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Value Relevance of Climate Change Risks: A Canadian Study

Sylvie Berthelot [1]

Michel Coulmont [2]

École de Gestion, Université de Sherbrooke,
Sherbrooke, Québec, Canada

Anne Marie Gosselin [3]

École des sciences de la gestion, Université du Québec à Montréal,
Montréal, Québec, Canada

The objective of this study is to examine whether shareholders value the climate change risk disclosures firms communicate in their annual reports. The risks associated with climate change voluntarily disclosed by companies were identified based on the annual reports of 210 firms included in the S&P/TSX Composite Index. The value relevance of this information was then examined with a regression model founded on Ohlson's model (1995). The results of the analyses tend to show that, with the exception of market risks, very few of the disclosed risks appear to be relevant to shareholders. This may possibly be explained by the very generic information content of these disclosures. These results enable us to conclude that Canadian companies' voluntary disclosures on climate change in their current state contain very little informational content and appear to be more symbolic in nature. The study's findings raise doubts and questions about the informational contributions of these disclosures in their current format. Since they focus on the impact that climate change may have on the company (i.e., financial materiality), there is reason to question their informational contributions in relation to the information that shareholders can obtain from the media, government institutions or other sources of external information.

Keywords: *Climate change; Informational content; Risks, Disclosures; Value-relevance*

[1] Sylvie Berthelot, Ph. D., FCPA, CPA, Full Professor, École de Gestion, Université de Sherbrooke, 2500, boul. Université, Sherbrooke, (Québec) J1K 2R1, CANADA, Phone: +1 819 437 0434, sylvie.berthelot@usherbrooke.ca. https://orcid.org/0000-0001-6928-4169

[2] Michel Coulmont, DBA, CPA, Full Professor, École de Gestion, Université de Sherbrooke, 2500, boul. Université, Sherbrooke, (Québec) J1K 2R1, CANADA, Phone: +1 819 434 5320, michel.coulmont@usherbrooke.ca. https://orcid.org/0000-0003-1948-9347

[3] Gosselin, Anne Marie, DBA, CPA, Associate Professor, ESG, UQAM, 315, rue Sainte-Catherine Est, Montréal, (Québec) H2X 3X2, CANADA, Phone : +1 506 229 2410, gosselin.anne_marie.2@uqam.ca. https://orcid.org/0000-0002-6312-9691

INTRODUCTION

The 30th Conference of the Parties, designated COP 30, organised by the United Nations Climate Organization in 2025 in Belem, Brazil, unfortunately, and despite the urgency of the situation, did not lead to a significant agreement on mitigating the use of fossil fuels, which are responsible for a very large portion of CO2 emissions. In fact, according to the Intergovernmental Panel on Climate Change (IPCC), it will soon be impossible to limit global warming to 2°C, which will inevitably result in a significant increase in forest fires, torrential rains and floods (Léveillé, 2021). Global warming is largely caused by greenhouse gas (GHG) emissions from human activities. The accumulation of GHGs in the atmosphere traps heat within it, causing the average global temperature to rise. Global warming is a global issue that requires mobilisation on a global scale (Galas and Prieto, 2020). Due to the nature of GHG emissions, which constitute an externality, this mobilisation is difficult to orchestrate. Because GHG emitters experience only a very small portion of the impact of their emissions (Galas and Prieto, 2020), their interests are thus diametrically opposed to those affected by climate change.

On an international scale, many steps are being taken to limit GHG emissions. In 1992, 197 parties joined the United Nations Framework Convention on Climate Change (UNFCCC) to consider what steps can be taken to limit climate change. In 1998, the World Meteorological Organization (WMO) and UN Environment created the IPCC, with the objective of obtaining detailed scientific, technical and socio-economic knowledge on climate change, its causes and its potential impacts (United Nations, 2022). In 1997, 192 parties signed the Kyoto Protocol, which set the first concrete limits on GHG emissions. In 2016, the Paris Agreement, signed by 175 countries, promoted measures to maintain climate change below 2°C by the end of the century. Finally, in concert with these initiatives, COP 26 in 2021 led to the Glasgow Climate Pact, under which many countries committed to carbon neutrality and several committed to specific initiatives intended to reduce greenhouse gas emissions. Since then, however, there has been minimal progress on the world stage.

On the Canadian scene, the federal government and 11 of the 13 provinces and territories signed the Pan-Canadian Framework on Clean Growth and Climate Change in 2016. Several provinces and territories have also implemented various regulations aimed at limiting GHG emissions from businesses (CPA Canada, 2017). The oil and gas industry poses a significant challenge since it accounts for some 5% of Canada's gross domestic product (GDP) and 21% of Alberta's GDP, as well as about 0.4% of Canada's jobs and 2.9% of Alberta's jobs. However, it also accounts for roughly 26% of Canada's total GHG emissions. The economic importance of this sector interferes with the policy positions taken by federal governments and explains, at least in part, the timidity of concrete steps to reduce GHG emissions in Canada.

In addition to this political context, domestic and international financial markets and more and more investors, particularly institutional investors, are taking an interest in the risks associated with climate change. In October 2021, the Canadian Securities Administrators (CSA) launched a consultation on climate-related disclosures for listed companies (CSA, 2021). The resulting document provides qualitative disclosures with respect to governance practices, strategies, risk management, and measures and targets. It also proposes quantitative disclosures specifically targeting GHG emissions.

