



Sustainable investing in the US and European insurance industry: a text mining analysis

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Abstract

This paper uses a text mining analysis to study the development of sustainable investing in the European and US insurance industry as reflected in their public reports from 2013 to 2018. The sample comprises 1215 annual, sustainability- and investment-related documents of 77 firms. We develop a dictionary with principles, criteria and terminologies as well as strategies, and differentiate between the quality of reports. Our results show that the number of firms referring to as well as the word count related to sustainable investing substantially increase over the sample period, and that insurers reporting about sustainable investing are on average significantly larger. We also find that European insurers report much more extensively on their sustainable investment practices as compared to US insurers in our sample. Most relevant in 2018 are references to general *ESG* criteria, followed by *responsible investment* and the *Sustainable Development Goals*. Top strategies mentioned were *ESG integration* and *impact investing*, whereby we observe that insurers evolve from mentioning one single towards multiple strategies over time. Finally, a regression analysis does not show a value-effect of sustainable investment-related keywords in reporting on Tobin's *Q*, which may be due to the rather long-term investment perspective.

Keywords Sustainable investing · Environmental, social and governance (ESG) · Text mining

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Introduction

In recent years, sustainable investment approaches have become increasingly important, as also reflected in more than USD 35 trillion sustainable investments globally at the beginning of 2020.¹ In this context, e.g. the UN-backed network “Principles for Responsible Investment” (PRI) with its about 3000 signatories with more than USD 100 trillion in assets under management in 2020 strongly promotes the incorporation of environmental, social and governance (ESG) criteria in the investment process.² The majority of the literature thereby suggests that investors can potentially benefit in terms of attractive long-term investment returns and enhanced risk management,³ whereby most studies seem to make use of specific (and mostly external) data sources to identify sustainable investment activities.⁴ Moreover, specifically for Europe, reporting requirements with respect to sustainability issues and sustainable investments are increasingly regulated, e.g. by the EU Directive 2014/95/EU on enhanced non-financial reporting as well as the EU Directive 2016/2341 for pension funds and life insurers with respect to accounting for ESG criteria in their business organization and reporting. One driving factor is also the ambitious sustainable finance-related Action Plan introduced by the European Commission (2018) to improve reporting, amongst other aspects.⁵ In the US, in contrast, only the SEC’s (2010) guidance document on disclosing issues related to climate change seems to be one of the few comparable (and in this case rather topic-specific) regulations. As insurance companies are among the largest institutional investors with an asset volume of about EUR 10 trillion in Europe alone,⁶ and given that Europe and the US are the two largest sustainable investment markets,⁷ their approach to sustainable investing should be of great interest for various stakeholders. However, the investment policy of institutional investors is still largely unexplored, as pointed out by Cunha et al. (2021).

Against this background, the aim of this paper is to contribute to the literature by providing a detailed study of sustainable investing in the European and US insurance

¹ This represents more than one third of all assets being managed by investment professionals from the regions included by the Global Sustainable Investment Alliance (GSIA 2021).

² See <https://www.unpri.org/download?ac=10948>, accessed 09 Jul 2021.

³ See, e.g., Margolis and Walsh (2003), Malik (2015), Brooks and Oikonomou (2018), USSIF (2018).

⁴ The impact of taking into account sustainability or ESG factors in asset management on financial performance has been extensively researched as well (see, e.g., Revelli and Viviani 2015, for a review). Besides focusing on firm- and investment- or portfolio-levels, an increasing number of articles also specifically focuses on institutional investors (see, e.g., Bengtsson 2008; Scholtens and Sievänen 2013; Dyck et al. 2019).

⁵ The European Commission’s (2018, p. 2) “Action Plan: Financing Sustainable Growth” aims to “1. reorient capital flows towards sustainable investment in order to achieve sustainable and inclusive growth; 2. manage financial risks stemming from climate change, resource depletion, environmental degradation and social issues; and 3. foster transparency and long-termism in financial and economic activity”. With regard to the second point, the Solvency II review and its potential contribution is explicitly mentioned in this context, for instance.

⁶ See <https://www.insuranceurope.eu/statistics>, accessed 09 Jul 2021.

⁷ According to the GSIA (2021), Europe and the US account for more than 80% of all sustainably invested assets on a global scale from 2018 to 2020.



industry, as reflected in insurers' public reports from 2013 to 2018. To conduct such an in-depth analysis, we first develop a sustainable investing keyword dictionary and then use a text mining approach applied to annual, sustainability- and investment-related reports and documents. Our sample comprises 77 large-cap European and US insurance companies with a market capitalization share of about 56% of the initial sample, retrieved from Refinitiv Eikon and Datastream. This results in 1215 annual, sustainability- and investment-related reports and documents based on which we aim to gain insight regarding sustainable investing of European and US insurers. The application of the text mining approach avoids reliance on external data providers, while capturing minor and major prevalent principles, criteria, terminologies and strategies in this context for a large number of firms. We thus contribute to the ongoing discussion in the academic and practitioner-oriented literature on sustainable investing and provide a first in-depth reporting-based analysis of the development and status in the insurance industry as a major (sustainable) institutional investor.

The remainder of this paper is structured as follows. Section “[Data sample](#)” presents the data sample; Sect. “[Methodology](#)” describes the text mining approach with the developed sustainable investment dictionary; Sect. “[Results](#)” presents the results; and Sect. “[Summary](#)” concludes.

Data sample

We use the Refinitiv Eikon database and start with all firms from the Thomson Reuters Business Classification (TRBC) sector ‘Insurance’ located in the European Union (including the UK) and the US with an available market capitalization at the end of 2018 in Datastream. As publicly traded companies are more likely to report their sustainable investment approach, we consider large cap firms with more than USD 1 billion market capitalization in 2018 and emitted ordinary shares. Finally, we exclude nine firms with a missing market capitalization in Datastream between 2013 and 2018 and one insurer with a missing annual report. We also check their business description in their annual reports, amongst others, and exclude insurance brokers, for instance.⁸ This approach leads to 48 US and 29 European insurance companies with a total market capitalization of USD 884 billion, representing 56.4% of the market capitalization of the initial sample.

We use a text mining approach to identify whether insurance companies report about sustainable investing starting from 2013 to 2018, which is based on (group) annual reports, reviews and summaries (Annual Reporting “AR”) and sustainability

⁸ We exclude four insurance brokers (Aon PLC, Willis Towers Watson PLC, Arthur J Gallagher & Co and Brown & Brown Inc), one professional services firm including insurance brokerage (Marsh & McLennan Companies Inc), two conglomerates (Berkshire Hathaway Inc and Loews Corp) and one firm with a missing annual report in English (Wuestenrot & Wuerttembergische AG) from the final sample as well. Note that the exclusion of Berkshire Hathaway Inc has a large impact on the remaining market share of our sample with a market capitalization of USD 502 billion in 2018, which represents around one third of the initial sample.



reports (Sustainability Reporting “SR”). Besides the AR and SR categories, further reports, presentations, documents and policies related to corporate social responsibility (CSR), ethics or to the sustainable investment approach introduced by insurers represent a third category in this analysis (Sustainability-, Investment-related and Others “SIO”). As these (unaudited) documents may be less reliable concerning the quality of information compared to AR and SR, we consider the SIO category in additional analyses in the Appendix. The majority of these files is available on corporate websites in PDF format and are related to the six-year sample period 2013–2018.⁹ ‘Annual’ and ‘ESG Disclosure’ filings are reviewed in the Refinitiv Eikon database for each company as well. The SEC’s EDGAR platform is also used to search for missing forms and amendments.¹⁰

Furthermore, in line with studies examining CSR disclosures (see, e.g., Dhaliwal et al. 2011), we screen the following external sources for supplementary reports and documents: the Global Reporting Initiative (GRI) Sustainability Disclosure Database, CorporateRegister.com, the UN Global Compact participants archive (‘Communication on Progress’) as well as the disclosures of signatory companies of the Principles for Sustainable Insurance (PSI). An internet search using the first three Google pages is additionally performed for SR and SIO documents of the considered firms, e.g. including the keywords “responsible”, “investment”, “policy” or document names, if it is not clear whether a firm published it for a given year.¹¹ We do not consider stand-alone reports and documents published by asset managers (possible disclaimer issues), related to the Climate Risk Disclosure Survey (regionally limited), the Carbon Disclosure Project, PRI Transparency reports as well as

⁹ Sustainability reports are considered as an additional information source possibly extending annual reports and 10-K forms (see Dhaliwal et al. 2011). Typical labels for this kind of report are, for instance, Corporate (Social) Responsibility Report, Integrated Report, GRI Table or Content Index, Corporate Citizenship Report, ESG Report or Sustainability Report. The inclusion of a (reporting package of) document(s) in the SR category is based on the name of the report as well as on information from the corporate websites and external sources. Policies or certain statements from the SIO category, which had been published before 2013 or in one of the sample years, are assumed either to be in place in the following year(s) until the last sample year or until a new or updated version is found for the specific insurance company. A missing or non-recurring consideration would affect the reproduction of the actual investment strategies of the firms.

