Chief Risk Officers and Firm Value: Empirical Evidence from the Insurance Industry

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ABSTRACT

We study the relationship between enterprise risk management and firm value. We analyze how the influence and reporting of the chief risk officer (CRO) and the incentives to compensate him or her contribute to firm value. We use U.S. publicly traded insurers data between 2009 and 2017 and find that the participation of a CRO is insufficient for value creation in insurers. Our results present a negative relationship between a CRO and firm value. However, we find empirical evidence of a positive relationship between firm value and the incentives related to the compensation of the CRO, specifically including the CRO in the compensation committee of the board and providing the CRO with an equity-based compensation plan.

KEYWORDS: Enterprise risk management; Chief risk officer; Compensation; Firm value; Insurance industry

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1. Introduction

The literature on risk management provides extensive empirical analysis of enterprise risk management (ERM). The relationship between ERM and firm value has been documented by several studies (e.g., Meulbroek, 2002; Beasley et al., 2005; Nocco and Stulz, 2006; Pagach and Warr, 2010; Hoyt and Liebenberg, 2011; Aebi et al., 2012; Paape and Speklé, 2012; Ellul and Yerramilli, 2013; Florio and Leoni, 2017). These findings are of interest to companies and regulators because they support the view that enterprise risk management is pivotal to reduce losses and improve firms' performance by enabling them to manage risk in a holistic manner.

While several studies have focused on the determinants, adoption, and maturity of an ERM system and the relationship with firm value, the process by which chief risk officers (CROs) influence firm value is less clear. In particular, empirical evidence on the association between firm value creation and the compensation of CROs is lacking. Hence, this study explores the incentives to compensate CROs and evaluates their relationship with firm value.

Unlike previous studies, we focus on the role played by the CRO in value creation. We identify how the influence and reporting of the CRO and the incentives to compensate him or her contribute to firm value. We use U.S. publicly traded insurers data (i.e., overall disclosure and corporate governance characteristics) from 2009 to 2017. We collect additional information about CROs such as name, function, and individual characteristics (i.e., age and sex) for all firm-years with available information in our sample.

We follow Hoyt and Liebenberg (2011) and use a maximum-likelihood treatment effects model to capture the decision to employ a CRO and the effect of having a CRO on firm value. The model estimates the treatment effects considering self-selectivity problems. Further, we run an ordinary least squares (OLS) regression model to evaluate the CRO's specific variables related to

value. As a robustness check, we analyze the average treatment effect on the treated (ATET) for value creation by matching firms with the same covariates (size, leverage, and sales growth).

We show that the participation of a CRO (solely) is insufficient for value creation in insurers. In fact, our results reveal a negative association between the presence of a CRO and firm value, in line with the findings of Aebi et al. (2012), Grace et al. (2015), and Florio and Leoni (2017). However, we find empirical evidence of a positive relationship between firm value and incentives to compensate the CRO (i.e., including the CRO in the compensation committee of the board and providing the CRO with an equity-based compensation plan). To the best of our knowledge, this is the first study to present such an outcome.

Our study sheds light on the findings of Grace et al. (2015) and Pernell et al. (2017) and our results are in line with those of Baker et al. (1998) and Kuo et al. (2013) in the area of corporate governance. Moreover, we add to Hoyt and Liebenberg (2011), Florio and Leoni (2017), and Pernell et al. (2017) by breaking down the disclosure and oversight of risk management and compensation policies for proxy statements.

From a practical perspective, our study provides a meaningful analysis of an important risk management issue. According to the rules specified in Items 402, 403, 405, and 407 of Regulation S-K (U.S. Securities and Exchange Commission, 2009, 2017a) and Section 16 of the Securities Exchange Act of 1934 (U.S. Securities and Exchange Commission, 2017b), we exploit the compensation plans of executives such as CROs and verify that their compensation incentives help enhance firm value.

The remainder of the paper is organized as follows. Section 2 provides the related literature and the hypotheses of our study. Section 3 defines our variables and shows the descriptive statistics.

Section 4 details our empirical strategy. Section 5 reports our results. The final section presents our conclusions.

2. Prior research and hypotheses development

Our study is connected to several strands of the literature. The first is the literature documenting the value creation of ERM. In imperfect capital markets, ERM can create value by improving risk management, capital allocation, and capital structure decisions (Mayers and Smith, 1982; Cummins et al., 2001; Myers and Read, 2001, Graham and Rogers, 2002; Nocco and Stulz, 2006). Moreover, the development of ERM systems attenuates the direct and indirect costs of financial distress and earnings dispersion (Beasley et al., 2005, 2008; Hoyt and Liebenberg, 2011).

A second stream of research aims to provide the consequences of ERM on firms' financial and market performance (McShane et al., 2011; Baxter et al., 2013; Farrell and Gallagher, 2015). More closely related to our work is research studying the relationship between ERM systems and risk governance characteristics to evaluate performance and identify value creation (Caldarelli et al., 2016; Florio and Leoni, 2017). Moreover, previous studies associate ERM implementation to the appointment of CROs and risk committees (Liebenberg and Hoyt, 2003; Subramaniam et al., 2009; Yatim, 2010).

Although the participation of CROs in risk management duties has received considerable attention in recent empirical work (Florio and Leoni, 2017; Pernell et al., 2017), little attention has been devoted to the compensation plans arising from CROs' management strategies that aim to enhance value. In fact, the results on the appointment of CROs are ambiguous. Beasley et al. (2008) specify that the appointment of a CRO relates to positive equity market reactions for non-financial

firms but not for financial firms. Hoyt and Liebenberg (2011) find a positive and significant relationship between value and a CRO's appointment in U.S. insurance companies. Florio and Leoni (2017) study the appointment of a CRO, the presence of a risk committee, and the board of directors (as proxies for ERM sophistication) to evaluate performance. They find that ERM sophistication is important to increase performance.

Our research focuses on the relationship between CROs' compensation incentives and value creation. COSO (2004) recommends appointing a CRO to drive the ERM systems in a company. Notably, the CRO oversees the disseminating and monitoring of the integrated risk management strategy to all parts of the company. The Dodd–Frank Act of 2010 requires that banking holdings and other types of holding companies with more than $10 billion of total assets have a separate risk committee with at least one experienced risk professional. Pagach and Warr (2011) point out that CROs are hired by large companies facing a greater predisposition to risk.

2.1. Presence of a CRO and firm value

The employment of a CRO as an executive in charge of ERM in the United States has consolidated since the release of Sections 302 and 404 of the Sarbanes–Oxley Act of 2002 (Sarbanes-Oxley Act, 2002). This has partly occurred in response to market pressure for better risk management practices (CAS, 2003; COSO, 2004; New York Stock Exchange 2004; Standard & Poor's, 2005). On the contrary, the importance of regulatory forces after the 2008 global financial crisis is directly related to the presence of a CRO in companies (U.S. Securities and Exchange Commission, 2009; Dodd–Frank Act, 2010; Federal Reserve Regulation YY, 2012; NAIC, 2012, 2014). According to Whitman (2015), the requirements and rules provided by these forces have become a new rulebook for risk management procedures, and these strengthen arguments in favor

of the appointment of a CRO as a key part of companies' risk management. COSO (2004, 2017) recommends hiring a CRO because he or she has the resources to drive ERM to benefit the entire company by overseeing the monitoring of each step of the process. CROs are also responsible for disseminating the risk management duties and strategic philosophy of the company to managers. Their message must thus be clear to avoid inconsistencies and management conflicts.

CROs benefit firms in several ways such as reducing stock price volatility (Liebenberg and Hoyt, 2003; Pagach and Warr, 2011), attenuating information asymmetry (Liebenberg and Hoyt, 2003; Beasley et al., 2008), and decreasing the cost of capital (The Economist Intelligence Unit, 2005; Berry-Stölzle and Xu, 2015). These benefits are linked to the adoption of a strategic risk management approach, where the presence of a CRO has been used as a proxy for the adoption of ERM (Hoyt and Liebenberg, 2011; Florio and Leoni, 2017). In this study, we follow Aebi et al. (2012), Grace et al. (2015), and Florio and Leoni (2017) to evaluate the correlation between firm value and the presence of a CRO. Hence, the first hypothesis of our study can be presented as follows:

H1: There is a negative relation between firm value and the presence of a CRO.

2.2. Influence and reporting of the CRO and firm value

According to Aebi et al. (2012), a CRO has more influence and power when he or she is an executive director. However, the increase in influence and power is not necessarily associated with value creation. Grace et al. (2015) state that a risk manager that has access to the board of directors may have more credibility than one that does not. Within the context of risk governance, Aebi et al. (2012), Grace et al. (2015), and Florio et al. (2017) assess the association between the firm's

value metrics and risk manager's strategy for reporting to the CEO, CFO, a risk committee, or the board of directors. The results are contradictory or not statistically significant. Our study also investigates the association between the attributes and reporting of the CRO and firm value. According to the empirical findings mentioned above, we evaluate the following hypotheses:

H2a: *Having a CRO who is an executive director is negatively associated with firm value*.

H2b: *Having a CRO who reports to the CEO or CFO is negatively associated with firm value*.

