

# Evolution of ESG Risk Management in Brazil

Flávio Geraldo Nogueira\*, Antonio Roberto Ramos Nogueira\*\*,  
Paula Castro Pires de Souza Chimenti\*\*\*

## Abstract

This study examines how insurance consumers and insurers in Brazil perceive and address environmental, social, and governance (ESG)<sup>1</sup> risks from 2015 to 2022, generating insights for insurance management in relation to extreme events in Brazil in 2024, through a survey administered via email to 505 executives in insurance companies. From 113 responses and structural equation modelling (SEM), our findings reveal a significant increase in awareness of ESG risks among both consumers and insurers. The results underscore consumers' social risk perceptions as a critical factor driving the integration of ESG considerations into insurance operations. In addition, a positive relationship is identified between consumer perceptions and insurers' ESG risk management practices. The SEM explains 86% of the variance in the incorporation of social risks, 66% in governance, and 63% in environmental risks within insurance practices. This paper enhances our understanding of ESG risk perceptions' influence on both the demand and supply of insurance, providing valuable insights for the development of sustainable insurance practices.

**Keywords:** Sustainable Development, Innovative Insurance, Green Insurance, ESG Risks, PSI, Brazil

to create the UNEPFI's Principles for Responsible Banking and Principles for Sustainable Insurance (PSI) as well as net-zero alliances (UNEPFI, n. d.). *The global status of sustainable insurance* set a foundation for the definition of sustainable insurance (SI) and integration of environmental, social, and governance (ESG) issues in the insurance industry (UNEPFI, 2009).

This paper focuses on SI from the perspective of insurance consumers and ESG risk management and underwriting in insurance companies to evaluate its evolution since 2015 in Brazil. We view SI as a strategic approach that encompasses all activities in the insurance value chain (UNEPFI, 2012) and a process (Scordis et al., 2014; UNEPFI, 2009) that can drive innovation and business opportunities, and affect (positively or negatively) corporate reputation and financial performance (International Insurance Society [IIS], 2021; Sunelwala et al., 2022).

The insurance industry's ESG agenda has accelerated since the 2015 Paris Agreement at the United Nations' Conference of the Parties (COP21) (Stricker et al., 2022). Soon after COP21, the Task Force on Climate-Related Financial Disclosures (TCFD) was established to provide guidance for asset managers, investors, and insurers to disclose and mitigate climate risks (TCFD, 2017, 2022).

## Introduction

The United Nations Environment Programme Finance Initiative (UNEPFI), with bankers and insurers with assets exceeding USD100 trillion, worked together

## Relevance

The global insurance industry's assets reached USD40.6 trillion in 2021 (Statista, 2022). Global insurance premiums exceeded USD7 trillion in 2022 (Swiss

\* Professor, Universidade Veiga de Almeida, Brazil. Email: fnogueira@ppe.ufrj.br

\*\* COPPEAD Graduate School of Business of the Federal University of Rio de Janeiro, Brazil.  
Email: roberto.nogueira@me.com

\*\*\* COPPEAD Graduate School of Business of the Federal University of Rio de Janeiro, Brazil. Email: paula.chimenti@me.com

<sup>1</sup> All acronyms are available in the glossary Appendix 1

**How to cite:** Nogueira, F. G., Nogueira, A. R. R., & Chimenti, P. C. P. D. S. (2026). Evolution of ESG risk management in Brazil. *International Journal of Banking, Risk and Insurance*, 14(1), 13-32.

Re, 2022a). The United States of America (USA) accounted for 56.2% of the Organisation for Economic Co-operation and Development's (OECD's) insurance market in 2020, issued premiums of USD2.934 trillion and paid USD1.615 trillion (55%) in claims (OECD, 2022). In 2022, the Brazilian insurance industry had assets of around USD345.02 billion<sup>2</sup>, issued premiums of USD118.61 billion and paid 71.8% of this value in claims and benefits (National Insurance Confederation [CNseg], 2022b). Brazil is the leading insurance market in Latin America, with 41% of the premiums issued in the region (Swiss Re, 2022b). According to the CNseg sustainability report, 93.5% of the participants of the research are committed to at least one sustainable development initiative such as the sustainable development goals (SDG), PSI, United Nations (UN) Global Compact, and Principles for Responsible Investment (PRI) (CNseg, 2022b).

## Literature Gaps

Recent literature indicates that the number of ESG regulations in financial services has increased (European Banking Authority [EBA], 2018; IIS, 2021; Marcoux, 2021). There has also been a burgeoning growth in papers in sustainable banking (Chandran et al., 2023), development of green insurance products (Pugnetti et al., 2022; Stricker et al., 2022; Zona et al., 2014), and an emphasis on analysing climate-related risks (Allianz & Euler Hermes, 2020; Nobanee et al., 2021, 2022; Pugnetti et al., 2022; Stricker et al., 2022).

Few studies have examined South America's insurance market. The articles usually provide little more than a snapshot of SI (Khovrak, 2020; Stricker et al., 2022). Some articles have examined the relations between risk perception and insurance demand (Mendes-Da-Silva et al., 2021; Regan, 2019); however, since Nogueira et al. (2018) no other study has assessed the relations between the ESG risks perceptions of insurance consumers and its incorporation in insurance companies' operations.

The present study aims to answer the following research questions:

- How have ESG risks perceptions evolved between insurance consumers and insurers since 2015?

<sup>2</sup> Exchange rate USD to BRL was 5.2171 on 31 December 2022; Source: Brazil Central Bank.

- How has ESG integration in insurance products and operations evolved since 2015?
- Are there gaps between ESG risks materiality and insurance products coverage?
- Can consumers' perceptions of ESG risks explain the incorporation of ESG risks in insurance companies' operations and products?
- How do insurers' operations integrate ESG risks?

Our findings show an increase in perceptions of ESG risks among insurance consumers and insurers between 2015 and 2022 in Brazil.

The structural equation modelling (SEM) was able to include all ESG constructs explaining 86% of the variance of the incorporation of social risks in insurance operations, 66% in governance, and 63% in environmental risks. The social risks construct was the main driver of consumers' ESG risk perceptions.

The remainder of this article is organised as follows: section 2 presents the background of the study, section 3 the model proposition and hypotheses, section 4 the methodology, section 5 the results and discussion, and section 6 our concluding remarks.

## Background

### Sustainable Insurance

The theory to support corporate allocations to SD was initially defined as corporate social responsibility (CSR) in stakeholder theory (Freeman, 1984; Johnson, 1971). Some authors opposed this vision of shareholder theory (Friedman, 1970) in which ESG performance limits financial benefits for companies because of the implementation costs that shareholders must pay and restrictions on investments areas.

This controversy is still in place (Bottenberg et al., 2017; Brogi et al., 2022) but has evolved into the concept of shared value creation in policies and operating practices that enhance competitiveness related to innovation and growth (Porter & Kramer, 2018). In *Reimagining capitalism in a world on fire* (Henderson, 2020), the author highlights insurance companies' role in the context of extreme climate events and the positive effects of ESG initiatives on financial results.

Nogueira et al. (2018) present a timeline for sustainability in financial services starting in 1992 with the creation of the UNEPFI. SI was discussed in *The global state of sustainable insurance* (UNEPFI, 2009) and the PSI (UNEPFI, 2012). SI calls for strategic ESG risk management (Scordis et al., 2014; Shea & Hutchin, 2013, 2018) and a new underwriting approach (Pugnetti et al., 2022).

Green insurance has been defined as an innovative promise of business sustainability practices and product development (Nobanee et al., 2021; Pugnetti et al., 2022; Stricker et al., 2022). Green insurance products encompass green building insurance, weather insurance, green car insurance, and renewable energy insurance (Zona et al., 2014).

SI as a business and social process, evolved as ESG risk (extreme weather events, cyberattacks, social demands, and health treats, among others) perceptions grew, necessitating the creation of new products and regulations. In this section we provided a snapshot of the literature on this issue until 2022.

## ESG Risk Management

Value creation in insurance is grounded in good risk management in the following sequence: risk discovery, quantification, control/mitigation, financing, and monitoring. Accepting risks before following these steps in underwriting and risk management can destroy value for insurers (UNEPFI, 2009; Shea & Hutchin, 2018). Initially considered emerging ESG risks Shea and Hutchin (2013) has now their impacts known Stricker et al. (2022) being classified as an established risk.

Swiss Re (2022c) estimated that natural catastrophes caused an estimated USD115 billion in insured losses in 2022 (above the 10-year average of USD81 billion). Ceres (2020) sees ESG risks as systemic with the potential to destabilise capital markets with serious negative consequences for financial institutions and the broader economy. Climate change and the COVID-19 pandemic are examples of systemic risk. Climate risks are highly interconnected with other ESG factors. For example, climate crises displaced 26.4 million people every year between 2008 and 2015; 50 to 700 million people will be forced to migrate by 2050 (Ceres, 2020).

Empirical studies (Giese et al., 2019; Sonnenberger & Weiss, 2021) show that companies with better risk control standards and high ESG ratings suffer less frequently from severe incidents such as fraud, embezzlement, corruption, and litigation cases. They also tend to show higher profitability and lower exposure to tail risk and short- and medium-term exposure to systemic risk.

According to Ceres (2020), ESG risks spread from environmental issues related to threats to the planet (glaciers ice melting, wildfires, biodiversity loss, and ocean and river pollution) to humans in the form of injuries and deaths due to extreme events (heat waves, floods, and storm surges), damage to property, and global warming that destroys buildings and reduces the lifespan of concrete structures. These concerns are reflected in environmental accounting for the management for biodiversity conservation (N, Ashok, & Tailor, 2021). In 2021, PSI developed a climate risks assessment model (PSI, 2021) that was customised to Brazil in 2022 (CNseg 2022a). According to UNEPFI (2021), insurance and reinsurance companies are targeting net-zero greenhouse gas (GHG) emissions by 2050.