¹⁰ A large number of US firms publishes comprehensive annual reports, which typically consist of an annual letter to the shareholders, financial highlights and (content of) the 10-K form. Alternatively, a short annual report, review or a stand-alone letter is prepared without the 10-K form. We primarily include comprehensive annual reports or at least 10-K forms and add further (qualitative) reports for US insurers, if applicable.

¹¹ As a clear reporting period or publication date is not always available or straightforward, we look at the document for information regarding the period or date as well as at the databases. If we do not find a clear statement, we search for further indicators (e.g. document name, copyright date, (financial) data, references from or to other documents). The year allocation is also based on the company- or document-specific publication cycle. In most of the cases, we allocate the documents to one single year, based on the aforementioned approach. However, while annual reports are always published for and assigned to one single year, other reports and documents may focus on multiple years, e.g. considering the years 2015 and 2016. In specific cases, we thus assign the document to two years, if, for instance, both years are (partially) covered by the document and a publication cycle is not available or being the last report within a cycle (e.g. four out of 250 documents from the SR category are used in more than one year in line with this approach).



summary sheets with key performance indicators (KPI) or Yes/No questions (inconvenient (query-response) structure). Strategic documents with focus beyond the sample period (forward-looking) and snapshots from corporate websites (problematic traceability and classification), created by and available in the Refinitiv Eikon ESG database (e.g. ‘ESG Web-based Reporting’), are also not included in the analysis. While either an annual report or a 10-K form must be available for each company and year, sustainability reporting is not a prerequisite in order to remain in the sample.¹²

This approach leads to a total number of 619 documents in the AR category (e.g. form-10K/A, (financial or annual) reviews, management reports, annual letters, especially relevant for US insurers) and 250 files in the SR category. The SIO category comprises 346 documents used for additional analyses in the Appendix. Hence, 1215 files are considered in total, including 131 copies of documents or policies in line with the aforementioned approach. Table 6 in the Appendix summarizes the data collection approach and the number of reports and documents per category and region.

Methodology: a text mining approach

We use the data mining software RapidMiner, which allows us to evaluate a large number of reports with a reduced error susceptibility and a standardized procedure by considering root words,¹³ while introducing other constraints such as paraphrasing or syllabification (see Heidinger and Gatzert 2018). Corrupted documents as well as a possible non-consideration of relevant context or punctuation represent further limitations. Besides examining the development over time in terms of absolute numbers, the text mining tool also enables us to take into account the development in relation to the total amount of words per report and in relation to all references to investments as is similarly done in Heidinger and Gatzert (2018) with an application to reputation risk management.

A multitude of terminologies and approaches has emerged in the literature capturing different perceptions of investing in a sustainable manner (see, e.g., Sandberg et al. 2009).¹⁴ In line with GSIA (2019, p. 3) as the global network of

¹² In contrast to annual reports with due dates, firms (sometimes) tend to publish sustainability-related reports and documents with (substantial) delay. Moreover, as our sample shows, some firms even combine multiple years in one sustainability report. We thus use 2018 as our cut-off year in order to provide a high level of consistency with the aim to reduce data availability bias, i.e. missing reports and documents for firms in the sample (specifically in the SR and SIO category), together with our comprehensive data collection approach.

¹³ ‘Stemming’ as process to generate root words is applied on the following words: ‘invest’, ‘sustain’, ‘integ’, ‘excl’, ‘engag’, ‘screen’, ‘bond’, ‘norm’, ‘approach’, ‘incorp’, ‘principle’, ‘responsibl’, ‘value’, ‘ethical’, ‘goal’, ‘income’ and ‘return’. These words are examined in combination with other words, such as ‘green’ ‘bond’ or ‘sustain’ ‘invest’.

¹⁴ For instance, while the *PRI*-promoted concept and term *responsible investment* does not require a moral return and is defined “as a strategy and practice to incorporate [...] [ESG] factors in investment decisions and active ownership” (<https://www.unpri.org/download?ac=10223>, accessed 21 Jun 2021), practitioners and academics claim that *socially responsible investments*, for instance, consider



sustainable investment organizations, we define *sustainable investing* as a generic concept encompassing all other linked terms, strategies and concepts such as *socially responsible investing* and *responsible investing* and which includes *ESG* criteria in the investment management and selection (see also GSIA 2021). As we study European and US insurance companies, we mainly revert to the relevant and most recent publications of the respective investment forums¹⁵ on the status of sustainable investing, which also offer definitions on sustainable investment strategies (see Eurosif 2018; USSIF 2018, 2020; GSIA 2019, 2021). Moreover, we also take into account the definitions of the PRI Association (2018) as well as academic publications from the research field. With regard to the latter, this also includes literature reviews and publications on emerging themes in the sustainable investment context (see, e.g., Inderst and Stewart 2018; Talan and Sharma 2019; Daugaard 2020).

Based on this, Table 1 summarizes our sustainable investment dictionary with important principles, criteria and terminologies as well as strategies from the sustainable investment theory and practice by offering the respective keyword(s), a contextual definition and the related source(s). As can be seen from Table 1, some terms have a different but still somewhat close interpretation according to the respective sources (e.g. *sustainable investment*, *sustainable and responsible investment*, *responsible investment*), which is why we later also provide aggregate statistics. While our dictionary generally matches with the previously mentioned publications, it still represents a selection of keywords and will thus not be fully exhaustive. Moreover, we do not consider the large variety of specific ESG- or sustainability-related themes and issues (e.g. “renewable energy” or “diversity”) or generic words that are frequently used in reporting or in a different context (e.g. “long-term investing” or “divesting”). We also exclude words and concepts with different meanings, such as “community investment” in the *impact investment* context (see, e.g., Tsang et al. 2009; Rowe et al. 2014; GSIA 2019).

Before we aggregate the counts of the keywords for each strategy and terminology as well as for the principles and criteria from Table 1, we perform a subtraction of double counts.¹⁶ We also identify three common wordings (“impact investment income”, “impact investment returns” and “sustain investment income”), in particular in the context of US firms, which would lead to false positive results for *impact investing* and *sustainable investment*, respectively, and are thus subtracted. Within the scope of the *engagement* strategy, *active ownership* represents another issue that has to be considered in more detail, as it is used as a *Sector specific Aspect* for the financial services sector in the *Social Category* (*Sub Category: Product*

Footnote 14 (continued)

moral aspects as a possible fourth dimension (see, e.g., Hebb et al. 2014). Following the PRI Association (2018), the *ESG* criteria refer to issues on the status and resilience of environment and nature (E), on social and civic rights, concerns and prosperity (S) as well as on corporate governance on investment level (G).

¹⁵ The major objective of these investment forums is to promote sustainable investing in their respective region (see Eurosif 2018; USSIF 2018).

¹⁶ For instance, the term ‘principle* for responsibl* invest*’ encloses ‘responsibl* invest*’. As the latter also includes the counts for the *PRI* term, the ‘responsibl* invest*’ count is adjusted, respectively.



Table 1 Overview and categorization of the sustainable investment dictionary with relevant principles, criteria and terminologies as well as strategies in the sustainable investment context

Principles/criteria/term/strategy	Keyword(s) for text mining	Definition	Source(s)
(a) Principles, criteria and terminologies in the sustainable investment context			
Principles for Responsible Investment (PRI)	<ul style="list-style-type: none"> • principle* for responsib]* invest* • un pri • unpri 	<p>“The six Principles for Responsible Investment [introduced in 2006] offer a menu of possible actions for incorporating ESG issues into investment practice”³⁴</p>	(see, e.g., PRI Association 2018; Gatzert et al. 2020)
Principles for Sustainable Insurance (PSI)	<ul style="list-style-type: none"> • principle* for sustain* insurance 	<p>“[T]he Principles are a framework for the global insurance industry to address environmental, social and governance risks and opportunities” (published in 2012)</p>	(UNEP FI 2012, p. 1)
Sustainable Development Goals (SDGs)	<ul style="list-style-type: none"> • sustain* development goal* • sdfs 	<p>“The [17] Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice”³⁵ (officially introduced in 2015)</p>	(see, e.g., USSIF 2018)
Environmental, social and governance (ESG)	<ul style="list-style-type: none"> • environmental social ((and) corporate) governance 	<p>ESG criteria refer to issues on the status and resilience of environment and nature (E), on social and civic rights, concerns and prosperity (S) as well as on corporate governance on investment level (G)</p>	(see PRI Association 2018)
ESG incorporation	<ul style="list-style-type: none"> • environmental social ((and) corporate) governance incorp* • incorp* (of) environmental social ((and) corporate) governance • esg incorp* • incorp* (of) esg 	<p>“[T]he review and use of ESG information in the investment decision-making process”³⁶</p>	(PRI Association 2018, p. 5)



Table 1 (continued)

