Abstract: This study employs a balanced panel of data which consists of 1281 firm-year pipeline accidents and incidents at a disaggregate level and 190 firm-year pipeline events at an aggregate level for 19 firms during the observation period between 2007 and 2016. This study examines the relationships among environmental accidents and incidents, environmental consciousness, and financial performance. Given that environmental consciousness acts as an overarching environmental context on the relationship between the accidents, incidents, and financial performance and could be relevant to shareholders to identify the weight of these accidents and incidents, this study carefully investigates how environmental consciousness moderates the relationship between pipeline accidents, incidents, and financial performance. This study applies the theoretical assumption of both corporate social responsibility (CSR) and corporate social irresponsibility, both of which explain the relationship between financial performance and the events that positively or negatively affect stakeholders. This study employs nested regression analyses with the fixed effects model to test the time-series panel data. The results show that environmental consciousness has an expected significant negative effect on financial performance, whereas pipeline accidents and incidents have no expected negative effect on financial performance. One surprising finding is that pipeline accidents and incidents weighted with environmental consciousness present a significant positive relationship with financial performance, suggesting that potential contextual factors should be considered to explain such an unexpected finding.

Keywords: pipeline accidents and incidents; environmental consciousness; financial performance

1. Introduction

With environmental issues being at the center of multiple constructs such as corporate social responsibility (CSR) and environmental, social, and governance (ESG) issues, it has been often studied how financially accountable firms address their consequent environmental performance. The initial step in understanding environmental performance may be through a better understanding of CSR and corporate social irresponsibility (CSIR), since both CSR and CSIR are concepts more heavily scrutinized in more recent years, as stakeholders require firms to be socially and environmentally responsible.

CSR is defined as the set of corporate actions that positively affect an identifiable social shareholder’s interests and do not violate the legitimate claims of another identifiable social shareholder in the long run [1]. CSIR is complementarily defined as corporate actions that would, in the long-term, have a negative effect on an identifiable social shareholder’s legitimate claims [2]. Strike et al. argued that the accumulation of positive actions would lead to a more responsible firm, with the opposite also being true. Nonetheless, some studies found no significant relationship between CSR and financial performance [3,4], or they found a significant negative relationship [5]—resulting, in turn, in confusing...
conclusions on the relationship between environmental performance and financial performance. Such confusing findings may mislead both academic theorists and practitioners alike.

To better understand the existing mixed findings, this study attempts to carefully qualify the question of CSR and CSIR in a more specific way by studying how the accumulation of industry-specific negative events can affect corporate financial performance. This study further carefully explores how environmental consciousness as an overarching environmental context potentially moderates the relationship between industry-specific pipeline accidents, incidents, and financial performance.

This study focuses on the Canadian energy sector because this sector is considerably important to the Canadian economy, and it provides a relevant and interesting research context to examine the relationship between negative accidents and financial performance for the following reasons. First, this industry sector well represents the energy transportation industry in Canada as a source of mediatized accidents that negatively impact lives and the surrounding environment. Obviously, the energy sector is the most polluting and environmentally damaging sector because of the non-renewable energies used, causing substantial amounts of carbon emissions, oil spills, gas leaks accidents, etc., in which every accident and incident can be a cause for some environmental risk. Accordingly, the negative pipeline accidents and incidents could well represent a potential measure of environmental performance because the media coverage received make them more impactful to the eye of social shareholders, especially when they are massive spills or damaging to lives and communities. For example, heavily mediatized recent accidents in Canada include the Fort McMurray accidents by Nexen Energy pipeline in May 2013, the Little Buffalo accident by Plains Midstream in April 2011, and the Elk Point accident by Enbridge in June 2012. Second, the Canadian dollar is closely tied to the oil barrel price because of the exploitation of Albertan bituminous sand. Though such pipeline accidents exist in the United States as well, Canada’s currency is more closely related to variations in oil prices. Canada’s economy is dependent on fossil energies, mainly because of the exploitation of Alberta’s bituminous sands. It is more common in a country like Canada where the oil industry influences its economy’s well-being regardless of having an expected low environmental performance. Thus, examining the relationship between industry-specific negative events and financial performance in the energy industry can bring more depth to this area of research. With these reasons in mind, both the importance of this sector in the Canadian economy and the rise of environmental consciousness may facilitate researchers to carefully explore how both the negative accidents and incidents and environmental consciousness in a high-polluting industry sector affect financial performance.

