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The Effectiveness of Risk Disclosure Practices in the European Insurance Industry

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Abstract

Purpose – This paper examines whether risk disclosure practices affect stock return volatility and company value in the European insurance industry.

Design/methodology/approach – Using a self-constructed "Risk Disclosure Index for Insurers" (RDII) to measure the extent of information disclosed on risks and employing panel data regression on a sample of European insurers for 2005–2010, it tests: i) the relationship between RDII and stock return volatility; ii) whether this relationship is affected by financial crisis; iii) whether RDII affects insurance companies' embedded value.

Findings – The main results indicate that higher RDII contributes to higher volatility, suggesting that "less is more" rather than "more is good". However, higher RDII leads to lower volatility when the insurer has a positive net income, thus "more is good when all is good" and "less is good when all is bad". Furthermore, the relationship between RDII and stock return volatility is not affected by financial crisis, raising concerns regarding the effectiveness of insurers' risk disclosure to reassure the market. Moreover, higher RDII is found to impact positively on embedded value, thus contributing towards higher firm value.

Practical implications – The findings could drive insurers' choices on communication and transparency, alongside regulators' decisions about market discipline. They also suggest that risk disclosure could be used to strengthen market discipline and should be added to the other variables traditionally used in stock return volatility and firm value estimation models in the insurance industry.

Originality/value – This paper offers new insights in the debate on the bright and dark sides of risk disclosure in the insurance industry and provides interesting implications for insurers and their stakeholders.

Keywords Risk disclosure, Insurance companies, Financial crisis, Volatility, Embedded value

JEL Codes G22, G14, G01

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1. Introduction

In recent years, several factors, including the global financial crisis, firms' need for capital, and market pressure, have led to an increased need for transparency and communication in the financial system. New and updated regulations have stressed this point, too, by introducing disclosure requirements (i.e., Basel III, MiFID II, and Solvency II). From this point of view, it is fundamental to investigate the impact of disclosure, as its effects could influence companies' *ex ante* choices on when, how, and what to communicate, as well as policymakers' initiatives on market discipline. This has important implications for stakeholders and companies themselves, thus raising the need to further investigate this phenomenon by testing whether a change in the extent of disclosure could be beneficial or counterproductive.

The existing literature is marred with controversial and contrasting results. On the one hand, studies indicate disclosure to be beneficial as it reduces uncertainty, information asymmetry, the impact of news about firms' performance, and, hence, volatility, with a subsequent reduction in the cost of capital (Botosan, 1997; Sengupta, 1998; Baumann and Nier, 2004; Ntim *et al.*, 2013). On the other hand, providing information is costly, it is subject to exploitation by competitors, and the quantity could be insufficient if it is not readable and comprehensive, especially for a complex business (Chen and Hasan, 2006; Ben-Shahar and Schneider, 2011; Bratten *et al.*, 2015). However, no empirical evidence is found on the effectiveness of risk disclosure practices for insurance companies.

Investigating risk disclosure practices and their effectiveness is particularly relevant in the insurance sector due to its unique characteristics with respect to other business sectors (i.e., banking and non-financial sectors): insurance companies are typically characterized by the reversal of the production cycle, the law of large numbers, the importance of investment activity, and, most importantly, the core business of an insurance company is providing protection to policyholders from identified risks. In this context, risk management assumes a crucial role in the insurance sector, and risk disclosure, in particular, is crucial for policyholders, regulators, and other external stakeholders interested in understanding how risks are faced and managed.

This research fills this gap in the existing literature by presenting empirical evidence on whether risk disclosure provided by European insurance companies over the period 2005–2010 impacted on financial markets and company value. First, it tests whether insurers that disclose more have lower stock return volatility than insurers that disclose less; thus, it tries to answer the following research question: *Does risk disclosure by European insurers affect their stock return volatility?* Moreover, it also investigates if the effectiveness of disclosure practices has increased or been hampered due to the financial crisis,

addressing the second research question: *Did the financial crisis affect the relationship between risk disclosure practices and stock return volatility?* Finally, it provides new empirical evidence on the impact of risk disclosure on company value, as measured by the insurers' embedded value, answering the third research question: *Does risk disclosure by European insurers affect company value?*

The main results show that risk disclosure is a significant predictor of stock return volatility, in the sense that higher risk disclosure contributes to higher volatility, suggesting that "less is more" rather than "more is good". However, the relationship becomes negative when the insurer has a positive net income, thus indicating that "more is good when all is good" and that "less is good when all is bad". However, the relationship between risk disclosure and stock return volatility is not significantly affected by financial crisis, indicating that "when the waters are stormy", insurers do not use risk disclosure effectively to reassure their stakeholders, or perhaps the information content provided fails to reassure the market. Moreover, risk disclosure has a positive impact on the company's value, thus increasing the value as perceived by shareholders.

This paper contributes to the existing literature on the effectiveness of risk disclosure practices for financial markets, insurance companies, and their stakeholders in the following ways. First, risk information disclosed by insurers on a voluntary basis amplifies market uncertainty, in line with previous literature that provides evidence on the dark side of disclosure. However, the impact of disclosure changes for companies that report a positive net income. As such, companies define their disclosure strategies depending on their performance; in doing so, "more is good when all is good" while, conversely, "less is good when all is bad". Its second contribution is the finding that, during the crisis, insurance companies did not use disclosure effectively to reduce uncertainty, as such the relationship between risk disclosure and volatility remains unchanged when controlling for the crisis. Finally, the third contribution is related to the impact of disclosure on company value. The evidence suggests that risk disclosure improves insurance companies' embedded value.