Principles/criteria/term/strategy	Keyword(s) for text mining	Definition	Source(s)
ESG investing	<ul style="list-style-type: none"> environmental social ((and) corporate) governance invest* esg invest* 	Wide range of various investment concepts aligned with different investment goals, which can be broadly divided into ESG integration (enhanced risk-return portfolio characteristics), values-based investing (consideration of moral aspects in the portfolio management) and impact investing (investments with positive environmental or social change)	(see Giese et al. 2019)
Responsible investment	<ul style="list-style-type: none"> responsibl* invest* invest* responsibl* 	"The PRI defines responsible investment as a strategy and practice to incorporate environmental, social and governance (ESG) factors in investment decisions and active ownership" ^d	(see, e.g., Hebb et al. 2014)
Socially responsible investment	<ul style="list-style-type: none"> socially responsibl* invest* invest* socially responsibl* 	Socially responsible investing combines the implementation of ESG criteria together with moral or ethical aspects as a possible fourth dimension in the investment process	(see, Sandberg et al. 2009; Hebb et al. 2014; Majjoch et al. 2017)
Sustainable investment	<ul style="list-style-type: none"> sustain* invest* invest* sustain* 	"Sustainable investing is an investment approach that considers environmental, social and governance (ESG) factors in portfolio selection and management"	(GSIA 2019, p. 3)
Sustainable and responsible investment	<ul style="list-style-type: none"> sustain* and responsibl* invest* invest* sustain* and responsibl* 	"Sustainable and responsible investment ("SRI") is a long-term oriented investment approach which integrates ESG factors in the research, analysis and selection process of securities within an investment portfolio. It combines fundamental analysis and engagement with an evaluation of ESG factors in order to better capture long term returns for investors, and to benefit society by influencing the behaviour of companies"	(Eurosif 2018, p. 12)
Green investment	<ul style="list-style-type: none"> green invest* invest* green 	There exists a large number of conceptions for green investment, from overall ESG considerations to green or thematic issues such as renewable energy ^e	(see Inderst et al. 2012)



Table 1 (continued)

Principles/criteria/term/strategy	Keyword(s) for text mining	Definition	Source(s)
Sustainable finance	<ul style="list-style-type: none"> ● sustain* finance 	<p>“For the Group, sustainable finance is about two imperatives. The first is to improve the contribution of finance to sustainable and inclusive growth as well as the mitigation of climate change. The second is to strengthen financial stability by incorporating environmental, social and governance (ESG) factors into investment decision-making.”</p>	(HLEG 2018, p. 6)
Other	<ul style="list-style-type: none"> ● ethical* invest* ● invest* ethical* ● sustain* responsibl* and impact invest* ● mission related invest* ● invest* mission related ● value* based invest* ● invest* value* based ● equator principle*^f 		(see, e.g., USSIF 2018, 2020)



Table 1 (continued)

Principles/criteria/term/strategy	Keyword(s) for text mining	Definition	Source(s)
(b) Sustainable investment strategies			
ESG integration	<ul style="list-style-type: none"> environmental social ((and) corporate) governance integ* integ* (of) environmental social ((and) corporate) governance esg integ* integ* (of) esg 	Extending and improving the investment analysis and decision processes by specifically and systematically including relevant ESG issues on portfolio as well as on investee level. It also encompasses asset classes such as fixed income and the effect of ESG factors on the credit rating ^g	(see, e.g., PRI Association 2018; USSIF 2018)
Screening			
ESG screening	<ul style="list-style-type: none"> environmental social ((and) corporate) governance screen* screen* (of/for) environmental social ((and) corporate) governance esg screen* screen* (of/for) esg 	Vaguely defined strategy, which can be understood as incorporating sustainability factors in the investment selection process as well as overall synonym for screening strategies	(see, e.g., Eurosif 2018; PRI Association 2018)
Negative screening	<ul style="list-style-type: none"> excl* of holdings from invest* universe excl* screen* negative excl* negative screen* 	Exclusion of specific products, operations, management practices, industries (e.g. coal or weapon industry) or regions from the investment universe characterized by ESG controversies and non-sustainability	(see Eurosif 2018; PRI Association 2018; USSIF 2018)
Positive/Best-in-class screening	<ul style="list-style-type: none"> positive screen* best in class approach* best in class invest* selection best in class screen* 	Consideration of investment targets with specific ESG performance or with the best ESG performance (no sector exclusion) based on products, operations, management practices, industries, regions and in comparison to peers of the target	(see Eurosif 2018; PRI Association 2018; USSIF 2018)
Norms-based screening	<ul style="list-style-type: none"> norm* based approach* norm* based excl* norm* based screen* 	Consideration (or exclusion) of investment targets complying with (or violating against) ESG-related norms and standards (on a certain level) such as labor standards or anti-corruption	(see Eurosif 2018; PRI Association 2018)



Table 1 (continued)

Principles/criteria/term/strategy	Keyword(s) for text mining	Definition	Source(s)
Sustainability themed investing	<ul style="list-style-type: none"> ● sustain* themed invest* ● invest* sustain* themed 	Investments or investment vehicles (funds or portfolios) with special focus on (single or several) ESG themes and sustainability such as diversity, renewables, low carbon, agriculture, water or waste management	(see, e.g., PRI Association 2018)
Engagement	<ul style="list-style-type: none"> ● active ownership ● active ownership and engag* ● collaborative engag* ● engag* and voting ● responsibl* ownership 	Dedication to initiate (collaborative) dialogue with (potential) investment targets or apply shareholder rights on ESG (disclosure) issues. Also referred to as active ownership. Other asset classes such as debt are considered as well	(see Eurosif 2018; PRI Association 2018; USSIF 2018)
Impact investing	<ul style="list-style-type: none"> ● impact invest* 	"Investment in companies, organizations and funds with the explicit intention to generate positive social and environmental impact alongside a financial return, which can range from below market to market rate" ^{rh}	(USSIF 2018, p. 13)
Green bonds	<ul style="list-style-type: none"> ● green bond* 	"Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects [...] and which are aligned with the four core components of the [Green Bond Principles]" ^{ri}	(ICMA 2021a, p. 3)
Social bonds	<ul style="list-style-type: none"> ● social bond* 	Same definition and components as green bonds, but (re-)financing social projects	(see ICMA 2021b)
Sustainability bonds	<ul style="list-style-type: none"> ● sustain* bond* 	Same definition and components as green and social bonds, but (re-)financing aggregated green and social projects	(see ICMA 2021c)

^rDenotes the application of 'stemming' in the context of the respective keyword in the text mining procedure

^a<https://www.unpri.org/pri/about-the-pri>, accessed 04 Nov 2021.

^b<https://www.un.org/sustainabledevelopment/sustainable-development-goals/>, accessed 18 Jun 2021.

^cUSSIF (2018, p. 13) states in the context of *ESG incorporation* that "asset managers complement traditional, quantitative techniques of analyzing financial risk and return with qualitative and quantitative analyses of ESG policies, performance, practices and impacts. ESG incorporation can be accomplished in numerous ways: Positive/Best-in-Class[...] [...] Negative/Exclusionary Screening[...] [...] ESG Integration[...] [...] Impact Investing[...] [...] Sustainability Themed Investing". While USSIF (2018) further

Table 1 (continued)

considers *impact investing*, the PRI Association (2018) includes *norms-based screening* as well as a combination of these strategies. See Table 1b for more information on the sustainable investment strategies.

^d<https://www.unpri.org/download?ac=10223>, accessed 18 Jun 2021.

^eFor reasons of simplicity, Inderst et al. (2012) understand the term as a subcategory of the other presented concepts, which can be used as a synonym.

^fSee <https://equator-principles.com/about/>, accessed 28 Jun 2021.

^gUSSIF (2018, p. 13) defines *ESG integration* as “[t]he systematic and explicit inclusion of ESG risks and opportunities into the process of financial analysis, which can include adjusting estimated future cash flows or modeled discount rates based upon evaluation of ESG-related risks and opportunities and identifying and measuring the impact of off-balance sheet ESG-related assets and liabilities”.

^hNote that the PRI Association (2018) does not consider *impact investing* as an individual investment strategy, while USSIF (2018, 2020) does. See also Gatzert et al. (2020) for more information on this issue.

ⁱThe four core components are: “1. Use of Proceeds[;] 2. Process for Project Evaluation and Selection[;] 3. Management of Proceeds[;] 4. Reporting” (ICMA 2021a, p. 4). Eurosif (2018) lists *green*, *social* and *sustainability bonds* in the context of *impact investing*. Thus, these *bonds* can be understood as investment tool of the *impact investing* strategy. Since bonds are of particular interest in the insurance industry, we study these instruments separately.



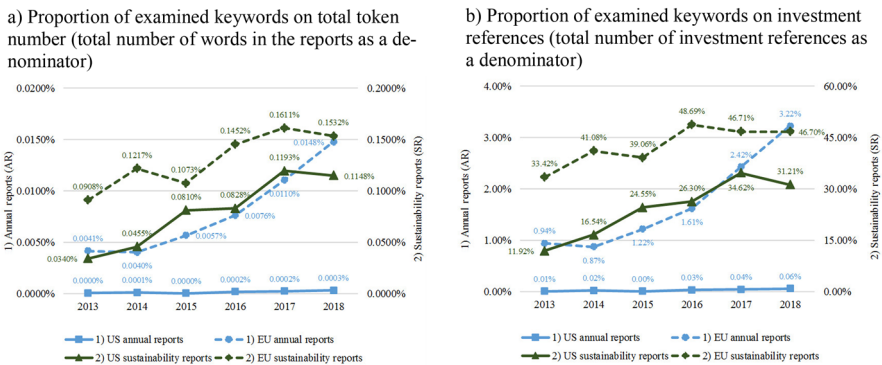
Responsibility) within the GRI (2013, p. 8) framework.¹⁷ Insurers which follow the GRI standards might thus list this *Sector specific Aspect* in their GRI content index without providing information on the application, for instance. We thus review all documents with a positive hit for *active ownership* and again adjust the word counts and number of identified firms if the insurer negates the application or if no further information is provided.

