


Insurance and Climate Change Risk Management: Rescaling to Look Beyond the Horizon

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Climate change represents a significant financial risk to the insurance industry, but research has yet to assess whether the industry is managing this risk. Through the application of scale as a vertically nested hierarchy of relationships, this paper seeks to evaluate whether insurers are ‘rescaling’ risk management practices to accommodate the temporal and spatial uncertainty associated with climate change. This framework is applied to a content analysis of 178 (183) firm responses to the 2012 (2015) U.S. National Association of Insurance Commissioners Climate Risk Disclosure Survey to detect evidence of rescaling through climate change risk management (CCRM). The results reveal that the majority of companies do not integrate climate change into their risk management practices, but reinsurers are rescaling in a greater proportion than primary insurers. This finding confirms that a nested spatial and temporal scale in the insurance industry creates resistance to CCRM. The use of scale contributes to emerging scholarship on organizations and climate change by offering a framework for measuring organizational responses and justifying a research agenda on rescaling strategies as a means of risk management.

Introduction

The insurance industry has been identified as the ‘canary in the coal mine’ for the financial risks associated with climate change (LeBlanc and Linkin 2010, p. 113). Growing insured losses generated by the increasing frequency of extreme weather incentivize efforts to manage this risk (Ball, 2015; Dlugodecki, 2006; Mills, 2009; Swiss Re Sigma, 2015). These losses are consistent with Intergovernmental Panel on Climate Change (IPCC) research suggesting that climate change will increase the intensity and frequency of extreme weather (Cutter *et al.*, 2012; Seneviratne *et al.*, 2012). Climate change is identified as both a threat and an opportunity for the insurance

industry: a threat because losses limit the availability and affordability of coverage, and an opportunity because risk can be priced into premiums and investments, thereby creating incentives to support mitigation and adaptation strategies throughout the global economy (Botzen and van der Bergh, 2008; Kunreuther, Michel-Kerjan and Ranger, 2013; Mills, 2009). For these reasons, non-governmental organizations (NGOs), policy-makers and thought-leaders seeking to strengthen global climate change governance have engaged the insurance industry as a potential market-based system for pricing the risks associated with climate change throughout the economy (Paterson, 2001).

Despite this potential, recent research by the UK’s Prudential Regulatory Authority suggests that climate change represents a ‘tragedy of the horizons’ (Carney, 2015, p. 4) for the finance and insurance sector, as the economic risk associated with its effects (e.g. extreme weather) is beyond

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the time and spatial horizon of most organizations (PRA, 2015). This characterization invokes *scale* as a means of explaining the challenge presented by climate change for the insurance industry, specifically the need to adjust existing practices to accommodate a wider range of spatial and temporal uncertainty. Indeed, scholars have described the spatial and temporal scale of climate change as an alteration in the natural variation of environmental change, such as increases in the frequency and geographical exposure of extreme weather (Clark, 1987; Wilbanks and Kates, 1999). Shifts in scale can motivate transformational change in organizational logics that support ‘rescaling’, whereby existing practices adjust to new environments (Spicer, 2006). Insurers, regulators and NGOs have recognized this need for transformation in the insurance industry by championing practices that support CCRM (Kunreuther *et al.*, 2009; Mills, 2009; PRA, 2015). The conceptualization of climate change as a shift in scale justifying organizational change in the insurance industry raises two important research questions, which responds to both researchers’ (see Aerts and Botzen 2011; Hall, 2011; Webster and Clarke, 2017) and practitioners’ (see ClimateWise, 2015b) recent calls for greater clarity as to the insurance industry’s exposure and response to climate change. The research questions guiding this project are: *Does the insurance industry exhibit evidence of organizational logic rescaling to address climate change-related risks? Which firms exhibit a higher proclivity, if any, toward organizational logic rescaling?*

Despite some evidence that insurers are changing practices in response to climate change, research measuring this shift remains scarce (see ClimateWise, 2015a; Thistlethwaite, 2012). This paper employs scale as a framework to assess whether the insurance industry is integrating CCRM across the scope of corporate governance, underwriting, and investment practices. Survey data from the U.S. National Association of Insurance Commissioners (NAIC) Climate Risk Disclosure Survey were analyzed to detect whether there is evidence of insurers’ adopting risk-management practices consistent with organizational logics necessary to capture the scale of risk associated with the effects of climate change on the insurance industry. Based on this analysis, the paper argues that the majority of US insurers have yet to rescale practices consistent with an organizational logic necessary for managing the industry’s exposure to

climate change risk, supporting the notion that the industry is currently exposed to a ‘tragedy of the horizons’ (Carney, 2015, p. 4). Instead, insurers are defending the existing organizational logics embedded within a nested spatial and temporal scale that treats increasing loss-events as anomalous rather than correlated to climate change. There is, however, evidence of early-adopters of CCRM specifically among reinsurers and insurers prioritizing climate change risk in corporate governance, and assessing underwriting and investment logics for evidence that climate change is correlating instead of diversifying risk across time and space. This finding contributes to research on climate change and insurance and, more broadly, organizations and the environment, by demonstrating the value of scale in measuring organizational change and justifying research on rescaling as a means of risk management.

The paper is organized as follows. The first section leverages research on scale and organizational change to demonstrate the nested hierarchy that defines the insurance industry’s spatial and temporal organizational logics and how climate change represents a change in external scale that supports a rescaling of these logics. The second section introduces content analysis as a method of using this framework to assess survey data from the NAIC Climate Risk Disclosure Survey. The third section provides the results of this analysis. The fourth section discusses the coded responses to demonstrate how nested and rescaling organizational logics influence the adoption of CCRM. The fifth section concludes the paper and justifies a research agenda identifying strategies to overcome resistance to rescaling.

Literature review

Scale and the structure of the insurance industry

Scale is a widely applied concept for understanding phenomena, but with divergent conceptualizations and assumptions (Sheppard and McMaster, 2004). Some assume that processes are spatially dependent and conceive of scale as a vertically nested hierarchy ranging from local, regional, national to global (e.g. Adger, Arnell and Tompkins, 2005). Others view processes as networked connections of flows between human and non-human actors, and thus best understood through a horizontal conceptualization of scale (e.g. Leitner, 2004).

Some offer arguments in favour of hybrid conceptualization of scale that integrates both the vertical and horizontal ontologies of processes (e.g. Swyngedouw, 1997). Finally, some reject both the vertical and horizontal ontologies of scale altogether for a flat ontology in which the importance and nuance of social sites are paramount for understanding social phenomena (e.g. Marston, Jones and Woodward, 2005).

To understand the relationship between climate change and the insurance industry, this paper adopts a vertical conceptualization of scale. A vertical conceptualization of scale is consistent with climate change, given it is a global process related to the increase in atmospheric greenhouse gases (GHGs), which manifests over decades and materializes as events at the national, regional and local scale around the globe (e.g. extreme weather events, forest fire, droughts, sea-level rise, melting of polar ice) (IPCC, 2014). The insurance industry's economic structure is also consistent with a vertical conceptualization of scale, such that local property owners purchase insurance through several regional or national primary insurers, who in turn transfer risk to a few global reinsurance companies. Indeed, 'it is this ability to move capital across scales that allows the industry to manage risk' (Oulahan, 2015, p. 605). Premiums are pooled from distinct geographical areas that face variation in the scale of risk exposure and frequency (e.g. wildfire, flood or convective storm) and spread across time, as they are paid annually, but held in pools or long-term investment assets, which can be drawn upon after a loss event (Kunreuther *et al.*, 2009). This approach ensures their coverage is diversified sufficiently through space (i.e. geographical exposure) and time (i.e. frequency) so that capital is available to cover a significant loss event.