Considerable effort has been made in the past to document the relevance to investors of quantitative disclosures associated with companies' GHG emissions (Matsumura et al., 2014; Clarkson et al., 2015; Baboukardos, 2017; Cooper et al., 2018; Radu and Maram, 2021; Choi and Luo, 2021). In contrast, a relatively smaller number of researchers have shown interest in qualitative disclosures.

With this in mind, we examined the relevance of corporate disclosures to the risks associated with climate change. Based on the annual reports of companies included in the S&P/TSX Composite Index, we identified the risks associated with climate change that companies voluntarily disclosed. We then examined the value relevance of this information with a regression model based on Ohlson's model (1995). The results of our analyses, founded on disclosures from 210 companies, tend to show that very few of the disclosed risks, with the exception of market risks, appear to be relevant to shareholders. From a perspective aligned with the results noted by Arian and Sands (2024), our findings raise doubts and questions about the informational contributions of these disclosures in their current format. Since they focus on the impact that climate change may have on the company (i.e., financial materiality), there is reason to question their informational contributions relative to the information that shareholders can obtain from the media, government institutions or other sources of non-corporate information. It should also be noted that these other sources of information are in most cases likely to provide more timely informational content than the disclosures included in companies' annual reports, which are published once a year a few months after the closing date of the financial statements. In all, our results raise doubts about the validity of regulations limited to disclosure of the risks associated with climate change. For stakeholders to be able to truly assess an organisation's climate change actions, it is essential to extend regulations to encompass direct and indirect greenhouse gas emissions, as some European countries have done, and as required by the IFRS S2 Climate-related Disclosures.

The rest of this article is organised as follows. The next section reports on previous work contributing to knowledge about voluntary disclosures associated with corporate climate change. The subsequent sections present the methodological choices made, as well as the study's main results. The article concludes with a discussion of its contributions and limitations as well as potential future avenues of research.

In summary, the objective of this study is to examine the value relevance of voluntary disclosures on climate change risks and their management made by a sample of Canadian companies.

STUDY BACKGROUND

Climate Change Risk Disclosures

As with any factor that can impact companies' future cash flows, information about the impact of climate change on these cash flows can also lead to informational problems such as moral hazard and adverse selection. The dynamic between the shareholders of a listed company and its senior management is the same as it is in relation to accounting information. Numerous shareholders (principals) own the company's capital but are not directly involved in its activities since they have delegated its day-to-day management to managers (agents). As a result, shareholders' perception of

the performance of senior executives (agents) and the company is largely consistent with the information the executives communicate. However, managers can take advantage of shareholders' non-involvement in the company's day-to-day operations by: 1) not disclosing all relevant information about the company's performance in order to predict the best possible future cash flows (adverse selection problem); and 2) seeking to manipulate the information used to evaluate their performance as agents to their advantage (moral hazard problem) (Scott and O'Brien, 2020). Accounting information and especially its standardisation at the international level have developed to limit these informational problems (Eisenhardt, 1989; Lambert, 2001; Scott and O'Brien, 2020).

As noted above, while information about the impact of climate change on a company's future cash flows can also be a source of disclosure that is to the advantage of senior management and to the disadvantage of shareholders, carbon accounting has gradually developed over the past few decades (Csutora and Harangozo, 2017; Comite et al., 2025). Csutora and Hanrangozo (2017) define it as a wide range of activities related to the calculation, measurement, verification, and reporting of carbon emissions. The Greenhouse Gas (GHG) Protocol developed by the World Business Council for Sustainable Development and the World Resources Institute (WBCSD – WRI, 2004; 2011) (Csutora and Harangozo, 2017) are the most widely used global guidelines for carbon accounting The concept of climate change accounting, which encompasses the costs of emissions as well as the adaptation and mitigation costs due to climate change (Csutora and Harangozo, 2017), has also been developed. In 2023, the IFRS Foundation issued standardised accounting standard IFRS S2 Climate-related Disclosures requiring companies to disclose information about their climate-related risks and opportunities for annual reporting periods beginning on or after January 1, 2024.

Increasing pressure from shareholders and other stakeholders has also encouraged the development of other initiatives, such as the Carbon Disclosure Project (CDP) and the Task Force on Climate-related Financial Disclosures (TCFD). To meet the information needs of nearly 600 institutional investors, CDP, a non-profit organisation founded in 2000, collects certain information, including that on GHG emissions, from large companies on a voluntary basis (Depoers et al., 2016). This information is then made available to institutional investors. Created in 2017, the TCFD is an initiative of G20 finance ministers and the Financial Stability Board to encourage companies to disclose their strategies to address the risks and opportunities arising from climate change. Its recommendations suggest that companies disclose the following in their annual financial filings: (1) their governance practices tied to climate-related risks and opportunities; (2) the current and potential material impacts of climate-related risks and opportunities on their operations, strategies and financial planning; (3) how they identify, assess and manage their climate-related risks; and (4) measures and targets used to assess and manage material risks and opportunities associated with climate change (Eccles and Krzus, 2017).). The new IFRS S2 Climate-related Disclosures integrated the TCFD recommendations, which led to the disbanding of the TCFD in 2023 (although firms can continue to use the TCFD recommendations if they choose to). The CDP and TCFD have served as benchmarks for many firms, including Canadian companies, where climate-related disclosures have up to now been voluntary. In fact, they represent two perspectives on the content and format of climate change-related information.