The results from this study provide interesting implications for insurers and their stakeholders; in particular, they could drive companies' choices on communication and transparency, as well as regulators' decisions about market discipline. These findings also suggest that risk disclosure could be used to strengthen market discipline, and should be added to other variables traditionally used in stock return volatility and firm value estimation models in the insurance industry.

The remainder of the paper is organized as follows. Section 2 reviews the existing literature and identifies the research hypotheses. Section 3 defines the methodology. Section 4 discusses the empirical results. Section 5 concludes the paper.

2. Literature review

2.1 Bright and dark side of disclosure

The amount of information companies disclose in the public domain is an important issue widely debated in the literature, due to its consequences on companies, their stakeholders, and the financial system as a whole. The amount of information disclosed by companies in their annual reports is usually measured in the existing literature through the construction of a disclosure index. This requires identifying a set of relevant information, testing its presence in the disclosure tools identified, and assigning a score based on the amount of information provided (Botosan, 1997; Ho and Wong, 2003; Baumann and Nier, 2004; Perignon and Smith, 2010; Höring and Gründl, 2011; Elshandidy *et al.*, 2013; Malafronte *et al.*, 2016). Part of the literature focuses on specific items, such as risk disclosure practices, based on the consideration that investors need to understand the risks a company takes and desire information on the sustainability of value creation strategies (Cabedo and Tirado, 2004; Lajili and Zeghal, 2005; Linsley and Shrives, 2005; Starita and Malafronte, 2014). While it is important to implement risk management systems, it is equally important to communicate effectively on the risks faced and the plans to seize opportunities and minimize the risk of failure (Beretta and Bozzolan, 2004).

Previous research discusses both the bright and dark side of disclosure, finding contrasting results. Some studies show that companies could benefit from a higher level of disclosure, in terms of lower information asymmetry, access to critical resources, social acceptance, and approval by stakeholders (Ntim *et al.*, 2013). In addition, a high level of disclosure could reduce the heterogeneity of beliefs on firm value, improve corporate reputation, and reduce the cost of equity, cost of debt, risk, and price volatility (Diamond and Verrecchia, 1991; Botosan, 1997; Sengupta, 1998; Botosan and Plumlee, 2002; Baumann and Nier, 2004; Francis *et al.*, 2008). However, other studies find disclosure to have damaging consequences. Disclosure is costly, both in terms of the direct costs of producing and disseminating information and the indirect costs when competitors are able to exploit the information provided (Baumann and Nier, 2004).

2.2 Disclosure and stock return volatility

A stream of literature investigates the relationship between disclosure practices and stock return volatility. There are several reasons why an increase in disclosure could affect stock return volatility. On the one hand, disclosure could mitigate uncertainty, reducing the magnitude of the impact of news about a firm's performance, thus reducing information asymmetry in the market and the heterogeneity of beliefs about the true value of the firm. On the other hand, an increase in disclosure implies that more information is released thus providing the markets with more data that might be misconstrued by analysts and market participants, leading to higher volatility (Baumann and Nier, 2004). Favorable disclosure leads to a decline in the cost of capital, stock return volatility, and analyst forecast dispersion, while unfavorable disclosure increases risk measures (Kothari *et al.*, 2009). Moreover, theories from information economics link the informativeness of public information to informed trading (Grossman and Stiglitz, 1980; Verrecchia, 1982; Diamond, 1985; Baiman and Verrecchia, 1996; Easley and O'Hara, 2004). These theories state an inverse relationship between the informativeness of public information and the incentives to acquire private information or exploit the existing ones; moreover, these theories predict that the level of informed trading, as the informational advantage of informed traders, is inversely related to the informativeness of public disclosure (Jayaraman, 2008). Although financial markets tend to prefer smooth earnings (Graham *et al.*, 2005), the relationship between informed trading and earnings volatility depends on how the reporting is able to provide or garble information (Jayaraman, 2008).

Despite the importance of disclosure in the financial industry, evidence on the impact of disclosure by financial institutions is limited. The lack of studies can be attributed to the complexity of the information disclosed, which is strictly related to the risk management activity. Beaver *et al.* (1989) find that supplemental disclosure provided by banks with respect to default risk (non-performing loan data) and interest-rate risk (loan maturity data) explains variation in the market-to-book value of banks' common equity. Bushee and Noe (2000) also find that an increase in firm disclosure practices, as measured by the Association for Investment Management and Research (AIMR), positively affects the level of institutional investor ownership and, hence, reduces stock return volatility. Moreover, Baumann and Nier (2004) show that banks that provide more information on key items of disclosure have lower stock volatility than banks that disclose less information; consequently, disclosure may be useful to investors, banks, and supervisors.