Insurers and their regulators need to understand the relationships between the physical scale of risk (i.e. the ontology of a global process) and the industry's perception of the scale of this risk (i.e. the epistemology of risk management) (Bansal, Kim and Wood, 2018). A primary insurer, for example, needs to determine how much premium to charge and reinsurance to purchase for the scale of potential risk for their policyholders. In the event that risk exceeds an insurer's understanding of this scale, losses can lead to higher premiums and reductions in the availability and affordability of coverage, and even insolvency if reserves or reinsurance are insufficient (Kunreuther, Hogarth

and Meszaros, 1993). More specifically, insurers need to identify when the scale of risk becomes correlated or when a single event leads to losses across geographies or over a short period of time (Botzen and van der Bergh, 2008). In 2005, for example, Hurricanes Katrina, Wilma and Rita all generated significant damage to a wide spatial area over a short period of time in the US Gulf Coast region (Mills, 2009). The cost of damages affected local property owners, which were then paid by primary insurers to a point, then transferred up to reinsurers to cover remaining costs. Because reinsurers suffered significant losses, they faced credit-rating downgrades, which forced them to recoup losses by passing down costs to primary insurers, who in turn passed those increased costs to consumers, reducing the availability and affordability of coverage across their global portfolio (Thistlethwaite, 2012). Figure 1 depicts this relationship. The next subsection discusses how climate change influences the scale of risk that insurers need to align with their epistemologies of risk management.

Climate change and external scale

Climate change represents a shift in external scale or 'change in the broader space that an organization is positioned within' (Spicer, 2006, p. 1473). This is confirmed by scholars that use time and space to describe the scalar dimensions of environmental change (Innes, 1998) and, in particular, the scale relationship between climate change and society (Clark, 1987). Temporally, the frequency and duration of climate change-related events need to be understood at different scales. For example, climate change is causing urban flooding to occur more frequently and with greater duration at smaller scales, but, at a regional scale, precipitation might be decreasing gradually (Revi *et al.*, 2014). Similarly, the spatial extent and distribution of climate change-related events need to be understood. Coastal flooding associated with storm surges are increasing in response to climate change in many communities, but the sea-level rise that causes the increase in flooding linked with melting polar ice occurs over a much larger spatial extent (Handmer *et al.*, 2012).

This change in the scale of risk creates a challenge for the insurance industry that the UK's Prudential Regulatory Authority calls the 'tragedy of the horizons', or the perception that variation in the temporal and spatial aspects of environmental

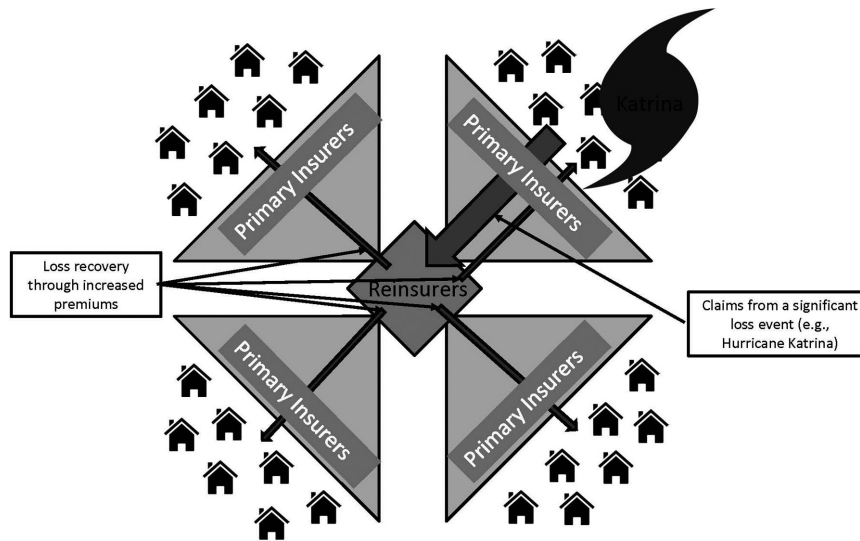


Figure 1. The economic structure of the insurance industry, depicting the claim cycle

change associated with anthropogenic warming is anomalous rather than correlated (Carney, 2015, p. 4). These spatial and temporal perceptions are evident in the industry's organizational logics, or the 'understandings of what is legitimate, reasonable and effective in a given context' (Spicer, 2006, p. 1468). Existing underwriting and investment logics rely on models that 'provide an estimate of today's risk rather than to anticipate climate trends or to extrapolate impact of these trends into the future' (PRA, 2015, p. 33). Research by Standard & Poor's, for example, has found that losses associated with the one-in-ten year and one-in-250 year hazard events are underestimated in these models by as much as 50% (ClimateWise, 2015b). Insurance coverage is also spatially constrained, as local and regional firms offer coverage proximate to their physical locations, which limits consideration for the global spatial extent of climate change (Herweijer, Ranger and Ward, 2009).

Climate change challenges the relationships between processes across nested scales (Fairclough, 2002) by strengthening the correlation between climate change and the risks generated by extreme weather across space and time (Herweijer, Ranger and Ward, 2009). For example, an insurer that diversifies coverage across the U.S. would assume a natural variation in the exposure of wildfire and flooding, with loss-events for the former occurring during drier years and for the latter during wetter years. Climate change correlates risk for these events, as spatial exposure and frequency can

increase in the same year, limiting the effectiveness of diversification across space and time, leading to market failure and decreases in availability and affordability (Botzen and van der Bergh 2008; Kunreuther, Hogarth and Meszaros, 1993). The influence of climate change on the scale of risk challenges insurers that view extreme weather events as nested with existing spatial and temporal scales, informed by organization logics using historical and spatially constrained models. The next subsection explores how climate change justifies a rescaling of insurance organizational logics on risk management.

Transformations in insurance organizational logics

According to Spicer (2006), shifts in scale are evident from changes in capital accumulation, regulation and discourse that challenge the nested hierarchy of existing organizational logics. Climate change is influencing capital accumulation in the insurance industry by increasing the frequency and intensity of damage from extreme weather events, which threatens the availability and affordability of coverage and the ability to diversify risk across investment portfolios. Analysis by Swiss Re confirmed that the frequency of major loss events has increased, as only six years since 1970 had produced insured losses that exceeded US\$40 billion globally, all of which have occurred since 1992, with the top five between 2004 and 2014 (Swiss Re Sigma, 2015). Upon closer analysis of these

increasing insured losses, Kunreuther and Michel-Kerjan (2007) observed that 80% of the 20 most significant loss-events over the last 35 years were weather-generated. Munich Re (2012) reached a similar conclusion arguing that in the last 30 years the frequency of weather-related loss events has tripled (PRA, 2015). In response to these sustained losses, insurers are forced to respond by limiting the availability and affordability of coverage, particularly in areas such as coastlines where localized flood events are linked to regional sea-level rise (Mills, Roth and Lecomte, 2005). These losses are intensified by growing rates of population and property values in high-risk areas (Bouwer, 2010). Physical risk driven by changing environmental conditions (e.g. increases in coastal flooding associated sea-level rise) could reduce global economic growth and returns from investment, limiting an insurer's ability to diversify risk across portfolios. For example, the Economist Intelligence Unit (2015) has calculated a value-at-risk of US\$4.2 trillion for globally managed assets as a consequence of climate change.