In addition to primary research questions, this study also attempts to qualify the measurement quality of publicly available information on pipeline accidents and incidents in Canada. After comparing Canadian industry sectors, it is assumed that companies contributing to poor environmental performance should be held to the highest degree of scrutiny from social stakeholders. With CSR being a continuously developing field of research branching out to multiple sectors and industries, the metrics for measuring the relationship between environmental performance and financial performance are lacking in diversity, and a more specific metric could prove valuable to firms’ decision-makers and researchers alike. It is also assumed from a firm’s perspective that leveraging higher environmental performance than competitors in the energy sector should be a more valuable resource than in a less scrutinized sector. Accordingly, this study attempts to test poor environmental performance through a new measure that could help quantify the impact of this performance (here measured through pipeline incidents and accidents). With this new measure critical to the context of Canada’s energy sector, this study aims at bringing more depth to the relationship between environmental and financial performance, especially when it comes to CSIR and studying the impact of negative events. The questions posed in this study regard, more specifically, how reported accidents and incidents affect financial performance and how these negative events weighted by environmental consciousness can have a different impact on financial performance.

The next section addresses the theoretical connections among CSR, CSIR, environmental performance, and financial performance to develop and test the main hypotheses in question. The
following data and methods section presents details of the sample and analytic methodology, and, the results section explains the results from the nested regression models. The discussion and conclusion sections follow.

2. Literature Review and Hypotheses

2.1. CSR, Environmental, and Financial Performance

CSR can be seen as the cumulative corporate actions that will leave a positive impact on a social stakeholder in the long run without negatively affecting another social stakeholder [1,2], and its counterpart CSIR refers to corporate actions with a negative impact on legitimate claims of an identifiable social stakeholder in the long-term [2]. The inclusion of environmental social responsibility into the core of firm strategy has already been theorized and tested in the strategic management arena. Sharma et al. [6] and Kim [7] argued that corporate environmental strategy needs to be at the center of the research, bringing the decision making of the manager to the forefront. The resource-based view (RBV) [8,9] has been more delicately theorized by the natural resource-based view (NRBV), strengthening the importance of environmental social responsibility [10,11]. Both the RBV and NRBV posit that firms tend to implement environmental practices to respond to the natural environment’s pressures and then take new opportunities. Some existing studies found that corporate environmental practices are closely related with both environmental and financial performance [12–16]. The NRBV especially argues that firms can take their environmental practices on a continuum ranging from reactive to proactive environmental practices [17,18]. For example, Kim [7] found that, in USA heavy polluting industries, reactive environmental practices lead to larger toxic releases, while proactive environmental practices lead to smaller toxic releases. When considering the resource-based view, with the assumption that the firm operates in an environment where CSR and environmental performance are both held to high standards by the social stakeholders, a resource or an asset that positively affects the CSR of the firm might be more valuable to building competitive advantage. The opposite also is theoretically true with CSIR. Another point to consider with the integration of CSR and the resource-based view is that, given the importance resources attribute to the paths, it can be logically assumed that the more a firm gains its competitive advantage from resources affecting CSR or CSIR more heavily in past decisions, the more it would today have resources dependent upon those of the past [7], along with their effect of CSR and CSIR. Both the RBV and NRBV have asked whether firms doing better environmentally are likely to perform better in the following years [19], given the assumption that current corporate environmental actions are likely to be depending on their past environmental capability.

Environmental performance, which indicates a key part of the environmental social responsibility, reflects corporate actions specifically tied to the environment. CSR also includes a concept that encompasses the environmental performance of a firm within its multiple different definitions. The International Organization for Standardization [20] defines corporate environmental performance (CEP) as the “results of an organization’s management of its environmental aspects.” By extrapolating from previous research about CSR, environmental performance can be directly linked to the analysis of environmental social responsibility [11].

