

Carbon Risk and Accounting Conservatism: Evidence from Canadian High-Emission Industries

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Abstract

Purpose – This study explores whether carbon risk is linked with accounting conservatism in Canadian listed firms operating in high-emission industries. The main concern is whether firms facing greater carbon exposure responds with more cautious financial reporting when climate-related risks can materially affect their finances.

Design/methodology/approach – A quantitative panel approach was applied to non-financial Canadian firms recorded by Refinitiv from 2016 to 2025. The sample cover four high-emission sectors: Energy, Materials, Transportation, and Utilities. Accounting conservatism are measured through the Khan and Watts model, while carbon risk is represented by carbon emission intensity.

Findings - The evidence indicate a positive link between carbon risk and accounting conservatism. However, the strength of this link change when different model specifications are applied, meaning the statistical support are not equally strong in every specification.

Implication – These findings suggests that carbon risk may be reflected in can enters the financial reporting behaviour, especially in industries with process, particularly when firms operate under high carbon exposure. The findings are relevant this issue matter for investors, regulators, and standard setters because they indicate that climate-related risks risk may influence not only affects more than sustainability disclosures but reporting. It may also shape the way firms recognize and reports financial reporting practices information.



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INTRODUCTION

Climate change and extreme weather linked to carbon emissions has created new pressure for companies around the world. Firms can no longer treats environmental responsibility as a minor issue (Islam et al., 2024; Wu et al., 2022). Carbon risk cover physical threats to business activities as well as transition pressure created by stricter climate rules. Both forms can

threatens a firm's financial condition (Dai et al., 2025; Zhang et al., 2025). The effect may also reach financial reporting because greater carbon exposure can increase the possibility of future financial losses. Firms with high carbon exposure are more likely to face potential impairment losses (Khalifa et al., 2024; Wu et al., 2022), environmental liabilities (Wu et al., 2022), compliance costs (Liu et al., 2024; Shu & Tan, 2023), carbon taxes (Mbanyele et al., 2024), litigation costs (Islam et al., 2024), and reputational losses (Ferdous et al., 2024; Zhang et al., 2025). These risks may reduce future cash flows and increase uncertainty about asset values and future obligations. Therefore, carbon risk is not only an environmental issue, but also a financial reporting issue because it may affect how firms recognize expected losses and disclose financial risks (Ferdous et al., 2024; Islam et al., 2024). Firms with high carbon emissions face many uncertainties (R. Ding et al., 2024). These risks can reduce earnings and increase operating costs, which make firms become more financially vulnerable (Islam et al., 2024; Zhang et al., 2025). This issue becomes clearer with the issuance of IFRS S2. The standard shows that firms need to consider climate risks not only as corporate social responsibility issue, but also as part of financial reporting and long-term business survival (IFRS Foundation, 2023; Islam et al., 2024).

As stakeholders increasingly demand greater transparency regarding carbon-related exposures, firms' financial reporting practices are expected to be influenced by their level of environmental risk (Ferdous et al., 2024; Islam et al., 2024). Accounting conservatism, which refers to recognizing losses faster than gains, is an important mechanism to reduce information asymmetry between managers and investors (Islam et al., 2024). Firms may respond to carbon risk through several channels, such as ESG disclosure, operational changes, risk management practices, or financial reporting choices. This study focuses on accounting conservatism because it represents a financial reporting response that affects the recognition of bad news and the credibility of accounting information. Executives are expected to evaluate the risk environment before making accounting policy decisions because these decisions often reflect the firm's risk tolerance (Wu et al., 2022). When firms face higher carbon-related uncertainty, accounting conservatism becomes relevant because its main characteristic is timely loss recognition. Conservative reporting requires firms to recognize bad news or expected losses more quickly than good news or expected gains (Basu, 1997; Watts, 2003; Glover & Xue, 2023). Therefore, when carbon risk increases the possibility of future losses, firms may respond by recognizing impairment losses, provisions, accrual expenses, or other loss-related items in a more timely manner (R. Ding et al., 2024; Islam et al., 2024). From the perspective of stakeholder theories, firms with high carbon risk are encouraged to adopt more conservative reporting to signal financial discipline and reassure investors that the company is managing environmental uncertainty carefully (Ferdous et al., 2024; Islam et al., 2024). Agency theory provides another possible explanation. From this view, information asymmetry can give managers room to hide weak performance or adjust reported earnings when carbon-related pressure becomes stronger (Ismail & Obiedallah, 2023; Khalifa et al., 2024).

The way firms report carbon-related financial risks are therefore important for regulators and policymakers seeking reliable and transparent reporting in an economy facing tighter carbon limits (Islam et al., 2024; Wu et al., 2022). The carbon risk and accounting conservatism link may also change from one country to another. Climate readiness differs across economies (X. Ding et al., 2024), as does the strength of regulatory enforcement (Laux & Laux, 2024). Where climate threats are easier to observe and are monitored more closely, firms may experience stronger pressure to include carbon-related uncertainty in their financial reports.