Regulatory changes include the impact of regulation on premium prices and transition risks associated with carbon pricing and policies that support low-carbon energy projects. In response to increases in premiums in areas exposed to significant risk, regulators have responded by forcing insurers to reduce prices (Kern, 2007). Transition risks to the insurance industry are the anticipated financial risks associated with the shift to a low-carbon economy, mainly in the potential for, and rate of, re-pricing of carbon-intensive financial assets (European Systemic Risk Board, 2016; PRA, 2015). For example, certain assets could face a sudden depreciation if they are 'imperilled' by investors that shift capital away from GHG-intensive industries that make up a disproportionate amount of a portfolio (Lee and Ellis, 2013). Regulations encouraging the disclosure of climate change risk within the financial sector are also gaining authority with the recent release of the Financial Stability Board's recommendations for climate-related disclosures (TCFD, 2016).

Discursive change is also evident within the insurance industry, as climate change is increasingly described as one of its most significant challenges. John Coomber, a former CEO of Swiss Re argued in 2006 that 'climate change is the number one risk in the world ahead of terrorism,

demographic change, and other global risk scenarios' (Kunreuther and Michel-Kerjan, 2007, p. 3). Recent surveys in 2011 and 2013 asking insurers to identify their most significant risk consistently found that climate change and natural disasters are ranked in the top 10 alongside more short-term concerns such as regulation and economic instability (PwC, 2011, 2013). Changes in capital accumulation, regulation and discourse reveal how climate change is producing a new arrangement of external spatial scale for the insurance industry.

Rescaling through climate change risk management

A new external scalar arrangement, such as the impact of climate change on the insurance industry, often leads to a transformation or rescaling that involves the 'repositioning of an organizational logic onto a new spatial scale' (Spicer, 2006, p. 1475). Evidence of this rescaling is emerging in the insurance industry through the use of CCRM (see Messervy, 2016).

Risk management, more broadly, requires organizations to identify and assess risk exposure and then choose a course of action or treatment (SRA, 2015). Within a firm, 'enterprise risk management' (ERM), involves a company-wide approach whereby all aspects of a company's operations are responsible for integrating a continuous focus on risk (Bromiley *et al.*, 2015). In terms of practice, ERM is evident when firms exhibit a 'risk rationality' by recognizing and committing to manage uncertainty, assign corporate roles and expertise to manage risk (e.g. Chief Risk Officer, risk committee), and employ 'technologies' specifically, 'complex sets of practices, procedures, and instruments enacted to accomplish the management and control of risks' (Arena, Arnaboldi and Azzone 2010, p. 662).

Climate change introduces a far greater range of uncertainty for ERM, since organizations lack the experience and expertise compared with more traditional risks such as regulatory or credit risk that have historical precedent and are nested in specific local or national scales rather than moving across scales (Linnenlueke, Griffiths and Winn, 2012). For this reason, CCRM seeks to reduce such uncertainty by incorporating the latest knowledge from climate change science such as projections and models of future temperature and precipitation scenarios based on different GHG emission

trajectories, and changes in the frequency and intensity of extreme weather events (Rogers and Preston, 2011; William and Bates, 2014). This change in practice has been championed by insurers, regulators including the NAIC, the UK Prudential Regulatory Authority, the European Systemic Risk Board, Lloyd's of London, and

NGOs including Ceres and ClimateWise (an initiative established by various industry trade bodies, including the Association of British Insurers). A review of the documents produced by these organizations revealed three categories of CCRM, including corporate governance, underwriting, and investments (see Table 1).

Table 1. Climate change risk management practices in the insurance industry^a

Source	Corporate Governance	Underwriting	Investment
ClimateWise (2014, 2015a, b)	<ul style="list-style-type: none"> • support climate change research that informs business strategy, including the development of future weather and catastrophe scenarios affected by climate change. • publish statements on risks for insurers and actions taken to support climate change risk management. 	<ul style="list-style-type: none"> • use climate change research to improve data quality to inform the adjustment of pricing, capital and reserves. 	<ul style="list-style-type: none"> • assess how climate change risk will influence investment decisions and shareholder value and communicate to clients.
Ceres (2014); Messervy (2016)	<ul style="list-style-type: none"> • board member and senior executive management of climate change risk. • develop a climate change risk management program. • board members should receive education on climate change risk, and be evaluated and compensated based on climate change risk performance. 	<ul style="list-style-type: none"> • perils should be modeled that deviate from historical trends including catastrophe models with projections for future changes beyond 1-5 years used to stress test reserves and pricing. 	<ul style="list-style-type: none"> • portfolios should be stress tested for different GHG emission exposures and risk.
European Systemic Risk Board (2016)	N/A	N/A	<ul style="list-style-type: none"> • stress tests on portfolios should include scenarios for significant increases in renewable energy, changes in investor perception of carbon intensive sectors, and increases in physical risks to infrastructure and investments.
Lloyd's of London (2014)	N/A	<ul style="list-style-type: none"> • research should improve the forward-looking and predictive capacity of the catastrophe models that inform policy pricing through the use of models that capture nonlinear changes in extreme events. 	N/A
PRA (2015)	<ul style="list-style-type: none"> • climate change risk should be prioritized in risk committees. • senior management should have oversight over climate change risk. • engage scientific and research community with expertise on climate change. 	<ul style="list-style-type: none"> • incorporate latest science into risk assessments specifically the potential of sudden changes in the climate. 	<ul style="list-style-type: none"> • assess different forms of climate change risk and adopt stress and scenario testing.

^a Specific best practices in CCRM according to regulators and NGOs, specifically, ClimateWise, Prudential Regulatory Authority, European Systemic Risk Board, Lloyd's of London and CERES across three main categories of insurance companies' operations - corporate governance, underwriting, and investment.

CCRM in corporate governance includes disclosure that recognizes and commits to the management and prioritization of climate change risk through the implementation of a programme or appointment of senior management to oversee risk management (Messervy, 2016; PRA, 2015). CCRM practices for underwriting place a significant emphasis on expanding research on changing risk exposures either internally or through partnerships with academic and research organizations (ClimateWise, 2015b). Research should be directed towards improving the forward-looking and predictive capacity of the catastrophe models that inform policy pricing through the use of models that capture non-linear changes in extreme events (Lloyd's of London, 2014), produce scenarios, and 'stress test' pricing and reserves for changes in the frequency and intensity of liabilities from major claim events beyond a 1–5-year outlook (Messervy 2016). Similar practices exist for investment, specifically the use of climate change projections and models to guide investment decision-making (ClimateWise 2015a). Insurers should use climate change models to perform stress tests for both physical risks associated with a significant increase in natural hazards and transition risk created by emerging GHG regulation or shifts in capital away from GHG intensive industries (European Systemic Risk Board, 2016; PRA, 2015). The integration of climate change science into risk management reveals evidence of a rescaling, as the organization must consider changes in the scale of risk exposure and frequency. This analysis supports the paper's first hypothesis:

H1: Climate change is leading to a rescaling of organizational logic in the insurance industry through the adoption of CCRM.