Environmental performance has been covered substantially in relation to financial performance. Murphy [21] published a recapitulative study of past research that studied the relationship between environmental and financial performance, concluding that positive environmental performance is closely connected to positive financial results, while negative environmental performance is linked with negative financial results. Given these existing findings, the conclusions from some of the early studies are supportive of the premise of this research: The effect of negative accidents and events on poor financial performance. In the area of interest of oil spills and chemical leaks—more specifically, after the Union Carbide Bhobal chemical leak—it was concluded that firms resting on their chemical business were negatively impacted in terms of share price returns [22]. Furthermore, White [23]
explored the impact of the Exxon Valdez oil spills on the company’s financial performance, and he concluded that the negative event had an immediate and lasting negative impact on the shares’ value. These event-specific studies might not be indicative of the current estimated behavior in the Canadian market related to negative events and oil spills, because previously mentioned studies that observed the relationship between CSR and financial indicators help attribute validity to past studies about oil spills. Accordingly, a study demonstrating this relationship between negative pipeline events and financial performance in the Canadian market has yet to be done.

2.2. Environmental Consciousness

Environmental consciousness, environmental awareness, and environmental concern are all terms that can be interchangeably interpreted. Consciousness and awareness are somewhat defined as having the perception of a situation or a fact. Some studies indicate that environmental consciousness is derived from individual demographic and core beliefs [24–26]. Feldman [25], for example, stated that the attitudes of individuals toward environmentalism were dependent on their own core beliefs, which could be explained by religious beliefs as well [24]. Even though there exist multiple studies examining environmental consciousness, they differ from certain terms expressed in their definition. For instance, Krause [26] studied U.S. demographics to conclude that a strong concern for major environmental issues existed at the time of the study. By examining the link between green purchasing decisions from consumers and measures of environmental consciousness, Schlegelmilch et al. [27] found that environmental consciousness was expressed by consumers through their product. Though Schlegelmilch et al. studied the relationship between green-decision making and green-purchases at the level of consumers, they concluded that demographic data from consumers could explain, in part, pro-environment purchases: “The regression results suggest that ‘measures of environmental consciousness’ may indeed be more useful than either socio-demographic or personality variables, given that the latter variable types explain very little variation in responses to environmental phenomena” (p. 48). In a more recent research endeavor, the theory on environmental consciousness influencing consumers’ purchase choices was tested and supported. In a study about the choice of a light bulb and the relationship with environmental consciousness in households in Ghana [28], it was concluded that people with a higher environmental consciousness level were more inclined to support the more energy efficient light bulb company.

Though it has been shown that environmental consciousness exists at a consumer level and impacts financial decisions, it seems logical that if a consumer or individual possesses a degree of care about major environmental issues that influence its financial decision, a social stakeholder or a corporation could also possess a degree of environmental consciousness [29,30]. In other words, when measuring environmental consciousness at the industry-level for stakeholders, it could be irrelevant to solely follow the demographic variable expressed in the existing studies. In the research by Clarkson et al. [29] on the relationship between the market valuation of environmental capital expenditure investment and pollution abatement in the pulp and paper industry, for example, they suggested that the environmental consciousness of shareholders would be able to evaluate and compare environmental performance at an industry level. Kriwy and Mecking [30] also argued that the relationship between environmental consciousness and financial performance can be studied at an industry level. As previously stated, financial performance is impacted by CSR or environmental performance only when a firm’s events and actions positively affect a social stakeholder without damaging another social stakeholder, with CSIR and environmental non-performance being the opposite.

2.3. Hypotheses

This study follows the theoretical assumption of CSIR established by Strike et al. [2] but specifically focuses on the environmental performance section, which translates into negative environmental performance. When applying the previously mentioned definition of CSIR into this study, it can be assumed that the number of pipeline accidents and incidents is a negative activity by the firm that
negatively affects the shareholders. These negative events should be related to the environmental section of the corporate social irresponsibility of the firm attached to those accidents and incidents. It also implies that the social stakeholders are influenced by those accidents and incidents. These events are recorded and publicly reported in a valid and trusted governmental database, in turn helping shareholders to use this database (or not) in their evaluation of related firms. This information could possibly reflect a negative environmental impact because of damage to the natural environment directly caused by the accidents and incidents. In addition, considering the concept of path dependency [31], a higher level of accidents and incidents compared to competitors would reflect a higher risk of future accidents and incidents. While media attention is not controlled in this study, such a reported database is directly related to the impact of an accident or incident on the financial performance of the firm due to the information potentially being more accessible and more analyzed.