Recent cross-country evidence presents a more positive view of climate risk. It suggests that firms may respond to climate pressure by adopting more cautious reporting practices, which can improve the quality of information available to users of financial statements (Ferdous et al., 2024). Investors and lenders also demand more careful financial reporting under

high uncertainty (R. Ding et al., 2024; Ferdous et al., 2024; Islam et al., 2024). On the other hand, studies also found a dark side, where firms facing higher climate risk becomes less conservative because managers engage in more aggressive reporting practices to hide earnings volatility and avoid debt covenant problems (Khalifa et al., 2024). These mixed findings may occur because prior studies examine firms across different countries and industries where carbon risk may not be equally material. This study addresses this gap by focusing on Canadian high-emission industries, where carbon risk is more likely to be financially relevant. This leads to the research question: does carbon risk shape accounting conservatism among Canadian firms in high-emission industries?

Canada is selected because it provides a relevant setting for examining carbon risk. Based on Ritchie et al. (2023), Canada is among the countries with relatively high CO₂ emissions per capita, indicating that carbon-related issues are material at the country level. This condition is also supported by Canada's economically important high-emission industries, particularly Energy, Materials, Utilities, and Transportation. Therefore, Canada is an appropriate context to examine whether carbon risk is reflected in accounting conservatism when carbon exposure is financially material.

This study contributes to the literature by showing that the relationship between carbon risk and accounting conservatism is context-dependent. By focusing on Canadian high-emission industries, this study examines whether carbon risk is associated with conservative reporting behavior in a setting where carbon exposure is more financially material. The findings provide evidence of a positive association between carbon risk and accounting conservatism in the main regression. This suggests that firms with higher carbon risk tend to apply more conservative financial reporting. However, the robustness tests show mixed evidence, indicating that the findings should be interpreted as suggestive rather than fully conclusive. From a theoretical perspective, this study add to discussions of stakeholder and agency theory by suggesting that carbon risk does not have a fixed effect on accounting conservatism. Its role may depends on how material and visible a firm's carbon exposure are. From an empirical perspective, the study provide evidence from Canadian high-emission industries, where carbon exposure can carries greater economic consequences. For practical use, the findings suggests that investors and regulators should gives closer attention to carbon-intensive firms because climate exposure may also appears through changes in financial reporting behavior.

The main novelty of this study come from its use of high-emission industries as the central setting. Instead of placing firms from all sectors into one broad group, the study consider carbon risk more relevant when firms operates in activities with greater carbon exposure. The evidence also indicate a stronger relationship among smaller firms and during the period after 2020. This pattern suggest that firm vulnerability and more recent climate pressure can affects how carbon risk enters financial reporting. The findings therefore has practical value for regulators, investors, and standard setters because financial reporting responses to carbon exposure may depends on industry conditions, firm size, time period, pressure from stakeholders, as well as managerial incentives.

LITERATURE REVIEW AND RESEARCH HYPOTHESIS

Carbon risk refers to possible uncertainty and financial damage arising from climate change (Dai et al., 2025; Luo et al., 2026). IFRS S2 Par. 3 identify two climate-related risks that may affects an entity's prospects: (1) climate-related physical risks and (2) climate-related transition risks (IFRS Foundation, 2023). Physical risks can come from climate events that damages property or interrupt business activities. Transition risks can instead arise from new climate regulations, carbon pricing, technological shifts, and changing market expectations. Such pressures may produce higher compliance expenses, carbon taxes, asset losses, legal claims, and reputational damage (Islam et al., 2024; Zhang et al., 2025). As carbon concerns

become more connected with business performance, financial reporting may also respond to the amount of carbon risk carried by firms (Ferdous et al., 2024; Wu et al., 2022). However, the expected direction is still debated because previous studies provides both positive and negative explanations.

Accounting conservatism has two forms which are conditional and unconditional conservatism. Conditional conservatism refers to the asymmetric timeliness of earnings in incorporating economic news, whereby bad news is reflected in earnings more quickly than good news. In contrast, unconditional conservatism refers to the systematic understatement of net asset values that arises independently of contemporaneous economic news. This study focuses specifically on conditional accounting conservatism, as carbon risk can generate adverse economic news that may affect firm's future cash flows, asset values, and obligations. Accordingly, the relevant question is whether firms greater carbon risk incorporate such adverse economic news into earnings more quickly than favorable news.

From stakeholder theory, firms with high carbon risk is expected to use more conservative accounting to respond to the needs of investors, regulators, and the public (Ferdous et al., 2024; Zhang et al., 2025). The expected positive association is based on the idea that carbon risk increases the likelihood of future economic losses and strengthens stakeholder demand for credible financial reporting (X. Ding et al., 2024; Wu et al., 2022). Carbon risk may affect firms' future cash flows through potential impairment losses (Khalifa et al., 2024; Wu et al., 2022), environmental liabilities (Wu et al., 2022), compliance costs (Liu et al., 2024; Shu & Tan, 2023), carbon taxes (Mbanyele et al., 2024), litigation costs (Islam et al., 2024), and reputational losses (Ferdous et al., 2024; Zhang et al., 2025).