In contrast, a 'business-as-usual' approach where climate change uncertainty is not incorporated across the firm reveals evidence that a company's organizational logic remains nested within existing scales and assumes that any potential risk is accounted for in existing management strategy (e.g. Linnenlueke, Griffiths and Winn, 2012). According to Spicer (2006), organizations can resist rescaling by defending the organizational logic embedded on the existing scale. These insurers that defend their existing organizational logic on risk management support a 'price risk as it occurs' strategy, whereby existing governance, underwriting and investment practices are

considered adequate in capturing the spatial and temporal uncertainty in climate change (see Paterson, 2001; Thistlethwaite, 2012). Regarding governance, there is no evidence of a commitment to CCRM or that climate-change risk is treated with a similar priority as other risks within the management framework (e.g. legal or regulatory risk). Similarly, organizational logics that are not rescaling involve assumptions that existing modelling (i.e. based on historical trends) used to inform annual premium adjustments adequately capture temporal and spatial uncertainty associated with climate change. Evidence of this in practice includes the use of a third-party vendor catastrophe model as a basis for informing premiums and reserves that include no forward-looking, predictive or future adjustment for climate change. Investment practices that are nested assume that existing portfolio diversification strategies are sufficient for avoiding exposure in industries exposed to physical or transition risks. Insurers without any internal climate-change risk stress or scenario testing constitute an example of this approach.

Within the insurance industry, there is evidence that reinsurers are moving beyond these nested practices, using risk management as a means of navigating the spatial and temporal uncertainty associated with climate change (Institute and Faculty of Actuaries, 2015; Kunreuther *et al.*, 2013). Relative to primary insurers, the reinsurance industry operates at a higher level of scale that is disproportionately exposed to climate-change risk. Primary insurers purchase reinsurance to cover events with lower probabilities but higher impacts. Climate change is influencing the scale of risk associated with these extreme events.

Also, reinsurers offer coverage around the world, meaning there is a greater probability for a loss-event than there is for insurers only offering coverage in a local market (Hauffer, 2009). Regulation supporting mitigation and adaptation is also, therefore, more important for reinsurers, and the industry has promoted a discourse that recognizes the risks associated with climate change. Indeed, reinsurers were one of the first businesses to speak publicly about the risks of climate change and lobby the United Nations and national governments to implement regulation (Paterson, 2001). The pressures to rescale within the reinsurance industry support the paper's second hypothesis:

H2: Rescaling should be most significant and pronounced in the reinsurance industry which operates on a global scale.

Sample, data and methods

Given that the goal of this paper is to assess the degree to which insurance companies are integrating CCRM, a content analysis of the NAIC Climate Risk Disclosure Survey was undertaken. The Climate Risk Disclosure Survey was introduced by the NAIC in 2010 as a way to assess insurers' mitigation and adaptation efforts toward climate change-related risk (NAIC, 2016). The survey is constructed of eight open-ended questions. Survey response data are publicly available and were accessed through the California Department of Insurance, which, since 2012, has administered the survey and maintained the data online. The survey is mandatory for all insurance companies that reported premium amounts more than US\$100,000,000 for the previous financial reporting year and are licensed to operate in any of the participating states. For those firms that fell below this mandatory reporting threshold, survey participation was voluntary.

Content analysis is an approach for making inferences through the systematic and objective identification of specified characteristics in the text (Holsti, 1969) and is particularly useful for coding open-ended survey questions (Weber, 1990). As the purpose of this paper is to assess the degree to which firms are responding to climate change-related risks, manual coding was preferred, as it involves a deep examination of language for determining *how* things are being said as opposed to *what* is being said (Pennebaker, Mehl and Niederhoffer, 2003; Weber, 1990).

The following section describes the steps for completing a content analysis (Harris, 2001).

Content analysis

A content analysis was used to assess whether the pressure to rescale organizational logics beyond the nested spatial and temporal horizons is evident through the firms' incorporation of CCRM practices. A company's rescaling of organizational logics will be reflected in how they describe changes to their corporate governance, underwriting, and investments in light climate change-related risks. Firms that are not rescaling will exhibit a nested,

geographically constrained and short-term focus that assumes existing practices are adequate for managing climate-change risk.

The 2012 and 2015 NAIC Climate Risk Disclosure Surveys were selected for analysis because the former was the first year for which data were publicly available, and the latter was the most recent year of data at the time of this study. In 2012, companies licensed to operate in California, Connecticut, Minnesota, New York and Washington and with annual premium amounts greater than the reporting threshold mentioned above, were required to complete the survey. In 2015, New Mexico was added to the lists of states mandating participation in the survey. This study focuses on companies offering property insurance, as they face the most significant incentives to rescale organizational logics in response to climate change.

The analysis was carried out on a subset of questions from the Climate Risk Disclosure Survey (as shown in the Appendix), that is, only those directly related to changes in practices to address climate change risk to the organization, as opposed to external constituencies.

For the 2012 (2015) survey, 313 (289) responses were sorted and duplicates removed to prevent double counting. Once duplicates were removed, a total sample of 178 (183) firm responses remained.

Categories for codes were developed by breaking down CCRM across the main categories of an insurance company's operations. These categories include corporate governance (i.e. recognition and commitment to manage climate change uncertainty and delegation of authority within the organization to implement management), underwriting (i.e. integration of climate-change science into underwriting practices and procedures) and investment (i.e. integration of climate-change science into investment practices procedures).

CCRM best practices were identified and extracted from insurance regulator and NGO reports, specifically, ClimateWise, Prudential Regulatory Authority, European Systemic Risk Board, Lloyd's of London and CERES as evidence of rescaling organizational logics across an insurance company's operations (shown in Table 1) as compared with a nested logic. A coding manual (shown in Table 2) was developed based on a synthesis of best practices identified in Table 1.

Once the coding manual was populated with codes, two pilot studies were run on 40 survey responses (using by four independent coders) to

Table 2. Coding manual for identifying rescaling of organizational logics^a

Insurance practice	Nested	Code	Rescaling	Code
Corporate governance	<ul style="list-style-type: none"> Lack a public statement describing the impact of climate change on the firm or industry. Firm has not adopted a climate change risk strategy. Climate change risk has not been prioritized by senior management or risk committees (i.e. given similar priority to other risks). 	0	<ul style="list-style-type: none"> Public statement on the impact of climate change on the firm or industry. Adoption of a climate change risk management strategy. Prioritization of climate change risk management through senior management oversight or assignment of risk committee. 	1
Underwriting	<ul style="list-style-type: none"> Climate change research is not factored into underwriting practices and decision making. Historical trends and “business-as-usual” actuarial processes are used to inform annual premium and reserve adjustments without long-term climate change adjustment. 	0	<ul style="list-style-type: none"> Climate change modeling and future projections used to inform adjustments in premium pricing, claims and reserves. Scenario and stress testing of underwriting pricing and reserves based on non-linear changes in distribution and frequency of extreme weather events associated with climate change. 	1
Investment	<ul style="list-style-type: none"> Climate change research is integrated into investment decision-making over allocation of assets throughout. Portfolio exposure is not stress tested or evaluated for risk associated with climate change scenarios. 	0	<ul style="list-style-type: none"> Stress and scenario testing of portfolio exposure to physical risks associated with increases in extreme weather claim events and transition risk created by emerging GHG regulation or shifts in capital away from GHG intensive sectors. 	1

^a Synthesis of best practices in CCRM as evidence of organisational logic rescaling, according to ClimateWise, Prudential Regulatory Authority, European Systemic Risk Board, Lloyd’s of London and CERES.

determine whether the codes were mutually exclusive and exhaustive; the coding manual was refined accordingly.