H2c: *Having a CRO who reports to a risk committee or the board is positively associated with firm value*.

2.3. CRO compensation incentives and firm value

According to Jensen and Meckling (1976), executive compensation plays an important role in the firm's ability to incentivize managers. A thorough understanding of internal incentive structures is critical to developing a viable theory of the firm, since these incentives largely determine how the individuals within an organization behave (Baker et al., 1998). Compensation policy can provide value-increasing incentives through several mechanisms including performance-based bonuses, stock options, and performance-based dismissal decisions. Stock ownership or equity-based plans are another way through which an executive's welfare varies directly with firm performance, independent of any link between compensation and performance. Although the process through which CEOs select their equilibrium stockholdings is not well understood, the incentives generated by these shareholdings clearly add to the incentives generated by the compensation package. Although such holdings are small and declining, the most powerful CEO performance incentives come from ownership of their firms' stock (Jensen and Murphy,

1990). Kuo et al. (2013) show that the positive impact of CEO equity incentives on firm performance is more pronounced not only for companies with lower and moderate levels of CEO stock-based incentive pay, but also for less profitable firms.

In the context of risk management, Grace et al. (2015) were the first to provide evidence of a link between incentives and executive compensation/risk management. The authors use the survey of ERM by Tillinghast Towers Perrin[1] to insurance companies in 2004 and 2006 and create an indicator to describe whether firms use the output from ERM to influence executive compensation. The results show no association between this indicator and the value metrics adopted (cost and revenue efficiency). In another approach, Pernell et al. (2017) suggest that CROs in the banking industry encourage increased risk-taking by contracting new derivatives. The authors also suggest that CEOs' performance-related pay (ratio of bonus to salary compensation) favors new derivatives, whereas the effect of bonus pay does not change with the presence of a CRO.

Demand for the disclosure and oversight of risk management and compensation policies for proxy statements is increasing (Whitman, 2015). Items 402, 403, and 405 of Regulation S-K require that companies specify the role of the board of directors and committees in overseeing risk management in their proxy statements, their compensation policies and practices for executives and other employees, and if those policies and practices create risks that are reasonably likely to have a material adverse effect on the company (U.S. Securities and Exchange Commission, 2009, 2017a). In 2012, the Federal Reserve created, for large financial institutions, a set of guidelines

[1] According Grace et al. (2015), the survey conducted by Tillinghast Towers Perrin asked participants whether ERM measures are incorporated into incentive compensation at their company. The survey gave participants examples of risk performance metrics. The respondents, however, were not required to provide details.

under which the board of directors should provide effective corporate governance with the support of senior management, ensuring that compensation arrangements and other incentives are consistent with the corporate culture and institutional risk appetite (Federal Reserve Regulation YY, 2012). The literature and associated regulation above suggest a link between incentives for executive compensation and strategic risk management when the CRO is at the center of this process. Encouraged by this scenario, we postulate the following hypotheses:

H3a: *Having a CRO on the compensation committee of the board (i.e., involved in the annual review, oversight, and assessment of the compensation plans of senior executives) is positively associated with firm value.*

H3b: *Having a CRO with an equity-based compensation plan is positively associated with firm value.*

3. Sample selection, variables, and descriptive statistics

3.1. Sample selection

We tested our hypotheses on all U.S. publicly traded insurers following Hoyt and Liebenberg (2011). The initial sample was drawn from the universe of insurance companies (SIC codes between 6311 and 6399) available in the S&P Capital IQ database for 2009–2017. The sample was composed of 243 companies that operated in any year during the nine-year period. We hand-collected our variables on CROs and corporate governance from insurers in the 10-k (annual report), DEF 14A (proxy statement), and Forms 3 and 4 in the SEC's EDGAR database, LexisNexis Academic database, and LinkedIn. We excluded 136 insurance companies without 10-k and DEF 14A filings in the SEC's EDGAR database from our sample as well as five subsidiaries that already

had their respective headquarters in the database, thus avoiding the duplication of companies in the sample. Finally, we excluded 11 companies with missing financial and accounting data (total assets, shares outstanding, market value of equity, leverage, sales growth). Therefore, our final sample contained 91 insurance companies (762 firm-year observations).

3.2. Variable definitions

We use *Tobin's Q* (i.e., the market value of equity plus the book value of liabilities divided by the book value of assets) as a proxy for firm value following previous empirical ERM studies (Hoyt and Liebenberg, 2011; Baxter et al., 2013; Florio and Leoni, 2017). In addition, we collect insurer-specific data (i.e., overall disclosure and corporate governance characteristics). Similar to Hoyt and Liebenberg (2011), we control for the determinants of firm value and include firms' characteristics such as the sector type of insurers ($SECTOR$), size ($SIZE$), financial leverage ($LEVERAGE$), profitability (ROA), systematic risk ($BETA$), growth opportunity ($SALESGROWTH$), payment of dividends ($DIVIDENDS$), international diversification (DIV_INT), and industrial diversification (DIV_IND).

The control variables on corporate governance follow those adopted in the literature: firms audited by a Big Four audit firm ($BIG4$), the natural logarithm of the number of board members ($BOARDSIZE$), the natural logarithm of the number of outsider board members ($BOARDIND$), and the duality of the CEO ($CEO\_DUALITY$) (Aebi et al., 2012; Baxter et al., 2013; Mafrolla et al., 2016; Florio and Leoni, 2017). We also use the percentage of outstanding shares owned by institutions ($INST\_OWNER$) and the percentage of outstanding shares owned by insiders ($INSIDERS$) (Bhagat et al., 2008; Cornett et al., 2009; Hoyt and Liebenberg, 2011; Baxter et al., 2013) as well as the natural logarithm of the total compensation of the CEO

($CEO\_COMPENSATION$) and the CEO having an equity-based plan ($CEO\_EQUITYBASEDPLAN$) (Jensen and Murphy, 1990; Kuo et al., 2013). Finally, year dummies are used to control for the time variation in *Tobin's Q* over the sample period. Table 1 presents all the variables used in this study.

Insert Table 1

We are interested in studying the presence, influence, and reporting of CROs and firms' incentives to compensate them. We use the DEF 14A, 10-k, and Forms 3 and 4 available in the SEC's EDGAR database, LexisNexis Academic database, and LinkedIn to collect these information disclosures by firm for 2009–2017. In these forms, we identify firms that disclose the presence of a risk manager or a chief risk officer, searching for the keyword "chief risk officer" or its synonyms such as "director of risk," "risk manager," "chief of risk," "executive vice president of risk," and "chief enterprise risk officer." Thus, we create a CRO dummy variable (1 for firm-years that have a CRO and 0 otherwise) as an indicator to evaluate the hypothesis **H1**. Previous research investigates the participation of an executive dedicated to risk management duties and often associates the presence of a risk manager with the level of ERM implementation (Hoyt and Liebenberg, 2011; Grace et al., 2015; Florio and Leoni, 2017). In this study, we highlight the presence of a CRO as a key factor in the company's ERM structure. Hence, we identify the presence of a CRO in the reports of each company in our sample. Further, we collect the officer's name, function, and individual characteristics (i.e., age and sex) for all firm-years with available information in our sample.

In contrast to Aebi et al. (2012), we identify whether the risk manager is an executive director (i.e., senior director, vice president, senior vice president, executive vice president, or senior executive vice president) for all firm-years, allowing us to create two indicators for the hypothesis **H2a** ($CRO\_ISEXECDIRECTOR$ and $CRO\_OFFICER$). We also create dummy variables for the hypotheses **H2b** and **H2c**, identifying, respectively, all the firm-years that disclose whether the CRO reports directly to the CEO or CFO ($CRO\_REPORTtoCEOorCFO$) or directly to the board of directors ($CRO\_REPORTtoBOARD$) (Aebi et al., 2012; Grace et al., 2015; Florio and Leoni, 2017).

Following the context described in Section 2.3, we create indicators (dummy variables) to test the hypotheses **H3a** and **H3b**. The first indicator ($CRO\_COMPENSATIONPLANS$) identifies the participation of the CRO in reviewing and assisting the activities of the compensation committee of the board (hypothesis **H3a**) generally responsible for reviewing the company's compensation practices and overseeing risk management with respect to its compensation arrangements. The information on the participation of the CRO in risk management and the activities of the compensation committee comes from the firm's disclosure in the "Corporate Governance – Board's Role in the Oversight Risk" and "Compensation Discussion and Analysis" sections of the DEF 14A Proxy Statement (SEC's EDGAR database). Thus, we identify all the firm-years that disclose whether the CRO is involved in the review, oversight, and assessment of the compensation plans of executive directors at least annually. Hence, we create a second indicator ($CRO\_EQUITYBASEDPLAN$) that provides information on the equity-based compensation of the CRO (hypothesis **H3b**). We identify all the firm-years in which the CRO has an equity-based compensation plan (stock awards and/or options awards) and code this indicator 1 and 0 otherwise. We hand-collected this information from the DEF 14A Proxy Statement and Forms 3 and 4 in the

SEC's EDGAR database. We also use the LexisNexis Academic database and LinkedIn to enhance the cross between the firm-year and name of the CRO. Finally, according to Section 16 of the Securities Exchange Act of 1934 (U.S. Securities and Exchange Commission, 2017b), every person directly or indirectly a beneficial owner of over 10% of a company, or who is a director or an officer of the issuer of such a security, must file Forms 3 and 4. Thus, in Forms 3 and 4, we find all the firm-years in which the CRO was the owner of equity granted by stock awards and/or options awards.