Text mining results: sustainable investing in the US and European insurance industry

Development of references to sustainable investing in annual and sustainability reports in US and European insurance companies from 2013 to 2018

As a first indication for the development of sustainable investing in the US and European insurance industry, Fig. 1 displays the proportion of examined keywords from our sustainable investment dictionary in Table 1 in relation to the total number of words (tokens) in the reports (Fig. 1a) and in relation to the total number of investment references (Fig. 1b) over the sample period. We further distinguish between the region and the type of report, thereby focusing on the annual (recurring) report types AR (left y-axis) and SR (right y-axis).

Figure 1 indicates that sustainable investing has become increasingly important in relative terms and that there are strong differences depending on the type of report and region. For instance, it seems that US annual reports are hardly used to



Notes: ‘invest’, ‘invests’, ‘invested’, ‘investing’, ‘investment’ and ‘investments’ represent the counted investment references per report.

Fig. 1 Development over time of the proportion of keywords in Table 1 on total number of words in a and on investment references in b depending on the region and report type: (1) annual reports (AR) (left y-axis), (2) sustainability reports (SR) (right y-axis)

¹⁷ This includes “[v]oting policy(ies) applied to environmental or social issues” (GRI 2013, p. 36) and two related indicators.



inform about sustainable investing, which remains rather stable over time in both Fig. 1a and b (lowest solid line with squares). However, US insurers increasingly use their sustainability reports to present information about their sustainable investment approach. In Europe, in contrast, annual reports do appear to serve as an instrument to report about a sustainable investment approach in addition to sustainability reports, which has been strongly increasing over time. These observations remain consistent in Fig. 1b.

Table 2 presents more detailed descriptive statistics for the years 2013 and 2018. In line with the previous observations, we do not only see an increase in the number of keyword hits for almost all categories in Table 2a and b but also in the number of firms using these keywords.

Looking at Table 2a, most relevant in 2018 are references to the *Sustainable Development Goals* (400 word counts), closely followed by *responsible investment* (374 word counts) and *ESG criteria* (250 word counts; 514 word counts for all ESG references combined¹⁸). This is in line with the references to the *Principles for Responsible Investment* (107 word counts),¹⁹ an initiative that strongly builds on the term *responsible investment* and *ESG criteria*. Moreover, the *PRI* network also promotes and supports (the achievement of) the *SDGs* as sustainability issues among its stakeholders.²⁰ However, when looking at the number of firms referring to the principles, criteria and terminologies, we find a slightly different ranking, with the highest number of firms (44 of 77) in the sample mentioning *ESG criteria*, while the second highest number of firms (38) refers to *responsible investment*. The high word count for the *SDGs* (by 28 firms) appears to be driven by firms which comprehensively report about them, as reflected in the largest standard deviation and maximum.

Whereas the *SDGs* present strong growth rates both in terms of the word counts and number of firms since their official introduction in 2015,²¹ keyword hits related to the *PRI* and *PSI* show an overall smaller or no increase. However, when looking at the number of firms, the text mining results still indicate a strong increase in awareness for the *PRI*. We find that 23 insurers in our sample mention the *PRI* in 2018, starting from eleven insurers in 2013. The number of firms mentioning the *PSI* is smaller with initially seven insurers in 2013 and ten in 2018. Overall, these results indicate an increasing relevance of initiatives such as the *PRI* or *PSI* among insurers as well as a growing relevance of sustainability risks and opportunities in the insurance industry in general (see also Gatzert et al. 2020; Gatzert and Reichel 2022).

¹⁸ This includes word counts for *environmental, social and governance* (250), *ESG investing* (48), *ESG incorporation* (42), *ESG integration* (155) and *ESG screening* (19; included in *screening* with 39 word counts) in 2018.

¹⁹ Note that there is no double counting, as the number of relevant word counts for *Principles for Responsible Investment* is subtracted from the counts for *responsible investment*, for instance.

²⁰ See <https://www.unpri.org/sustainability-issues/sustainable-development-goals>, accessed 05 Jul 2021.

²¹ See <https://www.un.org/sustainabledevelopment/development-agenda/>, accessed 05 Jul 2021. First hits in 2013 and 2014 refer to an outlook on the introduction of the *SDGs* by two different insurers.



With regard to further terminologies in Table 2a, *ESG investing* and *ESG incorporation* show a large increase in the number of references by firms, but the number of word counts is relatively small, which might be explained by further references to other ESG-related terms and strategies in the reports and documents. While the number of references to *sustainable investment* more than doubles over time, references to *sustainable and responsible investment* and *sustainable, responsible and impact investing* (included in the category *other*) as promoted by Eurosif (2018) and USSIF (2018), respectively, are hardly found or not at all. The same can be concluded for the *Equator Principles* (included in *other*).

Concerning the keyword counts and number of firms referring to sustainable investment strategies in Table 2b, most often referenced in 2018 are *ESG integration* (19 firms with 155 hits) and *impact investing* (19 firms with 84 hits), followed by references to *green bonds* (16 firms with 52 hits). While insurance companies report less about *screening* and *engagement*, we find hardly any references to *sustainability themed investing* as well as to *social bonds* and *sustainability bonds*. With regard to the latter strategies, it appears that these thematic-driven investments are rather at the beginning of their development in the insurance industry, being mentioned either in 2017 or 2018 for the first time.

As the *PRI* play an increasing role among institutional investors while also promoting the application of sustainable investment strategies, we additionally calculate Pearson's and Spearman's correlation coefficients and find statistically significant and positive correlations between firms referring to the *PRI* and their amount of word counts for each strategy. *Green bonds* (Pearson's) and *ESG integration* (Spearman's) show the highest correlation coefficients in this context.

Differences in reporting in US and European insurance companies with respect to sustainable investing and the impact of regulation

We next study differences between European and US insurers regarding the number of references to sustainable investment-related keywords in Table 3 and regarding the number of firms with such references in Table 4. Starting with the principles, criteria and terminologies in Table 3a, the results again indicate strong regional discrepancies within the sample. In 2018, European insurers with positive hits in regard to keywords in Table 1a have a total keyword count of 1193, which is close to four times the keyword count of US insurers (307 in total). In 2013, US insurers have only 24 out of 463 positive hits. Furthermore, the respective rankings differ. When looking at the number of firms in Table 4a, it appears that in our sample, *ESG* criteria and the *PRI* did not play a large role in the US insurance industry until 2016. It also seems as if the *PSI* are hardly disseminated in the US, with the first two references in 2017 and one consecutive hit in 2018 attributed to only one firm. With respect to investment strategies in Tables 3b or 4b, besides *ESG integration*, the *impact investing* strategy is mentioned by seven US firms in 2018, while the strategies *engagement* and *screening* do not play a relevant role in the US sample.

One potential driver for the general increase in the reporting on sustainable investing, especially for European insurers, is likely regulation as described in the



introduction, e.g. the EU Directive 2014/95/EU from 2014, effective 2017. This so-called Non-Financial Reporting Directive (NFRD) focuses on more corporate transparency in regard to non-financial and diversity reporting. In the US, in contrast, it seems as if more transparency in regard to the consideration of sustainable investment has not yet been in the focus of regulation. On a global scale, the adoption of the Paris Agreement by 196 parties in December 2015 might also represent a key event in this context, as the mobilization of the financial market participants constitutes a central element as an enabler to reduce emissions and to become more resilient to climate change.²²

To study the impact of these regulations in more detail, we use a paired t-test in order to test whether there is a significantly higher number of references to keywords in our sustainable investment dictionary, i.e. a higher word count in Table 3, for the year 2017 as compared to the year 2016 for European insurers, and for the year 2016 compared to the year 2015 for the whole sample. The results show that on average, the word count is significantly higher in the year 2016 after the adoption of the Paris Agreement for the whole sample ($\bar{x}_{\text{Total15}}=9.857$ and $\bar{x}_{\text{Total16}}=14.195$; $\bar{x}_{\text{Total16}} - \bar{x}_{\text{Total15}}=4.338$; p value=0.001). Moreover, on average, the word count is also significantly higher in the year 2017 as the first effective year of the NFRD for the European sample ($\bar{x}_{\text{EU16}}=33.241$ and $\bar{x}_{\text{EU17}}=44.759$; $\bar{x}_{\text{EU17}} - \bar{x}_{\text{EU16}}=11.518$; p value=0.003).²³

Using a two-sample t-test and considering all firm-year observations, we further find statistically significant differences in means between European and US insurers at the 1% level for *ESG integration*, *impact investing*, *green bonds*, *screening* and *engagement*, with higher means for EU insurers. The same can be concluded with respect to the number of firms referring to these strategies.²⁴

We also note that a relevant number of European insurers in our sample still does not report at all about these concepts. Figure 2a illustrates this issue in more detail by presenting the number of firms per region with at least one positive hit from our sustainable investment dictionary in Table 1. Out of all 29 European insurers in the sample, in 2013, eight insurers do not mention sustainable investment-related keywords at all, and in 2018, there is still one UK insurer without any keyword hit. In the US, in 2018, we have 28 out of 48 insurers without any positive hit from the sustainable investment dictionary, compared to 42 “non-reporting” US insurers in 2013.

