regression coefficient 0.009, p-value 0.071). The SCR has a negative but not significant effect (p-value 0.304). For the event window (0;3), the effect of the unadjusted solvency ratio is again no longer significant (p-value 0.258). For the second

[10] For robustness purposes, we also ran the regression analysis with the unadjusted variables, which yielded similar results.

regression (Equation (5)), the results of the split sample are similar to those of the overall sample, i.e., there is no significant effect of the variables of interest. Overall, considering all results for the divided sample (CARs in general, tests for group of firms with (non-)negative CARs, regression analyses), we find rather similar results with in tendency fewer significant effects, also due to the smaller sample size.

5. Discussion and Implications

Our analysis shows which elements of the SFCRs apparently matter most to investors, such that insurers may want to pay particular attention to these aspects. Generally, it seems that key figures in SFCR disclosure play a bigger role than textual elements. The highest impact can be observed with regard to the solvency ratio calculated without adjustments or transitionals, i.e., the generally more 'accurate' solvency ratio. This implies that improving the reported solvency ratio by using the four possible measures has no significant effect in our study in terms of market reactions. While, in this study of the first-time SFCR disclosure, the positive effect of the unadjusted solvency ratio is only significant for a longer event window, it is likely that, for future disclosures, investors will require less time for a reaction to this mostly not explicitly reported figure. Hence, insurers should actively manage their solvency ratio and work on understanding respective optimization potentials in the future (see also zeb, 2017).

Possible explanations as to why our analysis does not yield higher market reactions and a higher amount of significant drivers of the CARs for the current SFCR disclosure could be the presence of pervasive issues with SFCR disclosure concerning accessibility/availability and resulting information costs, as well as reliability, which could be improved in the future to further contribute to the overall aim of transparency and market discipline.

First, market reactions tend to be higher if search and information costs are low. For instance, before the introduction of U.S. SEC (Securities and Exchange Commission) EDGAR (Electronic Data Gathering, Analysis, and Retrieval) system, which considerably facilitated access to 10-K files, for example, only limited statistical evidence of investor responses to these regulatory filings existed (see, e.g., Griffin, 2003; Li and Ramesh, 2009). Asthana and Balsam (2001) also observe market reactions to 10-Ks only in the post-EDGAR period as information became practically costless. SFCRs, however, have to be downloaded from the websites of single insurers, as no public central platform currently exists, and are not easy to find in many cases. In addition, even though SFCRs follow a mandatory structure, as defined in Annex XX of the Commission Delegated Regulation (2015), large differences exist in terms of quantity, which can also be seen in the descriptive statistics concerning the number of words (*Length*) in Section 4.1, and the quality of the reporting, which is also observed by Höring and Gründl (2011) in relation to risk disclosures in the annual reports of European insurers. In the context of SFCRs, various industry studies with

different samples highlight considerable differences concerning length and detailedness, even among similar insurers (see Regan and Lynch, 2017; Skinner and Kaye, 2017; BaFin, 2017). Therefore, Crean and Foroughi (2017) suggest more standardized templates.

Relevant information is sometimes not included in the narratives, but only in the QRTs, which makes an analysis of the SFCRs in general difficult and time-consuming. By way of an illustrative example, this is frequently the case for the amount of total liabilities according to the Solvency II balance sheet. Thus, disclosing SFCRs in the search-facilitating XBRL (eXtensive Business Reporting Language) format, in which information is tagged, could, for example, increase transparency and therefore market reactions (for a discussion of XBRL in the context of Solvency II, see Bonsón et al., 2010). In the context of banks, Hao and Kohlbeck (2013) find positive abnormal returns, an increased trading volume and reduced systematic risk for the first mandatory XBRL implementation concerning banks' quarterly consolidated reports of condition and income.

Furthermore, a harmonization of the reporting language and currency would foster transparency. Even though our study investigated publicly listed insurers with many international stakeholders, 16 firms in the scope of Solvency II had to be excluded from the sample because their SFCRs were not available in English, only in their national language. Two insurers in our sample disclosed the SFCR first in the national language and several days later in English, where we found stronger market reactions to the English disclosure, meaning that the absolute values of the CARs are, in general, higher for different event windows. Besides language issues, the use of different reporting currencies does not facilitate comparisons. In our sample, more than 40% of the firms did not report in EUR, for instance.

Finally, investors' perceptions on the reliability of reported information could also be influenced by the countries' highly varying external audit requirements concerning the SFCRs. A survey by Accountancy Europe (2016) gives an overview about which parts of the SFCRs are subject to auditing in different countries. Hence, differing external verification could render the information contained in the SFCRs as less comparable in the eyes of investors.

6. SUMMARY

This article examined market reactions to the first disclosure of SFCRs in the European Union of all publicly listed insurance companies that published an English report, representing about 42% of the entire European market in terms of gross written premiums. The paper therefore extends the corporate-related (risk) disclosure literature, whose results predominantly support the informativeness of disclosures, to this form of publication. We first conducted an event study to determine CARs after the disclosure of the SFCRs. Next, we investigated which key figures and textual attributes of the SFCRs drive the emergence of cumulative abnormal market returns.