3.3. Descriptive statistics

Table 2 shows our basic descriptive statistics. We provide information on the distribution of the insurer's companies, CROs, and firm value ($Tobin's\ Q$) by SIC code and year. The proportion of CROs increases for all types of insurers (except for title insurance and insurance carriers; SIC codes 6361 and 6399) from 2009 to 2017. The same applies for firm value (hospital and medical and fire, marine, and casualty insurers stand out).

Insert Table 2

Table 3 presents the summary statistics for all the variables of our study (see Table 1 for the definitions). Panels A and B report the summary statistics of the characteristics of the firms and corporate governance variables, respectively. The mean and median values of firm value for our sample are 1.071 and 1.009, respectively. The mean and median values of $SIZE$, $LEVERAGE$, ROA, $DIVIDENDS$, $INST\_OWNER$, and $INSIDERS$ are close to those of Hoyt and Liebenberg

(2011). The mean values and median values of $BOARDSIZE$ and $CEO\_DUALITY$ are close to those of Baxter et al. (2013), who use a sample of financial firms from the banking and insurance industries. On average, 82.1% of firm-years are audited by the Big Four and the CEO is also the board chair in 49.3% of firm-years. Finally, average CEO compensation ($CEO\_COMPENSATION$) is $5 million and the CEO has an equity-based plan ($CEO_EQUITYBASEDPLAN$) in 80.7% of firm-years on average.

Insert Table 3

Panel C of Table 3 and Table 4 describes the profile and attributes of the CROs of our sample. We only consider nominally identified CROs with the available information. On average, 32.4% of the firm-years in our sample period have a CRO. The typical CRO is 52 years, male (76.2%), and has about 5.5 years of professional experience. The dominant undergraduate degree majors are Business (Accounting, Business Administration, Economics and Actuary), Mathematics, and Others (Philosophy and Law, Political Science, Liberal Arts, Oceanography, and Computer Science). Typically, 75.7% of the CROs have executive functions and 60.7% are chief of an officer (regardless of being named Chief Risk Officer). We verify that 38.3% of the CROs report to the CEO or CFO and 82.9% report to the board of directors. Focusing on the CROs' compensation incentives, 39.3% are involved in the review, oversight, and assessment of the compensation plans of senior executive directors (including the CRO in the compensation committee of the board) and 48.6% have equity-based compensation plans (stock awards and/or option awards). Finally, Table 4 indicates the evolution of the attributes and incentives of CROs in our sample period. The presence of CROs in insurers has risen markedly from 23.1% in 2009 to

46.2% in 2017 and the decision-making power of these managers ($CRO\_OFFICER$) has also increased from 50% in 2009 to 69.4% in 2017. In addition, there is a greater proportion of equity-based compensation plans (from 33.3% in 2009 to 61.1% in 2017).

Insert Table 4

4. Empirical strategy

Our empirical approach focuses on evaluating the relationship between the participation of CROs in risk management duties and value creation. We first carry out a basic mean test for the differences in value creation in companies with and without a CRO in our sample period. We then run an OLS regression to obtain the relationship between value creation and a dummy variable that equals 1 for firm-years with a CRO and 0 otherwise. We control for both the firm and the corporate governance characteristics following Hoyt and Liebenberg (2011), Aebi et al. (2012), Baxter et al. (2013), and Florio and Leoni (2017). Hoyt and Liebenberg (2011) provide a detailed presentation of $Tobin's\ Q$ determinants. Our first equation is specified as follows:

$$\begin{aligned}\boldsymbol{Value_{it}} = {} & \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEVERAGE_{it} + \beta_3 ROA_{it} + \beta_4 BETA_{it} + \beta_5 SALESGROWTH_{it} \\ & + \beta_6 DIVIDENDS_{it} + \beta_7 DIV\_INT_{it} + \beta_8 DIV\_IND_{it} + \beta_9 BIG4_{it} \\ & + \beta_{10} BOARDSIZE_{it} + \beta_{11} BOARDIND_{it} + \beta_{12} CEO\_DUALITY_{it} \\ & + \beta_{13} INST\_OWNER_{it} + \beta_{14} INSIDERS_{it} + \beta_{15} CEO\_COMPENSATION_{it} \\ & + \beta_{16} CEO\_EQUITYBASEDPLAN_{it} + \boldsymbol{\beta_{17} CRO_{it}} + \varepsilon_{it} \end{aligned} \quad (1)$$

where:

$$Value_{it} = Tobin's\ Q_{it},$$

$$CRO_{it} = \begin{cases} 1, & if\ there\ is\ a\ CRO\ for\ firm_i\ in\ time_t \\ 0, & otherwise \end{cases},$$

and the βs are the parameters to be estimated. Table 1 presents the remaining variables.

Further, we follow Hoyt and Liebenberg (2011) and measure $Tobin's\ Q$ as a function of the CRO and other control variables. We use a maximum-likelihood treatment effects model that simultaneously estimates the decision to employ a CRO and the effect of having a CRO on $Tobin's\ Q$. The model estimates the treatment effects considering self-selectivity problems (i.e., the decision to hire a CRO does not yield valid estimates of the causal effect because the selection mechanism is not random). Hence, the OLS model provides a biased estimation if the error terms of the equations are correlated. Equations (2) and (3) are simultaneously estimated using the likelihood function presented in Maddala (1983). We also control for the firm and corporate governance characteristics. The simultaneously estimated equations are specified as follows:

$$\begin{aligned} CRO_{it} = {} & \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 LEVERAGE_{it} + \alpha_3 BETA_{it} + \alpha_4 DIVIDENDS_{it} + \alpha_5 DIV\_INT_{it} \\ & + \alpha_6 DIV\_IND_{it} + \alpha_7 INST\_OWNER_{it} + \alpha_8 CEO\_EQUITYBASEDPLAN_{it} \\ & + u_{it} \end{aligned} \quad (2)$$

$$\boldsymbol{Value_{it}} = \gamma_0 + \gamma_1 SIZE_{it} + \gamma_2 LEVERAGE_{it} + \gamma_3 ROA_{it} + \gamma_4 BETA_{it} + \gamma_5 SALESGROWTH_{it} + \gamma_6 DIVIDENDS_{it} + \gamma_7 DIV\_INT_{it} + \gamma_8 DIV\_IND_{it} + \gamma_9 BIG4_{it} + \gamma_{10} BOARDSIZE_{it} + \gamma_{11} BOARDIND_{it} + \gamma_{12} CEO\_DUALITY_{it} + \gamma_{13} INST\_OWNER_{it} + \gamma_{14} INSIDERS_{it} + \gamma_{15} CEO\_COMPENSATION_{it} + \gamma_{16} CEO\_EQUITYBASEDPLAN_{it} + \boldsymbol{\gamma_{17}\ CRO_{it}} + \varepsilon_{it} \quad (3)$$

where $\alpha \; and \; \gamma$ are the parameters to be estimated.

We further exploit the CRO's variables related to value to evaluate the determinants of value creation for firms with a CRO in each point of our sample period. We consider in our final sample only firms with a CRO that undertakes risk management duties. In all the regressions, standard errors are clustered at the firm level and robust to heteroscedasticity. We also present the mean variance inflation factor (VIF) in our OLS regressions to show that our data do not have multicollinearity problems.

We run an OLS regression to obtain the relationship between value creation and the CRO's equity-based compensation plan ($CRO\_EQUITYBASEDPLAN$). We use the following specification:

$$\boldsymbol{Value_{it}} = \delta_0 + \delta_1 SIZE_{it} + \delta_2 LEVERAGE_{it} + \delta_3 ROA_{it} + \delta_4 BETA_{it} + \delta_5 SALESGROWTH_{it}$$
$$+ \delta_6 DIVIDENDS_{it} + \delta_7 DIV\_INT_{it} + \delta_8 DIV\_IND_{it} + \delta_9 BIG4_{it}$$
$$+ \delta_{10} BOARDSIZE_{it} + \delta_{11} BOARDIND_{it} + \delta_{12} CEO\_DUALITY_{it}$$
$$+ \delta_{13} INST\_OWNER_{it} + \delta_{14} INSIDERSs_{it} + \delta_{15} CEO\_COMPENSATION_{it}$$
$$+ \delta_{16} CEO\_EQUITYBASEDPLAN_{it} + \delta_{17} CRO\_EXECDIRECTOR_{it}$$
$$+ \delta_{18} CRO\_REPORTtoCEOorCFO_{it} + \delta_{19} CRO\_REPORT\_RCorBOARD_{it}$$
$$+ \boldsymbol{\delta_{20} CRO\_COMPENSATIONPLANS_{it}} + \boldsymbol{\delta_{21} CRO\_EQUITYBASEDPLAN_{it}}$$
$$+ \vartheta_{it} \quad (4)$$

where the δs are the parameters to be estimated. We also run three more OLS regressions considering the alternative CRO compensation variables (see Table 1).