Accounting conservatism become important in this discussion because it gives priority to earlier recognition of losses. Under this approach, bad news and expected losses are recorded sooner than good news and expected gains (Basu, 1997; Watts, 2003; Laux & Laux, 2024). When carbon risk becomes financially important, this approach can brings possible climate-related losses into financial statements through impairment, provisions, accrual expenses, and other loss-related estimates (Ferdous et al., 2024; Islam et al., 2024; Wu et al., 2022). Accounting conservatism therefore represent more than general caution in reporting. It provides a specific way for firms to recognize possible economic losses earlier (Laux & Laux, 2024). By recording carbon-related bad news sooner, firms may provides a clearer picture of the financial effects created by environmental uncertainty.

Agency theory presents a different, less favorable possibility. Information asymmetry may allows managers to postpone the recognition of carbon-related losses because managers usually possesses more detailed information about the firm's condition than outside users. They may responds to carbon pressure through obfuscation, greenwashing, or aggressive reporting, especially when earnings are unstable or when bonus and debt covenant pressures exists (Dai et al., 2025; R. Ding et al., 2024). Under this explanation, greater carbon risk may leads to lower accounting conservatism (Khalifa et al., 2024). Managers and shareholders may has different interests when firms face climate-related pressure (Ismail & Obiedallah, 2023). Climate events and stricter environmental rules can weakens firm performance and makes earnings less stable (Huang et al., 2020). Managers seeking to avoid debt covenant problems or protect compensation may therefore delays bad news and uses more aggressive reporting practices (Khalifa et al., 2024). Such behavior can makes financial reporting less conservative (Garanina & Kim, 2023). Khalifa et al. (2024) reported evidence from developing economies showing that higher climate risk were linked with lower accounting conservatism because managers used aggressive reporting to reduces the visible effect of earnings instability.

Expected positive link can be understood through several connected steps. First, greater carbon risk raises the possibility of future economic losses, such as impairment losses (Khalifa et al., 2024; Wu et al., 2022), environmental liabilities (Wu et al., 2022), compliance expenses

(Liu et al., 2024; Shu & Tan, 2023), carbon taxes (Mbanyele et al., 2024), litigation costs (Islam et al., 2024), and reputational damage (Ferdous et al., 2024; Zhang et al., 2025). Second, these possible losses creates more uncertainty around future cash flows, asset values, and financial obligations. Third, managers usually knows more about the firm's actual carbon exposure than outside investors or creditors, which can widens information asymmetry (Luo et al., 2026; Zhang et al., 2025). Fourth, investors and creditors may demands more reliable financial reporting so that carbon-related bad news is not postponed (Ferdous et al., 2024; Islam et al., 2024). Finally, accounting conservatism become relevant because it gives earlier recognition to losses than gains (Basu, 1997; Watts, 2003). Thus, firms carrying higher carbon risk may records negative financial consequences sooner and displays stronger accounting conservatism. From these two competing explanations, this study propose the following hypothesis:

H1: Carbon risk is positively associated with accounting conservatism.

In conclusion, Fig. 1 depicts the proposed conceptual framework.

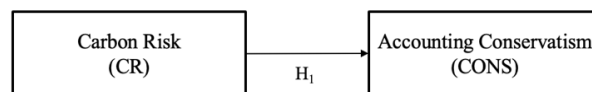


Figure 1. Research Framework

RESEARCH DESIGN

Data and Sample Selection

This study adopts a quantitative research design to examine the association between carbon risk and accounting conservatism among Canadian listed firms in high-emission industries during 2016–2025. Canada has high CO₂ emissions per capita. Based on Our World in Data as of May 20, 2026, Canada is among the countries with the highest per-capita CO₂ emissions, making carbon-related issues are economically and environmentally material. Using a single-country setting also reduce cross-country institutional differences and allows the study to focus on firm-level variation in carbon risk and accounting conservatism.

The sample consists of non-financial firms covered by Refinitiv operating in Energy, Materials, Transportation, and Utilities, which aligned with Canada's sectoral greenhouse gas emission profile in 2024. Canada has also implemented the Output-Based Pricing System (OBPS), a carbon pricing mechanism for large industrial emitters. The initial data collection covers fiscal years 2016–2025. However, 2025 observations includes only firm-year observations for which the required financial, market, and carbon emissions data were available as of May 18, 2026 and therefore do not represent complete fiscal-year 2025 coverage. As shown in Table 1, the reduction in the sample is primarily attributable to the country and industry selection criteria rather than to missing carbon emission data. To reduce the influence of extreme values, all continuous variables are winsorized at the 1st and 99th percentiles, especially because carbon risk data are highly skewed.

The sample may nevertheless be subject to selection bias because this study relies on firms with available carbon emission data in Refinitiv. Such firms may be larger, more transparent, more sustainability-oriented, and more likely to have better reporting systems. Consequently, the final sample may overrepresent firms with better disclosure quality and stronger sustainability awareness.