Accordingly, it is a central and starting point to the research question: Are the reported pipeline accidents and incidents by Statistics Canada affecting the financial performance of the firm? In other words, is there any financial repercussion, or negative impact, on the publicly traded firms owning these pipelines? With this issue largely discussed for ethical reasons, a firm’s ownership for its pipelines could be transferred to responsibility for their accidents and incidents. However, staying away from subjective reasoning and morally induced hypotheses, the first hypothesis could stand to prove how CSIR can negatively affect financial performance of firms in the Canadian energy sector through the measure of pipeline accidents and incidents. Oeyono et al. [32], for example, argued that the higher the engagement of a firm in CSR, the higher the financial performance. Strike et al. [2] also argued that the accumulation of positive actions would lead to a more responsible firm, and the opposite can be also true. This assumption has been successfully tested when researching the positive relationship between CSR and financial performance indicators in Indonesia, where a significant positive relationship was proven between the financial performance indicators and CSR activities. Therefore, the following hypothesis can be tested:

Hypothesis 1. The number of pipeline accidents and incidents reported in the Canadian energy sector is likely to have a negative effect on the financial performance of the publicly traded firm owning these pipelines.

Pipeline accidents or incidents have always happened in the past, but they may or may not have been recorded or have been considered a source of valuable information. As mentioned earlier, environmental consciousness is assumed to influence the perception or care that the social shareholders have towards these reported accidents or incidents. As environmental consciousness rises by the rise of environmental regulations, for example, firms are likely to react by spending more on physical equipment or reevaluating the efficacy of their waste removal facilities [11]. Social concerns might have been more apparent earlier on because of moral and ethical decisions that were already made in daily lives. An observable greener turn has been made in recent years, which has made shareholders react to the consequences of a firm’s negative impact on the natural environment. A way to measure the environmental consciousness level of firms in the Canadian energy sector has not been clearly identified. However, the disclosure of environmental capital expenditures has been identified, not as a way to indicate the expectation by a firm for future improvement in environmental performance but as a communicational tool to acquire strategic value [33]. If the disclosure and its extent is also dependent on the willingness of the company to share it, capital expenditures tend to reflect more on the mindfulness of the firm relating to its environmental impact rather than its environmental performance. While it is probable that part of these spending is mandatory and unavoidable, environmental capital expenditures and their disclosure are choices that reflect the level of environmental consciousness within the firm. They are choices due to both being an informational tool reflecting the spending decisions on environmental issues and the decision of releasing the information. These investments are reactive to the rise in environmental consciousness and would most likely incur a cost that would not always translate into a profit. Therefore, this study attempts
to examine the potential negative relationship between environmental consciousness and corporate financial performance.

**Hypothesis 2.** Environmental consciousness in the Canadian energy sector is likely to have a negative effect on the financial performance of the publicly traded firm owning these pipelines.

As mentioned earlier, environmental consciousness refers to a degree of responsibility a person will attribute to himself for environmental problems [34]. In addition, expanding on Strike et al.’s CSIR definition, studying negative events would increase the negative impact of those events on the shareholders, which, in turn, would increase the CSIR. Given the previous hypotheses about the negative relationship that environmental accidents and incidents or environmental consciousness might have on financial performance, it is logical to follow that, as investors and stakeholders show more interest in environmental performance, the weight of bad environmental performance will be more noticeable. The theory behind this, as explained earlier, is that the environmental consciousness level within a specific industry might interact with the negative impact that an accident or incident has on a social stakeholder. It is common knowledge that firms usually try to satisfy the demands of the majority of stakeholders. When observing the industry, the overall level of environmental consciousness of the firms should also reflect the general wishes of stakeholders over time. With the increase in environmental consciousness of the public, consumers, media, and other shareholders, the industry as a whole readjusted its efforts towards environmental performance. When looking at the relationship between negative environmental events and corporate financial performance, it would make sense to assess this weight if the impact of such negative events depends, over time, on the level of care associated to such events.