As a robustness check, we present the ATET by matching firms with the same covariates (size, leverage, and sales growth). Considering that we deal with observational data, the treated subjects (firms with a CRO) can considerably differ from untreated firms. Therefore, we rely on propensity score matching to capture the same distribution of our covariates and evaluate the relationship between firm value and CRO attributes. Each firm is matched using the nearest neighbor technique. The average treatment effect is computed by taking the average of the difference between the observed and potential outcomes for each firm.

5. Results

Table 5 compares insurers with and without a CRO. Panel A shows that both the mean and the median firm value are slightly higher for insurers with a CRO, but the difference is not statistically significant. Second, insurers with a CRO are different from insurers without a CRO in terms of

their financial characteristics and corporate governance variables. On average, insurers with a CRO are larger, are more leveraged, present higher return volatility, pay more dividends, and are more diversified internationally than non-CRO insurers. Regarding the corporate governance variables, insurers with a CRO generally have better indicators (on average, they have more board members/outsider board members, higher levels of institutional ownership, and fewer insiders than non-CRO insurers). We also verify that they pay their CEOs higher compensation and have a higher percentage of CEOs with an equity-based plan on average compared with insurers with a CRO. Finally, Panel B shows the descriptive statistics for firm value. We do not find significant differences between insurers with and without a CRO.

Insert Table 5

Table 6 shows the results of the pooled OLS model for firm value ($Tobin's\ Q$) and the maximum-likelihood treatment effects model in which the CRO and $Tobin's\ Q$ equations are estimated jointly. The Wald test for independent equations does not reject the null hypothesis that the residuals from Equations (1) and (2) are uncorrelated and supports their joint estimation at the 1% significance level. The results for the firm value estimation using a pooled OLS model are consistent with those obtained using the maximum-likelihood treatment effects model. The coefficient of CRO is negative in both models, but only significant in the maximum-likelihood treatment effects model, after controlling for other value determinants and potential endogeneity bias. This result indicates that the presence (solely) of a CRO as a risk manager seems to diminish value for insurers in line with the findings of previous research (Aebi et al., 2012; Grace et al., 2015; Florio et al., 2017). Regarding our control variables, we find a positive association between

firm value and ROA, return volatility ($BETA$), institutional ownership ($INST\_OWNER$), and CEO compensation ($CEO\_COMPENSATION$). None of the other control variables is statistically significant.

Insert Table 6

Table 7 reports the results of the pooled OLS regression for firm value and the influence and reporting of the CRO as well as the incentives to compensate him or her. We only consider firms who appointed a CRO as a risk manager in our sample period (232 firm-year observations for 34 insurers).

Insert Table 7

We find a negative and significant association between firm value and CRO influence ($CRO\_EXECDIRECTOR$ and $CRO\_OFFICER$). Although $CRO\_EXECDIRECTOR$ and $CRO\_OFFICER$ have similar assignments, $CRO\_OFFICER$ has greater decision-making power. However, in terms of their relationship with firm value, both variables predict $Tobin's\ Q$ negatively. The results are consistent with those of Aebi et al. (2012), who find a negative but non-significant association. Our results are also robust to the two indicators of CRO influence. Unlike Aebi et al. (2012) and Grace et al. (2015), we find no significant relationship between firm value and the CRO reporting variables ($CRO\_REPORTtoCEOorCFO$ and $CRO\_REPORTtoRCorBOARD$). Most importantly, we present evidence of a positive association between firm value and the incentives

to compensate the CRO (including the CRO in the compensation committee of the board, $CRO\_COMPENSATIONPLANS$, and providing the CRO with an equity-based compensation plan, $CRO\_EQUITYBASEDPLAN$), supporting the hypotheses **H3a** and **H3b**. $CRO\_COMPENSATIONPLANS$ presents a positive relationship with firm value, statistically significant at the 1% level for the hypothesis **H3a**. We find a similar result for $CRO\_EQUITYBASEDPLAN$, which is significant at the 5% level for the hypothesis **H3b**. Considering the CRO payment incentives used to enhance firm value, our study thus sheds light on the findings of Grace et al. (2015) and Pernell et al. (2017). From the perspective of corporate governance, our results are in line with those of Baker et al. (1998) and Kuo et al. (2013). Although $CEO\_EQUITYBASEDPLAN$ is not statistically significant, the interaction between $CRO\_EQUITYBASEDPLAN$ and $CEO\_EQUITYBASEDPLAN$ is negative and significant at the 1% level. This result indicates that compensation through an equity-based plan is a substitute for the CEO and CRO.

Table 8 shows our robustness check. We display the ATET by matching firms with the same covariates (size, leverage, and sales growth). As previously stated, we find a reduction in firm value for firms with a CRO in the sample period. The variables of incentives to compensate the CRO ($CRO\_COMPENSATIONPLANS$ and $CRO\_EQUITYBASEDPLAN$) remain positive and significant.

Insert Table 8

6. Conclusion

This study investigates the relationship between CROs' compensation incentives and firm value. The focus on U.S. publicly traded insurers allows us to gauge the CRO's role in adding value for a firm. Hence, our research focuses on the participation of the CRO in the risk management process. We follow the literature by controlling for the determinants of firm value. In particular, we include the firm's characteristics and corporate governance variables in our analysis. Our study thus builds on previous studies by exploring the characteristics of the CRO. We provide information on the influence and reporting of the CRO as well as the incentives to compensate them.

Our empirical approach evaluates the relationship between the participation of CROs in risk management duties and value creation. Based on a maximum-likelihood treatment effects model, our regressions simultaneously estimate the decision of adopting a CRO and the influence of compensation incentives on firm value. Our research goes further and evaluates the relationship between CRO compensation plans and firm value considering solely firms with a CRO in our sample period. We rely on OLS and propensity score matching models to tackle our research questions.

Collectively, we add to the literature by providing evidence that CRO compensation plans improve firm value. Our results show that simply having a CRO does not add value to the company. In fact, the presence of a CRO can lower value when incentives based on compensation plans for risk management duties are lacking. We also provide robust results for different specifications.

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TABLES

Table 1: Variable definitions.

Variable name	Definition	Source
Panel A: Firm value ($Tobin's\ Q$) and characteristics of firms.		
$Tobin's\ Q$	Is used as a proxy for firm value and is calculated as ([market value of equity + book value of liabilities]/book value of assets)	S&P Capital IQ([IQ_marketcap + (IQ_total_assets_1007 – IQ_total_common_equity_1006)] /IQ_total_assets_1007)
$SECTOR$	Sector type of insurers: 6311=Life insurance; 6321=Accident and health insurance; 6324=Hospital and medical service plans; 6331=Fire, marine, and casualty insurance; 6351=Surety insurance; 6361=Title insurance; 6399=Insurance carriers	SIC Code SEC (EDGAR database)
$SIZE$	Natural logarithm of the book value of assets at the end of the year	S&P Capital IQ(IQ_total_assets_1007)
$LEVERAGE$	Book value of liabilities/market value of equity	S&P Capital IQ(IQ_total_liab_1012/IQ_marketcap)
ROA	Net income/book value of assets	S&P Capital IQ(IQ_ni_15/IQ_total_assets_1007)
$BETA$	Covariance(firm excess returns, market returns)/variance(market returns) using the prior 60 months excess returns	S&P Capital IQ(IQ_custom_beta)
$SALESGROWTH$	$(Sales_t – Sales_{t-1})/Sales_{t-1}$	S&P Capital IQ([IQ_total_rev_29$_t$ – IQ_total_rev_29$_{t-1}$]/IQ_total_rev_29$_{t-1}$)
$DIVIDENDS$	Dummy variable equal to 1 if the firm paid dividends in the current year (dividends > 0), and 0 otherwise	S&P Capital IQ(IQ_total_div_paid_cf_2022)
DIV_INT	Reflects international diversification and takes a value of 1 for firms with geographic segments outside North America, and 0 otherwise	S&P Capital IQ(IQ_geo_seg_rev_abs)
DIV_IND	Reflects industrial diversification and takes a value of 1 for firms with sales (> 0) from non-insurance SIC codes (< 6311, > 6300), and 0 otherwise	S&P Capital IQ(IQ_non_ins_rev_248)
$BIG4$	Dummy variable equal to 1 for firm-years in which the firm was audited by the Big Four, and 0 otherwise	SEC filings 10-k (EDGAR database)

(The table is continued on the next page.)