The complete set of data (including responses used in the pilot studies) was coded by two independent coders. Survey responses revealing evidence of rescaling across any one of the three categories (i.e. corporate governance, underwriting, and investment) were coded as ‘1’ (no evidence, coded as ‘0’). A maximum score of ‘3’ was possible with clear evidence of rescaling in CCRM practices across all three categories. A score of ‘2’ or ‘1’ was assigned with clear evidence of rescaling within two categories, or one category, respectively.

Results

The analysis of the 2012 survey revealed that 11% ($n = 19$) firms in the sample had incorporated climate change-related risk into at least one of the three categories. The breakdown by the number of categories revealed that 8% of firms ($n = 13$) were found to have incorporated climate change-related risks into one of the three categories, 3% ($n = 5$) into two categories, and 2% ($n = 3$) into all three categories.

In 2012, reinsurance firms were 10% ($n = 18$) of the sample of the firms ($n = 178$) that responded to the survey. Of the 18 insurers found to be integrating CCRM, the proportion of companies did not change (reinsurance, $n = 2$; primary insurer, $n = 16$).

The analysis of the 2015 survey revealed that 39% ($n = 71$) firms in the sample had incorporated climate change-related risk into at least one of the three categories. The breakdown by the number of categories revealed that 20% of firms ($n = 36$) were found to have incorporated climate change-related risks into one of the three categories, 5% ($n = 10$) into two categories, and 3% ($n = 5$) into all three categories. Reinsurance firms were 14% ($n = 25$) of the sample of the firms ($n = 183$) that responded to the survey. Twenty-eight per cent ($n = 7$) of reinsurance firms were found to be integrating CCRM. The breakdown by the number of categories revealed that 8% ($n = 3$) of reinsurance firms were found to have incorporated climate change-related risks into one of the three categories, 20% ($n = 5$) into two categories, and 40% ($n = 2$) into all three categories relative to primary insurers.

These results show that there very few firms are integrating CCRM into their corporate governance, underwriting, and investment practices,

thus failing to rescale their organizational logics in the face of climate-change risk; Hypothesis 1 is not supported. In 2012, there was no difference between primary insurers and reinsurance firms in their adoption of CCRM. In 2015, however, the proportion of reinsurance firms integrating CCRM into their operations was greater than primary insurers, thus supporting Hypothesis 2. Taken together, these results reveal that little is being done on the part of the insurance industry to rescale their practices to align with the risks posed by climate change. For firms that are integrating CCRM, reinsurers are rescaling in greater proportion compared with primary insurers.

Validity and reliability

Threats to validity in the analysis include the non-representative nature of the sample and the potential for over-reporting of behaviour as motivated by a social desirability bias. As this is a convenience sample of firms that operate in one of the states that requires reporting, the results may not be generalizable to firms operating in different states or other countries around the world. Given that the survey is about climate change, is required by state regulators in which the firms operate, and the results are publicly available, there is a potential for social desirability bias in the survey responses (Podsakoff *et al.*, 2003). However, given that this paper employed a manual coding approach, which allows for a more nuanced assessment of text (Hart, 2001), the validity of firms' claims on the integration of CCRM could be differentiated between substantive and 'boiler-plate' responses.

The reliability of the coding was assessed by measuring the degree of agreement between two independent coders. The inter-rater agreement was assessed using Cohen's Kappa ($k_{2012} = 0.71$; $k_{2015} = 0.79$), which was found to be 'substantial' (Landis and Koch, 1977). In the few cases where there was no agreement between coders as to the evidence of rescaling, the responses were coded as '0'.

Discussion

This section uses disclosures captured by the content analysis to explain how the nested hierarchy of the insurance industry influences

organizational logics towards adaptation, specifically CCRM (See Appendix for Table 3, 4, 5 which contrast nested vs. rescaling organizational logics). This analysis confirms that insurers have different definitions of successful adaptation in terms of effectiveness, efficiency and legitimacy, based on their social construction of scale (see Adger, Arnell and Tompkins, 2005). Firms that maintain nested organizational logics reveal evidence of resistance to rescaling, as they believe the industry's 'business-as-usual' practices are effective, efficient and legitimate forms of CCRM. In contrast, firms that are rescaling organizational logics recognize that, for CCRM to be efficient and legitimate, it must involve new practices designed to explain the correlation between climate change and loss-events. In terms of effectiveness, firms with nested logics supported existing practices as sufficient for their objectives, whereas firms who are rescaling are adjusting underwriting and investment practices to accommodate climate change uncertainty. Firms with nested logics believed 'adaptation to short-term climate variability is all that is required to create an economically efficient response to climate change' (Adger, Arnell and Tompkins, 2005, p. 82), whereas those firms that are rescaling believe it is efficient to adapt to long-term climate variability using predictive models and risk stress-testing. Insurers exhibited differences in the legitimacy of adaptation by the extent to which climate change-related decisions are accepted by those affected by said decisions (Adger, Arnell and Tompkins, 2005, p. 83). Those resisting rescaling did not prioritize climate change risk within their organizational structure to the same extent as those embracing rescaling.

Nested organizational logics

Firms with nested organizational logics viewed existing practices as effective forms of CCRM: specifically, actions by risk modellers and reinsurers that embrace a broader spatial and temporal scale in their logics (Adger, Arnell and Tompkins, 2005). These insurers were confident that third-party catastrophe models, for example, were effective in capturing variation associated with future changes, since they are designed to manage 'exposure to catastrophic risks, including those caused by or relating to a changing climate' (Acuity, A Mutual Insurance Company, 2015). However, other insurers revealed that these third-party

models do not ‘explicitly adjust their estimate for future climate change that deviates from historical cycles’ (Mercury Casualty Company, 2015; see also California Casualty, 2015; Greater New York Mutual Insurance Company, 2015).

Firms resisting rescaling in favour of nested organizational logics argued that annual adjustments and prices, and portfolio diversification based on historical trends were efficient forms of adaptation rather than future predictions. This approach reveals how a short-term time horizon generates uncertainty about the benefits of CCRM, given the timing of climate change impacts. Auto-Owners Insurance Company (2015) provides an example of this perspective by arguing that modelling exposure on an annual basis would capture any climate-change risk and ‘be reflected in our loss trends which would then follow through to our rate indications’. Insurers also expressed confidence that portfolio diversification strategy embraced sufficient scale to capture climate change risk: ‘We believe that a well-diversified portfolio is our best defence against such [climate change] occurrences’ (Ohio Mutual Insurance Company, 2015). Insurers did note that climate change could impact investments in the future, but often concluded ‘that climate change risk ranks very low compared to our other risk drivers’ (Endurance American Insurance Company, 2015).