By considering the level of environmental capital expenditures (i.e., a proxy for environmental consciousness) in the Canadian energy sector, it is hypothesized that the increasing trend of environmental consciousness in the Canadian energy sector might have an effect on pipeline accidents and incidents. If that would be the case, environmental consciousness would moderate the relationship between pipeline accidents, incidents, and financial performance, in turn strengthening the negative relationship assumed in Hypothesis 1.

**Hypothesis 3.** Environmental consciousness in the Canadian energy sector will moderate the negative relationship between the weighted-accidents or weighted-incidents and financial performance toward a stronger negative relationship.

### 3. Data and Methods

#### 3.1. Sample

During the observation period, it was recognized that the Natural Energy Board of Canada (NEB), a government agency, has monitored around 90 firms. NEB regulates firms in the energy sector that own or operate interprovincial or international pipelines. Unfortunately, the Canadian energy sector is so segmented and large that some sub-sectors are less relevant to the pipeline sector if they, for example, are a part of renewable or direct energy. Accordingly, it was considerably tough to get the complete dataset of pipeline events for these 90 firms.

This study employed both Statistics Canada and Annual Statistics Collections for pipeline events, and it also used Eikon from Thomson Reuters for corporate financial data. In integrating three data sets, this study used the Statistics Canada as the primary reference because its data cover shorter years than other datasets during the observation period. Nonetheless, Statistics Canada provides reliable economic, social, and census data. The dataset reflects the better quality for the environmental performance of the pipeline sector. Though data on pipeline accidents and incidents in the Canadian energy industry are available from 2004 to 2017, the year 2007 is the beginning of the observation
period, the so-called “left-censoring” [35], as the data for the independent variable of environmental capital expenditures before 2007 are not available. This study also set the year 2016, when this study finished observing the sample data, as the end of the observation (so-called “right-censoring”).

Given that both Statistics Canada and EIKON are recorded in different ways, the authors verified whether the same company appeared in the two datasets to create an integrated database. Due to the lack of consistent data for many firms, this study could track the historical records of both pipeline events and financial measures for only 19 out of 90 firms, in turn creating the complete dataset for 19 firms at an aggregated firm level. The authors randomly checked several firms for data accuracy. The final sample consists of a so-called balanced time-series panel data. Given that 19 firms own or operate a different number of pipelines, this panel data consist of 1281 firm-year pipeline accidents and incidents at the disaggregate level. At the aggregate level, the panel data include 190 firm-year pipeline incidents and accidents for 19 firms during the observation period between 2007 and 2016.

3.2. Independent Variables

First, pipeline accidents and incidents were collected from both Statistics Canada and annual statistics collections regrouping all reported incidents and accidents on pipelines in Canada. The agency does not investigate all occurrences, but it instead employs a specific criterion expressed in the Occurrence Classification Policy to determine whether or not the occurrence should be investigated:

“The primary criterion for determining if an occurrence in any mode will be investigated is whether or not such analysis is likely to lead to a reduction of risk to persons, property, or the environment. [...] Other criteria include: Consideration of any Transportation Safety Board (TSB) obligations or commitments under international agreements, assistance to the provinces or other nations, etc. Consideration of the degree of public expectation of a TSB investigation—whether from a general public concern or concern for Canadian products, services, or citizens abroad.” [36]

If events are considered unworthy of investigation by the agency, the events do not have a strong impact on social stakeholders. By regrouping those pipelines of the subsidiary pipeline events under their respective parent companies, the number of accidents and incidents were counted yearly (given the assumption that the subsidiary pipeline company’s good or bad actions impact the parent company’s CSR level) [2]. The grouping of total yearly accidents and incidents to their publicly traded parent company is done to make the financial measures more easily accessible and measurable. In light of the desire to keep more complete years, the number of pipeline accidents and incidents was restricted to a 10-year period from 2007 to 2016. This study measures the total pipeline accidents and incidents (ACC) reported per year for the parent company. Namely, ACC measures the CSIR actions of a firm that negatively affect social stakeholders.