Table 1 (Continued)

Variable name	Definition	Source
Panel B: Corporate governance variables.		
BOARDSIZE	Natural logarithm of the number of board members	SEC filings DEF 14A (EDGAR database
BOARDIND	Natural logarithm of the number of outsider board members	SEC filings DEF 14A (EDGAR database)
CEO_DUALITY	Dummy variable equal to 1 for firm-years in which the CEO is also the board chair, and 0 otherwise	SEC filings DEF 14A (EDGAR database)
INST_OWNER	Percentage of outstanding shares owned by institutions	S&P Capital IQ(IQ_institutional_percent)
INSIDERS	Percentage of outstanding shares owned by insiders	S&P Capital IQ(IQ_insider_percent)
CEO_COMPENSATION	Natural logarithm of the total compensation of CEO (salary + stock awards + options awards + non-equity incentive plan compensation + all other compensation)	SEC filings DEF 14A (EDGAR database) and S&P Capital IQ(IQ_professional_annual_cash_comp) + IQ(IQ_professional_restricted_stock_comp) + IQ(IQ_professional_option_awards)
CEO_EQUITYBASEDPLAN	Dummy variable equal to 1 for firm-years in which the CEO has an equity-based plan (stock awards and/or options awards), and 0 otherwise	SEC filings DEF 14A (EDGAR database)
Panel C: Variables on *CRO*.		
CRO	Dummy variable equal to 1 for firm-years that have a CRO, and 0 otherwise	SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database); LexisNexis Academic database; LinkedIn
CRO_AGE	Age of the CRO (years)	SEC filings 10-k and DEF 14A (EDGAR database); LexisNexis Academic database; LinkedIn
CRO_GENDER	Dummy variable equal to 1 for firm-years in which the CRO is a man, and 0 otherwise	SEC filings 10-k and DEF 14A (EDGAR database); LexisNexis Academic database; LinkedIn
CRO_EXECDIRECTOR	Dummy variable equal to 1 for firm-years in which the CRO is an executive director (senior director, vice president, senior vice president, executive vice president, or senior executive vice president), and 0 otherwise	SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database); LexisNexis Academic database; LinkedIn

(The table is continued on the next page.)

Table 1 (Continued)

Variable name	Definition	Source
Panel C: Variables on CRO.		
$CRO\_OFFICER$	Dummy variable equal to 1 for firm-years in which the CRO is the CEO as well as the CRO), and 0 otherwise	SEC filings 10-k and DEF 14A (EDGAR database)
$CRO\_REPORTtoCEOorCFO$	Dummy variable equal to 1 for firm-years in which the CRO reports to the CEO or CFO, and 0 otherwise	SEC filings 10-k and DEF 14A (EDGAR database)
$CRO\_REPORTtoRCorBOARD$	Dummy variable equal to 1 for firm-years in which the CRO reports to the risk committee (at the board level) or board of directors, and 0 otherwise	SEC filings 10-k and DEF 14A (EDGAR database)
$CRO\_COMPENSATIONPLANS$	Dummy variable equal to 1 for firm-years in which the CRO is involved in the review, oversight, and assessment of the compensation plans of executive directors at least annually, and 0 otherwise	SEC filings 10-k and DEF 14A (EDGAR database)
$CRO\_EQUITYBASEDPLAN$	Dummy variable equal to 1 for firm-years in which the CRO has a compensation equity-based plan (stock awards and/or options awards), and 0 otherwise	SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database)

Table 2: Distribution of the insurer's companies and firm value ($Tobin's\ Q$) by SIC code and year.

$SECTOR$ (SIC code)	**Quantities**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2009–2017**
6311 – Life insurance	Number of firms	18	21	21	22	23	23	22	22	20	192
	% of CROs	33.33	33.33	38.10	36.36	39.13	43.48	45.45	45.45	50.00	40.63
	Mean of $Tobin's\ Q$	0.962	0.960	0.914	0.957	1.0902	1.047	1.039	1.056	1.036	1.009
6321 – Accident and health insurance	Number of firms	6	6	6	6	6	6	6	6	6	54
	% of CROs	33.33	33.33	33.33	33.33	33.33	50.00	50.00	66.67	66.67	44.44
	Mean of $Tobin's\ Q$	0.996	0.999	0.971	0.955	1.003	0.993	0.995	0.991	1.009	0.990
6324 – Hospital and medical serv. plans	Number of firms	7	8	9	9	9	9	9	9	8	77
	% of CROs	42.86	37.50	33.33	33.33	33.33	33.33	33.33	33.33	50.00	36.36
	Mean of $Tobin's\ Q$	1.115	1.123	1.185	1.120	1.249	1.363	1.376	1.363	1.693	1.288
6331 – Fire, marine, and casualty insurance	Number of firms	38	38	38	38	39	41	40	40	33	345
	% of CROs	15.79	18.42	23.68	26.32	28.21	31.71	35.00	37.50	42.42	28.70
	Mean of $Tobin's\ Q$	0.992	0.991	0.995	1.011	1.115	1.122	1.111	1.136	1.161	1.070
6351 – Surety insurance	Number of firms	5	5	5	5	6	6	6	6	6	50
	% of CROs	20.00	20.00	20.00	20.00	33.33	33.33	50.00	50.00	66.67	36.00
	Mean of $Tobin's\ Q$	0.943	1.016	0.976	1.018	1.202	1.107	0.999	1.057	1.186	1.062
6361 – Title insurance	Number of firms	3	4	4	4	4	4	4	4	4	35
	% of CROs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean of $Tobin's\ Q$	0.871	0.866	0.866	1.033	1.156	1.148	1.212	1.322	1.499	1.115
6399 – Insurance carriers	Number of firms	1	1	1	1	1	1	1	1	1	9
	% of CROs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mean of $Tobin's\ Q$	0.894	0.929	0.892	0.949	0.926	0.978	0.965	0.958	0.950	0.938
Overall total (all sectors)	Number of firms	78	83	84	85	88	90	88	88	78	762
	% of CROs	23.08	24.10	27.38	28,24	30.68	34.44	37.50	39.77	46.15	32.41
	Mean of $Tobin's\ Q$	0.987	0.991	0.985	1.005	1.121	1.117	1.107	1.130	1.189	1.071

Notes: $Tobin´s\ Q$ is used as a proxy for firm value and is calculated as $([Market\ value\ of\ equity + Book\ value\ of\ liabilities]/Book\ value\ of\ assets)$. CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). $SECTOR$ is a sector type of insurers (6311=Life insurance; 6321=Accident and health insurance; 6324=Hospital and medical service plans; 6331=Fire, marine and casualty insurance; 6351= Surety insurance; 6361=title insurance; 6399=Insurance carries). Accounting and market data are from the S&P Capital IQ.

Table 3: Summary statistics.

Panel A: Firm value ($Tobin's\ Q$) and characteristics of firms.

Variable	Mean	Minimum	1st quartile	Median	3rd quartile	Maximum	Standard deviation	No.
$Tobin's\ Q$	1.071	0.411	0.959	1.009	1.127	3.236	0.224	762
$Total\ assets\ (in\ millions)$	58,957	28	1,174	6,387	31,125	902,337	155,139	762
$SIZE$	8.749	3.367	7.068	8.762	10.346	13.713	2.323	762
$LEVERAGE$	5.698	0.024	1.377	2.878	6.107	63.993	7.703	752
ROA	1.742	–36.820	0.559	1.782	3.406	19.972	4.243	762
$BETA$	1.139	–0.888	0.669	0.945	1.446	6.141	0.759	752
$SALESGROWTH$	0.094	–2.948	–0.012	0.048	0.131	6.075	0.475	759
$DIVIDENDS$	0.726	0.000	0.000	1.000	1.000	1.000	0.446	762
DIV_INT	0.219	0.000	0.000	0.000	0.000	1.000	0.414	762
DIV_IND	0.104	0.000	0.000	0.000	0.000	1.000	0.305	762

Panel B: Corporate governance variables.

Variable	Mean	Minimum	1st quartile	Median	3rd quartile	Maximum	Standard deviation	No.
$BIG4$	0.821	0.000	1.000	1.000	1.000	1.000	0.384	759
$BOARDSIZE^{*}$	9.771	3.000	8.000	10.000	11.000	16.000	2.478	759
$BOARDIND^{*}$	7.829	2.000	6.000	8.000	10.000	14.000	2.658	759
$CEO\_DUALITY$	0.493	0.000	0.000	0.000	1.000	1.000	0.500	758
$INST\_OWNER$	49.105	0.000	33.758	51.295	66.053	99.365	22.475	762
$INSIDERS$	9.939	0.000	0.594	2.555	14.849	74.499	14.959	762
$CEO\_COMPENSATION^{*}$	5,021,154	144,873	1,175,776	3,067,112	7,033,318	42,755,012	5,304,621	757
$CEO\_EQUITYBASEDPLAN$	0.807	0.000	1.000	1.000	1.000	1.000	0.395	757

Panel C: CRO variables.