In the area of corporate governance, insurers with nested organizational logics did not legitimize adaptation to the same extent as those rescaling by prioritizing climate change risk within the organization. Firms that exhibited a nested organizational logic did not provide public statements acknowledging the challenge associated with climate change, dedicate management positions to overseeing climate change, and prioritize climate change as more significant than other risks to the industry (Beazley Insurance Company, 2015; Highmark Casualty Insurance Company, 2015). Alterra American Insurance Company (2015), for example, described that ‘the Company does not have specific [climate change] policies, but monitors these risks in the same way it assesses other risks in its business and investment portfolio’ (see also BCS Insurance, 2015).

Rescaling organizational logics

Organizational logics supporting rescaling in underwriting and investment involved practices

designed to manage both the physical and transition risks associated with climate change. Differences in effectiveness are evident in underwriting and investment where firms that are rescaling believe that predictive models and stress testing are necessary for CCRM to meet its objectives. These firms are recognizing the efficiency of pursuing this objective, as they are putting resources into predictive underwriting models and stress-testing portfolios to capture climate variability over a long-term time horizon, despite uncertainty associated with the timing of impacts. Rescaling in underwriting logics involved the use of climate change, internal adjustment of third-party models, and scenario testing of their pricing assumptions beyond a short-term time horizon. Swiss Re (2015) argued that they ‘have to make sure that we identify significant future trends in natural hazards, quantify their long term impact on insured losses and include findings in our risk models and underwriting processes’. Argonaut Insurance Company (2015) offers a more specific example using climate change models to ‘make assumptions in its model regarding increases in ambient temperature, and has revised its appetite for flood risk in the US in certain zones’. Fireman’s Fund Insurance Company (2012) adopted a similar practice by assessing ‘how changes in global and national average precipitation and temperature patterns will vary at the regional and local scale’ (Illinois National, 2012). Several firms also explained how they use climate change scenarios to assess non-linear changes in the frequency of extreme events to stress test the accuracy of their pricing and adequacy of reserves (American Select Insurance Company, 2015; Greenwich Insurance Company, 2015).

Rescaling in investment logics involved the incorporation of climate change risk into investment portfolios by considering exposure to extreme weather in assessing municipal bonds, transition risk in high-carbon industries, and new opportunities in clean technology. United Fire Group (2015) completed an assessment of climate change risk in their portfolio, which led to limits on exposure to municipal bonds in areas exposed to hurricanes. Nationwide monitors sectors more exposed to climate change risk and considers impacts on water scarcity and coastal migrations out of warmer climates when assessing municipal bonds (Nationwide Mutual Insurance Company 2015). The Argonaut Insurance Company (2015)

expressed concern about imperilled assets associated with transition risk as a motivation to conduct ‘an exercise to define which industry sectors represent high-carbon industries’ and ‘to develop a longer-term investment strategy with respect to these type of asset classes’. Swiss Re (2015) has developed an internal model to assess the carbon-intensity of equity and bond holdings in their portfolio. In response to the European Union’s climate change policy supporting a 20% increase in the share of low-carbon energy projects, Munich Re (2012) expanded its investments by US\$3.3 billion.

Firms that are rescaling acknowledge the legitimacy of CCRM through distinct practices in corporate governance, where some firms prioritize climate-change risk, and show acceptance among managers in the firm. Examples include Munich Re (2012), which publicly stated that climate change is ‘closely linked to our core business as it can have a financial impacts on nearly all our lines of business’, and adopts a ‘multidisciplinary approach’ that incorporates climate-change science into a ‘company-wide risk management process’. Other insurers created specific categories for climate change risk within corporate governance by identifying it as a ‘high priority’ or as a ‘comprehensive risk category’ (Argonaut Insurance Company 2015; Erie Insurance Company 2015; FM Global 2015; State Farm 2015). Senior management’s oversight and prioritization of climate change risk were also evident among insurers such as FM Global, who has assigned the CEO and COO with the management of the firm’s climate strategy, including regular reporting from the manager of research and director of the structures and natural hazards research area (FM Global, 2015).

In summary, insurers that support existing practices consistent with CCRM reveal the influence of the industry’s nested organizational logic, as they define ‘business-as-usual’ practices as effective, efficient and legitimate forms of CCRM. For example, local insurers expressed confidence that their approach is robust because it is the responsibility of reinsurers and risk modellers to adopt long-term and broad consideration of environmental change. Although there is evidence that reinsurers are more likely to adopt CCRM, this perspective ignores the potential for correlated risk that limits diversification of risk across space and time with their coverage areas. Reinsurers and primary

insurers that are rescaling their organizational logics reveal a different definition of successful CCRM by committing management resources to integrating climate-change science into modelling assumptions in underwriting and investment. In particular, many are trying to identify the strength of the correlation between climate change and loss-events across space and time to ensure that risk is diversified.

Conclusion

The U.S. property insurance industry has yet to integrate practices to manage climate change risk comprehensively. This finding is based on a content analysis of firm responses to the NAIC’s 2012 and 2015 Climate Risk Disclosure Survey. A coding manual was developed to guide the content analysis, which identified ERM practices consistent with an effort to rescale organizational logics to align with the temporal and spatial scale of climate change risk. Evidence of rescaling is in line with a departure from a nested approach to risk management through the expansion of near-term and spatially constrained logics in the areas of corporate governance, underwriting, and investment. These firms adopted a more rigorous definition of CCRM compared with those operating with a nested organizational logic. A review of leading authorities on CCRM in the insurance industry was conducted to identify practices that align with these categories and inform a coding scheme.

Analysis of the data revealed that the majority of insurers resist rescaling by failing to adopt a CCRM policy, prioritize climate change risks (e.g. through senior management oversight) or employ climate change models and projections to adjust premium pricing and stress-test reserves and investment portfolios. Reinsurers and a minority of primary insurers did reveal evidence of rescaling through the prioritization of climate change risk in corporate governance and adjustments based on climate change models and projections in underwriting pricing, and reserves and investment decision-making. These results were then validated by confirming reliability of coding (Cohen’s Kappa $k_{2012} = 0.71$; $k_{2015} = 0.79$).

These findings reveal that some insurers are contesting the nested scale of the industry by rescaling their practices through CCRM and recognize the effectiveness, efficiency and legitimacy of

adaptation. These firms are challenging assumptions in existing organizational logics, specifically the models used to inform underwriting and investment by assessing potential correlations between climate change and risk across time and space. Firms that maintained nested practices defend the industry's current scale by arguing that existing logics are effective, efficient and legitimate for capturing climate change variability, since risk is likely to manifest gradually with limited correlation across time and space. Many insurers also described the existing nested scale as a strategy for managing climate change risk, as they assume that reinsurers and third-party model firms adopt a more regional, global and long-term logics.

This use of scale represents a valuable contribution to research on climate change and insurance and, more broadly, organizations and the environment by providing a framework to evaluate responses to environmental change and justifying strategies that promote rescaling as a form of risk management. In the case of insurance and climate change, the differentiation between the scale of climate change risk and the scale embedded in insurer risk management organizational logics provides a framework that confirms evidence for a 'tragedy of the horizons' as the majority of insurers are ignoring the threat of climate change to their business model (e.g. Carney, 2015, p. 4).