Although climate change has gained the spotlight in the last years, other ESG risks, such as social vulnerability, cyberattacks, biodiversity loss, and ageing populations, have also emerged (Allianz, 2022; Bouten et al., 2017; Gatzert et al., 2020; Nogueira et al., 2018; UNEPFI, 2009). Nobanee et al. (2022) identified the need for international collaboration to help countries outside Europe and the USA to understand and mitigate the impacts of climate change and encourage the possible transition towards a low carbon economy. Regulators worldwide are also urging banks, asset managers, and insurance companies to disclose and manage ESG risks such as climate change, social exclusion, hunger, poverty, and income disparities (Superintendence of Private Insurance [SUSEP], 2022; Ziolo, 2020).

Insurance industry associations such as the National Association of Insurance Commissioners, the United Kingdom Prudential Regulation Authority, and the European Insurance and Occupational Pensions Authority have requested the inclusion of ESG risks management in company strategies, products, and services, and governance transparency (Marcoux, 2021). In Brazil, SUSEP's circular letter no 666 outlines a timeline for

insurance companies to address ESG risk in their products and operations (SUSEP, 2022).

### Model Proposition and Hypotheses

This study’s model constructs are based primarily on those of Nogueira et al. (2018) and UNEPFI (2009). The constructs have been improved using the ESG risk taxonomy for financial services (EBA, 2018) adapted for the insurance industry and other variables (UNEPFI, 2009). Dependent variables are based on the ESG pillars, but there is no unique standard of indicators to assess ESG issues. Khovrak (2020) compared the ESG ratings of major ESG rating agencies. Morgan Stanley Capital International (MSCI) identified 35 ESG issues around 10 themes; Bloomberg ESG Data Service uses 120 indicators; and RepRisk uses 95 ESG factors.

The insurance industry assesses sustainability around ESG risks (Shea & Hutchin, 2013, 2018; UNEPFI,

2009). To compare the results of this survey with those of Nogueira et al. (2018), we start with the structure used in that survey and improve the questionnaire by refining definitions of each ESG risk.

Table 1 presents the relations between the 12 variables used by Nogueira et al. (2018) and the 23 used in this survey. To assess insurance consumers’ perceptions, respondents must answer the statement: *We can state that the insurance consumer identifies as very important the risks associated with ... the 23 ESG risks issues.* For insurer’s perceptions of their own insurance company, the respondent must answer the statement: *We can state that our organisation fully incorporates into its operations the ESG risks associated with ... the 23 ESG risks issues proposed.* The full questionnaire is available in Appendix 2. In the SEM and descriptive statistics, the variables begin with C for consumers and I for insurers, followed by E for environmental risks variables, S for social, and G for governance risks.

**Table 1: ESG Risk Variables: Nogueira et al. (2018) vs This Study**

| ESG Risks Construct    | Nogueira et al. 2018                      | 2022   |
|------------------------|---|--|
| Environmental          | Climate Change                            | CE - COEQ Emissions                            |
|                        |   | CE - Extreme Events                            |
|                        | Biodiversity Loss & Ecosystem Degradation | CE - Ecosystem Degradation                     |
|                        |   | CE - Biodiversity Loss                         |
|                        | Water Management                          | CE - Water Usage                               |
|                        |   | CE - Water Access                              |
|                        | Pollution                                 | CE - Pollution Continued                       |
|                        |   | CE - Pollution Acute                           |
| Social                 | Financial Inclusion                       | CS - Financial Inclusion                       |
|                        | Human Rights                              | CS - Human Right fault                         |
|                        | Emerging Man-Made Risks                   | CS - Emerging Health Risks                     |
|                        | Health Risks and Ageing Populations       | CS - PopHealthPromot                           |
|                        |   | CS - AgeingPopulation                          |
| Governance             | Regulations                               | CG - Regulatory Standards                      |
|                        |   | CG - Reg Standards Publicity                   |
|                        | Disclosure                                | CG - ESG Publicity to stakeholders             |
|                        |   | CG - ESG Publicity to stakeholders - Frequency |
|                        |   | CG - Ethic CodePublicity                       |
|                        | Ethics & Principles                       | CG - Ethic Code to Stakeholders                |
|                        |   | CG - Ethic Code exceed Regulations             |
|                        |   | CG - Ethic Code Check                          |
| Alignment of Interests | CG - Interest aling to Stakeholder        |  |
|                        | CG - Interest aling to Employee           |  |

This study investigates the relations between consumers' ESG risk perceptions and the inclusion of ESG risks in the insurance companies' operations and products. Many studies have analysed ESG and financial performance (BaFin, 2019; Henderson, 2020). For a review of ESG risks versus financial performance in the insurance industry see Brogi et al. (2022) and Xhafa (2023).

Various studies have identified a positive correlation between ESG performance and key performance indicators. Koh et al. (2022) found positive effects of consumers' ESG management on brand image, product quality, and purchase intention in South Korean insurance companies. Lee et al. (2017) also found that CSR activities enhance brand image, corporate reputation, and customer loyalty in Taiwan non-life insurance industry. UNEPFI (2009) recommended the integration of material<sup>3</sup> ESG factors into core insurance processes, products, and strategy. Shea and Hutchin (2018) concluded that companies should prioritise social and governance in universal ESG underwriting guidelines. Mendes-Da-Silva et al. (2021) found that exposure to risks (from domestic violence to extreme climatic events) increases risks perceptions and insurance demand. Nogueira et al. (2018) found a positive correlation between consumers' ESG risk perceptions and the incorporation of environmental risks in insurance companies' operations.

These studies suggest positive relations between ESG risk perceptions from consumers and product development and inclusion of these risks in operations. The constructs were designed through ESG risks perceptions from consumers and insurers, respectively. Our hypotheses are:

*Hypothesis 1:* Consumers' perceptions of environmental (CE) risks are associated with the incorporation of environmental risks in insurance operations (IE).

*Hypothesis 2:* Consumers' perceptions of social risks (CS) are associated with the incorporation of social risks in insurance operations (IS).

*Hypothesis 3:* Consumers' perceptions of governance risks (CG) are associated with the incorporation of governance

risks in insurance operations (IG).

*Hypothesis 4:* Company size is associated with the inclusion of ESG risks in operations and products.

The constructs of consumers' ESG risks perceptions were labelled CESGR and for insurers IESGR.

Studies that analysed the demand for flood insurance (Landry & Turner, 2020; Mendes-Da-Silva et al., 2021) show a positive correlation between risk perception and demand for insurance and product development (Huang et al., 2022; Shea & Hutchin, 2018), suggesting a positive relation between environmental risk perception and insurance (CE => IE), also the evolution of underwriting processes.

Pugnetti et al. (2022) found that insurance customers are requiring more involvement in sustainability from their insurers, resulting in an increase in demand for more transparency and new products in traditional (health and life) insurance as well in new areas (climate and cyber risks). The incorporation of these risks is increasing the need for risk management and governance (Committee of Sponsoring Organizations [COSO] and World Business Council for Sustainable Development [WBCSD], 2018). The literature suggests a positive relation between consumers' social risk perceptions and social risk management by insurance companies and supports the hypothesis (CS => IS).

Yu et al. (2019) found a strong and positive relationship between risk perception, social norms, and pro-environmental behaviour. This relationship extended to individuals' intentions to engage in pro-environmental actions, such as purchasing risk financing products (for example, flood insurance) in response to the challenges posed by climate change. Thus, we expect a positive relation between consumers' environmental and social risk perceptions and insurance companies' operations (CE => IE; CS => IS).

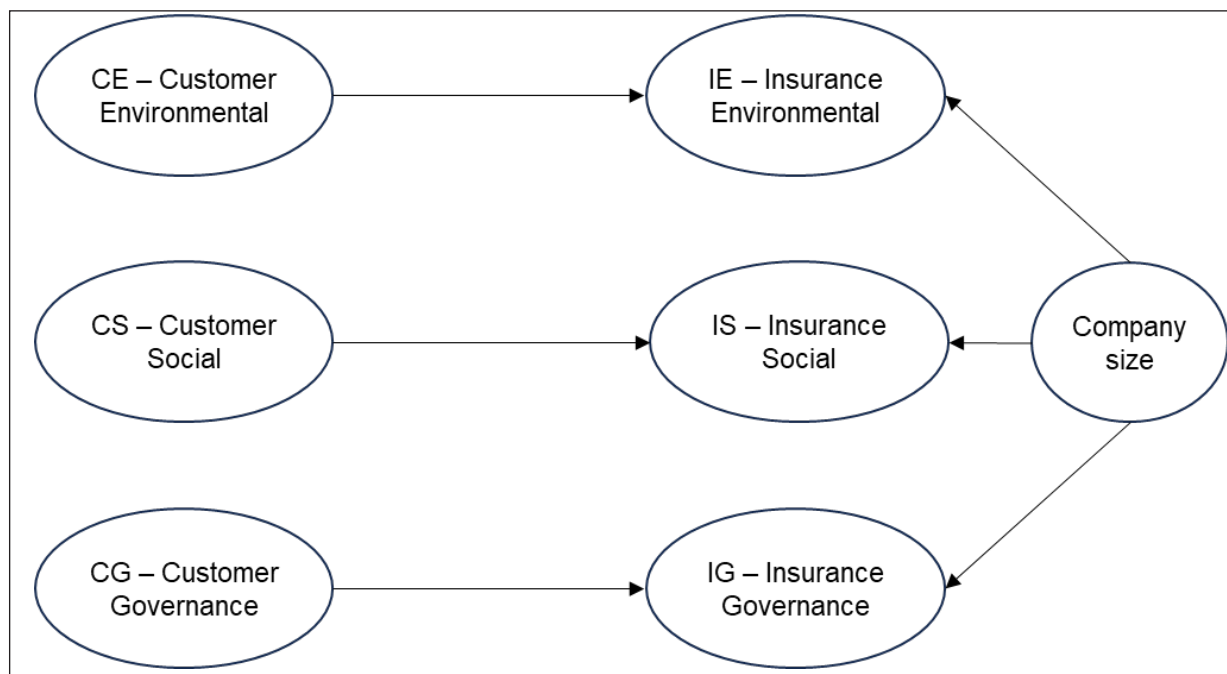
Insurance company policyholders, third parties, reinsurers, as well as supervisors and shareholders are requiring more transparency in ESG risk management (Anderloni et al., 2020; Huang et al., 2022; Regan, 2019; TCFD, 2017). Thus, we expect a positive relation between consumers' perceptions of governance risks and insurance companies' operations (CG => IG).