A number of researchers have addressed the benefits of these initiatives. For example, the relevance of carbon disclosures has been the subject of several reviews that produced relatively consistent results (Wang, 2023). These studies conclude that investors appear to take most of the carbon information companies disclose into account. Furthermore, the results of previous work tend to demonstrate that investors negatively consider disclosures of GHG emission thresholds (through CDP or government registries) (Saka and Oshika, 2014; Matsumura et al., 2014; Lee et al., 2015; Griffin et al., 2017; Baboukardos, 2017; Jaggi et al., 2018; Cooper et al., 2018; Choi and Luo, 2021; Radu and Maram, 2021), with some exceptions (Wang, 2023; Mahmudah et al., 2023), while they positively consider those associated with management practices (Saka and Oshika, 2014; Jaggi et al., 2018). However, in examining carbon emissions materiality in relation to the financial statements of the 50 largest publicly traded US companies in the S&P 500 index, Lopez and Rotaru (2024) found that their 10-ks narratives do not discuss or explain the impact of emissions on financial performance. They thus concluded that the investors are not receiving the information they need to be able to evaluate investments.

Moreover, few studies have examined the relevance of climate change risk disclosures, although some researchers have shown interest in the reliability of such disclosures (Sobhy and Megeid, 2024), particularly those made by companies in relation to the TCFD recommendations. Overall, these studies conclude that: (1) companies disclose little information (Liesen et al., 2015; Liu and Yang, 2018); and 2) there are variations among firms (Mondal and Bauri, 2022; Principale and Pizzi, 2023; Andersson and Arvidsson, 2023). Some scholars argue that the disclosures appear to have been made from a symbolic perspective (Di Marco et al., 2023) in order to address the firms' quest for legitimacy (Liesen et al., 2015; Hrasky, 2012; Pitrakkos and Maroun, 2020). Amar et al. (2022) and Di Marco et al. (2023) also noted an improvement in disclosures over time.

The Canadian Context

Like many other jurisdictions, the CSA has not regulated climate-related disclosures made by listed companies. It has, however, regulated, at least in part, the content of their annual reports. In addition, under National Instrument 51-102 Continuous Disclosure Obligations, companies are required to address material risks that could affect their financial statements in their MD&A, which is an integral part of their annual report. Furthermore, CSA Staff Notice 51-333 was published in 2010 to provide clarification on environmental disclosure requirements, including climate change issues (CPA Canada, 2017)). It is largely through the MD&A that the recommendations of this opinion can be implemented. In 2005, the Canadian Institute of Chartered Accountants (CICA, 2005) (now CPA Canada), through its Canada Performance Reporting Board, also published a discussion paper that provided recommendations on the nature of disclosures in the MD&A on the financial impact of climate change. These recommendations suggest disclosing climate-related information respecting assumed risks, management strategies, key performance drivers, impacts and results (CICA, 2005). In 2008, a new CICA (2008) publication (*Building a Better MD&A Climate Change Disclosures*) reiterated its recommendations, further elaborating them on the assumptions of risk, GHG emissions and governance processes. In 2017, the Financial Stability Board's (FSB) Task Force on Climate-related Financial Disclosures (TCFD) recommended that

corporate disclosures should concentrate on governance, strategy, risk management, and measures and objectives (CPA Canada, 2022). However, the focus is on disclosures addressing the actual or potential impacts of climate-related risks on the company's operations, strategy and financial planning, indicators and targets used for risk assessment and management, as well as GHG emission thresholds (TCFD, 2017; CPA Canada, 2022). It is largely owing to this document that several Canadian companies listed on the Toronto Stock Exchange disclose their risks associated with climate change.

In conjunction with these prescriptive initiatives on climate-related corporate disclosures, in 2017, CPA Canada conducted a review of disclosures made (in annual information forms, MD&A, financial statements and proxy circulars) in 2015 by a sample of 75 Canadian public offerings. The review found that although the majority (79%) of firms reported climate-related disclosures, these disclosures had several shortcomings, including non-contextualization, inconsistent terminology contributing to lack of comparability spread across multiple documents, and infrequent use of financial metrics or targets. However, 57% of the companies surveyed identified regulatory and litigation risks associated with GHG emissions and 56% identified risks and opportunities that climate change poses to their business model (e.g., changing customer preferences, changes in production processes, new markets) (CPA Canada, 2017). CSA staff identified similar findings from a sample of 48 large listed companies (CSA, 2021). While 92% disclosed information on climate-related risks in their regulated documents, the most frequently disclosed information concerned regulatory and policy risks. In addition, only 59% of the disclosures were found to be relevant, detailed and company-specific, while the remainder were viewed as boilerplate, vague or incomplete (CSA, 2021). Other studies, such as those by Berthelot and Robert (2011) and Gagné and Berthelot (2021), have also observed relatively limited disclosures, but noted some improvement in terms of risk disclosure.

Although these disclosures are voluntary, many companies still incur accounting and legal fees to collect, synthesise and disseminate information about their climate change risks in order to meet investors' expectations. These climate-risk related disclosures should enable investors to more effectively allocate their capital by improving the accuracy of their pricing of assets (Di Marco et al., 2023). Under the “efficient market hypothesis”, these disclosures will enable investors, lenders and insurance underwriters to allocate capital in ways that promote the transition towards both a climate-resilient and a climate-neutral economy (Di Marco et al., 2023). If this is the case, we should examine how shareholders consider this type of information. In other words, they should incorporate this information into the share pricing, which leads us to the following assumptions:

H1: Shareholders negatively view voluntary corporate disclosures of climate-related risks .