By characterizing the tragedy of the horizons as evidence of resistance to rescaling, a research agenda is justified on strategies to overcome logics in spatially and temporally nested scales. First, research is necessary on the influence of firm-level (e.g. organizational structure) and institutional-level variables (e.g. home country policy differences) that enable or constrain the effect of scale over decision-making. For example, considering the importance of the structural distribution of attention by way of an organization's communication channels, as informed by the attention-based view (Ocasio, 1997), could reveal important explanations for why some firms are rescaling. In the insurance industry, actuaries have been identified as

important authorities in managing climate change risk (Institute and Faculty of Actuaries, 2015), but their position within an insurer's organizational structure varies and remains unexplored as an influence in rescaling. Institutional variables such as home country also deserve further scrutiny, as insurance experts assume that European firms are more advanced in CCRM than their North American counterparts (see Jergler, 2016).

Secondly, and in line with recent theory advanced by Bansal, Kim and Wood (2018) that argues for the importance of fit between the ontology of the natural world and the epistemology of the organization in reducing the likelihood of missing issues, more research is required for a better understanding of the extent of rescaling necessary for the varying temporal and spatial scales of the natural environment, and who should be responsible for such rescaling. As demonstrated among insurers, the nested hierarchy within the industry represented a source of resistance that questioned the amount of rescaling necessary for firms operating at different levels and whether the responsibility for rescaling best falls to certain types of organizations within the industry (i.e. risk modellers and reinsurers). For example, CCRM would be more efficient for local insurers in the US Midwest to understand the changing frequency of flood events in their coverage areas in response to climate change, but impacts on large-scale changes of sea-level rise on multiple coverage areas is a more efficient objective for global reinsurers. Similarly, research could explore whether sudden shifts in external scale (e.g. increases in frequency and spatial extent of natural disasters, advances in technology, or social movements) enable or constrain rescaling in organizational logics, and whether changes in decision-making endure.

Pursuing this agenda contributes to growing research on business sustainability and management, as the temporal and spatial scale of the natural environment remains a source of uncertainty for managers. Rescaling organizational logics 'beyond the horizon' represents an important means of mitigating this uncertainty.

Table 3. Nested versus rescaling of organizational logics in corporate governance

Nested	Example	Rescaling	Example
<ul style="list-style-type: none"> • Lack a public statement describing the impact of climate change on the firm or industry. 	<ul style="list-style-type: none"> ◆ The company has not issued a public statement on its climate policy (Beazley Insurance Company, 2015). 	<ul style="list-style-type: none"> • Public statement on the impact of climate change on the firm or industry. 	<ul style="list-style-type: none"> ◆ Federated's Climate Risk Executive Committee has adopted Federated's Climate Risk Policy that includes the plan described in the answer to Question 1 and provides guidelines for Federated's investment portfolio which includes, among other things, consideration of investments in low-carbon and no-carbon technologies. The policy includes review of Federated's investment portfolio to evaluate climate risks that may exist in the portfolio and to review options to eliminate, reduce, or mitigate that risk (Federated Mutual Insurance Company, 2015).
<ul style="list-style-type: none"> • Firm has not adopted a climate change risk strategy. 	<ul style="list-style-type: none"> ◆ Currently, the Company does not have a formal climate change policy with respect to risk management and investment management (Highmark Casualty Insurance Company, 2015) 	<ul style="list-style-type: none"> • Adoption of a climate change risk management strategy. 	<ul style="list-style-type: none"> ◆ The Executive Vice President and Head of Global Technology and Operations oversees MetLife's climate change and environmental sustainability initiatives and is an Executive Group member who reports directly to the Chief Executive Officer (CEO) (Metropolitan Property and Casualty Insurance Company, 2015).
<ul style="list-style-type: none"> • Climate change risk has not been prioritized by senior management or risk committees (i.e. given similar priority to other risks). 	<ul style="list-style-type: none"> ◆ The Company does not have specific policies, but monitors these risks in the same way it assesses other risks in its business and investment portfolio (Allterra America Insurance Company, 2015) ◆ We do not have a policy with respect to climate change risk management at this time, nor do we have a process to identify climate change related risk. We do conduct an enterprise risk assessment every 12 months, but climate change risk has not been identified as a material risk to any of our current lines of business. The Company does not have an investment management policy with respect to climate change at this time (BCS Insurance Company, 2015). ◆ No. Efforts continue to support the development of an understanding of the emerging weather, financial, regulatory and reputational risks associated with climate change and the development of a strategy to address these risks. Climate risk, among other factors, is included in discussions to assess the risk profiles for the various lines of business, claims and support functions (Coast National Insurance Company, 2015). 	<ul style="list-style-type: none"> • Prioritization of climate change risk management through senior management oversight or assignment of risk committee. 	<ul style="list-style-type: none"> ◆ Climate change is one of eight selected risks of high priority within ERIE's Emerging Risk Program ("ERP") (Erie Insurance Company, 2015). ◆ FM Global's CEO and COO monitor and manage changes to climate strategy. The CEO and COO are kept apprised of climate risk and advised on the subject in a variety of ways, including directly by the Manager of Research and the Director of the Structures and Natural Hazards Research Area (FM Global, 2015). ◆ Climate change is recognized as an important business issue and the highest level of direct responsibility in this area is Murlit Buluswar, Vice President, AIG and Chief Science Officer, AIG Property Casualty (AIG PC). Mr. Buluswar is two levels removed from reporting directly to the AIG CEO. Mr. Buluswar has the highest level of responsibility for evaluating climate science and interpreting how the risks and opportunities of climate change may affect AIG PC operations (Illinois National 2012).

Table 4. Nested versus rescaling of organizational logics in underwriting

Nested	Example	Rescaling	Example
<ul style="list-style-type: none"> Climate change research is not factored into underwriting practices and decision making. 	<ul style="list-style-type: none"> California Casualty models a number of perils (fire-following EQ, tornado/hail, winter storm, and hurricane) which could be affected by climate change. However, these models do not reflect the effects of climate change in the probabilistic results (California Casualty & Fire Insurance Company, 2015). 	<ul style="list-style-type: none"> Climate change modeling and future projections used to inform adjustments in premium pricing, claims and reserves. 	<ul style="list-style-type: none"> Argo Group considers the impact of climate risk in its modeling of risks and exposures for the relevant product lines and insurance coverages that it offers. Argo Group also considers the influence of climate change risk in its relevant underwriting decisions. For example, in modeling flood catastrophe exposure, Argo Group makes assumptions in its model regarding increases in ambient temperature, and has revised its appetite for flood risk in the US in certain zones (Argonaut Insurance Company, 2015).
<ul style="list-style-type: none"> Historical trends and “business-as-usual” actuarial processes are used to inform annual premium and reserve adjustments without long-term climate change adjustment. 	<ul style="list-style-type: none"> To the extent climate change influences weather, including hail, wind, tornado, or hurricane, we model our exposure on an annual basis. Any trends would be reflected in updated models. Changes in claim activity influenced by climate change would also be reflected in our loss trends. As part of the company’s regular review of underwriting appetite, the company considers many factors including climate related issues where relevant. The company uses computer models acquired from vendors and some proprietary models, but it is not aware that any such models include factors specific to climate risk (Mid-Continent E&S Ins. Company, 2015). 	<ul style="list-style-type: none"> Scenario and stress testing of underwriting pricing and reserves based on non-linear changes in distribution and frequency of extreme weather events associated with climate change. 	<ul style="list-style-type: none"> Our modeling techniques combine data about our portfolio (such as the geographic distribution and characteristics of insured objects and their values) with simulated natural disaster scenarios to estimate the magnitude and frequency of potential losses. Where such stochastic models do not exist, we use deterministic scenario-based approaches to estimate probable losses. As climate science accuracy, resolution and data continues to improve, Allianz is working towards appropriate integration of observed and predicted climate impacts within its models – led by the Allianz Re Cat Management team. Our challenge is to find the right data of sufficient quality as inputs for these models – considering both climate perils and the relevant trends and attributes of insured assets. Through dialogue with modeling firms we are able to break down underlying assumptions and parameters to ensure sound underwriting and business decisions (Fireman Fund’s Insurance Company, 2015).
			<ul style="list-style-type: none"> We monitor exposure to non-modeled perils including flood and wildfire. Additionally, we monitor exposure to perils that are modeled but where climate change may not be fully contemplated. Long-term demographic, sociological, and climate trends are also considered (American Select Insurance Company, 2015). As part of our ERM activities, we apply a suite of stress tests, tools, risk indicators, metrics and reporting processes that examine the consequences of low probability/high severity events (including those related to emerging risks and including climate risks) in order to take mitigating actions where required (Greenwich Insurance Company, 2015).