Table 1
Sample Selection Criteria

Sample selection criteria	Firms	Firm-year observations
Initial dataset	624	3,612
Less: firms outside Canada	(375)	(2,038)
Canadian listed firms	249	1,574
Less: firms outside the selected high-emission industries	(121)	(708)
Canadian firms in high-emission industries	128	866
Less: observations with missing carbon emission data	(0)	(0)
Less: observations with missing C-Score data	(0)	(0)
Less: observations with missing variables required for the main model	(0)	(2)
Final sample	128	864

Variables Measurements

Carbon risk (CR) are represented by carbon emission intensity obtained from Refinitiv. The measure divides total CO₂ equivalent emissions by operating revenue. A higher ratio mean that a firm produces more emissions for each unit of economic output and therefore face greater exposure to transition risk, regulatory pressure, and carbon-related costs. Refinitiv are useful because its environmental database provide standardized firm-level information across different firms and years. However, the dataset can contains missing observations, estimated figures, and differences in disclosure quality. Carbon intensity also tend to have a highly uneven distribution because a small number of firms generates extremely high emissions. For this reason, continuous variables is winsorized at the 1st and 99th percentiles, followed by robustness tests addressing extreme observations. This proxy captures the environmental and regulatory pressure faced by a firm relative to its economic output (Shu & Tan, 2023; Zhang et al., 2025). More specifically, the measure are obtained from total CO₂ equivalent emissions divided by total operating revenue (Deng et al., 2025; Liu et al., 2024). A larger carbon intensity ratio represents greater exposure to transition risks (Han et al., 2024; Zhang et al., 2025).

Accounting Conservatism (C-Score). Accounting conservatism is measured using the firm-year C-Score developed by Khan and Watts (2009), which extends the asymmetric timeliness model of Basu (1997). The C-Score estimation is conducted in two steps. First, the extended Basu model is estimated separately for each year using annual cross-sectional regressions. The estimation uses all firms in the final estimation sample with the required accounting and market data, rather than estimating separate regressions by industry. The first-stage estimation period covers 2016–2025; 2015 serves as the initial year required to construct lagged market variables and therefore does not yield a C-Score estimate. The annual specification allows the estimated coefficients to vary over time while assuming that, within each year, the association between asymmetric earnings timeliness and the firm characteristics used in the model is common across firms. Following Khan and Watts (2009), the first-stage model incorporates firm size, market-to-book ratio, and leverage and their interactions with stock returns and the negative-return indicator.

The C-Score are calculated using yearly coefficients from the interaction between stock returns and negative returns. Because these coefficients is estimated separately for each year, the C-Score can differs across both firms and years. Firm-level differences are also affected by factors such as firm size, market-to-book ratio, together with leverage. A larger C-Score mean that the firm recognizes bad news more quickly than good news, which indicate stronger conditional accounting conservatism. Negative C-Scores is kept in the dataset. They are not changed to zero or treated as missing observations because they still represents valid results

from the Khan and Watts model. These values indicates that, for some firm-years, the estimated speed of recognizing bad news are lower than that of good news.

Regression Model

To examine the association between carbon risk and accounting conservatism, this paper constructs the following Equation (1) model:

$$CON_{it} = \beta_0 + \beta_1 CR_{it} + Controls_{it} + Fixed\ Effects + \varepsilon_{it} \quad (1)$$

Carbon risk (CR) are the main independent variable, while accounting conservatism (CON) are the dependent variable. Several firm-level factors is also included as control variables. Firm size (CSIZE) are controlled because large companies usually receives more attention from regulators, investors, and the public, which may encourages more careful reporting (Ferdous et al., 2024; Islam et al., 2024). Leverage (LEVERAGE) is included because highly indebted firms may have stronger reasons to use conservative accounting to satisfy creditors and avoids debt covenant problems (Khalifa et al., 2024). Profitability (PROF) are also controlled because firms with different profit levels may has different reporting incentives and financial resources (Ferdous et al., 2024). Firm fixed effects is added to capture firm characteristics that do not changes over time, while year fixed effects captures changes in economic conditions and regulations. Standard errors are clustered by firm to reduce problems caused by heteroskedasticity and correlation within firms over time.

Potential Endogeneity Problem

Several endogeneity problems may affects results. One concern are omitted variables. For example, management quality, corporate governance, organizational culture, or industry conditions may affects both carbon risk and accounting conservatism but may not be fully captured by the model. Another concern are reverse causality. Firms with certain reporting practices may later experiences different levels of carbon exposure or different levels of pressure to disclose environmental information. Firms with different environmental conditions may also differs in governance, transparency, and reporting behavior. Because of these possible problems, the findings should be understood as evidence of a relationship rather than proof that carbon risk directly causes accounting conservatism. Future studies could uses stronger research designs, such as instrumental variables or quasi-experimental methods, if suitable instruments or external events are available.

Table 2
Descriptive Statistics

Panel A. Descriptive Statistics Full Sample								
	N	Minimum	p25	Median	Mean	p75	Maximum	StdDev
CR	864	0	0.00014	.00037	.00085	.00074	.01123	.00179
CON	864	-.6883	-0.06254	.04042	.02578	.12504	.66007	.20467
CSIZE	864	18.74961	21.16442	22.01343	22.16419	23.06824	25.79338	1.44866
LEVERAGE	864	.00005	0.10497	.2168	.23735	.37211	.71867	.1634
PROF	864	-.36928	0.00294	.03322	.03881	.07478	.30471	.08737
Panel B. Descriptive Statistics by Industry								
Energy								
	N	Minimum	p25	Median	Mean	p75	Maximum	StdDev
CR	282	0	0.00026	.00061	.00074	.00098	.00574	.00072
CON	282	-.6883	-0.06599	.04473	.0236	.11888	.66007	.21064