To get further insight into the potential depth of the application of a sustainable investment approach, Fig. 2b displays the number of US and EU insurers

²² See <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>, accessed 01 Mar 2022; https://unfccc.int/sites/default/files/english_paris_agreement.pdf, accessed 01 Mar 2022.

²³ We also apply a Wilcoxon signed-rank test, respectively, which generally confirms our results (European sample: p value=0.006; whole sample: p value=0.001).

²⁴ The number of observations for European insurers is $n_{\text{EU}}=174$ and the number of observations for US insurers is $n_{\text{US}}=288$. For instance, the difference in means for the word count of *impact investing* is 0.716 ($\bar{x}_{\text{IHEU}}=1.167$ and $\bar{x}_{\text{IHWUS}}=0.451$; p value=0.003) and 0.174 for the number of firms referring to *impact investing* ($\bar{x}_{\text{IIFEU}}=0.264$ and $\bar{x}_{\text{IIFUS}}=0.090$; p value=0.000). We also apply a Wilcoxon rank-sum test as well as a chi-square test of independence for binary variables, which generally confirm our results.



that have at least one keyword hit in Table 1a *and* at least one keyword hit in Table 1b. The results show an increase from 13 firms (out of 77) in 2013 to 34 in 2018, with considerably less US than European insurers. All these insurers use and combine keywords from both Table 1a and b, e.g. by offering a *sustainable investment* section which includes the applied strategies such as *ESG integration*.

The impact of firm size

Apart from regional differences, we also study whether firms with and without at least one keyword hit from the sustainable investment dictionary (Fig. 2a) differ in terms of their firm size, and analogously for firms in Fig. 2b.

Table 5 shows group differences in means and medians as well as Pearson's and Spearman's correlation coefficients. The results show that insurers reporting about sustainable investing as reflected in Fig. 2a and b are significantly larger on average than those that do not report accordingly, and that there is a statistically significant and positive relation (in terms of correlations) between insurers that do report about sustainable investing and their firm size. The differences in means and medians are even higher for firms identified in Fig. 2b.

The number of sustainable investment strategies applied in US and European insurance companies according to their annual and sustainability reports

We further investigate the firms from Fig. 2a (i.e., at least one keyword hit from Table 1) in regard to the number of reported sustainable investment strategies (listed in Table 1b, i.e. at most six) depending on the region and year in Fig. 3. We can observe that the number of firms applying multiple sustainable investment strategies increases over time. While the majority of insurers (28 out of 34) report about one to three different strategies in 2018, five firms mention four strategies, and one insurer even refers to all six strategies. In contrast, 13 of the 14 identified insurers in 2013 mention one to three different strategies, while the maximum number of strategies applied is four by one insurer. We also note that the majority of firms cite only one strategy in their first year and that the results are driven by European insurers in the sample. Overall, the analysis of the reports suggests that insurers develop their sustainable investment approaches further by applying multiple strategies, which is also recommended by the PRI Association (2018) (e.g. to combine *screening* and *engagement*) and also observed by the GSIA (2021) for the overall investment community.



Differences between subsectors

Differences depending on the subsectors life & health (LH), multiline insurance (ML) and property & casualty (PC) are summarized in Table 7 in the Appendix.²⁵ When looking at the number of firms per strategy (see Table 7a), we find that the results are driven by life & health insurers, followed by multiline and property & casualty insurers. With respect to word counts (see Table 7b), multiline insurers show the strongest relative increase over time with a factor of around eight. Although around half of our sample firms are property & casualty insurers, we only find a small number of mainly European firms from this subsector referring to sustainable investment strategies in the first years. The number of reported strategies then particularly increases in the years 2017 and 2018. One reason for this result might be the fact that most US companies are property & casualty insurers (more than 60% (37%) within the US sample (overall sample)), and that according to previous observations, US insurers in the sample mention considerably less sustainable investing activities in their reports and documents (e.g. between 2014 and 2017, no US property & casualty insurer reports about sustainable investment strategies). In addition, aforementioned regulation initiatives and the long-term investment perspective of life & health insurers might be reasons for the stronger focus on sustainable investing, specifically with focus on *ESG integration*, *impact investing*, including *bonds*, and *engagement*.

Robustness checks: including sustainability-, investment-related and other documents

Finally, when adding the documents from the “Sustainability-, Investment-related and Others” (SIO) category to previous analyses as a robustness check, we find that the majority of the already identified firms uses these types of documents to further inform their stakeholders about their sustainable investment approach. Many word counts substantially increase, e.g. in 2018, the word counts for the *PSI* as well as for *ESG integration* are even higher within the SIO category than in the AR and SR categories combined (see Table 8 in the Appendix). The additional growth in the number of identified firms reporting about sustainable investing is again mainly driven by European insurers (see Table 9 in the Appendix). Moreover, Fig. 4a in the Appendix shows the additional number of European and US insurers in the sample with at least one keyword hit from the sustainable investment dictionary in Table 1 based on the supplementary consideration of the SIO category. We find that only two European firms are newly identified compared to Fig. 2a (the increase in 2015 and 2016 is based on the same firm). The remaining firms already have references to the principles, criteria and terminologies in their AR and/or SR and further disseminate information on their investment strategies by using the SIO documents. This also explains the increase in Fig. 4b in the Appendix compared to Fig. 2b.

²⁵ Our sample consists of 20 life & health insurers (13 US, 7 European), 18 multiline insurers (6 US, 12 European) and 39 property & casualty insurers (29 US, 10 European).





Table 2 Summary statistics for the years 2013 and 2018

	2013					2018				
	Firms	Hits	Mean	SD	Max	Firms	Hits	Mean	SD	Max
(a) Principles, criteria and terminologies in the sustainable investment context (Table 1a)										
Sustainable Development Goals	1	1	0.0	0.1	1	28	400	5.2	11.8	69
Responsible investment	15	155	2.0	6.4	34	38	374	4.9	8.8	48
Environmental, social and governance	16	72	0.9	2.8	17	44	250	3.2	5.9	45
Sustainable investment	10	40	0.5	2.9	25	24	109	1.4	3.1	14
Principles for Responsible Investment	11	82	1.1	5.1	43	23	107	1.4	3.0	15
ESG investing	1	1	0.0	0.1	1	19	48	0.6	1.8	13
Principles for Sustainable Insurance	7	42	0.5	3.3	28	10	42	0.5	1.9	11
ESG incorporation	5	11	0.1	0.7	6	18	42	0.5	1.3	7
Socially responsible investment	8	37	0.5	1.8	12	18	40	0.5	1.2	5
Green investment	4	10	0.1	0.7	5	10	38	0.5	1.8	11
Sustainable finance	1	1	0.0	0.1	1	11	34	0.4	1.4	8
Sustainable and responsible investment	2	4	0.1	0.3	2	6	13	0.2	0.7	4
Other	3	7	0.1	0.5	4	3	3	0.0	0.2	1
(b) Sustainable investment strategies (Table 1b)										
ESG integration	7	41	0.5	2.7	23	19	155	2.0	8.0	65
Impact investing	7	23	0.3	1.1	6	19	84	1.1	3.1	22
Green bonds	2	7	0.1	0.6	5	16	52	0.7	1.9	13
Screening	5	20	0.3	1.4	11	12	39	0.5	1.8	11
Engagement	3	4	0.1	0.3	2	9	30	0.4	1.4	8
Sustainability themed investing	0	0	0.0	0.0	0	2	9	0.1	0.8	6
Social bonds	0	0	0.0	0.0	0	1	2	0.0	0.2	2
Sustainability bonds	0	0	0.0	0.0	0	1	2	0.0	0.2	2

Sorted for number of hits in 2018; out of 77=48 US and 29 European insurers

Table 3 Number of hits from the sustainable investment dictionary in Table 1 by European and US insurers