Second, this study employs the environmental capital expenditures to measure environmental consciousness (EC) in the Canadian pipeline transportation industry, as the existing studies previously argued [29,30]. In the organic food industry, for example, Kriwy and Mecking [30] linked the concepts of environmental consciousness and capital together. Clarkson et al. [29] also examined the relationship between the market valuation of environmental capital expenditure investment and pollution abatement in the pulp and paper industry. Clarkson et al. found that there exist incremental economic benefits with environmental capital expenditure investment for low-polluting companies, but not high-polluting companies, and that un-booked environmental risks are researched by shareholders by acquiring information on environmental performance. This finding suggests that environmental capital expenditures would be a more suitable proxy for a measure of the environmental consciousness of shareholders as it would be able to evaluate and compare environmental performance in an industry. By using environmental capital expenditure as a measure of environmental consciousness of stakeholders, it can be possible to evaluate the weight of environmental consciousness on the relationship between the negative events and financial performance. Though the government agency segmented the total capital expenditures into sub-sections (environmental monitoring, environmental
assessments and audits, reclamation and decommissioning, wildlife and habitat protection, and pollution prevention processes), the total expenditures presented were more consistent as a whole and could still accurately represent the trend in environmental consciousness. Due to the amount going up to the exponential 10th power and for consistency with EBITDA, the value for EC will be expressed in the millions (exponential 6th power). The dataset provided by Statistics Canada regarding environmental capital expenditure was presented bi-yearly. The extrapolated trend was calculated and used for those missing years of capital expenditures as a way to represent the expected environmental consciousness level for that year, but it may be one of the limitations about the data set. When analyzing the dataset for the robustness check, both regression using the original bi-yearly environmental capital expenditures and the yearly environmental capital expenditures were analyzed with no significant differences in the conclusions presented.

3.3. Dependent Variable

EIKON from Thomson Reuters was used as the database to collect the financial performance measures of the firms. The data are expressed yearly standardized in millions of Canadian dollars. A variety of financial performance measures were employed in an experimental and exploratory way, such as stock returns in comparison firms [36], stock returns in comparison to history and the market [37–39], return on equity [11,40–42], capital costs, and cost savings [43–45]. These financial performance measures could be interchangeably used. However, only a few provided conclusive results in the investigation of its relationship with environmental performance. Specifically, Oeyono et al. [32] found that CSR had a positive relationship with EBITDA. Accordingly, this study employed EBITDA to reflect the argument of the recent literature review. The motives and conclusions related to the other relevant financial measures will be further elaborated in the discussion section.

3.4. Control Variables

This study attempts to control for some firm-specific and macro economy variables to reduce confounding effects. Firm size, innovation score, and oil barrel price are all taken from EIKON’s database. Firm size has been considered as a primary third variable because firm size may confound the positive relationship between corporate social responsibility and financial performance [46]. Firm size can be measured as number of employees [47–49], sales [11], and total assets [49–51]. Given the lack of data for sales and number of employees, this study measured firm size as the log-transformed total assets of each firm [32,52]. Strike et al. [2] argued that large firms tend to possess larger CSR and CSIR not only because of their exposure to a wide range of the public but also because of the subsidiaries’ actions that are likely to influence the CSR or CSIR of the parent company.

For the innovation score, this variable is a graded category under the environmental pillar used by Thomson Reuters to calculate firms’ overall Thomson Reuters ESG Score, which was used in empirical studies on CSR issues [53]. This innovation category is graded with a percentile score through the evaluation of 20 indicators of both qualitative and quantitative data. It is a variable that reflects development in environmental technology or products with the purpose of reducing environmental costs. In the database, the score was extracted from a letter grading system with “+” and “−” similar to the education grading system from A+ to D−, which was converted into an equivalent numeral grade on a 4.5 scale. The evaluation of innovation given by their innovation score is a good proxy for the usually used control variable of R&D, since there is a lack of consistency in firms’ publicly released amounts for R&D expenditures. The innovation score is a control variable that fulfills the role of substituting for the R&D score usually covered in comparable studies.