<sup>3</sup> Material risks are the ones that have impacts on corporate financial or marketing performance.

Dorfleitner et al. (2015) compared ESG ratings databases (ASSET4, Bloomberg, KLD) and found that large companies tend to receive better ESG scores in the ASSET4 rating. Scholtens (2011) used Spearman rank correlation and found a positive relation between CSR performance and company size in the insurance industry, although other authors found no relation between size and CSR performance (Çera et al., 2020; Nayak & Venkatraman, 2011). Sung et al.'s (2022) empirical studies demonstrated that CSR for national causes has a positive impact for large companies, while local causes benefit

smaller companies. These findings suggest the relation between insurance company size and ESG performance (Size => IESGR) varies according to regions and market conditions.

Fig. 1 presents the theoretical model to evaluate the relations between consumers' and insurers' ESG risks perceptions. This model is supported by previous studies (Nogueira et al., 2018; Shea & Hutchin, 2013, 2018; UNEPFI, 2009). The lines in Fig. 1 indicate the expected positive relationships.



**Fig. 1: Proposed Model**

## Method and Sample Description

A survey was designed and conducted using a standardised questionnaire (Babbie, 2001) to assess insurance professionals' perceptions of their consumer's behaviour towards ESG risks and the incorporation of ESG risks in their company operations. The instrument was developed based on the Nogueira et al. (2018) questionnaire and the questions were based on other studies (Shea & Hutchin 2013, 2018; UNEPFI, 2009). For example, Nogueira et al. (2018) use the following question to address climate change risk:

*How does the insured manage the risks associated with climate change (e.g., increased frequency and severity*

*of floods, hurricanes, windstorms, droughts, and other weather-related events), including the management of its greenhouse gas emissions?*

The question does not identify a specific risk category (extreme events or GHG emissions). Our study focuses on perceptions of the importance of the risk for consumers and insurers in just one risk category (Mendes-Da-Silva et al., 2021; Regan, 2019). To improve the discrimination of each question we formulated specific affirmations, as follows:

*Answer the questions considering your perception of the insurance consumer. We can state that the insurance consumer identifies as very important the risks associated with: Question 1: Greenhouse gases emissions; Question*

2: *Extreme natural events (storms, floods, droughts ...)*.

These changes make the questionnaire move from 12 to 23 questions. We also changed the scale from a ESG risk underwriting progress scale to a traditional seven-point Likert scale (Likert, 1932). (1 = completely disagree to 7 = completely agree; both scales have seven levels to enable comparisons).

Data were analysed using SEM; therefore, the results are both descriptive and causal (Byrne, 2010; Hair et al., 2009). The survey instrument was developed and tested for validity and reliability in accordance with Aaker et al. (1997), Churchill (1979), and Hair et al. (2009).

Content validity was achieved using face-to-face pre-tests with seven specialists to identify potential problems and improve the questionnaire. Convergent validity was assessed by means of a confirmatory factor analysis (CFA) using the procedures recommended by Kline (1998) and Byrne (2010). Discriminant validity was assessed by the Fornell–Lacker criteria of comparison among squared Average Variance Extracted (AVE) values with the constructs' correlations. Composite reliability and Cronbach's alpha were used to test for internal consistency reliability, observing values above 0.70 (Bagozzi et al., 1991; DeVellis, 1991).

The final questionnaire was administered via email to 505 executives in insurance companies by CNseg<sup>4</sup> and insurance communities on LinkedIn. Of these, 148 responded to the invitation to participate, 113 responded to all the questions on insurance consumer and insurer ESG risks perception, and 66 responded to the full questionnaire including questions on ESG risks materiality.

Next, we asked the 66 respondents who completed the whole questionnaire to answer a single question: *Overall, can we say that your organisation has a completely sustainable ESG risks management strategy?* We received 13 responses and compared the results with the mean of their answer to the questionnaire's 23 questions. The Student's t-test with a 1% significance level showed no difference between the means, suggesting consistency in the questionnaire responses.

<sup>4</sup> CNseg represents 98.6% of the companies supervised by SUSEP (property and casualties) and 37.6% of the health insurance market.

The final sample used in SEM consisted of 84 questionnaires with complementary external information. Respondent profiles can be seen in section 4.1. Data were analysed by univariate descriptive and multivariate statistics. SEM was used to test the hypotheses using the procedures and parameters recommended by Hair et al. (2009) and Byrne (2010). SPSS 26 and Amos 28 software were used for the analysis.

Each construct is reflexive, manifesting itself on at least three observed variables. For hypothesis testing Amos 28 was used to assess the SEM proposed. Several other statistical analyses were also produced, enabling sample description as well as the insurance market characteristics.

### Sample Description, Univariate Analysis, and Construct Validity and Reliability

At the end of 2021, the Brazilian insurance market had 161 insurance companies, 940 health plan operators and private insurance healthcare, 13 open private pension entities, 16 capitalisation companies, and 146 reinsurance companies. The market is very concentrated. The top 10 property and casualty insurance companies have 71.6% of the market share, 92.4% for life and pensions, and 47.9% for healthcare (CNseg, 2022b).

The descriptive analysis is based on 113 complete observations of ESG risk perception. The sample is not statistical, since it was obtained by convenience due to accessibility, so it is not possible to infer population data from it. Nevertheless, the sample contains responses from 40 insurance corporations that account for 65% of the general insurance premiums issued by companies supervised by the private insurance regulator SUSEP in 2022 (SUSEP, n. d.), so it can be considered representative of Brazil's insurance industry.

The respondents have on average 15 years' professional experience. Women are 43% of the sample, an increase from 37% in 2015 as observed in other studies (Koh, et al., 2022; Monteiro and Galiza, 2022; MSCI, 2022). The respondents' demographic details are presented in the following tables: age (Table 2), employer (Table 3), academic training (Table 4), function (Table 5), and job position (Table 6). Statistics on insurance professionals of the entire industry were obtained from Monteiro and Galiza (2022).

**Table 2: Respondents by Age and Gender**

| Age Range           | Women | Men | All |
|---------------------|-------|-----|-----|
| Less than 30 years  | 4%    | 13% | 9%  |
| From 30 to 39 years | 55%   | 28% | 40% |
| From 40 to 49 years | 18%   | 20% | 19% |
| From 50 to 54 years | 10%   | 16% | 13% |
| More than 55 years  | 12%   | 23% | 19% |

Note: The respondents are older than the industry (4% of women and 6% of men have more than 55 years).

**Table 3: Respondents by Employer and Gender**

| Employer                        | Women | Men | All |
|---------------------------------|-------|-----|-----|
| Insurance company               | 92%   | 81% | 86% |
| Insurance broker                |       | 5%  | 3%  |
| Insurance Confederation - Cnseg | 6%    | 9%  | 6%  |
| Not identified                  | 2%    | 5%  | 5%  |

**Table 4: Respondents by Academic Training and Gender**

| Academic Training | Women | Men | All |
|-------------------|-------|-----|-----|
| PHD               | 6%    | 4%  | 4%  |
| MSC               | 18%   | 19% | 19% |
| Graduate          | 76%   | 77% | 77% |

Note: The respondents had a higher level of academic education than the industry where 13% had PhD/MSc.

**Table 5: Respondents by Job Position and Gender**

| Job Position | Women | Men | All |
|--------------|-------|-----|-----|
| Director     | 8%    | 19% | 14% |
| Manager      | 43%   | 44% | 43% |
| Clerk        | 49%   | 38% | 42% |

Note: The proportion of directors increased from 11% in 2015 to 14% and for managers from 34% to 43%.

**Table 6: Respondents by Job Function and Gender**

| Job Function           | Women | Men | All |
|------------------------|-------|-----|-----|
| Underwriter            | 20%   | 28% | 25% |
| Business executive     | 6%    | 20% | 14% |
| Sustainability manager | 16%   | 3%  | 9%  |
| Product development    | 6%    | 8%  | 7%  |

| Job Function        | Women | Men | All |
|---------------------|-------|-----|-----|
| Sales and Marketing | 6%    | 3%  | 4%  |
| Treasury            | 0%    | 5%  | 3%  |
| Others              | 45%   | 33% | 38% |

Note: The proportion of underwriters increased from 19% in 2015 to 25% and the proportion of sustainability managers from 2% to 9%.

The descriptive statistics of the ESG risks perceptions of insurance consumers and insurers can be seen in Appendix 3. The sample was older than in the market average, consistent with the higher job positions and academic training. We also observed a greater participation of women, sustainability managers, and underwriters.

## Result and Discussion

### Evolution of ESG Risk Perceptions

To compare the evolution of insurance professionals' perceptions on ESG risks since 2015 we performed an Analysis of Variance (ANOVA) procedure on the ESG constructs (rescaled 1 to 10 for a better understanding) as shown in Table 7.