H2: Shareholders positively view voluntary disclosures by climate change risk management companies.

Previous work thus suggests that shareholders take companies' greenhouse gas emissions into account. However, in terms of climate-change risks, studies have focused on the gaps in the related disclosures. The purpose of this study is to

complement this work by examining whether shareholders take this type of disclosure into account.

The following section presents the main elements (sample, risk measurement and value relevance model) of the methodological approach used to corroborate these research hypotheses.

METHODOLOGY

Sample

The research sample used in this study is derived from the S&P/TSX Composite Index, which serves as the primary Canadian benchmark index for monitoring the Canadian economy (Yan and Wu, 2023). Initially, the sample consisted of 236 companies. However, 20 trust funds were excluded from the analysis as they do not issue common shares. An additional six companies were eliminated because they had negative book value (4) or exhibited extreme data (2). The final sample thus consisted of 210 companies from the S&P/TSX Composite Index.

Table 1 presents the composition of our firm sample and the frequency and percentage of occurrence of the firm in different sectors of activity. In all, 11 different sectors were represented in the sample. Notably, the materials sector is slightly over-represented (24%), followed by the energy (18%), financial (13%), and industrial (12%) sectors.

Table 1: Sectors of Activity Represented by the Sample of Firms

Sectors	Frequency	Percentage
Materials	50	23.0%
Energy	38	18.1%
Financial	28	13.3%
Industrial	26	12.4%
Utilities	15	7.1%
Information Technology	13	6.2%
Consumer Discretionary	13	6.2%
Consumer Staples	11	5.2%
Communication Services	7	3.3%
Health Care	5	2.4%
Real Estate	4	1.9%
Total	210	100.0%

Risk Measurement

It should be noted that we limited our analyses to these firm's annual reports mainly because the universality of these reports made it possible to compare our findings with previous research on other types of firms or firms in other countries (Yongvanich and Gutherie, 2007). Since the annual report presents the company's financial statements, it is also one of the documents stakeholders and investors most often consult. Given

that firms aim at communicating information to their stakeholders, the annual report should be viewed as a valuable communication tool. These documents, which are readily accessible to various stakeholders, contain credible information since the auditors are required to verify its consistency and plausibility (Depoers and Jeanjean, 2012). It is also in this document that the CSA requires companies to address material risks that could affect their financial statements. These factors explain our decision to work with companies' annual reports rather than other documents. In this study, we decided to focus solely on the risk section of the MD&A, specifically examining risks associated with climate change. Data were manually collected from the annual reports for the fiscal year 2021, available on the CSA web site (www.sedar.com), and analysed according to TCFD recommendations.

The TCFD has divided climate-related risks into two main categories: physical risks and transition risks towards a low-carbon economy (TCFD, 2017). Physical risks may be acute, such as hurricanes and floods, or chronic, such as rising temperatures and sea levels. Regulatory, technological, commercial and reputational risks are all grouped under transition risks (TCFD, 2017). The TCFD has formulated disclosure recommendations around the following four themes: governance, strategy, risk management, and metrics and targets. However, in our data collection we were unable to identify a company that disclosed all of these elements. Since companies disclose only certain risks and some note how they manage them, our collection was limited to these elements. If a company identified a risk associated with climate change, the encoding was to give it a value of 1 and 0 otherwise. Similarly, if the company mentioned how it managed the risk associated with climate change, it was given a value of 1 and a value of 0 otherwise.

Table 2 presents the distribution of the frequency of disclosed risks by the firms included in the sample. According the TCFD (2017), the following five categories of climate change risks can impact the firms: policy and legal risks, technology risks, market risks, reputation risks and physical risks (e.g., direct damage to assets and indirect impacts from supply chain disruption). As Table 2 shows, a significant portion of firms chose not to disclose any risks (44%), with only 11% disclosing three or more climate change risks.

Table 2: Frequency of Disclosed Climate Change Risks

Number of risks disclosed	Frequency	Percentage
0	90	43.9%
1	39	18.6%
2	58	27.6%
3	14	6.7%
4	2	1.0%
5	7	3.3%
Total	210	100.0%

Value Relevance Model

To examine how investors integrate the publication of disclosure and manage climate change risks, we drew on an empirical version of the Ohlson model (1995), similar to that used by Xu et al. (2007), Cormier et al. (2022), Radu and Maram (2021), and Menezes da Costa Neto et al. (2023). This model relates firm market capitalisation four months after the end of fiscal year ($P_{i, t+4}$ * number of common shares outstanding) to the book value of equity and earnings. The addition of sectoral variables relating to the most important sectors makes it possible to control the potential influence of the companies' sector of activity on the results. If, for reasons not covered in this study, differences exist in the market capitalisation of firms operating in these sectors of activity, these differences will be captured by these control variables. The model is expressed as follows:

$$MV_{i, t+4} = \alpha_0 + \alpha_1 BV_{i, t} + \alpha_2 EARN_{i, t} + \alpha_3 EARN_{i, t} * NEG_{i, t} + \alpha_4 SEC\_MAT_{i, t} + \alpha_5 SEC\_ENE_{i, t} + \alpha_6 SEC\_FIN_{i, t} + \quad (1)$$

where,

$MV_{i, t+4}$ is the market value for the firm i four months after the fiscal year-end t.