Besides providing a descriptive analysis of the examined SFCRs, regarding the various variables of interest, we tested for group differences between firms with negative and non-negative CARs after SFCR disclosure, followed by multivariate regression analyses. Determining from our findings which aspects matter most to investors, we discussed implications for insurers and lastly pointed out how transparency and market discipline, as the aim of Solvency II Pillar 3, can be further increased.

The results of the univariate analysis of differences between the group of firms that experienced negative CARs versus the group that experienced non-negative CARs show significant differences concerning the solvency ratios. In particular, the mean (median) solvency ratio calculated without adjustments or transitionals among firms with negative CARs is 50.29% (43.00%) lower. For the solvency ratio as reported (i.e., including transitional measures), only the median is significantly lower (by 37.50%) for firms with negative CARs.

The regression analyses confirm the significant positive effect of the unadjusted solvency ratio on the CARs is in line with our hypotheses (despite the challenges regarding a comparability of solvency ratios across different firms), while the solvency ratio as reported has no significant impact. This indicates that investors value the generally more ‘accurate’ solvency figure and are not impacted by transitional measures. Our analysis reveals that an unadjusted solvency ratio that is 10 percentage points higher leads to a CAR that is 0.23 percentage points higher. For a shorter event window, the positive relation between the unadjusted solvency ratio and the CAR is not significant, probably because investors need some time to calculate this figure, which is mostly not explicitly reported, for first-time disclosure. As investors will be more used to SFCRs after the next publication, we would expect to find a significant reaction closer to the SFCR disclosure date. Also in line with our hypotheses, we find that firms with a higher SCR have significantly lower CARs, as a higher capital requirement is in general linked to lower profitability and a higher cost of capital may lead to increases in premiums. Specifically, an increase in the SCR by EUR 1 billion leads to a decrease of 0.2 percentage points in the CAR. Comparing effect sizes using standardized regression coefficients, our findings show that the unadjusted solvency ratio as the central figure is most relevant for market reactions.

While we observe significant effects for two of the examined solvency key figures, we obtain no significant results for the investigated textual attributes. A possible reason for this could be that, in accordance with the general risk disclosure literature, SFCRs are rather neutral and contain more information about the past and present, than forward-looking statements.

Finally, we discuss some issues regarding the general frame of SFCR disclosure, which, if changed in the future, could contribute to even higher transparency and thus lead to higher market reactions and more significant drivers of the CARs. First, based on previous findings and arguments in the

related literature, information and search costs could be reduced by introducing a central platform for SFCR publication (in addition to postings on insurers' single websites) and by providing the reports in the search-facilitating XBRL format, which tags information. Next, a requirement for publishing the SFCRs in English, besides respective national languages, would be beneficial, at least for publicly listed insurers with many international stakeholders, as well as a standardization of the reporting currency. Last, a harmonization of audit requirements could enhance the impression of reliability of the SFCRs.

Overall, since this is the first study concerning the impact of SFCRs on market reactions, and insurers have little experience concerning its impact, important first insights are obtained, which point to potential future research opportunities. For instance, future studies could assess whether similar effects occur for the second SFCR disclosure or whether differences exist, and, thus, whether the first publication had a special role. With the second publication of SFCRs, future research could also examine whether the figures in absolute terms are more important than changes to the last disclosure, for instance. As we analyze market effects, which requires insurers in the sample to be publicly listed, in addition to English SFCRs, for comparable textual attributes, our study has a rather small sample size, albeit capturing about 42% of the European insurance market. Hence, it would be interesting to investigate mutual insurers and study the effect of SFCR disclosure on other performance indicators, such as premium income or profitability.

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APPENDIX

Table A.1: Firms in the sample

Admiral Group PLC	Legal & General Group PLC
Aegon NV	Mapfre Middlesea PLC
Ageas SA	Minerva Insurance Company Public Ltd
Allianz SE	Münchener Rückversicherungs-Gesellschaft AG
Assicurazioni Generali SpA	NN Group NV
Atlantic Insurance Company Public Ltd	Old Mutual PLC
Aviva PLC	Personal Group Holdings PLC (Personal Assurance PLC)
AXA SA	Phoenix Group Holdings PLC (Phoenix Life Holdings Ltd)
Beazley PLC	Powszechny Zakład Ubezpieczeń SA
Chesnara PLC	Pozavarovalnica Sava d.d.
CNP Assurances SA	Prudential PLC
Coface SA	RSA Insurance Group PLC
Cosmos Insurance PCL	Sampo Oyj
Direct Line Insurance Group PLC	SCOR SE
Ecclesiastical Insurance Office PLC	St. James's Place PLC
esure Group PLC	Standard Life PLC
Euler Hermes Group SA (Euler Hermes SA)	Talanx AG (HDI Group)
European Reliance General Insurance Co SA	Tryg AS
FBD Holdings PLC	Unipol Gruppo SpA
Hannover Rück SE	UnipolSai Assicurazioni SpA
Hansard Global PLC (Hansard Europe DAC)	UNIQA Insurance Group AG
Hiscox Ltd (Hiscox Insurance Company Limited)	Vienna Insurance Group AG
Just Group PLC	Vittoria Assicurazioni SpA
Lancashire Holdings Limited	Zavarovalnica Triglav d.d.