Surprisingly, there is no evidence on the impact of disclosure practices in the insurance industry. Insurance companies are typically devoted to relevant risk management activities, and there is growing

need for financial markets and other stakeholders to analyze how risk information is disclosed and risk management activities are communicated. Most insurance activities are under supervisory control; however, some aspects of risk management activity, e.g., underwriting risk management, can be disclosed to financial markets and other stakeholders in a manner different from that mandated by the applicable accounting standards. This study fits into the emerging field of literature investigating the effectiveness of disclosure practices for insurance companies; in particular, it investigates the impact of risk disclosure on stock return volatility. In line with previous literature and relying on theories from information economics, the first research hypothesis tests the relationship between risk disclosure and stock return volatility, i.e., the availability of public information and financial markets' sensitivity to companies' communication:

H_1: Risk disclosure and stock return volatility are significantly related.

Moreover, the literature on corporate communication emphasizes the importance of open and proactive crisis communication (Claeys *et al.*, 2016). Indeed, in turbulent economic conditions firms must improve their corporate communication to meet the information requirements of capital markets (Satta *et al.*, 2015). However, there is no empirical evidence on the effectiveness of disclosure practices during the financial crisis. The second research hypothesis tests whether and how companies' disclosure practices change during financial crisis and if markets become particularly sensitive during periods of financial turmoil:

H_2: Financial crisis moderates the relationship between risk disclosure practices and stock return volatility.

2.3 Disclosure and company value

Company value is measured using a wide spectrum of models, ranging from simple to sophisticated, and from general to sector specific (Damodaran, 2007). Within the insurance sector, company value is estimated using embedded value, a special version of the discounted cash flow model, offering an actuarial estimate of the present value of the future net cash flows arising from the company's life insurance business. Embedded value is used by analysts, preferred over traditional accounting measures for valuation of insurance businesses, and represents a robust measure of firm value (El-Gazzar *et al.*, 2013).

The CFO Forum defines the embedded value of an insurance company as the consolidated value of the shareholders' interests in the company: embedded value corresponds to the present value of all future shareholders' cash flows from the covered in-force business, capital, and surplus, taking into account a realistic hypothesis on the macroeconomic indicators (e.g., the correct inflation rate) (CFO, 2009). Apart from practitioner-oriented studies on insurance companies (America Academy of Actuaries, 2009; Deloitte, 2014), the effect of disclosure on firm value has been largely neglected in academic literature. Considering that higher disclosure has a positive effect on firm performance (Bazrafshan *et al.*, 2016), it can be expected to have a similar effect on insurers' embedded value, through a positive effect on expected cash flows.

There are several reasons why an insurance company would adopt a set of consistent disclosure practices to influence its firm value. The greater the amount of information disclosed, the easier it is to measure the future cash flows of the insurance business and the risks associated therewith. Additionally, more information is essential to correctly understand the characteristics of the insurance business (i.e., the production cycle, the nature of insurers' debts, etc.).

Despite the importance of this evidence from a policy perspective, the fundamental assumptions about disclosure and its effects on the insurance industry have remained largely unexplored. Within this context, it is interesting to investigate how risk disclosure impacts on insurers' value. It is expected that an insurer's disclosure practices positively affect its firm value; thus, the third research hypothesis is:

H_3: Risk disclosure positively affects insurers' embedded value.

3. Methodology

3.1 Sample and data

The sample comprises 47 insurance companies operating across Europe and representing more than 50% of the European insurance industry in terms of premiums collected, based on CEA statistics (CEA, 2011). The insurance sector is more concentrated than other sectors of the European financial system (ECB, 2007) and represents an ideal setting to test the effectiveness of disclosure practices, as European insurance supervisors promote the same risk management standards across the insurance sector (EIOPA, 2013).

Data are collected from two main sources: companies' annual reports and the Bloomberg database, for the period 2005 to 2010. The period of analysis represents a sufficient time span to test the impact of disclosure and the joint effect of disclosure and financial crisis.

Insurers' disclosure practices are measured using a risk disclosure index for insurers built following the best practices suggested by the literature (Höring and Gründl, 2011; Malafronte *et al*., 2016).

Tables Ia and Ib report definition, source and descriptive statistics of the variables used in the analysis.

[Table Ia and Table Ib about here]

3.2 The risk disclosure index

The risk disclosure index for insurers (hereinafter RDII) measures the amount of risk information insurance companies provide in the risk management section of their annual reports. It is composed of 30 items organized into seven main categories: risk management, underwriting risk, market risk, credit risk, operational risk, liquidity risk, and other risks:

$$RDII_{i,t} = \sum_{m=1}^{30} Score_m \quad (1)$$

where *i* represents the insurance company, *t* is the year to which the annual report refers, and *m* indicates each item included in the index. The final score is obtained by assigning a score (0, 1, or 2) to a predefined list of items referring to the above seven categories. This index focuses on information related to risk management, which is a crucial activity for financial intermediaries as risk-taking enterprises; thus, it is expected to disclose risk-related information. The items were selected from disclosure index literature (Botosan, 1997; Baumann and Nier, 2004; Höring and Gründl, 2011; Malafronte *et al.*, 2016) and take into account the peculiarities of the insurance business, while focusing on information disclosed on voluntarily basis rather than those mandatory. See Appendix for details.