**Table 7: ESG Risks Perceptions of Consumers and Insurers**

| Construct    | 2022  | 2015  | Difference |
|--------------|-------|-------|------------|
| Consumer Env | 7,228 | 5,903 | 1,325      |
| Consumer Soc | 7,387 | 6,349 | 1,038      |
| Consumer Gov | 8,024 | 6,256 | 1,768      |
| Insurer Env  | 7,697 | 7,080 | 0.617      |
| Insurer Soc  | 8,186 | 7,958 | 0.228      |
| Insurer Gov  | 8,944 | 8,866 | 0.078      |

Consumers ESG risk perceptions were higher than in 2015, consistent with findings of other publications (Koh, 2022; MSCI, 2022) and the demand for environmental insurance. The increase in the intensity and frequency of extreme events in Brazil (Salvador & Brito, 2018; Souza & Silva, 2021) increased consumers' ESG risk perceptions (Mendes-Da-Silva et al., 2021; Souza & Silva, 2021).

From an insurers' perspective, environmental risk shows a significant increase, consistent with the growth

in environmental liability insurance (see Fig. 2). The increase in insurers’ perceptions of social and governance risks since 2015 is consistent with the increase in industry regulations (SUSEP, 2022; UNEPFI, 2009). The decrease in differences among CESGR and IESGR between 2015 and 2022 is consistent with the increase in consumers’ ESG risk perceptions (Koh, 2022; MSCI, 2022).

### ESG Risks Underwriting

The underwriting process starts with risk identification, followed by risk quantification, then definition of mitigations measures, and finally the risk transfer through the issuing of an insurance policy (UNEPFI, 2009). According to CNseg sustainability reports, the incorporation of ESG risks in the underwriting process has grown consistently from 19% to 60% of companies over the past decade in the Brazilian insurance industry (CNseg 2022b).

Respondents evaluated the underwriting process, according to the scale proposed by UNEPFI (2009): *This ESG risk is:*

- Not a factor;
- Emerging concern not supported by evidence;
- Social concern of few;
- Social concern of more;
- Evidence supported movement;
- Developing regulatory or legal framework;
- Developed regulatory or legal framework.

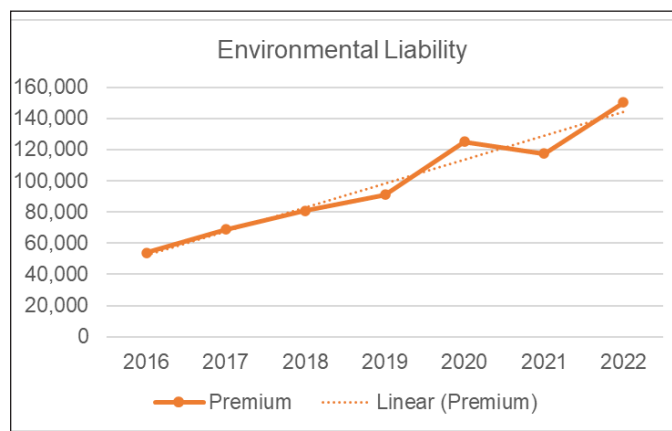
**Table 8: Underwriting Evolution on ESG Risk Factors**

| ESG Risk Factor                  | Underwriting Progress |      |
|----------------------------------|-----------------------|------|
|                                  | 2022                  | 2015 |
| Climate Change - CO2EQ Emissions | 3.99                  | 4.73 |
| Climate Change - Extreme events  | 4.99                  | 4.73 |
| Ecosystem Degradation            | 4.03                  | 4.73 |
| Biodiversity Loss                | 3.93                  | 4.73 |
| Water Management - Water usage   | 3.88                  | 5.12 |
| Water Management - Water access  | 3.77                  | 5.12 |
| Pollution Continued              | 3.97                  | 5.11 |
| Pollution Acute                  | 4.03                  | 5.11 |

| ESG Risk Factor                     | Underwriting Progress |      |
|-------------------------------------|-----------------------|------|
|                                     | 2022                  | 2015 |
| Disclosure                          | 4.39                  | 6.22 |
| Financial Inclusion                 | 4.18                  | 5.21 |
| Health Risks and Ageing Populations | 4.01                  | 5.21 |

The evolution of climate risks underwriting was expected due to the greater incorporation of environmental risks in underwriting in Brazil (CNseg 2022b) and an increase in extreme climate events (tornadoes and floods) and insurance demand (Mendes-Da-Silva et al., 2021; Salvador & Brito, 2018; Souza & Silva, 2021) as shown in Fig. 2. Although not significant, some results in Table 8 suggest less progress in underwriting in 2022 versus 2015 in four of seven risks, which seems odd. However, this result is consistent with Table 7 and shows significantly greater growth in consumers’ ESG risks perception constructs than the incorporation of these risks in insurers’ products and operations. Another possible explanation is the new ESG regulations (SUSEP, 2022) that require the integration of ESG risks in products and operations, which created a perception of the need for more advanced underwriting practices.

The rise in perceptions related to global warming and extreme climate events risks can be linked to losses caused by natural disasters, estimated at USD115 billion in insured losses in 2022 according to Swiss Re (2022c).



**Fig. 2: Evolution of Environmental Liability Insurance Revenues (BRL Thousands)**

In Brazil, the floods in Rio Grande do Sul (RS) in May 2024 are expected to result in losses of approximately

BRL90 billion. The disaster left 176 people dead and displaced 617,900 others. By 18 June, claims had reached BRL3.886 billion (CNseg, 2024). The flood in Porto Alegre city was partly due to poorly maintained floodgates. Pump houses and pumping stations were also flooded (Agencia Brasil, 2024). This region had many insured houses, businesses, and automobiles. The insurance industry could have provided early warnings, not only to its customers, but also to public authorities.

In 2015, the Mariana dam broke leaving 19 dead with insured claims of USD600 million. On 18 October 2024, Vale S A informed that Samarco Mineração S A and BHP Billiton Brasil Ltd reached a definitive agreement with the government in Brazil for the full reparation of the rupture of the Samarco Fundão (Mariana) dam in the total amount of BRL170 billion (USD29.85 billion<sup>5</sup>) (Vale Chega a Acordo Definitivo Com O Poder Público No Brasil Para a Reparação Integral Do Rompimento Da Barragem De Fundão Da Samarco, n.d.).

In 2019, the Vale Brumadinho dam broke leaving 23,000 people affected and 272 dead, generating agreements of BRL1.3 billion and a reparation agreement of BRL37.6 billion, with BRL500 million to be borne by the insurance market. Prosecutors charged 21 persons with qualified homicide (Defensoria, 2023). Both Brumadinho and Mariana were tragedies caused by known problems with the dams; both had insurance. Good ESG risk mitigation procedures and underwriting could have avoided, or at least reduced, the losses for the insurance companies, society, and the environment.

### Green Insurance Opportunities

We took environmental liability insurance as a proxy for environmental risks demand (Fig. 2). The growth in premiums issued is consistent with greater environmental risks perceptions (Table 7), the evolution of the underwriting process (Table 8), and insurance demand (Mendes-Da-Silva et al., 2021).

**Table 9: ESG Risk Materiality × Product Availability – Materiality GAP**

| ESG Risk Factor                     |                               | The Risk is Material |      | Product Availability |      | Risk Materialty Minus(-) Product Availability |      | Product Group with Greater Materiality |      |
|-------------------------------------|-------------------------------|----------------------|------|----------------------|------|---|------|--|------|
| 2015                                | 2022                          | 2022                 | 2015 | 2022                 | 2015 | 2022  | 2015 | 2022                                   | 2015 |
| CGH Emissions and Extreme Events    | Climate Change GHG Emissions  | 76%                  | 62%  | 13%                  | 37%  | 63%   | 25%  | ER                                     | PR   |
|                                     | Climate Change Extreme events | 85%                  | 62%  | 64%                  | 37%  | 21%   | 25%  | ER                                     | PR   |
| Ecosystem Degradation and Bio. Loss | Ecosystem Degradation         | 62%                  | 53%  | 18%                  | 15%  | 44%   | 38%  | ER                                     | ER   |
|                                     | Biodiversity Loss             | 53%                  | 53%  | 11%                  | 15%  | 42%   | 38%  | ER                                     | ER   |
| Open Water Access and Usage         | Water Usage                   | 52%                  | 45%  | 10%                  | 13%  | 42%   | 32%  | ER                                     | ER   |
|                                     | Water Access                  | 55%                  | 45%  | 10%                  | 13%  | 45%   | 32%  | ER                                     | ER   |
| Continued and Acute Pollution       | Pollution Continued           | 59%                  | 48%  | 10%                  | 24%  | 49%   | 24%  | ER                                     | ER   |
|                                     | Pollution Acute               | 64%                  | 48%  | 18%                  | 24%  | 46%   | 24%  | ER                                     | ER   |
| Transparent Governance              | Disclosure                    | 55%                  | 34%  | 8%                   | 24%  | 47%   | 10%  | ER                                     | PR   |
| Financial Inclusion                 | Financial Inclusion           | 73%                  | 55%  | 40%                  | 40%  | 33%   | 15%  | PE                                     | PE   |
| Ageing Population                   | Ageing Populations            | 68%                  | 77%  | 39%                  | 40%  | 29%   | 37%  | HC                                     | PE   |

The materiality gap is expressed by the difference in percentage of respondents who consider the ESG risk is material and the awareness of product availability to any group of products<sup>6</sup>. ESG risks have different materiality

<sup>5</sup> BRL5.698/USD – <https://www.bcb.gov.br/estabilidadefinancieira/historicocotacoes>

<sup>6</sup> Table 9 presents product lines with a major materiality gap (ER: environmental risks; PR: property and casualty; PE: people/life; HC: healthcare).

for each group of insurance products (PSI, 2021; UNEPFI, 2009) and varies across sectors and industries (Kaiser, 2020). For example, GHG emissions risk is material for coal mining company liability insurance but not material for home insurance. The product groups (ER, PR, PE) in Table 9 were most frequently identified by respondents as material. The materiality gap provides an industry roadmap for innovative product development. As expected, the risk materiality perception in 2022 is greater

than 2015 to all risks but ageing populations, which may be considered an established risk.