CSIZE	282	18.74961	21.20080	21.81463	22.2139	22.92134	25.79338	1.53064
LEVERAGE	282	.00005	0.13285	.20899	.23133	.31832	.60071	.14238
PROF	282	-.36928	0.00308	.03799	.0427	.08592	.30471	.11305

Materials								
	N	Minimum	p25	Median	Mean	p75	Maximum	StdDev
CR	420	0	0.00010	.00023	.00056	.00043	.01123	.00167
CON	422	-.60709	-0.03754	.0372	.03393	.11993	.66007	.17959
CSIZE	422	18.87051	20.87891	21.73751	21.71196	22.50788	24.72304	1.28423
LEVERAGE	422	.00005	0.04692	.13907	.1656	.25355	.58531	.13469
PROF	422	-.2936	-0.00277	.03571	.04103	.08186	.30471	.07969

Transportation								
	N	Minimum	p25	Median	Mean	p75	Maximum	StdDev
CR	48	.00014	0.00040	.00053	.00065	.00087	.00288	.00048
CON	48	-.6883	-0.18370	.00999	-.0348	.10961	.66007	.27174
CSIZE	48	20.67707	21.30226	23.49761	22.9657	24.18654	24.86041	1.42305
LEVERAGE	48	.25722	0.29988	.37255	.37777	.45052	.53972	.08125
PROF	48	-.2464	0.02638	.05065	.04292	.08749	.19262	.07178

Utilities								
	N	Minimum	p25	Median	Mean	p75	Maximum	StdDev
CR	114	0	0.00012	.00081	.00228	.00299	.01123	.00322
CON	114	-.59007	-0.11913	.04362	.0265	.15569	.66007	.24004
CSIZE	114	20.09884	22.75885	23.53849	23.37775	23.89284	25.31536	.85037
LEVERAGE	114	.25206	0.41039	.45611	.45872	.4812	.71867	.08076
PROF	114	-.04607	0.00792	.02244	.01922	.02929	.09193	.01993

Table 3. Correlation Matrix

	CR	CON	CSIZE	LEVERAGE	PROF
CR	1.00000				
CON	0.110* (0.001)	1.00000			
CSIZE	0.04400 (0.201)	-0.443* (0.000)	1.00000		
LEVERAGE	0.223* (0.000)	0.067* (0.048)	0.361* (0.000)	1.00000	
PROF	-0.148* (0.000)	-0.238* (0.000)	-0.00300 (0.929)	-0.258* (0.000)	1.00000

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

MAIN RESULTS

Descriptive Statistics

Table 2 summarizes characteristics Canadian firms included in the sample. The dataset contain 864 firm-year observations from high-emission industries. Carbon risk have a very uneven distribution. Its average value are 0.00085, while the highest value reaches 0.01123. This shows that a small group of firms has much greater carbon exposure than most other firms. Accounting conservatism also differ substantially across companies. Materials firms makes up the largest part of the sample, followed by Energy, Utilities, and Transportation. Utilities have the highest average carbon risk, whereas Transportation have the lowest average accounting conservatism. The differences in firm size, leverage, profitability, and conservatism across industries further supports the need to consider industry-related differences in the analysis.

Table 3 presents the correlation matrix. Carbon risk is positively and significantly correlated with accounting conservatism, providing preliminary evidence that firms with higher carbon risk tend to report more conservatively. Carbon risk is also positively associated with

leverage and negatively associated with profitability. The correlations among the explanatory variables are relatively low, suggesting that multicollinearity is unlikely to be a serious concern.

Regression Results

Before estimating the main regression, several diagnostic tests were performed. The VIF results indicate no serious multicollinearity concerns. However, the Modified Wald and Wooldridge tests reveal the presence of heteroskedasticity and autocorrelation. The Hausman test supports the use of a fixed-effects model over a random-effects model. Therefore, this study employs firm and year fixed effects with firm-clustered robust standard errors to ensure reliable statistical inference.

Table 4 shows the main regression results. Both models use firm fixed effects and year fixed effects, while Model (2) also uses firm-clustered standard errors. The coefficient of carbon risk is positive and significant in both models, with a coefficient of 18.031. This indicates that higher carbon risk is associated with higher accounting conservatism among Canadian firms in high-emission industries. The control variables also show consistent results. The positive and significant coefficient of CR supports H1, indicating that carbon risk is positively associated with accounting conservatism among Canadian firms in high-emission industries. However, the finding should be interpreted as an association, not a causal effect. Although the coefficient of CR is statistically significant, the economic interpretation should be made cautiously because carbon intensity is measured in very small decimal values and is highly skewed. Therefore, the result is more meaningful as evidence that carbon risk is directionally associated with conservatism, rather than as a precise economic magnitude.