3.3 Risk disclosure and stock return volatility

Eq.2 provides estimate on the effectiveness of risk disclosure practices on stock return volatility, in order to test the first research hypothesis (H_1) and answer the first research question. A random effect panel

data[a] regression is estimated, that measures the impact of the risk disclosure index for insurers (*RDII*) on stock return volatility (*VOLATILITY*):

$$VOLATILITY_{i,t} = \alpha + \beta RDII_{i,t} + \sum_{j=1}^{n} \gamma_j CONTROL_{i,t} + \varepsilon_{i,t} \quad (2)$$

where *i* represents the insurance company, *t* is each year over the period investigated (2005-2010) and *j* identifies the control variables. *VOLATILITY* is the annualized standard deviation of an insurer's daily equity returns, *RDII* is the measure of risk disclosure. *CONTROL* identifies a vector of control variables, including *MARKETCAP, BETA, ROE, DIVIDEND_RATIO*, *EARNINGS_PERSHARE.*

To improve the robustness of the estimation, a further random effect regression (Eq.3) introduces a set of variables (i.e., *SECTOR*) that is strictly related to the characteristics of the insurance business, including *PREMIUM_GROWTH, LEVERAGE, TYPE_INSURANCE*:

$$VOLATILITY_{i,t} = \alpha + \beta RDII_{i,t} + \sum_{j=1}^{n} \gamma_j CONTROL_{i,t} + \sum_{k=1}^{n} \delta_k SECTOR_{i,t} + \varepsilon_{i,t} \quad (3)$$

where *i* represents the insurance company, *t* is each year of the period investigated (2005-2010), *j* identifies the control variables capturing company performance, and *k* identifies control variables representing insurer-level characteristics.

In order to test the second research hypothesis (H_2) and answer the second research question, a dummy variable capturing financial crisis years (*D_CRISIS*) is introduced along with an interaction term (*RDII*D_CRISIS*) to test the effectiveness of risk disclosure practices on stock retunr volatility during financial crisis:

$$VOLATILITY_{i,t} = \alpha + \beta RDII_{i,t} + \theta D\_CRISIS_t + \vartheta D\_CRISIS_t * RDII_{i,t} + \sum_{j=1}^{n} \gamma_j CONTROL_{i,t} + \sum_{k=1}^{n} \delta_k SECTOR_{i,t} + \varepsilon_{i,t} \quad (4)$$

where *i* represents the insurance company, *t* is each year of the period investigated, *j* identifies the control variables capturing company performance, and *k* identifies insurer-level characteristics.

As robustness check and to counter endogeneity issues, the analysis is replicated using the dependent variable at time *t+1* as in Baumann and Nier (2004). This also allows taking into account the time when the annual reports were released as they become public in the year following the one to which their

[a] The choice of using random effects over fixed effects is based on theoretical motivations. Indeed, random effects regressions control for the cross-sectional differences as well as the country differences between insurers in the sample. In the context of this study, random effect assumes that differences across entities have some influence on the dependent variables and allows including time invariant variables (i.e., type insurance).

contents refer to (after closing and approving the financial statements). See Tables Ia and Ib for variable description.

3.4 Risk disclosure and company value

To test the third research hypothesis (H_3) and answer the third research question, Eq.5 estimates the impact of risk disclosure on insurance companies' value, as measured by *EMBEDDED_VALUE*:

$$EMBEDDED\_VALUE_{i,t} = \alpha + \beta RDII_{i,t} + \sum_{j=1}^{n} \gamma_j CONTROL_{i,t} + \sum_{k=1}^{n} \delta_k SECTOR_{i,t} + \varepsilon_{i,t} \quad (5)$$

where *i* represents the insurance company, *t* is each year of the period investigated, *j* identifies the control variables capturing company performance, and *k* identifies insurer-level characteristics.

The variable descriptions are set out in Tables Ia and Ib. Table II reports the correlation matrix among the regressors included in all the regression models, evidencing no multicollinearity issues.

[Table II about here]

4. Empirical results

4.1 Risk disclosure and stock return volatility

The main purpose of this study is to test if risk disclosure drives stock return volatility in the insurance industry. Following the consolidated literature in this field, this research postulates that stock return volatility is affected by changes in a firm's activity (i.e., idiosyncratic risk), as well as by changes in market conditions (i.e., systematic risk) (see, for example, Cao and Han, 2016). Further, it hypothesizes that an insurer's stock return volatility is driven by the information disclosed on the typical risks faced by the insurance business, in addition to the control variables.

Table III provides empirical evidence for the first research hypothesis (H_1). In all the model specifications in Table III, *RDII* is found to have a significant impact on stock return volatility. More specifically, the positive coefficient indicates that an increase in *RDII* leads to higher stock return volatility. Disclosing more risk information increases the magnitude of the impact of news about the insurer's performance, in line with the literature that emphasizes the dark side effects of voluntary disclosure. In contrast to the literature documenting a negative relationship between disclosure and volatility (Bushee and Noe, 2000; Baumann and Nier, 2004), this result shows that providing more

information on risk disclosure practices impacts on the equity market in terms of increased stock return volatility. This seems to suggest that "less is more" rather than "more is good" when presenting risk information. This first result implies that the choice of when, how, and what to communicate affects price movements; however, rather than smoothing the variability of prices, disclosure actually contributes to it: one unit increase in the *RDII* is associated with 1.09% increase in volatility (see Column 1 in Table III). This also suggests that stock markets react negatively to voluntarily disclosed information on a company's risk and risk management. More specifically, equity market participants react negatively to the disclosure of risk information of an insurance business, as it is, essentially, a complex system of risk management activities (i.e., the management of underwriting risk, credit risk, market risk, etc.). However, an alternative explanation of the effectiveness of risk disclosure practices could be that firms characterized by a high level of informativeness in their annual reports are associated with a high level of stock return volatility, due to informed trading. Indeed, financial markets react to higher disclosure levels through pricing that is frequently and accurately adjusted (according to theories on the link between the informativeness of public information and informed trading); in doing so, the dark side becomes a bright side.