$BV_{i, t}$ is the book value of common equity for the firm i at the year-end t.

$EARN_{i, t}$ is earnings before extraordinary items for the firm i the year t.

$NEG_{i, t}$ is a variable equal to 1 if the earnings of the firm i are negative in year t and 0 otherwise.

$SEC\_MAT_{i, t}$ is a variable equal to 1 if firm i operates in the materials sector and 0 otherwise.

$SEC\_ENE_{i, t}$ is a variable equal to 1 if firm i operates in the energy sector and 0 otherwise.

$SEC\_FIN_{i, t}$ is a variable equal to 1 if firm i operates in the financial sector and 0 otherwise.

$SEC\_IND_{i, t}$ is a variable equal to 1 if firm i operates in the industrial sector and 0 otherwise.

$\varepsilon_{i, t}$ is the error term.

The study proceeded to examine the incremental value relevance associated with the publication of disclosures and management of climate change risks by introducing 10 dummy variables into the model. These variables were incorporated to account for risks disclosed in annual reports as well as those managed. During the data collection phase, if a specific risk type was mentioned, the corresponding dummy variable was set to 1, and 0 otherwise. These risk types were aligned with the recommendations provided by the TCFD encompassing policy and legal, technological, market, reputation, and physical risks. Further variables were created to represent managed risks, with the respective dummy variable indicating whether or not the risk was actively managed. Consequently, Equation (1) was adjusted accordingly:

$$MV_{i,t+4} = \alpha_0 + \alpha_1 BV_{i,t} + \alpha_2 EARN_{i,t} + \alpha_3 EARN_{i,t} * NEG_{i,t} + \alpha_4 SEC\_MAT_{i,t} + \alpha_5 SEC\_ENE_{i,t} + \alpha_6 SEC\_FIN_{i,t} + \alpha_7 SEC\_IND_{i,t} + \alpha_8 DIS\_POLI_{i,t} + \alpha_9 DIS\_TECH_{i,t} + \alpha_{10} DIS\_MARK_{i,t} + \alpha_{11} DIS\_REPU_{i,t} + \alpha_{12} DIS\_PHYS_{i,t} + \alpha_{13} MAN\_POLI_{i,t} + \alpha_{14} MAN\_TECH_{i,t} + \alpha_{15} MAN\_MARK_{i,t} + \alpha_{16} MAN\_REPU_{i,t} + \alpha_{17} MAN\_PHYS_{i,t} + \varepsilon_{i,t} \quad (2)$$

Where the new variables are defined as:

$DIS\_POLI_{i,t}$ is a variable equal to 1 if firm i disclosed the policy and legal risk and 0 otherwise.

$DIS\_TECH_{i,t}$ is a variable equal to 1 if firm i disclosed the technology risk and 0 otherwise.

$DIS\_MARK_{i,t}$ is a variable equal to 1 if firm i disclosed the market risk and 0 otherwise.

$DIS\_REPU_{i,t}$ is a variable equal to 1 if firm i disclosed the reputation risk and 0 otherwise.

$DIS\_PHYS_{i,t}$ is a variable equal to 1 if firm i disclosed the physical risk and 0 otherwise.

$MAN\_POLI_{i,t}$ is a variable equal to 1 if firm i managed the policy and legal risk and 0 otherwise.

$MAN\_TECH_{i,t}$ is a variable equal to 1 if firm i managed the technology risk and 0 otherwise.

$MAN\_MARK_{i,t}$ is a variable equal to 1 if firm i managed the market risk and 0 otherwise.

$MAN\_REPU_{i,t}$ is a variable equal to 1 if firm i managed the reputation risk and 0 otherwise.

$MAN\_PHYS_{i,t}$ is a variable equal to 1 if firm i managed the physical risk and 0 otherwise.

Market capitalisation is estimated from financial data corresponding to four months after the end of the fiscal year from which the accounting data was taken, in order to ensure that climate change risks disclosed were available to investors and that they could have integrated this information into the company valuation within the framework of our analysis. As in Xu et al. (2007), we expect the coefficients associated with the book value of common equity (α_1) and net earnings of the company (α_2) to be positive and significant, and the coefficient associated with an interaction variable that is the product of net earnings and the dummy variable $NEG_{i,t}$ (α_3) to be negative and significant.

The financial and market information related to each of the companies, such as market capitalisation, book value and earnings, and business sector were retrieved from the S&P Capital IQ database for the 2021 fiscal year. The 2021 annual reports of each of the observations were extracted from SEDAR (a secure web-based system used by all market participants to file, disclose and search for information in Canada's capital markets) or from the companies' websites for the climate change risks disclosure data coding.

In summary, the study encompasses a sample of Canadian companies listed on the Toronto Stock Exchange and included in the S&P/TSX Composite Index. With the exception of the measure of voluntary disclosures respecting risks and the management of these risks, the preferred measures for the variables included in the analyses and the models used are similar to those used in previous work.

The next section presents descriptive statistics of the variables included in the statistical analyses, the main results of the study, and a discussion of these results.