	2013		2014		2015		2016		2017		2018							
	Hits	US	EU	Hits	US	EU	Hits	US	EU	Hits	US	EU						
	(a) Principles, criteria and terminologies in the sustainable investment context (Table 1a)																	
Sustainable Development Goals	1	0	1	9	0	9	37	17	20	109	4	105	12	253	400	31	369	
Responsible investment	155	7	148	217	6	211	178	18	160	282	16	266	73	291	374	94	280	
Environmental, social and governance	72	2	70	92	6	86	90	6	84	165	23	142	48	173	250	73	177	
Sustainable investment	40	3	37	54	13	41	60	9	51	58	13	45	10	65	109	14	95	
Principles for Responsible Investment	82	1	81	90	1	89	60	1	59	84	13	71	13	85	107	24	83	
ESG investing	1	1	0	6	0	6	10	1	9	9	2	7	18	2	16	48	12	36
Principles for Sustainable Insurance	42	0	42	71	0	71	57	0	57	66	0	66	2	60	42	1	41	
ESG incorporation	11	0	11	14	0	14	15	0	15	24	1	23	18	2	16	42	27	15
Socially responsible investment	37	4	33	48	4	44	29	6	23	37	12	25	12	39	40	13	27	
Green investment	10	6	4	9	4	5	24	10	14	27	9	18	32	9	23	38	15	23
Sustainable finance	1	0	1	1	0	1	10	0	10	13	0	13	27	1	26	34	2	32
Sustainable and responsible investment	4	0	4	15	0	15	14	0	14	18	0	18	14	0	14	13	1	12
Other	7	0	7	7	0	7	1	0	1	3	0	3	4	0	4	3	0	3
Total	463	24	439	633	34	599	585	68	517	895	93	802	184	1065	1500	307	1193	



Table 4 Number of European and US insurers with references to keywords from the sustainable investment dictionary in Table 1

	2013		2014		2015		2016		2017		2018							
	Sum	EU	Sum	US	Sum	US	Sum	US	Sum	US	Sum	US						
	EU	US	EU	US	EU	US	EU	US	EU	US	EU	US						
(a) Principles, criteria and terminologies in the sustainable investment context (Table 1a)																		
Environmental, social and governance	16	2	14	19	4	15	18	3	15	29	10	19	31	12	19	44	20	24
Responsible investment	15	1	14	14	1	13	19	3	16	22	4	18	28	9	19	38	12	26
Sustainable Development Goals	1	0	1	2	0	2	8	1	7	12	2	10	20	3	17	28	7	21
Sustainable investment	10	2	8	11	4	7	15	4	11	13	4	9	13	3	10	24	6	18
Principles for Responsible Investment	11	1	10	12	1	11	13	1	12	16	4	12	19	4	15	23	7	16
ESG investing	1	1	0	3	0	3	3	1	2	4	1	3	7	1	6	19	7	12
ESG incorporation	5	0	5	4	0	4	6	0	6	12	1	11	11	2	9	18	7	11
Socially responsible investment	8	2	6	10	3	7	10	2	8	12	4	8	18	4	14	18	6	12
Sustainable finance	1	0	1	1	0	1	4	0	4	6	0	6	7	1	6	11	2	9
Principles for Sustainable Insurance	7	0	7	8	0	8	9	0	9	8	0	8	10	1	9	10	1	9
Green investment	4	2	2	4	2	2	6	3	3	7	2	5	8	2	6	10	3	7
Sustainable and responsible investment	2	0	2	4	0	4	4	0	4	6	0	6	4	0	4	6	1	5
Other	3	0	3	3	0	3	1	0	1	3	0	3	2	0	2	3	0	3
(b) Sustainable investment strategies (Table 1b)																		
ESG integration	7	0	7	8	1	7	8	0	8	10	1	9	12	2	10	19	7	12
Impact investing	7	4	3	8	3	5	10	3	7	11	4	7	17	5	12	19	7	12
Green bonds	2	1	1	7	3	4	6	2	4	8	3	5	11	3	8	16	5	11
Screening	5	0	5	7	0	7	8	0	8	7	0	7	8	0	8	12	2	10
Engagement	3	0	3	7	0	7	5	0	5	6	0	6	9	1	8	9	2	7
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	1	1
Social bonds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Sustainability bonds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

The lists of principles, criteria, terms (Table 4a) and strategies (Table 4b), which are identified in reports and documents of 28 European (out of 29) and 20 US insurers (out of 48) with positive hits in 2018, are sorted for the total number of firms in 2018, respectively. Multiple hits per firm are possible



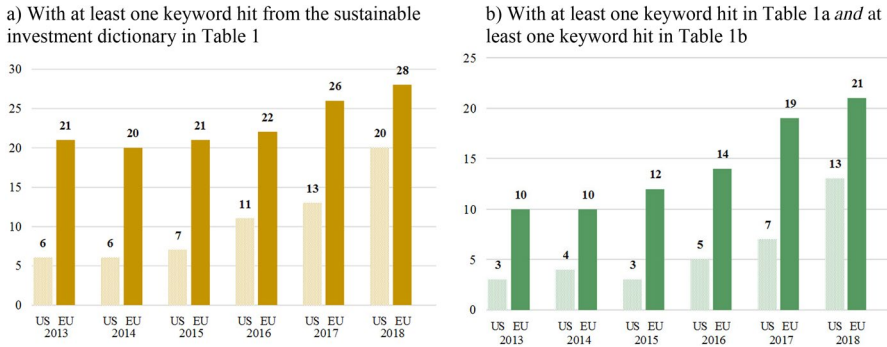


Fig. 2 Number of European and US insurers in the sample (i.e. out of 77 = 48 US and 29 European insurers)

The value-relevance of sustainable investment-related keywords

We conclude with a panel regression model with fixed effects to study the value-effect of sustainable investment-related keywords following e.g. Hoyt and Liebenberg (2011), Heidinger and Gatzert (2018) and Gatzert and Reichel (2022) by using Tobin's Q as the dependent variable. We thereby measure the variable of interest as the natural logarithm of all keyword counts from our sustainable investment dictionary (see Tables 1 and 3), which are identified in annual and sustainability reports per firm. Following previous literature, we further control for size, leverage and return on assets. Overall, the results do not show a statistically significant relation between sustainable investment-related keywords and the dependent variable Tobin's Q, which might be explained by the foundation of sustainable investing as a more long-term investment approach, where the implementation can be costly, while benefits might materialize over a longer time horizon.

Summary

The aim of this paper is to gain insight regarding sustainable investing activities in the European and US insurance industry. This topic is of high relevance especially for insurers as one of the largest institutional investors that also face an increasing regulatory pressure in this regard. We therefore develop a sustainable investment dictionary with keywords that take into account sustainable investment strategies as well as principles, criteria and terminologies. Based on this dictionary, we apply a text mining process to 1215 annual, sustainability- and investment-related reports and documents of 77 large-cap European and US insurance companies from 2013 to 2018.

First, we find that references to our sustainable investment dictionary have been strongly increasing in annual and sustainability reports over the sample period, and that insurers reporting about sustainable investing are significantly larger on average than those without keyword hits. Second, (the more regulated)



Table 5 Correlation coefficients and differences in means and medians between firms with and without at least one keyword hit from the sustainable investment dictionary identified in Fig. 2a and b

(a) Firms identified in Fig. 2a	Identified = 1		Identified = 0		Difference	
	(201 firm-year observations)		(261 firm-year observations)			
	Mean	Median	Mean	Median	In means	In medians
<i>Size</i>	18.404	18.458	16.386	16.333	2.018***	2.125***
Pearson's correlation coefficient:			0.566***			
Spearman's correlation coefficient:			0.558***			
(b) Firms identified in Fig. 2b	Identified = 1		Identified = 0		Difference	
	(121 firm-year observations)		(341 firm-year observations)			
	Mean	Median	Mean	Median	In means	In medians
<i>Size</i>	19.055	19.457	16.628	16.646	2.427***	2.811***
Pearson's correlation coefficient:			0.604***			
Spearman's correlation coefficient:			0.579***			

462 firm-year observations. *** denotes statistical significance at the 1% level. Differences in means are tested on the basis of a two-sample t-test. An equality-of-medians test represents the basis for statistical significance of differences in medians and a non-parametric Wilcoxon rank-sum test is performed as well, which generally confirms our results. *Size* is calculated as the natural logarithm of the (book value of) total assets retrieved from Datastream. The variables based on Fig. 2a and b represent dummy variables, respectively. In the context of Fig. 2a, a value of 1 stands for an insurer with at least one keyword hit from the sustainable investment dictionary in Table 1; in the context of Fig. 2b, a value of 1 stands for an insurer with at least one keyword hit in Table 1a and at least one keyword hit in Table 1b

European firms in the considered sample exhibit a much more extensive reporting about sustainable investment concepts and principles than US insurers. Third, while the rankings show similar tendencies across the two regions, we also observe differences. In regard to the number of firms and the related word count in the last sample year 2018, most often cited concepts are *ESG* criteria together with *responsible investment* and the *Sustainable Development Goals*, whereby the *SDGs* exhibit the strongest growth rates since their official introduction in 2015. Furthermore, while the *Principles for Responsible Investment* are also highly cited, the *Principles for Sustainable Insurance* are ranked lower with hardly any reference from the US. Fourth, with respect to investment strategies, *ESG integration* and *impact investing* are most often mentioned, while *engagement* and *screening* did not play a substantial role specifically in the US. We also find that more recently, an increasing number of insurers refers to multiple strategies and that especially life & health insurers refer to strategy-related keywords. Fifth, when including documents from our third reporting category “Sustainability-, Investment-related and Others”, the robustness results show that almost all firms are already identified based on their annual and sustainability reporting. Finally, a panel regression with fixed effects does not show a value-effect of sustainable



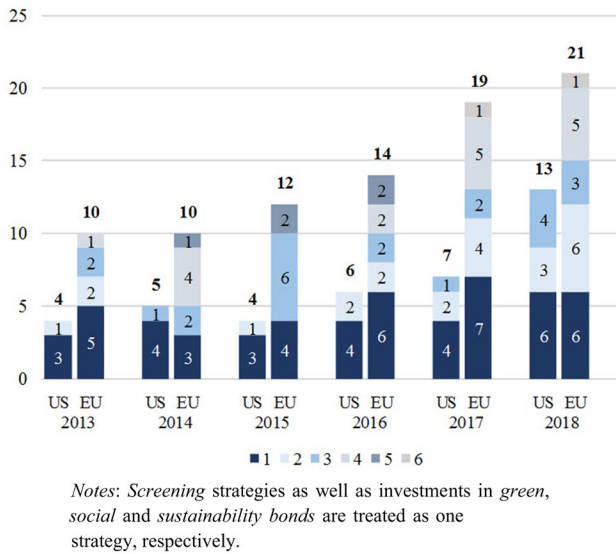


Fig. 3 Number of European and US insurers in Fig. 2a mentioning one up to six sustainable investment strategies

investment-related keywords used in insurers' annual or sustainability reports on Tobin's Q.