Table 4
Regression Results

	(1) <i>Fixed Effect Regression</i>	(2) <i>Fixed Effect and Firm Clustered Regression</i>
CR	18.031** (2.30)	18.031** (2.40)
CSIZE	-0.093*** (-5.25)	-0.093*** (-3.69)
LEVERAGE	0.365*** (5.09)	0.365*** (3.68)
PROF	-0.126** (-2.24)	-0.126* (-1.95)
<i>Firm Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>
<i>Year Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>
<i>Firm Clustered</i>	<i>No</i>	<i>Yes</i>
_cons	1.911*** (4.99)	1.911*** (3.53)
<i>N</i>	864	864
Within R-squared	0.640	0.640
<i>t</i> statistics in parentheses		
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$		

Heterogeneity Analysis

Table 5 examines whether firm size and leverage changes relationship between carbon risk and accounting conservatism. The positive relationship are stronger among smaller firms.

This may indicate that smaller companies are more affected by carbon-related pressure. However, the interaction between carbon risk and leverage are not statistically significant. Therefore, leverage does not appear to change the strength of the CR–CON relationship, although highly leveraged firms generally show higher levels of accounting conservatism. Overall, firm size appears to matter, while leverage does not significantly change the relationship. CSIZE is removed from the Large Firm model because the Large Firm variable itself is based on firm size. Keeping both variables would create overlap between the size classification and the continuous size control.

Table 5
Heterogeneity Analysis

	(1) Large vs Small Firms	(2) High vs Low Leverage
CR	59.250** (2.39)	24.379 (1.11)
Large Firm	-0.026 (-1.12)	
CR × Large Firm	-49.160** (-2.01)	
LEVERAGE	0.293*** (3.25)	
PROF	-0.127** (-2.03)	-0.182*** (-2.72)
High Leverage		0.062*** (3.15)
CR × High Leverage		-12.243 (-0.54)
CSIZE		-0.083*** (-3.95)
<i>Firm Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>
<i>Year Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>
<i>Firm Clustered</i>	<i>Yes</i>	<i>Yes</i>
_cons	-0.095*** (-2.74)	1.769*** (3.85)
F	210.571	212.326
Within R-squared	0.633	0.633
N	864	864
t statistics in parentheses		
* p < 0.10, ** p < 0.05, *** p < 0.01		

Robustness Test

Several robustness tests are used to check whether the main result changes when the research model, sample, or treatment of extreme observations are changed. This step is important because carbon risk is strongly skewed, meaning that a small number of observations may have a large influence on the results. The tests also help determine whether the findings depend on a particular fixed-effect structure or sample selection. Table 6 reports these

additional tests and shows how stable the main relationship remain under different specifications. The baseline model shows a positive and statistically significant association between carbon risk and accounting conservatism ($\beta = 18.031$, $p < 0.05$). However, the coefficient remains positive but becomes statistically insignificant when observations with extreme carbon-risk values are excluded ($\beta = 11.079$) and when industry-year fixed effects are introduced ($\beta = 9.517$). Thus, although the direction of the association remains consistently positive across the alternative specifications, its statistical significance is sensitive to sample composition and the fixed-effects structure. These findings provide suggestive rather than uniformly robust evidence of a positive association between carbon risk and accounting conservatism and should therefore be interpreted with appropriate caution.

Table 6
Robustness Tests

	(1) Main Model	(2) Exclude CR Outliers	(3) Industry- Year FE
CR	18.031** (2.40)	11.079 (0.81)	9.517 (1.52)
CSIZE	-0.093*** (-3.69)	-0.091*** (-3.52)	-0.069*** (-16.80)
LEVERAGE	0.365*** (3.68)	0.360*** (3.57)	0.199*** (3.87)
PROF	-0.126* (-1.95)	-0.143** (-2.24)	-0.272*** (-4.15)
<i>Firm Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>
<i>Industry Fixed Effect</i>	<i>No</i>	<i>No</i>	<i>Yes</i>
<i>Year Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Firm Clustered</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
_cons	1.911*** (3.53)	1.882*** (3.37)	1.501*** (17.70)
N	864	837	864

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As an additional robustness test, this study addresses the potential mechanical relationship arising from the construction of the Khan and Watts (2009) C-Score. Since firm size and leverage are used in constructing the C-Score and are also included as controls in the baseline regression, the model is re-estimated after excluding CSIZE and LEVERAGE. The coefficient on carbon risk remains positive and statistically significant ($\beta = 13.272$, $p = 0.001$). Thus, excluding these variables does not alter the direction or statistical significance of the relationship between carbon risk and accounting conservatism.

Additional Test

Additional tests was also performed to understand when carbon risk becomes more closely connected with accounting conservatism. The analysis considers differences in carbon exposure, time periods, and industries. First, a dummy variable for very high carbon risk are used. This test separates firms with extremely high carbon exposure from other firms. Such an approach are useful because the relationship between carbon risk and accounting conservatism may not be linear. Carbon exposure may only become financially important after reaching a

certain level. Firms with very high exposure may face stronger regulatory attention, stakeholder monitoring, carbon-related expenses, impairment risks, environmental obligations, and reputational pressure. The dummy-variable analysis therefore tests whether these highly exposed firms show stronger accounting conservatism than other firms.

Additional results show that the CR–CON relationship becomes stronger for firms with very high carbon risk and during the period after 2020. However, the relationship is not significant among firms outside high-emission industries. This pattern suggests that carbon risk matters more when it can create meaningful financial consequences and when climate-related pressure is stronger. The model using lagged carbon risk does not produce a significant result. This indicates that the relationship may occur at the same time rather than appearing after a delay. In other words, accounting conservatism seems to respond more closely to current carbon exposure than to carbon risk from the previous year.