Besides extreme events and ecosystem degradation fewer respondents identified available products. This result may be influenced by higher expectations of the respondents in relation to new ESG products as shown in Table 7 and the ESG regulation circular letter n° 666 (SUSEP, 2022).

### Constructs Assessment and Hypotheses Testing

The aim of this analysis is to test the hypotheses on the positive relationship between CESGR and IESGR. Insurer’s size (SIZE) was operationalised by the Log10 of

equities, revenues, profits, and workforce. A final sample of 84 responses was analysed and the constructs were operationalised and checked for validity and reliability.

The face validity was checked on pretesting with both researchers and practitioners that clearly understood the items on the questionnaire and their correct meaning, as discussed in section 4. Convergent validity was assured by the correlation values among constructs and their correspondent items. All values of the average variance extracted were above .700 indicating adequate convergent validity. Reliability was assessed by both composite reliability and Cronbach’s alpha values – both above 0.700 for all constructs (Table 10). This instrument covers all ESG aspects and presents improved validity and reliability in comparison with Nogueira et al. (2018).

**Table 10: Construct Validity and Reliability**

| Construct |                        | Items | AVE   | Comp Reliability | Cronbach’s Alpha |
|-----------|------------------------|-------|-------|------------------|------------------|
| CE        | Consumer Environment   | 7     | 0.760 | 0.807            | 0.960            |
| CS        | Consumer Social        | 3     | 0.747 | 0.747            | 0.830            |
| CG        | Consumer Governance    | 6     | 0.805 | 0.805            | 0.952            |
| IE        | Insurer Environment    | 7     | 0.798 | 0.834            | 0.967            |
| IS        | Insurer Social         | 3     | 0.747 | 0.747            | 0.830            |
| IG        | Insurer Governance     | 6     | 0.782 | 0.782            | 0.944            |
| SIZE      | Insurance company size | 4     | 0.796 | 0.796            | 0.915            |

Discriminant validity was assessed by both the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio (Table 11). An HTMT of less than 0.85 is generally considered evidence of discriminant validity (Henseler et al., 2015). Although there is no standard value for discriminant validity, values not greater than 0.85 and ideally less than 0.70 suggest that discriminant validity likely exists between the two constructs.

**Table 11: Construct Discriminant Validity**

|      | CE    | CS    | CG    |
|------|-------|-------|-------|
| CE   | 0.898 |       |       |
| CS   | 0.426 | 0.864 |       |
| CG   | 0.370 | 0.612 | 0.897 |
| IE   | 0.533 | 0.443 | 0.349 |
| IS   | 0.376 | 0.695 | 0.500 |
| IG   | 0.325 | 0.523 | 0.599 |
| Size | 0.017 | 0.205 | 0.182 |

The SEM was processed using IBM Amos 28 software with the recommendations of Hair et al. (2009) and Byrne

(2010) for the procedures, steps, and assessments. The model fit was adequate, and the indices are presented in Table 12.

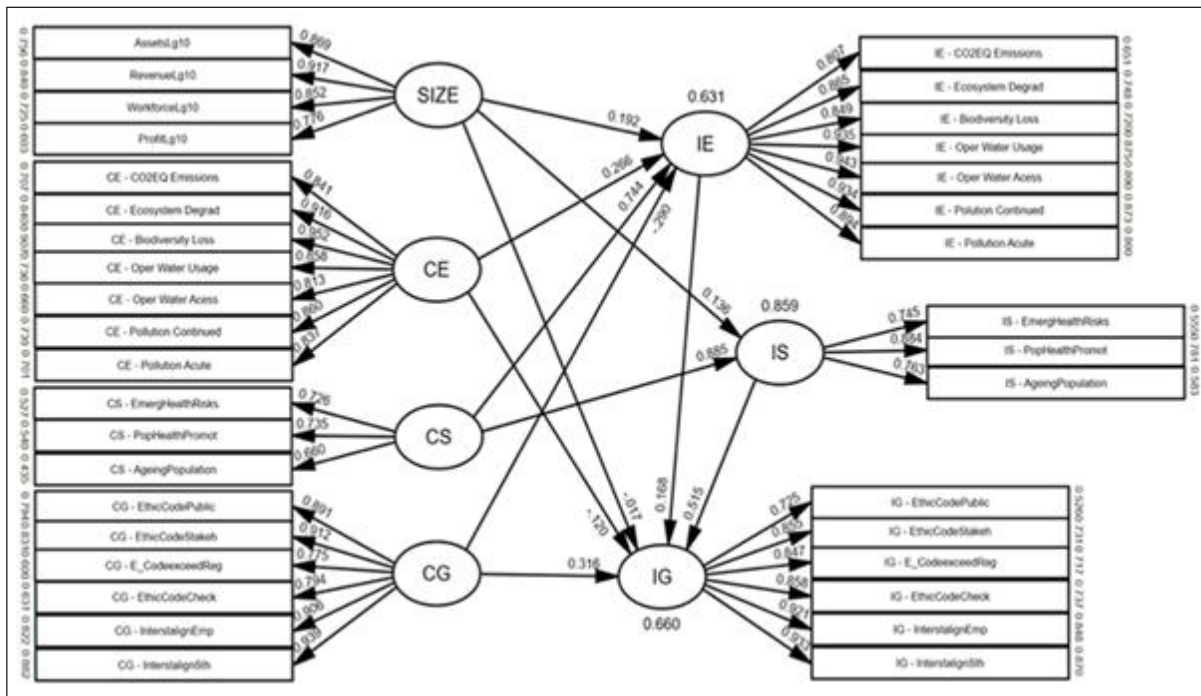
**Table 12: Model Fit of the Indices**

| Model Fit Indices                                  | Values |
|--|--------|
| CMIN/DF: Discrepancy–Chi-square/degrees of freedom | 1.882  |
| CFI: comparative fit index                         | 0.861  |
| RMSEA: root mean square of error of approximation  | 0.103  |

Fit was examined by means of absolute, incremental, and parsimonious fit measures (see Table 10) and the absolute fit measurement, two-tailed bias-corrected confidence intervals, use CFI and RMSEA. Based on these values, the model was accepted. Path coefficients obtained by maximum likelihood estimation and bootstrapping were used to estimate errors and two-tailed bias-corrected confidence intervals (see Table 13).

**Table 13: Hypothesis Testing Results**

| Hypothesis | Std Path Coefficients | Error | P     | Result        |
|------------|-----------------------|-------|-------|---------------|
| Size -> IE | 0.192                 | 0.159 | 0.328 | Not supported |
| CE -> IE   | 0.266                 | 0.154 | 0.126 | Not supported |
| CS -> IE   | 0.744                 | 0.300 | 0.010 | Supported     |
| CG -> IE   | -0.290                | 0.194 | 0.020 | Supported     |
| SIZE -> IS | 0.136                 | 0.151 | 0.492 | Not supported |
| CS -> IS   | 0.885                 | 0.118 | 0.012 | Supported     |
| SIZE -> IG | -0.017                | 0.100 | 0.912 | Not supported |
| CE -> IG   | -0.120                | 0.115 | 0.348 | Not supported |
| CG -> IG   | 0.316                 | 0.137 | 0.024 | Supported     |
| IE -> IG   | 0.168                 | 0.187 | 0.312 | Not supported |
| IS -> IG   | 0.515                 | 0.237 | 0.051 | Supported     |



**Fig. 3: Model with the Results**

The final version of the model measured seven constructs through 36 items. The convergent and discriminant validity construct was accessed using CFA (see Tables 10 and 11). Statistics yielded adequate values, indicating that the constructs and the complete structural model were valid and reliable (see Table 12). SIZE and CESGR constructs explained variances in IESGR constructs (63% of IE, 86% of IS, 66% of IG). These results indicate an improvement on Nogueira et al. (2018) that explained just 28% of IE and 36% of IG variance (see Table 14).

The numbers in Fig. 3 beside the variable’s boxes are the loading factors, the arrow points are the path coefficients to the construct represented by an ellipse, and the number close to it shows the amount of explained construct variance.

Two elements contribute to the incorporation of ESG risks into products and operations for insurance companies: first, a developed regulatory or legal framework, which was established in Brazil through Circular Letter No 666 (SUSEP, 2022); and second, the evolving risk perception

of consumers, as shown in Table 7. In addition, other studies, such as Yu et al. (2019), have found that pro-environmental behaviour influences risk perception, which supports the capacity of CESGR to explain IESGR.

**Table 14: Squared Multiple Correlations of the Dependent Constructs**

| Construct | Sq Mult Corr |
|-----------|--------------|
| IE        | 0.631        |
| IS        | 0.859        |
| IG        | 0.660        |

A squared multiple correlation of 0.50 or higher indicates a strong relationship, suggesting a ‘good’ model (Byrne, 2010; Hair et al., 2009).

The ESG factors are interconnected (Ceres, 2020; Nogueira et al., 2018; Shea & Hutchin, 2018; UNEPFI, 2009), which means that the risk perceptions of one ESG risk pillar can be perceived in other pillars.

The positive and significant relations between CS with IE and IS indicates that a greater social concern of ESG risks is driving the incorporation of these risks in insurance products and operations as in UNEPFI (2009). Pugnetti et al. (2022) showed that consumers are demanding new types of coverage in traditional product lines such as health and life insurance, as well cyber risks.

Environmental risks are increasing insurance demand (Landry & Turner, 2020; Mendes-Da-Silva et al., 2021) and improving social risk perceptions as observed in CS=>IE. The positive and significant relation between CG and IE was also captured by Nogueira et al. (2018). The positive relationship between IS and IG are consistent with an increase in demand for ethics and transparency in insurance companies’ governance (Anderloni et al., 2020; COSO & WBCSD, 2018; Huang et al., 2022).