Variable	Mean	Minimum	1st quartile	Median	3rd quartile	Maximum	Standard deviation	No.
CRO	0.324	0.000	0.000	0.000	1.000	1.000	0.468	762
CRO_AGE	52.124	33.000	48.000	53.000	56.000	68.000	6.927	177
CRO_GENDER	0.762	0.000	1.000	1.000	1.000	1.000	0.427	193

$CRO\_EXECDIRECTOR$	0.757	0.000	1.000	1.000	1.000	1.000	0.429	247
$CRO\_OFFICER$	0.607	0.000	0.000	1.000	1.000	1.000	0.489	247
$CRO\_REPORTtoCEOorCFO$	0.383	0.000	0.000	0.000	1.000	1.000	0.487	235
$CRO\_REPORTtoRCorBOARD$	0.829	0.000	1.000	1.000	1.000	1.000	0.377	234
$CRO\_COMPENSATIONPLANS$	0.393	0.000	0.000	0.000	1.000	1.000	0.489	234
$CRO\_EQUITYBASEDPLAN$	0.486	0.000	0.000	0.000	1.000	1.000	0.501	247

Notes: $Tobin´s\ Q$ is used as a proxy for firm value and is calculated as $([Market\ value\ of\ equity + Book\ value\ of\ liabilities]/Book\ value\ of\ assets)$. $SIZE^{*}$ is equal to book values of assets at the end of the year. $LEVERAGE$ is equal to the ratio of the book value of liabilities to the market value of equity. ROA reflects accounting performance and is equal to net income divided by the book value of assets. $BETA$ reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns, using the prior 60 months excess returns. $SALES\_GROWTH$ is calculated as $(Sales_t - Sales_{t-1})/Sales_{t-1}$. $DIVIDENDS$ is a dummy variable equal to 1 for firm-years in which dividends are paid in the current year, and 0 otherwise. DIV_INT reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, and 0 otherwise. DIV_IND reflects industrial diversification and is a dummy variable equal to 1 for firm-years positive sales in noninsurance SIC codes (< 6311, > 6399), and 0 otherwise. $BIG4$ is a dummy variable equal to 1, for firm-years that firm was audited for a Big Four, and 0 otherwise. $BOARDSIZE^{*}$ is equal to number of board members. $BOARDIND^{*}$ is equal to number of outsiders board members. $CEO\_DUALITY$ is a dummy variable equal to 1, for firm-years that CEO is also the Board Chair, and 0 otherwise. $INST\_OWNER$ is equal to the Percentage of outstanding shares owned by institutions. $INSIDERS$ is equal to the percentage of outstanding shares owned by insiders. $CEO\_COMPENSATION^{*}$ is equal to total compensation of CEO (salary + stock awards + options awards + non-equity incentive plan compensation + all other compensation). $CEO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CEO has equity-based plan (stock awards and/or options awards), and 0 otherwise. CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). CRO_AGE is equal to age of Chief Risk Officer (in years). CRO_GENDER is a dummy variable equal to 1, for firm-years that Chief Risk Officer is a male, and 0 otherwise. $CRO\_EXECDIRECTOR$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive director (Senior Director; Vice President; Senior Vice President; Executive Vice President or Senior Executive Vice President), and 0 otherwise. $CRO\_OFFICER$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive Chief Officer (regardless of being named Chief Risk Officer), and 0 otherwise. $CRO\_REPORTtoCEOorCFO$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer report to CEO or CFO, and 0 otherwise. $CRO\_REPORTtoRCorBOARD$ is a dummy variable equal to 1, firm-years that Chief Risk Officer report to Risk Committee (at the board level) or Board of Directors, and 0 otherwise. $CRO\_COMPENSATIONPLANS$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is involved in the review, oversight and assessment compensation plans to senior executives (executive directors), and 0 otherwise. $CRO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CRO has equity-based plan (stock awards and/or options awards), and 0 otherwise. Accounting and market data are from the S&P Capital IQ.

Table 4: Frequency distribution of the influence, reporting and compensation incentives of the CRO.

Variable	Equal to	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2009–2017 (%)	2009–2017 Frequency
CRO	0	76.92	75.90	72.62	71.76	69.32	65.56	62.50	60.23	53.85	67.69	515
	1	23.08	24.10	27.38	28.24	30.68	34.44	37.50	39.77	46.15	32.41	247
$CRO\_EXECDIRECTOR$	0	27.78	25.00	21.74	25.00	25.93	25.81	24.24	25.71	19.44	24.29	60
	1	72.22	75.00	78.26	75.00	74.07	74.19	75.76	74.29	80.56	75.71	187
$CRO\_OFFICER$	0	50.00	45.00	39.13	41.67	40.74	41.94	36.36	37.14	30.56	39.27	97
	1	50.00	55.00	60.87	58.33	59.26	58.06	63.64	62.86	69.44	60.73	150
$CRO\_REPORTtoCEOorCFO$	0	66.67	68.42	63.64	60.87	57.69	56.67	62.50	61.67	61.29	61.70	145
	1	33.33	31.58	36.36	39.13	42.31	43.33	37.50	38.24	38.71	38.30	90
$CRO\_REPORTtoRCorBOARD$	0	23.53	21.05	22.73	21.74	19.23	16.67	12.50	11.76	12.90	17.09	40
	1	76.47	78.95	77.27	78.26	80.77	83.33	87.50	88.24	87.10	82.91	194
$CRO\_COMPENSATIONPLANS$	0	58.82	57.89	59.09	56.52	61.54	63.33	65.63	64.71	54.84	60.68	142
	1	41.18	42.11	40.91	43.48	38.46	36.67	34.38	35.29	45.16	39.32	92
$CRO\_EQUITYBASEDPLAN$	0	66.67	65.00	52.17	58.33	55.56	51.61	48.48	42.86	38.89	51.42	127
	1	33.33	35.00	47.83	41.67	44.44	48.39	51.52	57.14	61.11	48.58	120

Notes: CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). $CRO\_EXECDIRECTOR$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive director (Senior Director; Vice President; Senior Vice President; Executive Vice President or Senior Executive Vice President), and 0 otherwise. $CRO\_OFFICER$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive Chief Officer (regardless of being named Chief Risk Officer), and 0 otherwise. $CRO\_REPORTtoCEOorCFO$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer report to CEO or CFO, and 0 otherwise. $CRO\_REPORTtoRCorBOARD$ is a dummy variable equal to 1, firm-years that Chief Risk Officer report to Risk Committee (at the board level) or Board of Directors, and 0 otherwise. $CRO\_COMPENSATIONPLANS$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is involved in the review, oversight and assessment compensation plans to senior executives (executive directors), and 0 otherwise. $CRO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CRO has equity-based plan (stock awards and/or options awards), and 0 otherwise.

Table 5: Comparisons of insurers with and without a CRO (2009–2017).

Panel A: Firm value ($Tobin's\ Q$), financial characteristics of firms, and corporate governance variables.

	CRO = Yes		CRO = No		Difference	Difference	No. of obs. CRO	
Variable	**(1) Mean**	**(2) Median**	**(3) Mean**	**(4) Median**	**(1) – (3)**	**(2) – (4)**	**Yes**	**No**
$Tobin's\ Q$	1.085	1.011	1.065	1.009	0.020	0.002*	247	515
$SIZE^{*}$	152,929	50,383	13,887	2,538	139,043***	47,845***	247	515
$LEVERAGE$	7.689	3.930	4.724	2.430	2.965***	1,500***	247	505
ROA	1.617	1.591	1.801	1.942	–0.184	–0.351**	247	515
$BETA$	1.421	1.237	1.003	0.867	0.418***	0,370***	246	506
$SALESGROWTH$	0.096	0.039	0.093	0.055	0.003	–0.016	246	513
$DIVIDENDS$	0.830	1.000	0.676	1.000	0.154***	0.000	247	515
DIV_INT	0.348	0.000	0.157	0.000	0.191***	0.000	247	515
DIV_IND	0.097	0.000	0.107	0.000	–0.009	0.000	247	515
$BIG4$	0.943	1.000	0.762	1.000	0.181***	0.000	246	513
$BOARDSIZE^{*}$	10.846	11.000	9.255	9.000	1.590***	2.000***	246	513
$BOARDIND^{*}$	9.077	10.000	7.230	7.000	1.847***	3.000***	246	513
$CEO\_DUALITY$	0.563	1.000	0.460	0.000	0.103***	1.000***	245	513
$INST\_OWNER$	56.990	58.064	45.324	47.572	11.667***	10.492***	247	515
$INSIDERS$	3.809	0.479	12.879	4.990	–9.070***	–4.511***	247	515
$CEO\_COMPENSATION^{*}$	8,325,552	6,881,956	3,430,387	1,964,839	4,895,165***	4,917,117***	246	511
$CEO\_EQUITYBASEDPLAN$	0.967	1.000	0.729	1.000	0.238***	0.000	246	511

Panel B: Descriptive statistics for firm value ($Tobin's\ Q$) by year.