The set of control variables borrowed from the existing literature reports significant coefficients. *MARKETCAP*, as a market measure of insurers' size, has a negative and significant coefficient, as expected: larger insurers have lower volatility than smaller insurers. Focusing on performance indicators, *ROE* and *EARNING_PERSHARE* have a negative and significant effect on stock return volatility.[b] On the other hand, *DIVIDEND_RATIO* and *BETA* report non-significant coefficients.

[Table III about here]

The results in Columns 2 and 3 of Table III further deepen understanding of disclosure, testing whether the extent of disclosure is conditioned by the insurer's end of year financials by introducing *D_NETINCOME,* a dummy variable that assumes a value equal to 1 when net income is higher than zero, and the interaction between *RDII* and *D_NETINCOME*. The results show that the effect of *RDII* on stock return volatility is driven by the sign of net income: a positive net income has a negative impact on stock return volatility; the interaction term has a negative and significant coefficient (the bright side of disclosure), while *RDII* confirms the positive and significant coefficient. This indicates that risk

[b] This indicates that the increase of net income over equity (*ROE*) and the increase of earnings over the number of shares (*EARNING_PERSHARE*) imply a reduction in the stock return volatility, as for non-financial companies. Consequently, the greater the gain related to the risks taken, the smaller the variability in stock prices. This also indicates that better performance is associated with lower volatility.

disclosure increases stock return volatility, but for insurers who present a good performance (net income higher than zero), risk disclosure mitigates stock return volatility. These results document the different impact of risk disclosure practices on stock return volatility depending on insurers' performance, with beneficial effects from risk disclosure practices for insurers that present a positive performance (as in Kothari *et al.*, 2009).

The results reported in Columns 4, 5, and 6 of Table III show the impact of risk disclosure on stock return volatility by introducing additional insurer-specific variables to improve the robustness of the empirical analysis. When controlling for insurer-specific characteristics, *RDII* maintains a positive and significant impact on stock return volatility.

These results show that risk disclosure has a significant impact on stock return volatility, which becomes lower for insurers with a positive net income. For companies with positive financial results (i.e., insurers that perform well in a certain year), higher risk disclosure is beneficial for both insurers and their stakeholders. Enhanced disclosure enables investors to take the most appropriate decisions when they value their investments. For insurers themselves, it could help to limit the damage to their reputation and ensure the long-term health of the company (Deumes, 2008).

On the one hand, if volatility is a measure of investor uncertainty and if disclosure reduces volatility in the case of positive performance, these results may indicate that more disclosure would reduce uncertainty in financial markets (as in Baumann and Nier, 2004). The findings confirm previous studies documenting a significant relationship between volatility and disclosure, and add to the existing literature by providing evidence concerning complex business sectors, such as insurance: in fact, disclosure amplifies the volatility while reduces it when an insurer has a positive net income. From the regulation perspective, incentives related to voluntary disclosure could strengthen the functioning of the market for corporate control (the more information disclosed, the easier it is to evaluate the firm). From a supervisory point of view, the effectiveness of disclosure could facilitate the homogeneity of supervisory mechanisms (i.e., the second pillar of Solvency II) and strengthen market discipline (i.e., the third pillar of Solvency II) (Eling, 2012). On the other hand, if volatility is a measure of more frequent and accurate pricing, disclosure increases market transparency, according to the theories of informed trading (i.e., the more information disclosed, the higher the stock return volatility, due to the pricing of information disclosed).

To test the second research hypothesis (H_2), this study further examines the relation between disclosure and volatility during the global financial crisis. As shown by previous literature, the "old news,

no news" paradigm is not the optimal behavior for an organization, while self-disclosure preserves its reputation (Claeys *et al.*, 2016). Table IV introduces the *D_CRISIS* and *RDII*D_CRISIS* variables. The first variable (*D_CRISIS*) is a dummy variable that reflects the years characterized by the so-called financial tsunami (2008–2010), whereas the second variable (*RDII*D_CRISIS*) captures the effectiveness of risk disclosure on stock return volatility while controlling for the impact of financial crisis. If the level of risk information disclosed reflects the will of insurers to counteract the perverse effects of the financial crisis (n.b., the insurers played no role in the origination and the diffusion of the financial crisis), the addition of these two variables into the regression specifications should facilitate correct understanding of the real level of the effectiveness of disclosure. This approach enables simultaneous assessment of the direct and indirect effects of the financial crisis in order to detect the market discipline for insurers.

[Table IV about here]

From Table IV, the direct impact of *RDII* on stock return volatility, as shown by the coefficient of *RDII*, remains positive and significant, and the indirect impact of *RDII*, i.e., the impact moderated by the financial crisis (the coefficient of *RDII*D_CRISIS*) is positive and significant. This means that the relationship between risk disclosure and stock return volatility is not affected by financial crisis. Estimates for accounting, market, and insurer-specific variables confirm the results presented in the previous model.