Despite inconsistency in ESG scores between service providers (Dorfleitner et al., 2015), some authors have observed a positive correlation between company size and ESG performance (Brogi et al., 2022; Scholtens, 2011). Conversely, other researchers (Çera et al., 2020; Nayak & Venkatraman, 2011) have not identified any significant relationship between these variables. Sung et al. (2022) found that the relationship may vary: it appears to be positive for larger companies when addressing national

causes and for smaller companies when dealing with local causes.

Possible reasons why the model did not capture significant relationships between the size of the insurance company and the incorporation of ESG risks into the operations of the insurance companies are:

- SUSEP No 666 defined ESG risk management and reporting requirements for all insurance companies. Although these requirements differ based on the size of the companies, insurance professionals began to demand a greater focus on sustainability as discussed in item 5.2 (Table 8), no matter the size of the company.
- Consumer demands increased for insurance after the COVID-19 pandemic, particularly in relation to health (Agencia Brasil, 2023) and automobile (Reclame AQUI, n. d.) insurance, showing higher levels of satisfaction with smaller insurance companies. This was also observed in the Australian insurance market (Nayak & Venkatraman, 2011).
- The Brazilian insurance market showed a huge movement towards mergers and acquisitions (M&As) in different segments (Luiz, 2022) as well as the development of Insurtech, allowing the offer of green insurance for small companies (Redação, 2022).

### Concluding Remarks

This paper examines the relationship between insurance consumers’ ESG risk perceptions and the incorporation of these risks in the insurance companies’ operations and products evolution between 2015 and 2022 in Brazil. Our sample comprised responses from 113 professionals across 40 insurance corporations, which collectively account for 65% of the premiums issued by SUSEP-supervised companies in 2022 (SUSEP, n.d.).

The sample description presented in section 4.1 shows an increase in the number of female respondents in 2022 versus 2015. Respondents are older and senior than in the market (Tables 2 and 5). The participation of underwriters and sustainability managers also increased. This profile suggests that professionals with higher ESG requirements may explain the lower (although not significant) progress in underwriting, as shown in Table 8.

Consumers' and insurers' environmental risk perceptions had increased since 2015 (Table 7). Among environmental risks, GHG emissions and extreme climatic events increased in the underwriting process (Table 8) and insurance demand (Fig. 2).

The final version of the model (Fig. 3) measured seven constructs (one for each ESG pillar for consumers and insurers and the size construct) through 36 items versus five constructs through 17 items, enabling the inclusion of social risks construct for consumers and insurers. The model was able to explain the 63% variance of IE, 86% of IS, and 66% of IG. The best predictor of IESGR variance was CS, validating the hypotheses of a positive relation between CS and IE, CG and IE, and CS and IS (Table 13).

Our model does not indicate significant relations between SIZE and IESGR constructs as in Çera et al. (2020), Nayak and Venkatraman (2011), and Sung et al. (2022). The possible reasons for this include new ESG regulations affecting all insurance companies, the growth in customer complaints against insurance companies, the post-COVID-19 era, the growth in M&As in the insurance industry, and the rise in Insurtech ESG services. ESG risk underwriting assessment highlights the evolution of GHG emissions and extreme events risks (Table 8). The results show that there is a lack of products for GHG emissions risks, ecosystem degradation, and continued pollution (Table 9).

This study contributes to the literature with the development of an ESG risk perceptions assessment framework and models. It also improves the discussion on the evolution of ESG risk perceptions over time and the relationship between insurance product availability and ESG risk materiality and underwriting. Our research contributes to strategic ESG risk management and product development within the context of new regulations.

In accordance with the mindset 'If you can't measure you can't improve', the insurance industry (companies and regulators) should keep ESG risk claims data as primary risks, for example: claims cost in property insurance are available from the SUSEP database, but not disclosures on specific climate risk such as heat waves, precipitation volume, or wind speed. This measurement would enable new products development as parametric insurance (available just for a few agricultural products).

The integration of ESG risks in the insurance business is a process that is evolving globally (Nobanee et al., 2021, 2022; Pugnetti et al., 2022; Stricker et al., 2022). Indian banks are increasingly focusing on adopting an integrated approach to risk management (Bhatt et al., 2023). Since 2015, Brazil's insurance industry has seen an increase in sustainability initiatives and committees (CNseg, 2022b), adherence to international protocols, especially the PSI (UNEPFI, 2018), and improvements in climate risk management and disclosure (UNEPFI, 2018; CNseg, 2022a).

We would like to make the following suggestions for Brazil's insurance industry:

- Work with the regulator to define standards for recording specific causes of ESG risk claims: for example, the rain volume in flood-associated claims in auto and properties and casualty policies.
- Increase risk analysis for climate risks related to extreme events, focusing on droughts and floods.
- Define standards for recording specific causes of ESG risk claims: for example, precipitation volume in flood-associated claims in auto and properties and casualty policies.
- Adhere to international standards of ESG performance as proposed by the International Sustainability Standards Board (ISSB).
- Create an open-access ESG products and performance (claims ratio) database.
- Increase investment in ESG risks research in universities and scientific research initiatives such as the Integrated Assessment Modeling Consortium (IAMC) for the development and analysis of scenarios for climate-related financial analysis.

## Limitations

This study captures the perceptions of the respondents about a phenomenon, without measuring the phenomenon. Although some insurers work for international insurance companies, the results are pertinent to Brazil and should be viewed in relation to the country and similar economies. The results should not be generalised across the entire industry, as the sample, while covering over 65% of premiums within the Brazilian market, may still

lack complete representativeness. Although this coverage renders the findings highly relevant, the model reflects insurance consumers' perspectives indirectly – filtered through the lens of insurers – making it secondary information.

## Future Studies

For new research we suggest improving the assessment of global warming-associated risks especially extreme climate events (floods, drought, windstorms); incorporation of ESG Apria in insurance companies' investments and, finally, the effects of ESG regulations in risk management and financial performance.

Assess ESG risks perception directly from insurance consumers and the relationship between ESG performance and ESG risk claims ratios.

## Acknowledgements

This research would not have been possible without access to and the commitment of insurance professionals, and the contribution of CNseg, especially the Innovation and Sustainability Committee and insurance professionals who participated in the survey. We thank you all.

## Funding Statement

This study was carried out independently without any financial support from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflicts of Interest Statement

The authors declare that they have no conflicts of interest related to the insurance organisations that participated in this research.

## References

- Aaker, D. A., Kumar, V., & Day, G. S. (1997). *Marketing research* (6<sup>th</sup> ed.).
- Abhishek, N., Ashok, M. L., & Tailor, R. K. (2021, November 28). An analysis of natural resources accounting framework in India. *Journal of Commerce & Accounting Research*, 10(4) 2021, 56–64. Available at SSRN: <https://ssrn.com/abstract=3973071>
- Agencia Brasil. (2023). Planos de saúde seguem no topo de queixas registradas no Idec. Retrieved December 11, 2023, from <https://agenciabrasil.ebc.com.br/geral/noticia/2023-03/planos-de-saude-seguem-no-topo-de-queixas-registradas-no-idec>
- Allianz. (2022). Allianz global corporate & specialty AGCS. Global claims review 2022. Retrieved January 19, 2023, from <https://www.agcs.allianz.com/content/dam/onemarketing/agcs/agcs/reports/AGCS-Global-Claims-Review-2022.pdf>
- Allianz & Euler Hermes. (2020). *Impact underwriting: sustainable insurance as an opportunity for society and business. Technical report*. Munich and Paris: Allianz Research and Euler Hermes Economic Research.
- Anderloni, L., Moro, L., & Tanda, A. (2020). Governance and performance in insurance companies: A bibliometric analysis and a meta-analysis. *International Journal of Economics and Finance*, 12(11).
- Babbie, E. (2001). *The practice of social research*. Belmont, CA: Wadsworth Cengage Learning.
- BaFin. (2019). *Merkblatt zum Umgang mit Nachhaltigkeitsrisiken. Technical Report*. Frankfurt: Bundesanstalt für Finanzdienstleistungsaufsicht BaFin.
- Bagozzi, R., Yi, Y., & Philips, L. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, 36(3), 421–458.
- Bhatt, M., Shaikh, N., & Patel, M. (2023). A study of customer perception toward digital banking payments. *International Journal of Banking, Risk and Insurance*, 11(2), 26–31.
- Bottenberg, K., Tuschke, A., & Flickinger, M. (2017). Corporate governance between shareholder and stakeholder orientation. *Journal of Management Inquiry*, 165–180.
- Bouten, L., Cho, C. H., Michelin, G., & Roberts, R. W. (2017). CSR Performance Proxies in Large-Sample Studies: Umbrella advocates, construct clarity and the validity police. *SSRN Electronic Journal*. doi:<https://doi.org/10.2139/ssrn.3107182>
- Broggi, M., Cappielow, A., Lagasio, V., & Santoboni, F. (2022). Determinants of insurance companies' environmental, social, and governance awareness.