This study also controls for the oil barrel price (year average) as a proxy for representing the state of the Canadian economy. Canada has a petrol-currency and it is a country with an economy highly dependent on the price the oil barrel, given that oil price shocks can significantly harm the Canadian economy [53]. This control variable is important because it is more case dependent.
3.5. Analysis

Given the panel of data used in this study, this study applied the Hausman test, a commonly recommended post-estimation test [54]. The Hausman test compares the fixed effects model to the random effects model, where the null hypothesis of the random effects model assumes that the individual-specific effects are uncorrelated with the independent variables in question, while the alternative null hypothesis of the fixed effects model assumes that the individual-specific effects are correlated with the independent variables. The Hausman test is strongly recommended to test whether the unique errors are correlated with the regressors, where the null hypothesis is that they are not. Accordingly, this study executed the post-estimation of Hausman test after running the linear regression with the fixed effects (FE) STATA command. The Hausman test supporting the alternative hypothesis at a significant $p$-value (0.0201) suggests that the fixed effects model rather than the random effects model is more appropriate to test the hypotheses in question. As Drukker [55] recommended, this study tested whether serial correlation in linear panel-data models exists—namely, with the null hypothesis of no first-order autocorrelation, the combination of variables was tested by including and excluding the environmental consciousness variable as the trend for the increasing relevance of environmental performance in firms.

This study also executed additional tests in order to obtain the most accurate results. First, this study tested whether heteroskedasticity presents where residual squares were regressed from the fixed-effect model on $X_{it}\hat{\beta}$ and its square using the clustered standard errors. The results, which gave a $p$-value of 0.3765, indicate that the alternative hypothesis of heteroskedasticity cannot be accepted. Second, to assure stationary panels related to the accidents and incidents (ACC) variable, this study applied the Levin–Lin–Chu unit-root test if there was the presence of unit-roots in ACC and moderated variables. The result rejected the null hypothesis that the panels contain unit roots, in turn suggesting that the panels are stationary.

4. Results

Table 1 describes the basic statistics of the variables in question. The results in Table 2 present a correlation matrix of the variables analyzed in this study. First, regarding the relationship between EBITDA and other variables, it can be recognized that firm size has a strongly significant and positive correlation with EBITDA. The relationship has extensively been discussed in the CSR literature. The innovation score also has a strongly significant and positive correlation with EBITDA. This result makes sense logically because of the assumed relationship that R&D, represented heavily in the innovation score, has with financial measures. R&D is positively correlated with firm size at a significant level, as is demonstrated in the relationship between innovation score and firm size. Second, regarding the reported accidents and incidents, a weakly significant and positive correlation is observed with firm size, which may represent the logic that bigger firms will be more likely to produce more accidents. However, the result shows that ACC has a significant and positive correlation with innovation score. It could be assumed that the bigger firms, which usually invest more in R&D, are more likely to have a higher ACC. Third, regarding the measure for environmental consciousness, which represents an industry-level context, this study assumed that EC would act more as an overarching environmental context. However, the result shows that EC does not correlate with other variables at a significant level. This result has yet to be further studied. Nevertheless, environmental consciousness can be used to examine its moderating role in explaining the relationship between the reported accidents, incidents, and financial performance, as the existing studies have emphasized.
Table 1. Summary statistics of the variables.

| Variables                  | Obs. | Mean   | Std. Deviation | Min    | Max   |
|----------------------------|------|--------|----------------|--------|-------|
| EBITDA (M CAD)             | 184  | 7699.68| 14,080.79      | −175.80| 78,209|
| Firm Size (Log-Asset)      | 187  | 3.8331 | 1.167          | −0.699 | 5.6693|
| Innovation Score           | 184  | 2.67   | 1.14           | 0      | 4.30  |
| Oil Barrel Price (CAD)     | 190  | 7.38   | 41.49          | −53.52 | 78.00 |
| ACC (# of Occurrence)      | 190  | 6.74   | 17.25          | 0      | 96    |
| EC (M CAD)                 | 190  | 170.90 | 123.52         | 70.31  | 470.93|

Note: ACC refers to ‘pipeline accidents and incidents’. EC refers to ‘environmental consciousness’. CAD indicates ‘Canadian dollars’. M CAD indicates ‘millions of Canadian dollars’.