One limitation of this approach is that firms may not fully disclose their sustainable investment strategies or only refer to their (anonymized) external asset manager. Moreover, the interpretation is restricted in that the context cannot be taken into account in an automated text mining process. However, the text mining approach allows us to analyze a large number of reports (in our case 1215 files), which would not be possible manually. Using this large database, it allows in-depth insight into the relevance of specific strategies, principles and terminologies that insurers cite in their reports and published documents, and their development over time.

Based on our analysis, several avenues for future research can be derived. To challenge the reported actions, to identify undisclosed strategies or to further evaluate implemented practices, a survey could be performed as an alternative promising approach as discussed, for instance, by Hoyt and Liebenberg (2011) or Krueger et al. (2020). Future research could also make use of surveys to identify insurance companies with major asset management operations or ESG units and then examine the relationship with sustainable investment approaches in more detail. Besides conducting surveys, interviews or case studies can be conducted to study the relevance of national or state-related ESG regulations in Europe or the US, which could be further specified for subsectors. Finally, following more recent publications such as Talan and Sharma (2019) and Daugaard (2020), our analysis could be extended to emerging markets, which have not been in the focus of research yet, and a more detailed analysis of the value-effect of sustainable investment-related reporting would be of interest as well.



Overall, against the background of the substantial investment amounts in the insurance industry and benefits for the environment and society as well as potentially attractive long-term returns as suggested by the literature, sustainable investment strategies should be a vital consideration of insurers. In addition, as transparency plays a key role in assessing risks inherent in an insurer's investment portfolio and since pressure increases by various stakeholders of insurance companies (regulation, NGOs, customers), we expect that the absolute and relative proportion of disclosing information on sustainable investing will increase over time. Our observations suggest that insurers increasingly develop more elaborated investment strategies. Instead of simply excluding specific sectors for instance, insurance companies will likely apply multiple strategies in the future.

Appendix

See Tables 6, 7, 8, and 9 and Fig. 4.





Table 6 Data collection approach

Sources		<ul style="list-style-type: none"> • Corporate website • Filings in Refinitiv Eikon • SEC's EDGAR platform • GRI Sustainability Disclosure Database • CorporateRegister.com • UN Global Compact participants archive • Principles for Sustainable Insurance disclosure of signatory companies • Google 																				
Exclusions (reason)		<p>Stand-alone reports and documents:</p> <ul style="list-style-type: none"> • Asset managers (possible disclaimer issues) • Climate Risk Disclosure Survey (regionally limited and query-response structure) • Carbon Disclosure Project (inconvenient (query-response) structure) • PRI Transparency reports (inconvenient (query-response) structure) • Summary/KPI sheets (inconvenient (query-response) structure) • Strategic documents with focus beyond the sample period (forward-looking) • Website snapshots (problematic traceability and classification) 																				
Year assignment factors		<ul style="list-style-type: none"> • Information on reporting period or publication date available in document or databases? - If not, use of further indicators such as the document name, copyright date, (financial) data, information from databases or references from/to other documents • Is there a company- or document-specific publication cycle in place? - E.g. reporting cycle 1. Jan. to 31. March of next year with key metrics from the financial year; considered in the last full calendar year, respectively • Does the report focus on multiple years? - Depending on company- or document-specific publication cycle, file copied and assigned to the covered years • Is there an updated policy version (policy can be effective prior to 2013 to be considered)? - E.g. Responsible Investment Policy from 2011 (considered from year 2013 to 2016), updated in 2017 and 2018 (new versions considered in 2017 and 2018) 																				
Reporting categories		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Annual Reporting (AR)</th> <th style="text-align: center;">US</th> <th style="text-align: center;">EU</th> <th style="text-align: center;">222</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Sustainability Reporting (SR)</td> <td style="text-align: center;">US</td> <td style="text-align: center;">EU</td> <td style="text-align: center;">158</td> </tr> <tr> <td style="text-align: left;">Sustainability-, Investment-Related and Others (SIO)</td> <td style="text-align: center;">US</td> <td style="text-align: center;">EU</td> <td style="text-align: center;">306</td> </tr> <tr> <td style="text-align: left;">Region</td> <td style="text-align: center;">397</td> <td style="text-align: center;">222</td> <td></td> </tr> <tr> <td style="text-align: left;">No</td> <td></td> <td></td> <td style="text-align: center;">92</td> </tr> </tbody> </table>	Annual Reporting (AR)	US	EU	222	Sustainability Reporting (SR)	US	EU	158	Sustainability-, Investment-Related and Others (SIO)	US	EU	306	Region	397	222		No			92
Annual Reporting (AR)	US	EU	222																			
Sustainability Reporting (SR)	US	EU	158																			
Sustainability-, Investment-Related and Others (SIO)	US	EU	306																			
Region	397	222																				
No			92																			

Table 6 (continued)

<ul style="list-style-type: none"> • Group Annual Report • Annual Review, Annual Report • Annual Report, Annual Report to Shareholders, 10-K • Board of Directors' Report and Financial Statements, Risk Management Report, Corporate Governance Statement • Independent Auditor's Report, Factsheet, Consolidated Financial Statements, Management Board's Report 	<ul style="list-style-type: none"> • Activity and Corporate Responsibility Report • Corporate Citizenship Report • Corporate Responsibility Report, GRI Index • Content Index, Sustainability Accounting Standards Board Report, Sustainability Report, Task Force on Climate-related Financial Disclosures Report • Climate-Related Financial Disclosures Report • Combined Non-financial Statement, Corporate Responsibility Report 	<ul style="list-style-type: none"> • Global Voting Policy (from 2008), Policy on Human Rights (from 2008, according to database), Responsible Investment Policy (from 2011), Asset Management Executing Our Strategy (all documents considered in 2013) • Climate Wise Principles Report, Communication on Progress UN Global Compact • Fact Sheet • Modern Slavery and Human Trafficking Statement • Climate Change Statement (from 2017, considered in 2018)
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Table 7 References made to sustainable investment strategies from Table 1b by different insurance subsectors

	2013			2014			2015			2016			2017			2018			
	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	
	Hits			Hits			Hits			Hits			Hits			Hits			
(a) Number of firms (multiple hits per firm)																			
LH																			
ESG integration	3	0	3	4	1	3	3	0	3	5	1	4	5	2	3	10	5	5	
Impact investing	5	3	2	7	3	4	6	2	4	5	2	3	7	3	4	10	4	6	
Bonds (green, social, sustainability)	2	1	1	4	2	2	4	2	2	5	2	3	6	2	4	5	1	4	
Engagement	2	0	2	4	0	4	3	0	3	3	0	3	5	1	4	5	2	3	
Screening	2	0	2	3	0	3	2	0	2	2	0	2	1	0	1	4	1	3	
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
ML																			
Impact investing	1	0	1	1	0	1	3	1	2	4	2	2	8	2	6	6	2	4	
Bonds (green, social, sustainability)	0	0	0	3	1	2	2	0	2	3	1	2	4	1	3	6	2	4	
ESG integration	3	0	3	3	0	3	4	0	4	4	0	4	5	0	5	4	0	4	
Screening	1	0	1	2	0	2	4	0	4	3	0	3	3	0	3	4	0	4	
Engagement	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	
PC																			
ESG integration	1	0	1	1	0	1	1	0	1	1	0	1	2	0	2	5	2	3	
Bonds (green, social, sustainability)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	2	3	
Screening	2	0	2	2	0	2	2	0	2	2	0	2	4	0	4	4	1	3	
Impact investing	1	1	0	0	0	0	1	0	1	2	0	2	2	0	2	3	1	2	
Engagement	1	0	1	2	0	2	1	0	1	2	0	2	3	0	3	3	0	3	
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	



Table 7 (continued)