	Total		CRO = Yes		CRO = No		Difference	Difference	Nr. of obs. CRO	
Year	**Mean**	**Median**	**(1) Mean**	**(2) Median**	**(3) Mean**	**(4) Median**	**(1) – (3)**	**(2) – (4)**	**Yes**	**No**
2009	0.987	0.983	0.992	0.994	0.986	0.975	0.006	0.019	18	60
2010	0.991	0.986	0.992	0.992	0.991	0.983	0.001	0.009	20	63
2011	0.985	0.967	0.955	0.966	0.996	0.972	–0.041	–0.006	23	61
2012	1.005	0.979	0.978	0.965	1.016	1.006	–0.038	–0.041	24	61
2013	1.121	1.037	1.146	1.023	1.109	1.053	0.037	–0.030	27	61
2014	1.117	1.027	1.106	1.023	1.122	1.031	–0.016	–0.008	31	59
2015	1.107	1.049	1.105	1.048	1.109	1.049	–0.004	–0.001	33	55
2016	1.130	1.077	1.148	1.078	1.118	1.075	0.030	0.003	35	53
2017	1.188	1.093	1.193	1.109	1.185	1.079	0.008	0,030	36	42

Notes: $Tobin's\ Q$ is used as a proxy for firm value and is calculated as $([Market\ value\ of\ equity + Book\ value\ of\ liabilities]/Book\ value\ of\ assets)$. $SIZE^*$ is equal to book values of assets at the end of the year. $LEVERAGE$ is equal to the ratio of the book value of liabilities to the market value of equity. ROA reflects accounting performance and is equal to net income divided by the book value of assets. $BETA$ reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns, using the prior 60 months excess returns. $SALES\_GROWTH$ is calculated as $(Sales_t - Sales_{t-1})/Sales_{t-1}$. $DIVIDENDS$ is a dummy variable equal to 1 for firm-years in which dividends are paid in the current year, and 0 otherwise. DIV_INT reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, and 0 otherwise. DIV_IND reflects industrial diversification and is a dummy variable equal to 1 for firm-years positive sales in noninsurance SIC codes (< 6311, > 6399), and 0 otherwise. $BIG4$ is a dummy variable equal to 1, for firm-years that firm was audited for a Big Four, and 0 otherwise. $BOARDSIZE^*$ is equal to number of board members. $BOARDIND^*$ is equal to number of outsiders board members. $CEO\_DUALITY$ is a dummy variable equal to 1, for firm-years that CEO is also the Board Chair, and 0 otherwise. $INST\_OWNER$ is equal to the Percentage of outstanding shares owned by institutions. $INSIDERS$ is equal to the percentage of outstanding shares owned by insiders. $CEO\_COMPENSATION^*$ is equal to total compensation of CEO (salary + stock awards + options awards + non-equity incentive plan compensation + all other compensation). $CEO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CEO has equity-based plan (stock awards and/or options awards), and 0 otherwise. CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). Accounting and market data are from the S&P Capital IQ. Statistical significance of difference in means is based on a t-test. Statistical significance of difference in medians is based on a nonparametric Wilcoxon rank sum test.

Levels of significance: * - 10%; ** - 5%; and *** - 1%.

Table 6: Regression results for firm value ($Tobin's\ Q$).

		Full maximum-likelihood treatment effects model	
Variable	**Pooled OLS model**	***CRO* (Equation 1)**	***Tobin's Q* (Equation 2)**
$Constant$	0.5182 (0.2090)**	–5.0413 (0.9585)***	0.4504 (0.1898)**
$SIZE$	–0.0209 (0.0192)	0.4334 (0.1017)***	–0.0073 (0.0231)
$LEVERAGE$	–0.0016 (0.0023)	–0.0242 (0.0163)	–0.0023 (0.0024)
ROA	0.0071 (0.0026)***		0.0072 (0.0026)***
$BETA$	0.0267 (0.0100)***	0.1567 (0.1871)	0.0318 (0.0126)**
$SALESGROWTH$	0.0246 (0.0169)		0.2269 (0.0156)
$DIVIDENDS$	0.0228 (0.0207)	0.0277 (0.3252)	0.0248 (0.0228)
DIV_INT	0.0269 (0.0421)	0.1409 (0.4256)	0.0415 (0.0420)
DIV_IND	0.0106 (0.0343)	–0.4576 (0.5149)	–0.0065 (0.0372)
$BIG4$	–0.0593 (0.0483)		–0.0669 (0.0482)
$BOARDSIZE$	0.0867 (0.0812)		0.0916 (0.0792)
$BOARDIND$	–0.0404 (0.0691)		–0.0354 (0.0669)
$CEO\_DUALITY$	0.0118 (0.0194)		0.0142 (0.0183)
$INST\_OWNER$	0.0013 (0.0007)*	0.0006 (0.0080)	0.0013 (0.0008)*
$INSIDERS$	–0.0013 (0.0014)		–0.0011 (0.0013)
$CEO\_COMPENSATION$	0.0387 (0.0167)**		0.0357 (0.0167)**
$CEO\_EQUITYBASEDPLAN$	0.0114 (0.0259)	0.6415 (0.4269)	0.0256 (0.0288)
$CRO\ (Reference = No)$	–0.0371 (0.0274)		–0.1623 (0.0678)**
$Years\ control\ (Dummies\ of\ YEAR)$	Yes***	Yes	Yes***
$Sector\ control\ (Dummies\ of\ SECTOR)$	Yes***	Yes	Yes***
No. of observations (firm-years)	744	744	
No. of clusters (insurers)	91	91	
R^2	0.4440	–	
Mean VIF	2.17	–	
Log pseudolikelihood	–	111.0546	
Wald test of independent equations (p-value)	–	4.8200 (0.0282)**	

Notes: $Tobin's\ Q$ is used as a proxy for firm value and is calculated as $([Market\ value\ of\ equity + Book\ value\ of\ liabilities]/Book\ value\ of\ assets)$. $SIZE^{*}$ is equal to book values of assets at the end of the year. $LEVERAGE$ is equal to the ratio of the book value of liabilities to the market value of equity. ROA reflects accounting performance and is equal to net income divided by the book value of assets. $BETA$ reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns, using the prior 60 months excess returns. $SALES\_GROWTH$ is calculated as $(Sales_t - Sales_{t-1})/Sales_{t-1}$. $DIVIDENDS$ is a dummy variable equal to 1 for firm-years in which dividends are paid in the current year, and 0 otherwise. DIV_INT reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, and 0 otherwise. DIV_IND reflects industrial diversification and is a dummy variable equal to 1 for firm-years positive sales in noninsurance SIC codes (< 6311, > 6399), and 0 otherwise. $BIG4$ is a dummy variable equal to 1, for firm-years that firm was audited for a Big Four, and 0 otherwise. $BOARDSIZE^{*}$ is equal to number of board members. $BOARDIND^{*}$ is equal to number of outsiders board members. $CEO\_DUALITY$ is a dummy variable equal to 1, for firm-years that CEO is also the Board Chair, and 0 otherwise. $INST\_OWNER$ is equal to the percentage of outstanding shares owned by institutions. $INSIDERS$ is equal to the percentage of outstanding shares owned by insiders. $CEO\_COMPENSATION^{*}$ is equal to total compensation of CEO (salary + stock awards + options awards + non-equity incentive plan compensation + all other compensation). $CEO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CEO has equity-based plan (stock awards and/or options awards), and 0 otherwise. CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). $SECTOR$ is a sector type of insurers (6311=Life insurance; 6321=Accident and health insurance; 6324=Hospital and medical service plans; 6331=Fire, marine and casualty insurance; 6351= Surety insurance; 6361=title insurance; 6399=Insurance carries). Accounting and market data are from the S&P Capital IQ. We evaluated the multicollinearity between the independent variables of the model by calculation of the variance inflation factors (VIF) that varied from 1.10 to 4.98 indicating, therefore, the absence of multicollinearity.

Levels of significance: * - 10%; ** - 5%; and *** - 1%.

Table 7: Pooled OLS regression results for firm value ($Tobin's\ Q$) and the influence and reporting of the CRO and the incentives to compensate him or her.