Leave-one-industry-out tests provide another check of the main result. When one industry is removed at a time, the CR coefficient remains positive and either significant or marginally significant. This suggests that the overall finding is not caused by only one industry. However, when each industry is analyzed on its own, the CR coefficient is no longer significant. One possible reason is the much smaller number of observations in each individual industry, which lowers the statistical power of the test. Therefore, the relationship is easier to detect when high-emission industries are examined together. Overall, these tests support the idea that carbon risk and accounting conservatism are connected mainly under specific conditions, especially when carbon exposure has greater financial importance.

Discussion

The findings show a positive association between carbon risk and accounting conservatism among Canadian firms in high-emission industries. Therefore, the hypothesis of this study is supported. More importantly, the result extends prior evidence by showing that the carbon risk–conservatism relationship is observable within a single-country setting concentrated on industries where carbon exposure is particularly relevant. While prior studies document similar relationships using broader international or environmental-risk settings (Ferdous et al., 2024; Islam et al., 2024; Wu et al., 2022), the present evidence suggests that the relationship also emerges after limiting the institutional environment to Canada and focusing specifically on high-emission industries. This helps distinguish firm-level differences in carbon exposure from cross-country institutional differences that may influence financial reporting practices.

Canada offers a useful setting for examining this relationship. The firms in the sample come from Energy, Materials, Transportation, and Utilities, where carbon exposure is closely connected with daily business activities and possible financial outcomes. Canada also uses carbon-pricing policies for large industrial emitters, including the Output-Based Pricing System (OBPS). As a result, carbon exposure in these industries is not simply an environmental issue. It can also create regulatory costs and financial consequences. When carbon risk increases, possible losses and future obligations may become more important to financial reporting decisions. This can give firms stronger reasons to recognize unfavorable economic effects more carefully and earlier.

The findings can also be understood through stakeholder theory. Firms with high carbon exposure face stakeholders who may be particularly interested in the financial consequences of climate risk. Investors, creditors, and regulators may therefore demand clearer information about possible losses and downside risks (R. Ding et al., 2024; Ferdous et al., 2024). Accounting conservatism can be one way for firms to respond to this pressure because it encourages earlier recognition of unfavorable financial information. The result does not mean that carbon risk automatically improves reporting quality. Instead, it suggests a more specific

pattern: when firms face greater carbon-related uncertainty, they tend to show higher conditional accounting conservatism.

Results are generally consistent with earlier research. Ferdous et al. (2024) found that firms facing greater climate risk tend to use more conservative reporting practices across a large international sample. Islam et al. (2024) also reported a positive relationship between carbon risk and conditional accounting conservatism. This study adds to those findings by examining a more specific group: Canadian firms operating in high-emission industries. Therefore, its contribution is not simply showing the same positive relationship again. Instead, it identifies a setting where the relationship appears especially relevant because firms are more directly exposed to carbon-related economic and regulatory pressure. The findings are also broadly similar to Wu et al. (2022), who reported more conservative accounting among firms facing higher air pollution. However, this study focuses specifically on carbon risk rather than environmental pollution in general. Together, these studies suggest that environmental risks with financial consequences can influence not only sustainability activities but also financial reporting decisions.

Results also show that the CR–CON relationship is not the same for every type of firm. A significant relationship is found in high-emission industries, while the same pattern does not appear in non-high-emission industries. This suggests that carbon risk becomes more important for accounting conservatism when the firm's carbon exposure creates meaningful financial effects. Therefore, the influence of carbon risk should not be expected to be identical across all companies. Differences in industry exposure may help explain why previous studies have produced different results when using different samples.

Firm-size analysis provides another important result. The CR–CON relationship is stronger among smaller firms. One possible explanation is that smaller firms may have fewer resources to deal with carbon-related costs. They may also experience greater information asymmetry, making carbon exposure more important to outside stakeholders. However, this explanation cannot be confirmed directly by the current analysis because the study tests the difference in the relationship rather than the specific mechanism behind it. The relationship is also stronger after 2020. This may reflect the growing attention given to climate risk in corporate reporting and regulation during the later sample period. Still, this result should only be viewed as a difference across time, not as evidence that a specific regulation directly caused the change.

Robustness results provide a more cautious picture. The main relationship becomes insignificant when extreme carbon-risk observations are removed and when industry-year fixed effects are included. This sensitivity is important because it means the baseline result is not equally strong under every specification. The loss of significance after removing extreme observations suggests that firms with exceptionally high carbon exposure may contribute substantially to the original relationship. The weaker result under industry-year fixed effects also suggests that some of the association may be connected with conditions that change over time within particular industries. Therefore, the baseline result should not be interpreted as a universal or causal effect. The overall evidence instead points to a positive relationship that is more visible when carbon exposure has greater economic importance and that depends on the model and sample used.

CONCLUSION

Overall, this study examines whether carbon risk is associated with accounting conservatism among Canadian firms operating in high-emission industries. The main analysis shows a positive relationship between the two variables. However, additional tests show that this relationship becomes weaker when extreme carbon-risk observations are removed or when alternative fixed effects are applied. Therefore, the evidence should be viewed as suggestive

rather than definitive. The findings indicates that carbon risk may be related to more conservative reporting, but they does not establish a clear causal effect.