	2013			2014			2015			2016			2017			2018			
	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	Sum/	US	EU	
	Hits			Hits			Hits			Hits			Hits			Hits			
(b) Word count																			
LH																			
Impact investing	20	12	8	38	8	30	34	8	26	51	22	29	60	30	30	58	33	25	
ESG integration	11	0	11	11	1	10	14	0	14	19	2	17	28	8	20	49	25	24	
Bonds (green, social, sustainability)	7	5	2	14	5	9	14	5	9	15	7	8	18	8	10	22	7	15	
Screening	5	0	5	5	0	5	4	0	4	2	0	2	1	0	1	5	1	4	
Engagement	3	0	3	7	0	7	8	0	8	9	0	9	7	1	6	5	2	3	
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	
Total	46	17	29	75	14	61	74	13	61	96	31	65	114	47	67	142	71	71	
ML																			
ESG integration	7	0	7	26	0	26	31	0	31	43	0	43	47	0	47	78	0	78	
Bonds (green, social, sustainability)	0	0	0	6	1	5	14	0	14	3	1	2	17	1	16	24	2	22	
Screening	11	0	11	21	0	21	28	0	28	23	0	23	33	0	33	24	0	24	
Impact investing	1	0	1	1	0	1	6	1	5	8	4	4	18	4	14	16	4	12	
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	6	0	6	
Engagement	0	0	0	1	0	1	4	0	4	4	0	4	5	0	5	5	0	5	
Total	19	0	19	55	1	54	83	1	82	81	5	76	122	5	117	153	6	147	
PC																			
ESG integration	23	0	23	39	0	39	9	0	9	9	0	9	16	0	16	28	3	25	
Engagement	1	0	1	4	0	4	1	0	1	2	0	2	7	0	7	20	0	20	
Bonds (green, social, sustainability)	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	10	2	8	
Screening	4	0	4	6	0	6	6	0	6	7	0	7	18	0	18	10	2	8	



Table 7 (continued)

	2013		2014		2015		2016		2017		2018									
	Sum/ Hits	EU US	Sum/ Hits	EU US	Sum/ Hits	EU US	Sum/ Hits	EU US	Sum/ Hits	EU US	Sum/ Hits	EU US								
Impact investing	2	2	0	0	0	0	1	0	1	3	0	0	3	6	0	0	6	10	2	8
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	30	2	28	49	0	49	17	0	17	21	0	21	49	0	49	0	49	78	9	69

The insurance companies from the sample are divided into three different subsectors, including the number of firms with positive hits in 2018: life & health (LH, 7 US and 7 European insurers in 2018), multiline insurance (ML, 3 US and 7 European insurers in 2018), and property & casualty (PC, 3 US and 7 European insurers in 2018). The lists of strategies are sorted for the total number of firms (Table 7a) and hits (Table 7b) in 2018, respectively. The TRBC sector is based on a data extract from end of January 2020. The *screening* strategies and the three different bond types (*green*, *social* and *sustainability bonds*) are aggregated to one strategy, respectively



Table 8 Additional number of hits from the sustainable investment dictionary in Table 1 by European and US insurers (SIO)

	2013		2014		2015		2016		2017		2018							
	Hits	US	EU	Hits	US	EU	Hits	US	EU	Hits	US	EU						
(a) Principles, criteria and terminologies in the sustainable investment context (Table 1a)																		
Responsible investment	115	0	115	74	0	74	107	0	107	134	0	134	191	1	190	184	2	182
Sustainable Development Goals	0	0	0	2	0	2	26	0	26	28	0	28	65	0	65	146	0	146
Environmental, social and governance	36	0	36	47	0	47	43	0	43	47	0	47	61	0	61	80	4	76
Principles for Responsible Investment	42	0	42	22	0	22	35	0	35	48	0	48	67	0	67	63	4	59
Principles for Sustainable Insurance	39	0	39	36	0	36	30	0	30	38	0	38	36	0	36	48	3	45
Green investment	1	0	1	2	0	2	8	0	8	19	0	19	38	0	38	34	0	34
Sustainable finance	0	0	0	0	0	0	11	0	11	11	0	11	33	0	33	31	0	31
ESG incorporation	1	0	1	2	0	2	8	0	8	8	0	8	23	0	23	18	1	17
ESG investing	2	0	2	2	0	2	3	0	3	5	0	5	7	0	7	16	4	12
Sustainable investment	10	0	10	12	0	12	3	0	3	5	0	5	13	0	13	15	0	15
Socially responsible investment	9	0	9	7	0	7	8	0	8	14	0	14	17	0	17	8	0	8
Sustainable and responsible investment	0	0	0	1	0	1	1	0	1	4	0	4	1	0	1	3	0	3
Other	2	0	2	0	0	0	2	0	2	0	0	0	2	0	2	1	0	1
Total	257	0	257	207	0	207	285	0	285	361	0	361	554	1	553	647	18	629



Table 8 (continued)

	2013		2014		2015		2016		2017		2018	
	Hits	EU	Hits	EU	Hits	EU	Hits	EU	Hits	EU	Hits	EU
(b) Sustainable investment strategies (Table 1 b)												
ESG integration	40	0	40	29	43	0	43	0	57	0	168	178
Green bonds	4	0	5	5	14	0	28	0	28	0	40	60
Impact investing	13	0	9	9	12	0	17	0	17	0	36	37
Engagement	4	0	3	3	9	0	13	0	13	0	25	32
Screening	3	0	1	1	2	0	10	0	10	0	22	19
Sustainability bonds	0	0	0	0	0	0	0	0	0	0	1	1
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0
Social bonds	0	0	0	0	0	0	0	0	0	0	0	0
Total	64	0	64	47	80	0	125	0	125	0	292	327

The number of hits per keyword are identified in reports and documents, which are included in the SIO category. The lists of principles, criteria, terms (Table 8a) and strategies (Table 8b) are sorted for the total number of hits in 2018, respectively

Table 9 Number of European and US insurers *additionally identified* with references to keywords from the sustainable investment dictionary in Table 1 (SIO)

	2013			2014			2015			2016			2017			2018					
	Sum	US	EU	Sum	US	EU	Sum	US	EU	Sum	US	EU	Sum	US	EU	Sum	US	EU			
		0	0	0	0	0	0	2	0	2	1	0	2	1	0	1	3	0	3	5	1
ESG incorporation	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	2	0	2	4	1	3
Principles for Responsible Investment	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	2	0	2	3	1	2
Principles for Sustainable Insurance	0	0	0	0	0	0	1	0	1	2	0	2	2	0	2	0	0	0	1	0	1
Sustainable Development Goals	0	0	0	0	0	0	1	0	1	2	0	2	2	0	2	3	0	3	1	0	1
Sustainable investment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green investment	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESG investing	1	0	1	1	0	1	1	0	1	2	0	2	2	0	2	1	0	1	1	1	0
Socially responsible investment	2	0	2	3	0	3	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1
Sustainable finance	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1
Other	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	2	0	2	1	0	1
Environmental, social and governance	1	0	1	0	0	0	2	0	2	1	0	1	1	0	1	0	0	0	0	0	0
Responsible investment	0	0	0	2	0	2	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0
Sustainable and responsible investment	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
(b) Sustainable investment strategies (Table 1b)	2	0	2	2	0	2	1	0	1	1	0	1	1	0	1	2	0	2	5	1	4
ESG integration	1	0	1	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	2	0	2
Engagement	1	0	1	1	0	1	2	0	2	1	0	1	1	0	1	1	0	1	2	0	2
Green bonds	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	1	1	0	1
Impact investing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Screening	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Sustainability bonds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Sustainability themed investing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Social bonds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) Principles, criteria and terminologies in the sustainable investment context (Table 1a)

(b) Sustainable investment strategies (Table 1b)

The number of hits per keyword are identified in reports and documents, which are included in the SIO category. The lists of principles, criteria, terms (Table 9a) and strategies (Table 9b) are sorted for the total number of firms in 2018, respectively. Multiple hits per firm are possible



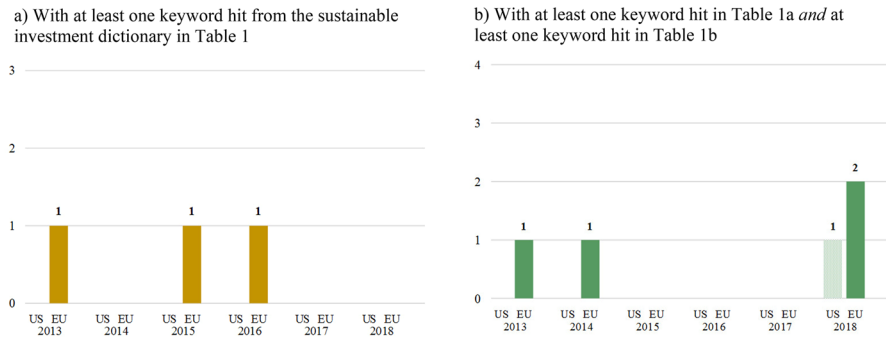


Fig. 4 Number of European and US insurers in the sample (i.e. out of 77 = 48 US and 29 European insurers) *additionally identified* when including the SIO category

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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