RESULTS

Descriptive Statistics of the Continuous Variables

Table 3 presents the descriptive statistics of the continuous variables (i.e. market value [$MV_{i, t+4}$], book value [$BV_{i,t}$] and earnings [$EARN_{i, t}$]) included in analysis. Given that the sample comprises companies exclusively from the S&P/TSX Composite Index, these companies are notably large in scale. The average market capitalisation of the sample firms stands at CAD$15.566 billion (with a median of CAD$4.729 billion). Furthermore, the average book value of common equity for the sample is CAD$7.102 billion (with a median of CAD$2.112 billion), while the average earnings amount to CAD$917 million (with a median of CAD$246 million).

Table 3: Descriptive Statistics of Continuous Variables

	Mean	SD	Median	Minimum	Maximum
$MV_{i, t+4}$	15.566	28.039	4.729	385	198.624
$BV_{i, t}$	7.102	13.544	2.112	9	95.878
$EARN_{i, t}$	917	2.086	246	-3.602	15.781

Financial figures are presented in millions of Canadian dollars.
$MV_{i, t+4}$ = market value of the firm's common shares outstanding for firm i four months after the fiscal year-end t; $BV_{i, t}$ = book value of the firm's common equity for firm i at the fiscal year-end t; $EARN_{i, t}$ = earnings of fiscal year t available for common shareholders of firm i.

Table 4 shows the outcomes of the correlation coefficients for the continuous variables (i.e., market value [$MV_{i, t+4}$], book value [$BV_{i,t}$] and earnings [$EARN_{i, t}$]) included in the regression model. Each coefficient demonstrates a notable and statistically significant correlation. It is anticipated that market capitalisation, book value and earnings would exhibit strong correlations, as larger companies with higher earnings typically correspond to larger market capitalisations.

Table 4: Correlation Coefficients (for continuous variables included in the regression model)

	$MV_{i, t+4}$	$BV_{i, t}$	$EARN_{i, t}$
$MV_{i, t+4}$	1.000		
$BV_{i, t}$	0.949^{***}	1.000	
$EARN_{i, t}$	0.906^{***}	0.923^{***}	1.000

*** $p \leq 0.001$, ** $p \leq 0.05$, * $p \leq 0.1$.
$MV_{i, t+4}$ = market value of the firm's common shares outstanding for firm i four months after the fiscal year-end t; $BV_{i, t}$ = book value of the firm's common equity for firm i at the fiscal year-end t; $EARN_{i, t}$ = earnings of fiscal year t available for common shareholders of firm i.

Descriptive Statistics Respecting the Climate Change Risks Disclosed

Table 5 presents the frequency and percentage of the type of climate change risks disclosed by business sector. According to this analysis, physical, legal and reputational risks are the risks companies most frequently disclose in all sectors combined, with percentages of 42%, 37% and 19% respectively. This can be explained by the fact that these risks are easily identifiable for companies and affect the vast majority of them. However, climate-related technological and market risks are the least frequently mentioned in the firms' annual reports.

Table 5: Type of Climate Change risks Disclosed by Business Sector

Sector	Firms	Policy & legal		Technology		Market		Reputation		Physical	
	Nb	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%
Communication Services	7	4	57%	1	14%	1	14%	2	29%	4	57%
Consumer Discretionary	13	2	15%	1	8%	1	8%	3	23%	4	31%
Consumer Staples	11	4	36%	1	9%	1	9%	5	45%	4	36%
Energy	38	20	53%	7	18%	6	16%	11	29%	21	55%
Financial	28	6	21%	0	0%	1	4%	9	32%	4	14%
Health Care	5	0	0%	0	0%	0	0%	0	0%	0	0%
Industrial	26	13	50%	1	4%	4	15%	4	15%	10	38%
Information technology	13	2	15%	0	0%	1	8%	0	0%	3	23%
Materials	50	23	46%	1	2%	1	2%	5	10%	28	56%
Real Estate	4	0	0%	0	0%	1	25%	1	25%	0	0%
Utilities	15	4	27%	1	7%	3	20%	2	13%	9	60%
Total	210	78	37%	13	6%	20	10%	42	20%	87	41%

Table 6 shows the frequency and percentage of the managed risks disclosed by the companies. The focus appears to be mainly on managing reputational risks. The remaining risks are reported to be managed fairly uniformly, at close to 50%.

Table 6: Type of Climate Change Risks Managed, Disclosed by Business Sector

Sector	Firms	Policy & legal		Technology		Market		Reputation		Physical	
	Nb	Nb	%	Nb	%	Nb	%	Nb	%	Nb	%
Communication Services	7	3	43%	1	14%	1	14%	2	29%	3	43%
Consumer Discretionary	13	2	15%	0	0%	0	0%	2	15%	3	23%
Consumer Staples	11	1	9%	0	0%	0	0%	3	27%	2	18%
Energy	38	9	24%	4	11%	4	11%	9	24%	9	24%
Financial	28	4	14%	0	0%	1	4%	7	25%	3	11%
Health Care	5	0	0%	0	0%	0	0%	0	0%	0	0%
Industrial	26	4	15%	1	4%	2	8%	2	8%	4	15%
Information technology	13	1	8%	0	0%	0	0%	0	0%	1	8%
Materials	50	13	26%	1	2%	0	0%	4	8%	12	24%
Real Estate	4	0	0%	0	0%	1	25%	1	25%	0	0%
Utilities	15	3	20%	1	7%	1	7%	2	13%	4	27%
Total	210	40	19%	8	4%	10	5%	32	15%	41	20%

Regression analysis

Table 7 presents the results of the regression analysis of the value relevance models. As mentioned previously, Model 1 is the regression model without the climate change risks disclosure variables. Model 2 includes them in order to measure the informational contribution to shareholders attributable to the disclosure of these risks and their management. We ran ordinary least squares regressions. The multicollinearity between the independent variables is not seen as problematic. In fact, the variance inflation factor obtained by the collinearity diagnostic for the independent variables ($BV_{i,t}$, $EARN_{i,t}$, and $EARN_{i,t} \times NEG_{i,t}$) is within the prescribed threshold of [1, 10] proposed by Hair et al. (2010).