This study add to previous research by showing that firms with greater carbon exposure may use more conservative financial reporting, particularly in high-emission industries. The result are consistent with stakeholder theory because firms facing greater environmental uncertainty may responds to pressure from investors, creditors, regulators, and other stakeholders by recognizing negative information more quickly. The finding also connects with agency theory. Conservative accounting can reduces information asymmetry by limiting the ability of managers to postpone the recognition of possible losses. In this way, accounting conservatism may helps external users obtain a more cautious view of the firm's financial condition.

Several limitations should be considered. The first concerns endogeneity. Firm and year fixed effects helps control for characteristics that remain stable within firms and for broad changes over time, but they cannot removes every possible source of bias. Unobserved factors, reverse causality, and self-selection may still affects the results. For example, management quality, corporate governance, risk culture, and disclosure incentives could influences both carbon risk and accounting conservatism. It is also possible that firms with more conservative reporting are more willing to disclose carbon information or manages environmental risks differently. For this reason, the results should be interpreted as an association rather than a causal relationship. Future studies could uses instrumental variables, difference-in-differences, or other quasi-experimental methods when suitable external instruments or events are available.

Second limitation concerns sample. The study depends on firms with available carbon information in Refinitiv. These firms may be larger, more transparent, or more focused on sustainability than firms without available data. Companies with weak disclosure practices, poor performance, or missing carbon information may therefore be left out. This sample selection can affects the estimated relationship and limits how widely the results can be applied. The findings should not automatically be extended to every Canadian listed company, every high-emission firm, or companies in other countries. A third issue are the highly uneven distribution of carbon risk. The robustness tests shows that extreme observations affect the main result. Although these observations may represent firms with genuinely high carbon exposure, their influence means the findings need to be interpreted carefully.

A final limitation concerns the measurement of accounting conservatism. This study uses the Khan and Watts (2009) C-Score, which are widely used to measure conditional conservatism at the firm-year level. However, the C-Score reflects a firm's general tendency to recognize economic losses faster than gains. It does not specifically identifies accounting changes caused by carbon-related financial effects. As a result, the measure may includes reporting behavior that are unrelated to carbon risk. If this measurement problem are random, it would normally weakens the estimated relationship. Finding a positive relationship despite this issue may therefore provides some support for the result. However, measurement error may also be systematic and connected with firm characteristics or carbon exposure, so the direction of the possible bias cannot be known with certainty. Therefore, the positive relationship should not be interpreted as proof that carbon risk directly causes specific carbon-related accounting adjustments. Future research could uses more direct measures, such as impairment losses, environmental liabilities, environmental provisions, or other accounting items that are more clearly connected to the financial effects of carbon risk.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the authors used AI in order to check for grammatical errors and for checking references. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Appendix 1. Additional Analysis - Sample and Time-Based Tests

	(1) Very High CR	(2) Non-High- Emission	(3) Pre-2020	(4) Post-2020	(5) Lagged CR
CR	32.343*** (3.58)	-11.304 (-0.16)	9.814 (0.60)	23.501** (2.40)	
CSIZE	-0.196*** (-4.02)	-0.095*** (-2.77)	-0.083* (-1.81)	-0.106*** (-3.38)	-0.100*** (-3.17)
LEVERAGE	0.710** (2.64)	0.243** (1.99)	0.316 (1.59)	0.509*** (4.14)	0.323** (2.30)
PROF	0.345** (2.43)	-0.147 (-1.05)	0.331*** (3.04)	-0.083 (-1.19)	-0.180*** (-2.65)
Lagged CR					1.659 (0.15)
<i>Firm Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Year Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Firm Clustered</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
_cons	4.049*** (3.87)	2.035*** (2.67)	1.728* (1.70)	2.254*** (3.35)	1.791** (2.59)
N	216	708	233	631	729
Within R-squared	0.739	0.694	0.910	0.448	0.677
t statistics in parentheses					
* p < 0.10, ** p < 0.05, *** p < 0.01					

Appendix 2. Additional Analysis - Leave-One-Industry-Out

	(1) Exclude Utilities	(2) Exclude Energy	(3) Exclude Transportation	(4) Exclude Materials
CR	38.343* (1.76)	13.282* (1.81)	17.395** (2.24)	16.371* (1.83)
CSIZE	-0.088*** (-3.47)	-0.099*** (-3.79)	-0.100*** (-4.06)	-0.031 (-0.59)
LEVERAGE	0.396*** (4.06)	0.166 (1.37)	0.402*** (4.27)	0.478*** (2.83)
PROF	-0.124* (-1.83)	-0.222** (-2.21)	-0.116** (-2.04)	0.014 (0.14)
<i>Firm Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Year Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Firm Clustered</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
_cons	1.797*** (3.27)	2.118*** (3.77)	2.066*** (3.89)	0.471 (0.41)
N	750	582	816	444
Within R-squared	0.688	0.597	0.648	0.672
t statistics in parentheses				
* p < 0.10, ** p < 0.05, *** p < 0.01				