Variable	(**1**)	(**2**)	(**3**)	(**4**)
$Constant$	0.7912 (0.3155)**	0.1577 (0.3540)	0.8282 (0.3077)***	0.1866 (0.3420)
$SIZE$	–0.0587 (0.0126)***	–0.0575 (0.0113)***	–0.0608 (0.0127)***	–0.0598 (0.0113)***
$LEVERAGE$	0.0015 (0.0023)	0.0007 (0.0022)	0.0012 (0.0023)	0.0004 (0.0022)
ROA	0.0039 (0.0030)	0.0036 (0.0024)	0.0047 (0.0030)	0.0046 (0.0024)*
$BETA$	0.0209 (0.0107)*	0.0294 (0.0119)**	0.0178 (0.0114)	0.0264 (0.0122)**
$SALESGROWTH$	–0.0182 (0.0255)	–0.0193 (0.0214)	–0.0221 (0.0248)	–0.0238 (0.0207)
$DIVIDENDS$	0.0142 (0.0322)	0.0191 (0.0281)	0.0175 (0.0329)	0.0228 (0.0289)
DIV_INT	0.0781 (0.0296)***	0.0729 (0.0252)***	0.0842 (0.0279)***	0.0792 (0.0259)***
DIV_IND	0.0428 (0.0275)	0.0268 (0.0281)	0.0195 (0.0302)	0.0001 (0.0289)
$BIG4$	–0.0624 (0.0442)	–0.0525 (0.0413)	–0.0551 (0.0462)	–0.0433 (0.0427)
$BOARDSIZE$	0.2284 (0.0997)**	0.1484 (0.1035)	0.1986 (0.0957)**	0.1138 (0.0993)
$BOARDIND$	–0.1823 (0.0756)**	–0.1138 (0.0813)	–0.1499 (0.0696)**	–0.0777 (0.0744)
$CEO\_DUALITY$	0.0503 (0.0146)***	0.0562 (0.0152)***	0.0468 (0.0143)***	0.0529 (0.0142)***
$INST\_OWNER$	0.0017 (0.0010)*	0.0010 (0.0008)	0.0012 (0.0011)	0.0004 (0.0008)
$INSIDERS$	–0.0018 (0.0010)*	–0.0022 (0.0013)*	–0.0014 (0.0009)	–0.0019 (0.0012)
$CEO\_COMPENSATION$	0.0382 (0.0196)*	0.0867 (0.0281)***	0.0374 (0.0190)**	0.0871 (0.0269)***
$CEO\_EQUITYBASEDPLAN$	0.0281 (0.0261)	–0.0171 (0.0262)	0.0223 (0.0259)	–0.0252 (0.0290)
$CRO\_EXECDIRECTOR$	–0.0625 (0.0254)**	–0.0665 (0.0209)***	–	–
$CRO\_OFFICER$	–	–	–0.0655 (0.0346)*	–0.0747 (0.0287)***
$CRO\_REPORTtoCEOorCFO$	0.0151 (0.0246)	0.0164 (0.0210)	–0.0005 (0.0221)	–0.0003 (0.0196)
$CRO\_REPORTtoRCorBOARD$	–0.0078 (0.0290)	–0.0459 (0.0319)	0.0149 (0.0292)	0.0217 (0.0321)
$CRO\_COMPENSATIONPLANS$	0.0571 (0.0173)***	0.0509 (0.0182)***	0.0596 (0.0193)***	0.0545 (0.0191)***
$CRO\_EQUITYBASEDPLAN$	0.0561 (0.0221)**	1.4975 (0.4948)***	0.0781 (0.0345)**	1.5580 (0.4799)***
$CRO\_EQUITYBASEDPLAN$ x $CEO\_EQUITYBASEDPLAN$	–	–0.0914 (0.0309)***	–	–0.0935 (0.0298)***
$Years\ control\ (Dummies\ of\ YEAR)$	Yes***	Yes***	Yes***	Yes***
$Sector\ control\ (Dummies\ of\ SECTOR)$	Yes***	Yes***	Yes***	Yes***
No. of observations (firm-years)	232	232	232	232
No. of clusters (insurers)	34	34	34	34
R^2	0.6951	0.7257	0.6924	0.7243
Mean VIF	3.11	3.29	3.21	3.35

Notes: $Tobin's\ Q$ is used as a proxy for firm value and is calculated as $([Market\ value\ of\ equity + Book\ value\ of\ liabilities]/Book\ value\ of\ assets)$. $SIZE^{*}$ is equal to book values of assets at the end of the year. $LEVERAGE$ is equal to the ratio of the book value of liabilities to the market value of equity. ROA reflects accounting performance and is equal to net income divided by the book value of assets. $BETA$ reflects return volatility and is equal to the covariance between firm excess returns and market excess returns, divided by the variance of market returns, using the prior 60 months excess returns. $SALES\_GROWTH$ is calculated as $(Sales_t - Sales_{t-1})/Sales_{t-1}$. $DIVIDENDS$ is a dummy variable equal to 1 for firm-years in which dividends are paid in the current year, and 0 otherwise. DIV_INT reflects international diversification and is a dummy variable equal to 1 for firm-years with sales outside of North America, and 0 otherwise. DIV_IND reflects industrial diversification and is a dummy variable equal to 1 for firm-years positive sales in noninsurance SIC codes (< 6311, > 6399), and 0 otherwise. $BIG4$ is a dummy variable equal to 1, for firm-years that firm was audited for a Big Four, and 0 otherwise. $BOARDSIZE^{*}$ is equal to number of board members. $BOARDIND^{*}$ is equal to number of outsider's board members. $CEO\_DUALITY$ is a dummy variable equal to 1, for firm-years that CEO is also the Board Chair, and 0 otherwise. $INST\_OWNER$ is equal to the Percentage of outstanding shares owned by institutions. $INSIDERS$ is equal to the percentage of outstanding shares owned by insiders. $CEO\_COMPENSATION^{*}$ is equal to total compensation of CEO (salary + stock awards + options awards + non-equity incentive plan compensation + all other compensation). $CEO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CEO has equity-based plan (stock awards and/or options awards), and 0 otherwise. CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). $CRO\_EXECDIRECTOR$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive director (Senior Director; Vice President; Senior Vice President; Executive Vice President or Senior Executive Vice President), and 0 otherwise. $CRO\_OFFICER$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive Chief Officer (regardless of being named Chief Risk Officer), and 0 otherwise. $CRO\_REPORTtoCEOorCFO$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer report to CEO or CFO, and 0 otherwise. $CRO\_REPORTtoRCorBOARD$ is a dummy variable equal to 1, firm-years that Chief Risk Officer report to Risk Committee (at the board level) or Board of Directors, and 0 otherwise. $CRO\_COMPENSATIONPLANS$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is involved in the review, oversight and assessment compensation plans to senior executives (executive directors), and 0 otherwise. $CRO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CRO has equity-based plan (stock awards and/or options awards), and 0 otherwise. $SECTOR$ is a sector type of insurers (6311=Life insurance; 6321=Accident and health insurance; 6324=Hospital and medical service plans; 6331=Fire, marine and casualty insurance; 6351= Surety insurance; 6361=title insurance; 6399=Insurance carries). Accounting and market data are from the S&P Capital IQ. We evaluated the multicollinearity between the independent variables of the model by calculation of the variance inflation factors (VIF) that varied from 1.39 to 9.54 to model (1), 1.45 to 9.71 to model (2), 1.41 to 9.77 to model (3) and 1.49 to 9.92 to model (4), respectively, indicating the absence of multicollinearity.

Levels of significance: * - 10%; ** - 5%; and *** - 1%.

Table 8: Propensity score matching – ATET for firm value ($Tobin's\ Q$).

Variable	$\boldsymbol{Tobin's\ Q}$ Coefficient (Std. Err.)
CRO	–0.0497 (0.0206)**
Controlled by $SIZE, LEVERAGE, SALESGROWTH$	
No. of observations (firm-years)	749
$CRO\_EXECDIRECTOR$	0.0305 (0.0176)*
Controlled by $SIZE, LEVERAGE$ and $SALESGROWTH$	
No. of observations (firm-years)	246
$CRO\_OFFICER$	0.0356 (0.0207)*
Controlled by $SIZE, LEVERAGE$ and $SALESGROWTH$	
No. of observations (firm-years)	246
$CRO\_REPORTtoCEOorCFO$	0.0595 (0.0385)
Controlled by $SIZE, LEVERAGE$ and $SALESGROWTH$	
No. of observations (firm-years)	234
$CRO\_REPORTtoRCorBOARD$	–0.0278 (0.0196)
Controlled by $SIZE, LEVERAGE$ and $SALESGROWTH$	
No. of observations (firm-years)	233
$CRO\_COMPENSATIONPLANS$	0.0684 (0.0158)***
Controlled by $SIZE, LEVERAGE$ and $SALESGROWTH$	
No. of observations (firm-years)	233
$CRO\_EQUITYBASEDPLAN$	0.0715 (0.0214)***
Controlled by $SIZE, LEVERAGE$ and $SALESGROWTH$	
No. of observations (firm-years)	246

Notes: $Tobin´s\ Q$ is used as a proxy for firm value and is calculated as $([Market\ value\ of\ equity + Book\ value\ of\ liabilities]/Book\ value\ of\ assets)$. $SIZE^{*}$ is equal to book values of assets at the end of the year. $LEVERAGE$ is equal to the ratio of the book value of liabilities to the market value of equity. $SALES\_GROWTH$ is calculated as $(Sales_t - Sales_{t-1})/Sales_{t-1}$. CRO is a dummy variable equal to 1, for firm-years that has a Chief Risk Officer, and 0 otherwise (CRO classification is based on a search of SEC filings 10-k, DEF 14A, Forms 3 and 4 (EDGAR database), LexisNexis Academic database and LinkedIn). $CRO\_EXECDIRECTOR$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive director (Senior Director; Vice President; Senior Vice President; Executive Vice President or Senior Executive Vice President), and 0 otherwise. $CRO\_OFFICER$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is an executive Chief Officer (regardless of being named Chief Risk Officer), and 0 otherwise. $CRO\_REPORTtoCEOorCFO$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer report to CEO or CFO, and 0 otherwise. $CRO\_REPORTtoRCorBOARD$ is a dummy variable equal to 1, firm-years that Chief Risk Officer report to Risk Committee (at the board level) or Board of Directors, and 0 otherwise. $CRO\_COMPENSATIONPLANS$ is a dummy variable equal to 1, for firm-years that Chief Risk Officer is involved in the review, oversight and assessment compensation plans to senior executives (executive directors), and 0 otherwise. $CRO\_EQUITYBASEDPLAN$ is a dummy variable equal to 1, for firm-years that CRO has equity-based plan (stock awards and/or options awards), and 0 otherwise. Accounting and market data are from the S&P Capital IQ.

Levels of significance: * - 10%; ** - 5%; and *** - 1%.