Table 7 shows for both models that the coefficients of the book value ($BV_{i,t}$) and the earnings ($EARN_{i,t}$) are positive and significant and the interaction variable of negative earnings ($EARN * NEG_{i,t}$) is negative and also significant as expected. The adjusted R^2 shows that the three variables of Model 1 explain 88.20% of the market capitalisation of the firms studied. Model 2 shows a slight increase in the percentage of variance explanation of the firms' market capitalisation (R^2ajusted = 88.80%). This change can be considered slight but remains significant with a p-value inferior to 0.05. Three dummy variables representing business sectors have significant coefficients, which means that investors include information about business sectors in their firm pricing. No coefficient is significant with respect to climate change risk disclosures.

Table 7. Results of the Regression Analysis

Independent variables	Model 1		Model 2	
$BV_{i, t}$	1,556	***	1.425	***
$EARN_{i, t}$	3,622	***	4.153	***
EARN * $NEG_{i, t}$	-3.824	**	-4.675	**
$SEC\_MAT_{i, t}$	-4,328,181	**	-3,795.417	**
$SEC\_ENE_{i, t}$	-3,328,077	**	-3,813.556	**
$SEC\_FIN_{i, t}$	-11,009,098	***	-9,500.445	***
$SEC\_IND_{i, t}$	2,369,858		2,113.897	
$DIS\_POLI_{i, t}$			-1,197.855	
$DIS\_TECH_{i, t}$			4,404.054	
$DIS\_MARK_{i, t}$			1,569.553	
$DIS\_REPU_{i, t}$			2,952.541	
$DIS\_PHYS_{i, t}$			1,005.527	
$MAN\_POLI_{i, t}$			1,924.636	
$MAN\_TECH_{i, t}$			-6,554.643	
$MAN\_MARK_{i, t}$			10,439.648	**
$MAN\_REPU_{i, t}$			-4,686.419	
$MAN\_PHYS_{i, t}$			667.820	
Constant	3,779.439	***	2,951.518	**
R^2	0.927		0.935	
Adjusted R^2	0.925		0.929	
F-Value	366.767	***	162.582	***
Incremental adjusted R^2	-		0.008	
F-test improved fit	-		2.361	**
D-Cook max	0.369		0.643	
Durbin-Watson	2.229		2.188	
No. of observations	210		210	

Dependent variable: $MV_{i, t+4}$, *** $p \leq 0.001$, ** $p \leq 0.05$, * $p \leq 0.1$.
$MV_{i, t+4}$ = market value of the firm's common shares outstanding four months after the fiscal year-end t; $BV_{i, t}$ = book value of the firm's common equity at the fiscal year-end t; $EARN_{i, t}$ = earnings of fiscal year t available for common shareholders of firm i; $NEG_{i, t}$ = equal to 1 if firm earnings are negative in year t. $SEC\_MAT_{i, t}$, $SEC\_ENE_{i, t}$, $SEC\_FIN_{i, t}$, $SEC\_IND_{i, t}$ = equal to 1 if firm i operates in the materials, energy, financial or industrial sectors respectively in year t; $DIS\_POLI_{i, t}$, $DIS\_TECH_{i, t}$, $DIS\_MARK_{i, t}$, $DIS\_REPU_{i, t}$, $DIS\_PHYS_{i, t}$ = equal to 1 if firm i disclosed the risk related to the policy and legal, the technology, the market, the reputation or the physical respectively in year t; $MAN\_POLI_{i, t}$, $MAN\_TECH_{i, t}$, $MAN\_MARK_{i, t}$, $MAN\_REPU_{i, t}$, $MAN\_PHYS_{i, t}$ = equal to 1 if firm i managed the risk related to the policy and legal, the technology, the market, the reputation or the physical respectively in year t.

Accordingly, hypothesis H_1 is not supported by our observations. As concerns the disclosure of the company's risk management, the coefficient associated with the management of climate change risks associated with the market is positive and

significant (p-value < 0.05). Shareholders do not seem to take the management of other types of climate change risks into account.

In conclusion, although Canadian companies voluntarily disclose many climate-change risks and their management, shareholders seem to take very little account of this information in their assessments of companies' future cash flows.