- Corporate Social Responsibility and Environmental Management*, 295, 1357–1369.
- Byrne, B. M. (2010). *Structural equation modeling with AMOS: basic concepts, applications, and programming* (2<sup>nd</sup> ed.) Routledge/Taylor & Francis Group.
- Çera, G., Belás, J., Maroušek, J., & Çera, E. (2020). Do size and age of small and medium-sized enterprises matter in corporate social responsibility? *Economics & Sociology*, 132, 86–99. doi:<https://doi.org/10.14254/2071-789x.2020/13-2/6>
- Ceres (2020). Addressing climate as a systemic risk: A call to action for U.S. financial regulators. Retrieved March 9, 2023, from <https://www.ceres.org/sites/default/files/reports/2020-06/Financial%20Regulators%20FULL%20FINAL.pdf>
- Chandran, M. C., Sathiyabama, B., & Santhoshkumar, N. (2023). Sustainable banking: A literature review and bibliometric analysis. *International Journal of Banking, Risk and Insurance*, 12(1), 2024.
- Churchill, G. (1979). A paradigm for developing measures of marketing constructs. *Journal of Marketing Research*, 161, 64–73.
- CNseg. (2024). Confederação Nacional das Seguradoras. Volume de indenizações de seguros no Rio Grande do Sul chega a quase R\$ 4 bilhões. Retrieved June 1, 2024, from <https://cnseg.org.br/noticias/volume-de-indenizacoes-de-seguros-no-rio-grande-do-sul-chega-a-quase-r-4-bilhoes>
- Committee of Sponsoring Organizations (COSO) and World Council for Sustainable Development (WBCSD). (2018). Enterprise risk management: applying enterprise risk management to environmental, social and governance-related risks. Retrieved December 8, 2023, from <https://wbcsd.secure.force.com/CampaignSubscriptionPage?id=7010N0000011RPE>
- Defensoria, M. G. (2023). Quatro anos depois, DPMG ultrapassa 25 mil atendimentos a pessoas atingidas pelo rompimento da barragem em Brumadinho. Retrieved July 8, 2024, from <https://defensoria.mg.def.br/quatro-anos-depois-defensoria-de-minas-ja-fez-mais-de-25-mil-atendimentos-a-pessoas-atingidas-pelo-rompimento-da-barragem-em-brumadinho-2/>
- DeVellis, R. F. (1991). *Scale development: Theory and application. Applied social research methods series, vol. 26*. Newbury Park, CA: Sage Publications.
- Dorfleitner, G., Halbritter, G., & Nguyen, M. (2015). Measuring the level and risk of corporate responsibility - An empirical comparison of different ESG rating approaches. *Journal of Asset Management*, 16, 450–466 2015. doi:<https://doi.org/10.1057/jam.2015.31>
- European Banking Authority (EBA). (2018). EBA Report on management and supervision of ESG risks for credit institutions and investment firms. EBA/REP/2021/18. Retrieved January 19, 2023, from [https://www.eba.europa.eu/sites/default/documents/files/document\\_library/Publications/Reports/2021/1015656/EBA%20Report%20on%20ESG%20risks%20management%20and%20supervision.pdf](https://www.eba.europa.eu/sites/default/documents/files/document_library/Publications/Reports/2021/1015656/EBA%20Report%20on%20ESG%20risks%20management%20and%20supervision.pdf)
- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Boston, MA: Pitman.
- Friedman, M. (1970). The social responsibility of business is to increase its profits. *The New York Times Magazine*, September 13, 122–126.
- Gatzert, N., Reichel, P., & Zitzmann, A. (2020). Sustainability risks & opportunities in the insurance industry. *Zeitschrift für die gesamte Versicherungswissenschaft*, 109, 311–331. 2020. doi:<https://doi.org/10.1007/s12297-020-00482-w>
- Giese, G., Lee, L., Melas, D., Nagy, Z. Z., & Nishikawa, L. (2019). Foundations of ESG investing: how ESG affects equity valuation, risk, and performance. *Journal of Portfolio Management*, 455, 69–83. doi:<https://doi.org/10.3905/jpm.2019.45.5.069>
- Hair, Jr., J., Black, W., Babin, B., & Anderson, R. (2009). *Multivariate data analysis* (7<sup>th</sup> ed.). Upper Saddle River, NJ: Prentice Hall.
- Henderson, R. (2020). *Reimagining capitalism in a world on fire*. New York: Public Affairs.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43, 115–135.
- Huang, Q., Li, Y., Lin, M., & McBrayer, G. A. (2022). Natural disasters, risk salience, and corporate ESG disclosure. *Journal of Corporate Finance*, 72, 102152. doi:<https://doi.org/10.1016/j.jcorpfin.2021.102152>
- International Insurance Society (IIS). (2021). The ESG agenda and insurance. Retrieved March 9, 2023,

- from <https://www.internationalinsurance.org/sites/default/files/2021-04/ESG%20Agenda%20and%20Insurance%204.12.2021.pdf>
- Johnson, H. (1971). *Business in contemporary society: Framework and issues*. Belmont, CA: Wadsworth Publishing Company.
- Kaiser, L. (2020). ESG integration: Value, growth and momentum. *Journal of Asset Management*, 21(1), 32–51. doi:<https://doi.org/10.1057/s41260-019-00148-y>
- Khovrak, I. (2020). ESG-driven approach to managing insurance companies' sustainable development. *Insurance Markets and Companies*, 111, 42–52. doi:<https://doi.org/10.21511/ins.111.2020.05>
- Kline, R. (1998). *Principles and practices of structural equation modeling*. New York, NY: Guilford Press.
- Koh, H. K., Burnasheva, R., & Suh, Y. G. (2022). Perceived environmental, social, governance and consumers' responses: The mediating role of brand credibility, brand image, and perceived quality. *Sustainability*, 14, 4515. doi:<https://doi.org/10.3390/su14084515>
- Landry, C., & Turner, D. (2020). Risk perceptions and flood insurance: insights from homeowners on the Georgia coast. *Sustainability*, 12(24), 10372. doi:<https://doi.org/10.3390/su122410372>
- Lee, C.-Y., Chang, W. -C. and Lee, H.-C. (2017). An investigation of the effects of corporate social responsibility on corporate reputation and customer loyalty – evidence from the Taiwan non-life insurance industry. *Social Responsibility Journal*, 13(2), 355–369. doi:<https://doi.org/10.1108/SRJ-01-2016-0006>
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 22, 140–155.
- Luiz. (2022, December 5). Últimas notícias. *InfoMoney*. Retrieved from <https://www.infomoney.com.br/busca/?q=M%26A+em+seguros+no+Brasil>
- Marcoux, B. (2021). The ESG agenda and insurance regulatory developments, goals and limitations. Retrieved January 23, 2023, from <https://www.internationalinsurance.org/sites/default/files/2021-04/ESG%20Agenda%20and%20Insurance%204.12.2021.pdf>
- Mendes-Da-Silva, W., Lucas, E. C., & De França Carvalho, J. V. (2021). Flood insurance: The propensity and attitudes of informed people with disabilities towards risk. *Journal of Environmental Management*, 294, 113032. doi:<https://doi.org/10.1016/j.jenvman.2021.113032>
- Monteiro, M. H., & Galiza, F. (2022). Mulheres no mercado de seguros no Brasil. Retrieved January 20, 2023, from [https://ens.edu.br:81/arquivos/Estudo\\_ENS\\_Mulheres\\_no\\_Mercado\\_de\\_Seguros\\_2022.pdf](https://ens.edu.br:81/arquivos/Estudo_ENS_Mulheres_no_Mercado_de_Seguros_2022.pdf)
- MSCI. (2022). ESG and climate trends to watch for 2023. Retrieved February 6, 2023, from <https://www.msci.com/documents/1296102/35124068/ESG+and+Climate+Trends+to+Watch+for+2023.pdf>
- National Insurance Confederation (CNseg). (2022a). Confederação Nacional das Seguradoras. CNseg em ação. Retrieved January 19, 2023, from <https://cnseg.org.br/publicacoes?categoria=CNseg%20em%20A%C3%A7%C3%A3o>
- National Insurance Confederation (CNseg). (2022b). Confederação Nacional das Seguradoras. Relatório de Sustentabilidade do Setor de Seguros 2022. Retrieved December 18, 2023, from <https://cnseg.org.br/noticias/c-nseg-lanca-a-8-edicao-de-seu-relatorio-de-sustentabilidade-do-setor-de-seguros>
- National Insurance Confederation (CNseg). (2024). Confederação Nacional das Seguradoras. Ranking do Setor de Seguros. Volume de indenizações de seguros no Rio Grande do Sul chega a quase R\$ 4 bilhões. Retrieved June 1, 2024, from <https://cnseg.org.br/noticias/volume-de-indenizacoes-de-seguros-no-rio-grande-do-sul-chega-a-quase-r-4-bilhoes>
- National Insurance Confederation (CNseg). (2024). Confederação Nacional das Seguradoras. Ranking do Setor de Seguros. Retrieved July 15, 2024, from <https://cnseg.org.br/noticias/volume-de-indenizacoes-de-seguros-no-rio-grande-do-sul-chega-a-quase-r-4-bilhoes>
- Nayak, R., & Venkatraman, S. (2011). Does the business size matter on corporate sustainable performance? The Australian business case. *World Review of Entrepreneurship, Management and Sustainable Development*, 7(3), 281. doi:<https://doi.org/10.1504/wremsd.2011.040810>
- Nobanee, H., Alqubaisi, G. B., Alhameli, A., Alqubaisi, H., Alhammadi, N., Almasahli, S. A., & Wazir, N. (2021). Green and sustainable life insurance: A bibliometric review. *Journal of Risk and Financial Management*, 14(11), 563. doi:<https://doi.org/10.3390/jrfm14110563>
- Nobanee, H., Dilshad, M. N., Lamdi, O. A., Ballool, B., Dhaheri, S. A., AlMheiri, N., Alyammahi, A., &