The results indicate that "when the waters are stormy", insurers do not effectively use risk disclosure to reassure their stakeholders, or perhaps that the information content they provide is insufficient to reassure the market. This could be attributed to two main reasons: first, as shown in the earlier regressions, insurers use disclosure only as a mean to showcase a positive financial result; second, insurers do not really consider information voluntarily disclosed to be sufficient to reduce the heterogeneity of beliefs on firm value, especially during financial crisis, as they address information on risk management activities through other channels (e.g., actuarial reports). As such, insurers do not use disclosure in the most appropriate manner. On the other hand, higher stock return volatility following risk disclosure could suggest that risk disclosure is insufficient to reassure the market or that its content generates greater concern.

4.2 Risk disclosure and insurers' embedded value

Table V provides empirical evidence for the third research hypothesis (H_3) focusing on a sample of insurance companies that provide voluntary information on embedded value over the period of analysis.

The results show that *RDII* positively affects estimation of a company's value (embedded value): the greater the disclosure of risk information (e.g., underwriting risk), the greater the value of the insurance business (the bright side of disclosure). This result should encourage insurers to disclose more on risks, as this information may be translated into more value as perceived by stakeholders and shareholders *in primis*.

[Table V about here]

Risk disclosure shows differential effects on stock return volatility, derived from stock prices, and on company value, derived from future cash flows. This difference may be related to the hypotheses underlying the models and, also, to the disclosure strategy pursued by insurers: more information implies less volatility (when net income is positive) and more value as perceived by the stakeholders. To the best of our knowledge, no papers provide an empirical investigation into the relationship between risk disclosure practices and this specification of discounted cash flow models applied to the insurance business.[c]

5. Conclusion

This paper examines whether risk information disclosed voluntarily plays a role in explaining stock return volatility and company value in the insurance sector. This analysis is motivated by the importance of risk information, especially for financial firms, considering that the lack of risk disclosure is considered one of the main reasons for financial crisis. For insurance businesses in particular, disclosure may be a useful tool to reassure stakeholders on insurers' ability to manage the risks undertaken. Using multiple firm-level data on European insurers, this research primarily finds risk disclosure to be a significant predictor of stock return volatility, supporting the literature that shows the dark side of disclosure; however, when insurers perform well in a given year, in terms of positive net income, the results show the bright side of disclosure. It seems that "more is good when all is good" and "less is more when all is bad". It could also imply that disclosing more information leads to higher stock return volatility due to the informativeness of the information disclosed. Second, the financial crisis does not significantly affect the relationship

[c] All the above models are re-estimated with the dependent variable at time $t+1$ rather than t to counter for endogeneity issues; the results are robust under these alternative specifications.

between risk disclosure practices and stock return volatility because, "when the waters are stormy", insurers do not effectively use risk disclosure to reassure their stakeholders, or perhaps the information content provided is not able to reassure the market. Third, the results show that information disclosed on risks contribute towards enhancing a company's value, displaying a different effect of risk disclosure on volatility and firm value.

The results from this study provide interesting implications for insurers and their stakeholders; in particular, they could drive insurers' choices on communication and transparency, as well as regulators' initiatives on market discipline. The results provide interesting evidence to insurance companies and their stakeholders, specifically regulators, policyholders, and financial markets. From the perspective of the insurance companies themselves, disclosure strategy can be adapted based on these results to ensure it is effective and used in the most appropriate manner, i.e., to reassure their stakeholders. From the stakeholders' perspective, information on risks and risk management activities should be carefully analyzed. From the regulation perspective, incentives related to voluntary disclosure could strengthen the functioning of the market for corporate control. From a supervisory point of view, the effectiveness of disclosure could facilitate the homogeneity of supervisory mechanisms (the second pillar of Solvency II) and strengthen market discipline (the third pillar of Solvency II). Finally, from the point of view of the financial system as a whole, risk disclosure could be used to strengthen market discipline, and should be added to the other variables traditionally used to explain volatility and the value estimations in the insurance industry.

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Table Ia. Variables description

Variable	Definition/Measurement	Source
RDII	Risk disclosure index for insurers	See Appendix for details
VOLATILITY	Annualized standard deviation of daily stock price returns	Stock prices from Bloomberg
MARKETCAP	Logarithm of total market capitalization, where market capitalization is calculated as shares outstanding multiplied by share price	Bloomberg
BETA	Measure of volatility of stock price relative to the volatility in the market index	Bloomberg
ROE	Ratio of net income to total equity	Bloomberg
DIVIDEND_RATIO	Ratio of dividends to net income	Bloomberg
EARNINGS_PERSHARE	Ratio of earnings to total common shares outstanding	Bloomberg
PREMIUM_GROWTH	Change in total premiums from *t* to *t+1*, as percentage of premiums in *t*	Premiums from Bloomberg
LEVERAGE	Ratio of technical provisions to total assets	Technical provisions and total assets from Bloomberg
EMBEDDED_VALUE	Present value of all future shareholders' cash flows from the covered in force business, capital and surplus taking into account a realistic hypothesis on the macroeconomic indicators.	Bloomberg