Table 5. Nested versus rescaling of organizational logics in investment

Nested	Example	Rescaling	Example
<ul style="list-style-type: none"> Climate change research is not integrated into investment decision-making over allocation of assets throughout portfolio. 	<ul style="list-style-type: none"> Based on the nature of its current holdings, the Company and its Investment Committee has not taken any action, adopted any specific policy, nor changed its investment strategy regarding any possible impact from climate change on the investment portfolio (First Acceptance Ins. Co. Inc., 2015). 	<ul style="list-style-type: none"> Stress and scenario testing of portfolio exposure to physical risks associated with increases in extreme weather claim events and transition risk created by emerging GHG regulation or shifts in capital away from GHG intensive sectors. 	<ul style="list-style-type: none"> United Fire Group does identify and try to quantify climate change/environmental risks related to our investment portfolio as a part of our overall risk assessment of our portfolio. Specifically, we seek to limit our exposure to municipal bonds written for hurricane-prone coastal areas and to credit risk related to our corporate bond portfolio. Our goal is to maintain an adequately diversified investment portfolio to guard against the risk associated with any individual issuer or type of exposure (United Fire Group, 2015).
<ul style="list-style-type: none"> Portfolio exposure is not stress tested or evaluated for risk associated with climate change scenarios. 	<ul style="list-style-type: none"> The Company has considered the impact of climate change on its investment portfolio. The Company has not altered its investment portfolio as a result of the analysis of this risk. The Company has a very sound investment policy with significant diversification; the portfolio is structured to meet the cash flow obligations of the Company pursuant to its obligations to its insureds under its insurance policies. The Company does not believe that it has any material exposure in any of its investments (Federated Rural Electric Insurance Exchange, 2015). Although we have not specifically addressed impact of climate change on our investment strategy, we feel the ongoing monitoring of the portfolio, the level of diversification and financial stability of our investments do provide security on a variety of risk factors (Merrimack Mutual Fire Insurance Company, 2015). 	<ul style="list-style-type: none"> Climate-change issues ranging from water scarcity in the Southwest to coastal migration in Florida are considered when evaluating potential investments. For corporate bond and equity investments, we review a company's policy and practice to manage climate change and environmental risks in order to assess their potential impact on overall credit worthiness. We also actively monitor industry sectors that are more sensitive to climate change and environmental risks (Nationwide Mutual Insurance Company, 2015). Last year, we applied an internally developed model to assess our listed equity and bond holdings on sector-driven carbon intensity. . . . The managers' individual performances are monitored in line with our Responsible Investment Policy, and they are required to report regularly on their responsible investment activities. The next step is to provide a deep-dive analysis on the portfolio's inherent carbon emissions to get detailed transparency and to better manage the risks and opportunities associated with climate change (Swiss Re, 2015). Concerns about climate change are changing the way assets are managed and giving rise to new and alternative asset classes, especially in the field of renewable energy and carbon investments. We are committed to integrating climate change – among other environmental, social and governance (ESG) factors – into our proprietary investment strategies and third-party asset management. Customer demand, a growing recognition of the importance of ESG factors and better risk-adjusted returns are sound business reasons for integrating ESG factors in our investments. By scrutinizing investments from an ESG perspective, we endeavor to identify long-term risks and opportunities that are not fully reflected in market prices and seek to capitalize on them for the benefit of shareholders, customers and other stakeholders (Fireman's Fund 2012). 	<ul style="list-style-type: none"> Climate-change issues ranging from water scarcity in the Southwest to coastal migration in Florida are considered when evaluating potential investments. For corporate bond and equity investments, we review a company's policy and practice to manage climate change and environmental risks in order to assess their potential impact on overall credit worthiness. We also actively monitor industry sectors that are more sensitive to climate change and environmental risks (Nationwide Mutual Insurance Company, 2015). Last year, we applied an internally developed model to assess our listed equity and bond holdings on sector-driven carbon intensity. . . . The managers' individual performances are monitored in line with our Responsible Investment Policy, and they are required to report regularly on their responsible investment activities. The next step is to provide a deep-dive analysis on the portfolio's inherent carbon emissions to get detailed transparency and to better manage the risks and opportunities associated with climate change (Swiss Re, 2015). Concerns about climate change are changing the way assets are managed and giving rise to new and alternative asset classes, especially in the field of renewable energy and carbon investments. We are committed to integrating climate change – among other environmental, social and governance (ESG) factors – into our proprietary investment strategies and third-party asset management. Customer demand, a growing recognition of the importance of ESG factors and better risk-adjusted returns are sound business reasons for integrating ESG factors in our investments. By scrutinizing investments from an ESG perspective, we endeavor to identify long-term risks and opportunities that are not fully reflected in market prices and seek to capitalize on them for the benefit of shareholders, customers and other stakeholders (Fireman's Fund 2012).

Appendix

Complete list of survey questions from the NAIC Climate Risk Disclosure Survey

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1. Does the company have a plan to assess, reduce or mitigate its emissions in its operations or organizations?
 - *2. Does the company have a climate change policy with respect to risk management and investment management?
 - *3. Describe your company's process for identifying climate-change-related risks and assessing the degree that they could affect your business, including financial implications.
 - *4. Summarize the current or anticipated risks that climate change poses to your company. Explain the ways that these risks could affect your business. Include identification of the geographical areas affected by these risks.
 - *5.
 - a) Has the company considered the impact of climate change on its investment portfolio?
 - b) Has it altered its investment strategy in response to these considerations?
 6. Summarize steps the company has taken to encourage policyholders to reduce the losses caused by climate change-influenced events.
 7. Discuss steps, if any, the company has taken to engage key constituencies on the topic of climate change.
 - *8. Describe actions the company is taking to manage the risks climate change poses to your business including, in general terms, the use of computer modelling.
-

*Indicates questions that were included in the content analysis as they related directly to changes in practices to address climate change risk to the organization, as opposed to external constituencies

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