- Alhemeiri, S. S. (2022). Insurance for climate change and environmental risk: A bibliometric review. *International Journal of Climate Change Strategies and Management*, 14(5), 440–461. doi:<https://doi.org/10.1108/IJCCSM-08-2021-0097>
- Nogueira, F. G., Lucena, A. F. P., & Nogueira, R. (2018). Sustainable insurance assessment: Towards an integrative model. *The Geneva Papers on Risk & Insurance Issues Practice*, 43, 275–299. doi:<https://doi.org/10.1057/s41288-017-0062-3>
- Organisation for Economic Cooperation and Development. (2022). OECD insurance statistics 2021. Retrieved January 20, 2023, from [https://read.oecd-ilibrary.org/finance-and-investment/oecd-insurance-statistics-2021\\_841fa619-en#page179](https://read.oecd-ilibrary.org/finance-and-investment/oecd-insurance-statistics-2021_841fa619-en#page179)
- Porter, M. E., & Kramer, M. R. (2018). Creating shared value: how to reinvent capitalism and unleash a wave of innovation and growth. In *Managing Sustainable Business: An Executive Education Case and Textbook* (pp. 323–346). Dordrecht: Springer Netherlands.
- Principles for Sustainable Insurance. (n. d.). Principles for Sustainable Insurance–United Nations Environment–Finance Initiative. Retrieved from <https://www.unepfi.org/insurance/insurance/>
- Principles for Sustainable Insurance. (2021). Insuring the climate transition. Enhancing the insurance industry’s assessment of climate change futures. Retrieved January 19, 2023, from <https://www.unepfi.org/psi/wp-content/uploads/2021/01/PSI-TCFD-final-report.pdf>
- Pugnetti, C., Gebert, T., Hürster, M., Huizenga, E., Moor, M., Stricker, L., Winistörfer, H., Zeier, A. R. (2022). Leading the green insurance revolution. *ZHAW: Zürcher Hochschule für Angewandte Wissenschaften*. Retrieved March 9, 2023, from [https://digitalcollection.zhaw.ch/bitstream/11475/24234/3/2022\\_Pugnetti-etal\\_Leading-the-Green-Insurance-Revolution.pdf](https://digitalcollection.zhaw.ch/bitstream/11475/24234/3/2022_Pugnetti-etal_Leading-the-Green-Insurance-Revolution.pdf)
- Reclame AQUI (2019). Comparador de empresas: Qual é a melhor? Retrieved from <https://www.reclameaqui.com.br/compare/>
- Redação (2022, January 17). 5 maneiras como Insurtech contribui para a sustentabilidade ambiental. Retrieved from <https://www.insurtech.com.br/seguros/5-manieras-como-insurtech-contribui-para-a-sustentabilidade-ambiental/>
- Regan, Á. (2019). Smart farming in Ireland: A risk perception study with key governance actors. *NJAS: Wageningen Journal of Life Sciences*, 90–91(1), 1–10. doi:<https://doi.org/10.1016/j.njas.2019.02.003>
- Salvador, M. D. A., & Brito, J. I. B. (2018). Trend of annual temperature and frequency of extreme events in the MATOPIBA region of Brazil. *Theoretical & Applied Climatology*, 133, 253–261 2018. doi:<https://doi.org/10.1007/s00704-017-2179-5>
- Scholten, B. (2011). Corporate social responsibility in the international insurance industry. *Sustainable Development*, 192, 143–156. doi:<https://doi.org/10.1002/sd.513>
- Scordis, N., Suzawa, Y., Zwick, A., & Ruckner, L. (2014). Principles for sustainable insurance: Risk management and value. *Risk Management and Insurance Review*, 172, 265–276.
- Shea, M., & Hutchin, J. (2013). The insurance industry must champion sustainability. *Thunderbird International Business Review*. doi:<https://doi.org/10.1002/tie.21582>
- Shea, M., & Hutchin, J. W. (2018). The importance of environmental, social, and Governance risks to surety underwriters. *Asia-Pacific Journal of Risk and Insurance*, 12, 20170016.
- Sonnenberger, D., & Weiss, G. N. F. (2021, January 11). The impact of corporate social responsibility on firms’ exposure to tail risk: The case of insurers. Retrieved January 26, 2023, from <https://ssrn.com/abstract=3764041> or doi:<http://dx.doi.org/10.2139/ssrn.3764041>
- Souza, D. C., & Silva, R. (2021). Ocean-land atmosphere model OLAM performance for major extreme meteorological events near the coastal region of southern Brazil. *Climate Research*, 84, 1–21. doi:<https://doi.org/10.3354/cr01651>
- Statista. (2022). Total assets of insurance companies worldwide from 2002 to 2021. Retrieved January 21, 2023, from <https://www.statista.com/statistics/421217/assets-of-global-insurance-companies/>
- Stricker, L., Pugnetti, C., Wagner, J., & Röschmann, A. Z. (2022). Green insurance: A roadmap for executive management. *Journal of Risk and Financial Management*, 15, 221. doi:<https://doi.org/10.3390/jrfm15050221>
- Sunelwala, H., Mehta, V., Gandhi, V., & Chhajer, P. (2022). Combining ESG risk ratings and fundamentals of

- companies for better investing. *Journal of Commerce and Accounting Research*, 11(2), 18–24. Retrieved from <https://mail.i-scholar.in/index.php/jcar/article/view/213382>
- Sung, Y. H., Lim, R. E., & Lee, W. N. (2022). Does company size matter in corporate social responsibility? An examination of the impact of company size and cause proximity fit on consumer response. *International Journal of Advertising*, 41(2), 284–308.
- Superintendence of Private Insurance (SUSEP). (n. d.) SES – Sistema de estatísticas da SUSEP. Retrieved February 3, 2023, from <https://www2.susep.gov.br/menuestatistica/ses/principal.aspx>
- Superintendence of Private Insurance (SUSEP). (2022). Circular SUSEP Nº 666, de 27 de Junho de 2022. Retrieved January 21, 2023, from <https://www2.susep.gov.br/safe/scripts/bnweb/bnmapi.exe?router=upload/26128>
- Superintendence of Private Insurance (SUSEP). (2023). Manual de Orientação—Tabelas Relatório de Sustentabilidade—Provisões Técnicas—Orientações da Susep ao Mercado. Retrieved December 12, 2023, from <https://www.gov.br/susep/pt-br/arquivos/arquivos-regulacao-prudencial/manual-tabelas-de-sustentabilidade-versao-abr23-e-vigencia-abr23.pdf>
- Swiss Re (2022a). Global insurance premiums to exceed \$7 trillion in 2022, says Swiss Re. Retrieved January 19, 2023, from <https://www.reinsurancene.ws/global-insurance-premiums-to-exceed-7-trillion-in-2022-says-swiss-re/>
- Swiss Re. (2022b). World Insurance in 2018: world insurance: Inflation risks front and centre. *Sigma*, 4, 2020. Retrieved January 19, 2023, from <https://www.swissre.com/dam/jcr:4500fe30-7d7b-4bc7-b217-085d7d87a35b/swiss-re-institute-sigma-4-2022.pdf>
- Swiss Re. (2022c). Hurricane Ian drives natural catastrophe year-to-date insured losses to US\$115 billion, Swiss Re Institute estimates. Retrieved March 19, 2023, from [https://www.swissre.com/press-release/Hurricane-Ian-drives-natural-catastrophe-year-to-date-insured-losses-to-US\\$-115-billion-Swiss-Re-Institute-estimates/2ab3a681-6817-4862-8411-94f4-b8385cee](https://www.swissre.com/press-release/Hurricane-Ian-drives-natural-catastrophe-year-to-date-insured-losses-to-US$-115-billion-Swiss-Re-Institute-estimates/2ab3a681-6817-4862-8411-94f4-b8385cee).
- Task Force on Climate Related Financial Disclosures (TCFD). (2017). Implementing the recommendations of the task force on climate-related financial disclosures. Retrieved January 15, 2023, from <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Annex-Amended-121517.pdf>
- Task Force on Climate Related Financial Disclosures (TCFD). (2022). About the task force on climate-related financial disclosures task force on climate-related financial disclosures. Retrieved January 15, 2023, from <https://www.fsb-tcfd.org/about/>
- United Nations Environment Programme Financial Initiative (UNEPFI). (2009). The global status of sustainable insurance. Retrieved January 26, 2023, from [https://www.unepfi.org/fileadmin/documents/global-state-of-sustainable-insurance\\_01.pdf](https://www.unepfi.org/fileadmin/documents/global-state-of-sustainable-insurance_01.pdf)
- United Nations Environment Programme Financial Initiative (UNEPFI). (2012). PSI principles for sustainable insurance. Retrieved January 15, 2023, from <http://www.unepfi.org/psi/wp-content/uploads/2012/06/PSI-document.pdf>
- United Nations Environment Programme Financial Initiative (UNEPFI). (2018). Rio declaration on climate risk transparency by the Brazilian insurance industry. Retrieved February 9, 2023, from <https://www.unepfi.org/psi/wp-content/uploads/2018/05/Rio-declaration-on-climate-risk-transparency-English.pdf>
- United Nations Environment Programme Financial Initiative (UNEPFI). (2021). Net-Zero Insurance Alliance. Retrieved January 15, 2023, from <https://www.unepfi.org/industries/insurance/global-insurance-and-reinsurance-leaders-establish-alliance-to-accelerate-transition-to-net-zero-emissions-economy/>
- Vale chega a acordo definitivo com o Poder Público no Brasil para a reparação integral do rompimento da barragem de Fundão da Samarco. (n.d.). Vale. <https://www.vale.com/pt/w/acordo-mariana>
- Xhafa, F. (2023). ESG scores impact on US insurance companies' financial performance. Retrieved June 15, 2024, from [https://digitalcommons.sacredheart.edu/cgi/viewcontent.cgi?article=1036&context=wcob\\_theses](https://digitalcommons.sacredheart.edu/cgi/viewcontent.cgi?article=1036&context=wcob_theses).
- Yu, T., Chang, Y., Chang, I., & Yu, T. (2019). A pro-environmental behavior model for investigating the roles of social norm, risk perception, and place attachment on adaptation strategies of climate change. *Environmental Science and Pollution*

*Research*, 2624, 25178–25189. doi:<https://doi.org/10.1007/s11356-019-05806-7>

Ziolo, M. (Ed.). (2020). *Finance and sustainable development: Designing sustainable financial systems*. Routledge.

Zona, R., Roll K., & Law, Z. (2014). Sustainable/green insurance products. *Casualty Actuarial Society E-Forum*, Winter 2014. Retrieved March 15, 2023, from [https://www.casact.org/sites/default/files/database/forum\\_14wforum\\_zona\\_roll\\_law.pdf](https://www.casact.org/sites/default/files/database/forum_14wforum_zona_roll_law.pdf)