Table Ib. Descriptive statistics

Variable	N.	Mean	Median	Min.	Max.	St.Dev.
RDII	205	22.70	24.00	2.00	30.00	5.05
VOLATILITY	205	0.35	0.29	0.13	0.91	0.17
MARKETCAP	205	8.48	8.31	5.10	11.11	1.20
BETA	205	11.29	0.94	-87.80	55.04	167.85
ROE	205	0.13	0.12	-0.29	0.55	0.11
DIVIDEND_RATIO	205	0.02	0.00	-0.13	0.21	0.18
EARNINGS_PERSHARE	205	3.73	1.03	-23.64	31.44	6.94
PREMIUM_GROWTH	199	0.06	0.04	-2.24	2.52	0.31
LEVERAGE	199	0.71	0.75	0.13	0.95	0.16
EMBEDDED_VALUE	99	12,196.95	9,683.00	1,169.58	40,476.00	9.735,05

Notes: This table reports descriptive statistics of accounting-based, market-based and disclosure variables for the sample European insurers. Variables are measured across each year *t* (2005-2010) for the insurer *i*.

Table II. Correlation matrix

Variables		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
RDII	(A)	1.000							
MARKETCAP	(B)	0.415***	1.000						
BETA	(C)	0.003	-0.033						
ROE	(D)	-0.140**	0.071	-0.031	1.000				
DIVIDEND_RATIO	(E)	0.071	-0.005	0.001	0.006	1.000			
EARNINGS_PERSHARE	(F)	0.117*	0.222***	-0.032	0.152***	-0.007	1.000		
PREMIUM_GROWTH	(G)	-0.149**	-0.076	0.006	0.160***	-0.042	-0.002	1.000	
LEVERAGE	(H)	0.210***	0.125**	-0.022	-0.119**	-0.081	0.122**	-0.100*	1.000

Notes: This table reports Pearson correlations among the variables used in the analysis. The sample consists of 47 European insurance companies and data are collected from 2005 to 2010. See Table Ia for variable definitions. *, **, *** denote significance levels at 10%, 5%, 1% levels.

Table III. Risk disclosure and stock return volatility

Variable	Equation 2			Equation 3		
	(1)	(2)	(3)	(4)	(5)	(6)
RDII	0.0109 ***	0.0105***	0.0366***	0.0113***	0.0102***	0.0330**
	(0.0024)	(0.0023)	(0.0128)	(0.0025)	(0.0024)	(0.0128)
MARKETCAP	-0.0460***	-0.0411***	-0.0401***	-0.0453***	-0.0401***	-0.0403***
	(0.0110)	(0.0105)	(0.0101)	(0.0110)	(0.0102)	(0.0100)
BETA	-0.0001	-0.0001	-0.0001	-0.0001	0.0000	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ROE	-0.5226***	-0.3186***	-0.3151***	-0.4788***	-0.2353**	-0.2402**
	(0.1004)	(0.1131)	(0.1097)	(0.1052)	(0.1174)	(0.1158)
DIVIDEND_RATIO	-0.0237	0.0000	-0.0020	-0.0142	0.0221	0.0167
	(0.0571)	(0.0561)	(0.0558)	(0.0592)	(0.0582)	(0.0580)
EARNINGS_PERSHARE	-0.0051***	-0.0046***	-0.0044***	-0.0051***	-0.0045***	-0.0044***
	(0.0017)	(0.0016)	(0.0016)	(0.0017)	(0.0016)	(0.0016)
D_NETINCOME		-0.1606***	0.5013		-0.1744***	0.4047
		(0.0482)	(0.3214)		(0.0483)	(0.3215)
*RDII*D_NETINCOME*			-0.0270**			-0.0236*
			(0.0129)			(0.0129)
PREMIUM_GROWTH				-0.1013***	-0.1026***	-0.0986***
				(0.0338)	(0.0328)	(0.0327)
LEVERAGE				0.0155	0.0396	0.0376
				(0.0903)	(0.0842)	(0.0826)
TYPE_INSURANCE				-0.0081	-0.0178	-0.0158
				(0.0286)	(0.0265)	(0.0260)
Constant	0.5792***	0.6678***	0.0175	0.5549***	0.6523***	0.0916
	(0.0945)	(0.0949)	(0.3186)	(0.1185)	(0.1138)	(0.3261)
Observations	205	205	205	199	199	199
R-squared within	0.4190	0.3977	0.3975	0.4551	0.4287	0.4308
R-squared between	0.1099	0.1493	0.1960	0.1491	0.2338	0.2690
R-squared overall	0.2641	0.3093	0.3266	0.3048	0.3543	0.3664

Notes: This table reports the results from the panel data random effect regression (Equations 2 and 3) on the relationship between risk disclosure and stock return volatility. The dependent variable is *VOLATILITY*. *D_NETINCOME* is a dummy variable equal to 1 when insurer's net income is positive, 0 otherwise. *RDII*D_NETINCOME* is obtained as interaction between the variables *RDII* and *D_NETINCOME*. *TYPE_INSURANCE* is a dummy variable equal to 1 when insurer's prevalent activity is life, 0 when it is non-life. Variables are described in Table Ia. Standard errors are reported in parenthesis. *, **, *** denote significance levels at 10%, 5%, 1% levels.