DISCUSSION

The results observed can possibly be explained by the informational content of climate change risk disclosures. As mentioned above, empirical work tends to show that these disclosures are of poor quality (Liesen et al., 2015; Liu and Yang, 2028; Di Marco et al., 2023; Andersson and Arvidsson, 2023). An examination of their informational content also leads us to question the marginal contribution of this informational content compared to the other information in the overall information environment that informed shareholders have already integrated into their assessment of the value of a company's shares. For example, Birchcliff Energy Ltd. identifies the following risks in its annual report:

> Climate change has been linked to long-term shifts in climate patterns, including rising mean temperature and sea levels and long-term changes in precipitation patterns. As the level of activity in the Canadian oil and natural gas industry is influenced by seasonal weather patterns, long-term shifts in climate patterns pose the risk of exacerbating operational delays and other risks posed by seasonal weather patterns. (Birchcliff Energy Ltd, 2021, p. 44)

> Claims have been made against certain energy companies alleging that GHG emissions from oil and natural gas operations constitute a public nuisance under certain laws or that such energy companies provided misleading disclosure to the public and investors of current or future risks associated with climate change. As a result, individuals, government authorities or other organizations may make claims against oil and natural gas companies, for alleged personal injury, property damage or other potential liabilities. While the Corporation is not a party to any such litigation or proceedings, it could be named in actions making similar allegations. An unfavorable ruling in any such case could adversely affect the demand for and price of securities issued by the Corporation, impact its operations and have an adverse effect on its financial condition, which could prove to be material (Birchcliff Energy Ltd, 2021, p. 45).

The information content of these disclosures is sufficiently generic in nature to raise the question of whether they can actually add informational content to what shareholders have already taken into account in integrating the information disseminated in the information environment surrounding Canadian and international capital markets. In addition to the study results, these observations raise questions about the benefits that companies can achieve by disclosing information associated with climate change, such as risks and risk management. According to Andersson and Arvidsson (2023), firms do not disclose all the information in their possession. If so, the Canadian carriers' current climate change disclosures seem to be more of a “ceremonial” practice (Di Marco et al., 2023) used to promote the “institutional myth”

of risk transparency rather than to help facilitate transformative change toward a more environmentally sustainable economy (Di Marco et al., 2023).

Our results raise concerns about the appropriateness of the disclosure requirements for climate-related risk disclosure, particularly in the context of the IFRS S2 Climate-related Disclosures. In fact, like the TCFD, this accounting standard may make it possible to more effectively define the elements associated with climate change that could have a short- and medium-term impact on companies' future cash flows. However, these are disclosures that can largely be communicated by other accounting standards, such as those relating to contingent liabilities (IAS 37) or by other sources of information such as government agencies and the media. If investors and other stakeholders are more interested in assessing the extent to which the company is meeting its social responsibilities, they are more likely to be interested in climate-related metrics (i.e. greenhouse gas emissions direct and indirect).

In terms of climate-related disclosures, it is particularly important to distinguish between financial materiality and impact materiality because, as mentioned earlier, greenhouse gas emissions represent "externalities". Moreover, companies that emit greenhouse gases are not necessarily those that face most of the risks associated with climate change (with the exception of the risk of tighter regulation). Because information about climate-related risks involves the cost of collecting and reporting information, and such information may be redundant in relation to other accounting standards and lag behind other data sources and can also be deployed strategically to cognitively influence its users and shareholders do not appear to seriously take it into account, il y a lieu de se demander whether accounting standard-setting bodies should focus on disclosing greenhouse gas emissions rather than on disclosing the risks and opportunities associated with climate change. The data stemming from long-established protocols for measuring greenhouse gas emissions can be audited. Strengthening the credibility and comparability of climate-change metrics seems essential to leverage firms' disclosure (and accounting) as a tool for climate change mitigation (Nyakuwanika and Panicker, 2025). In this respect, Kim et al. (2023) have observed reductions in the quantity, intensity and cost of carbon emissions relating to the SEC 2010 rule on climate change risk reporting in the 10-ks. Furthermore, there is no doubt that accounting can play an active role in the global fight against climate change. In the meantime, companies that truly care about their social responsibility should extend their voluntary disclosure to encompass their direct and indirect greenhouse gas emissions.

CONCLUSION

The purpose of this study is to examine whether shareholders value the climate change risk disclosures that firms communicate in their annual reports. With the exception of the management of market risk associated with climate change, investors do not appear to take this type of information into account. The very generic information content of these disclosures may possibly explain this lack of consideration. These results therefore raise questions about companies' real interest in communicating this type of information. Some, in fact, appear to view it as a quest for legitimacy (Liesen et al., 2015; Hrasky, 2012; Pitrakkos and Maroun, 2020), which would in turn affect its content.

This study has certain limitations. The sample consisted of only relatively large Canadian companies included in the Composite Index S&P/TSX. It should be noted that the disclosure of climate change risks is relatively recent in Canada. Shareholders may need more time to incorporate this type of information into their investment decisions. In addition, a significant number of the companies included in the sample operate in sectors of activity that emit high levels of greenhouse gases. Regulations to limit greenhouse gas emissions are the focus of many political debates in Canada, which could potentially affect not only disclosures but also their interpretation. Moreover, further analyses in other contexts could possibly lead to different results. It should also be noted that the qualitative nature of corporate disclosures has sometimes necessitated some trade-off in the categorisation of climate change risks.

This study points to different avenues of research. It could be worthwhile assessing the appropriateness of the risks that will be disclosed under the international accounting standard IFRS S2 Climate-related Disclosures. Given that these disclosures will be more regulated by the accounting profession, it could be interesting to examine whether shareholders will give more consideration to the information disclosed. It should also be noted that the international nature of these standards will allow for international comparisons. As well, it could be worthwhile to examine the relevance of climate change risks to shareholders in relation to other risks companies disclose in their annual reports. Such a study would make it possible to assess whether investors consider certain risks to be more relevant than others. Finally, an examination of the relevance of the information on climate-related risks comparatively to climate-related metrics (greenhouse gas emissions) would also be of significant interest.

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