Table IV. Risk disclosure, stock return volatility and financial crisis

Variable	Equation 4	
	(1)	(2)
RDII	0.0205*	0.0195
	(0.0120)	(0.0119)
D_CRISIS	-0.0677	0.0196
	(0.1012)	(0.1075)
*RDII*D_CRISIS*	0.0093**	0.0060
	(0.0042)	(0.0044)
MARKETCAP	-0.0183*	-0.0207**
	(0.0098)	(0.0097)
BETA	-0.0001	-0.0001
	(0.0001)	(0.0001)
ROE	-0.1367	-0.0365
	(0.1016)	(0.1077)
DIVIDEND_RATIO	0.0019	0.0023
	(0.0509)	(0.0520)
EARNINGS_PERSHARE	-0.0037**	-0.0036**
	(0.0014)	(0.0014)
D_NETINCOME	0.3542	0.3111
	(0.2931)	(0.2891)
*RDII*D_NETINCOME*	-0.0207*	-0.0194*
	(0.0117)	(0.0116)
PREMIUM_GROWTH		-0.0964***
		(0.0286)
LEVERAGE		0.0248
		(0.0752)
TYPE_INSURANCE		-0.0325
		(0.0238)
Constant	0.0927	0.1352
	(0.2998)	(0.3053)
Observations	205	199
R-squared within	0.5111	0.5458
R-squared between	0.3234	0.4338
R-squared overall	0.484	0.5292

Notes: This table reports the results from the panel data random effect regression (Equation 4) on the relationship between risk disclosure and stock return volatility, controlling for the financial crisis. The dependent variable is *VOLATILITY*. *D_CRISIS* is a dummy variable equal to 1 for the years 2008-2010, 0 for 2005-2007. *RDII*D_CRISIS* is obtained as interaction between the variables *RDII* and *D_CRISIS*. *D_NETINCOME* is a dummy variable equal to 1 when insurer's net income is positive, 0 otherwise. *RDII*D_NETINCOME* is obtained as interaction between the variables *RDII* and *D_NETINCOME*. *TYPE_INSURANCE* is a dummy variable equal to 1 when insurer's prevalent activity is life, 0 when it is non-life. Variables are described in Table Ia. Standard errors are reported in parenthesis. *, **, *** denote significance levels at 10%, 5%, 1% levels.

Table V. Risk disclosure and companies' value

Variable	Equation 5	
	(1)	(2)
RDII	256.839**	274.883**
	(111.243)	(107.902)
MARKETCAP	4446.523***	4533.623***
	(666.636)	(659.460)
BETA	9.382	-23.524
	(29.072)	(30.395)
PREMIUM_GROWTH		-477.781
		(784.901)
LEVERAGE		15292.74***
		(5148.499)
TYPE_INSURANCE		-699.978
		(1617.34)
Constant	-35372.67***	-48430.78***
	(7531.61)	(8707.591)
Observations	100	100
R-squared within	0.1585	0.2444
R-squared between	0.7165	0.7063
R-squared overall	0.6501	0.6473

Notes: This table reports the results from the panel data random effect regression (Equation 5) on the relationship between risk disclosure and company's value. The dependent variable is *EMBEDDED_VALUE*. *TYPE_INSURANCE* is a dummy variable equal to 1 when insurer's prevalent activity is life, 0 when it is non-life. Variables are described in Table Ia. Standard errors are reported in parenthesis. *, **, *** denote significance levels at 10%, 5%, 1% levels.

Appendix. Definition of Risk Disclosure Index for Insurers (RDII)

We use 30 disclosure items relative to 7 risk areas to compose an aggregate risk disclosure score for the selected insurance companies. We follow the relevant literature (Malafronte *et al.*, 2016) to compose the Risk Disclosure Index for Insurers (RDII), defined as follows:

Area A – Risk management:	(1) List and definition of risks
	(2) Description of capital adequacy approach
	(3) Description of capital requirements
	(4) Description of risk management policies
Area B – Underwriting risk:	(5) Definition of the risk
	(6) Description of risk mitigation activities
	(7) Quantification of risks
	(8) Description of stress tests and sensitivity analysis
Area C – Market risk:	(9) Definition of the risk
	(10) Description of risk mitigation activities
	(11) Quantification of risks
	(12) Description of stress tests and sensitivity analysis
Area D – Credit risk:	(13) Definition of the risk
	(14) Description of risk mitigation activities
	(15) Quantification of risks
	(16) Description of stress tests and sensitivity analysis
Area E – Operational risk:	(17) Definition of the risk
	(18) Description of risk mitigation activities
	(19) Quantification of risks
	(20) Description of stress tests and sensitivity analysis
Area F – Liquidity risk:	(21) Definition of the risk
	(22) Description of risk mitigation activities
	(23) Quantification of risks
	(24) Description of stress tests and sensitivity analysis
Area G – Other risks:	(25) Identification of other risks
	(26) Quantification of other risks
	(27) Rating
	(28) Competitive environment/Market share
	(29) Historical results
	(30) Forward-looking data

Each item takes a dummy value equal to one if it is disclosed, otherwise it takes a value of 0. Items numbered 3, 4, 8, 12, 16, 20, 24, 29, take value equal to one if disclosed in a basic way, 2 if disclosed in an extensive way, 0 if not disclosed.