Table 2. Correlation matrix of the variables (n = 184). (* p < 0.05; ** p < 0.01; *** p < 0.001; † p < 0.1).

| Variables                  | EBITDA | Firm Size | Innovation Score | Oil Barrel Price | ACC |
|----------------------------|--------|-----------|-------------------|------------------|-----|
| EBITDA (M CAD)             |        |           |                   |                  |     |
| Firm Size (Log-Asset)      | 0.6062 |           |                   |                  |     |
| Innovation Score           | 0.4071 | 0.4515    |                   |                  |     |
| Oil Barrel Price (CAD)     | −0.0361| −0.0293   | −0.0298           |                  |     |
| ACC (# of Occurrence)      | −0.1294| 0.1148 †  | 0.2715 ***        | −0.0053          |     |
| EC (M CAD)                 | −0.1002| −0.0289   | 0.0512            | −0.0284          | −0.0277|

Note: ACC refers to ‘pipeline accidents and incidents’. EC refers to ‘environmental consciousness’. CAD indicates ‘Canadian dollars’. M CAD indicates ‘millions of Canadian dollars’.

Table 3 shows the results from the nested regression models. The results in Model 1 show that the control variables chosen are weakly significantly related to EBITDA. First, firm size presents an expected positive relationship with EBITDA at a weakly significant level, meaning that as firms grow in size, they grow in capital financial performance. Second, innovation score has an expected negative relationship with EBITDA at a significant level. It can be interpreted from the result that a higher innovation score would result in higher expenses in R&D, in turn lowering immediate earnings. Third, oil barrel price has a negative relationship with EBITDA at a weakly significant level, which could be explained by fluctuation in demand and cost. To control for inflation fluctuation, this study executed an additional robustness test with an inflation-corrected oil barrel price, which was corrected with Statistics Canada’s consumer price index (CPI) index. The robustness test showed the same conclusions. Nonetheless, this study suggests that other alternative macroeconomic variables can be considered in future studies to control for a sort of confounding effects.
Table 3. Effect of pipeline accidents and incidents on EBITDA. (* \( p < 0.05; ** p < 0.01; *** p < 0.001; \dagger p < 0.1 \)).

| DV: EBITDA (M CAD) | Model 1 | Model 2 | Model 3 | Model 4 |
|--------------------|---------|---------|---------|---------|
| Control            |         |         |         |         |
| Firm Size (Log−Asset) | 2345.86† (1226.72) | 2348.47† (1231.35) | 1997.55† (1207.70) | 1611.04 (1210.69) |
| Innovation Score   | −1999.79* (913.20) | −2030.26* (942.82) | −1504.45 (938.73) | −1638.04† (931.13) |
| Oil Barrel Price (CAD) | −18.07† (10.41) | −18.07† (10.45) | −18.40† (10.20) | −18.20† (10.09) |
| Ind. Variables     |         |         |         |         |
| ACC (# of Occurrence) | 7.43 (53.87) | −6.93 (52.80) | −46.65 (55.98) |         |
| EC (M CAD)          | −9.52** (3.41) | −12.66** (3.72) |         |         |
| Interaction         | ACCxE (M CAD) | 0.48* (0.24) |         |         |
| Obs.                | 184     | 184     | 184     | 184     |
| R−Squared           | 0.0782  | 0.0783  | 0.1295  | 0.1545  |
| Model               | 3.82*   | 2.85*   | 3.96**  | 4.02*** |

Note: ACC refers to ‘pipeline accidents and incidents’. EC refers to ‘environmental consciousness’. CAD indicates ‘Canadian dollars’. M CAD indicates ‘millions of Canadian dollars’.

For Hypothesis 1, the result in Model 2 of Table 3 shows that pipeline accidents and incidents have no significant effect on EBITDA. The result in Model 3 shows that environmental consciousness has an expected negative effect on EBITDA at a significant level. In Model 4, this study investigated whether environmental consciousness has a stronger negative effect on EBITDA compared to Model 3. The results across all models show that environmental consciousness has an expected negative effect on financial performance at a significant level, in turn strongly supporting our Hypothesis 2. The result in Model 4 shows that the weighted-accidents and incidents have no stronger and significant negative relationship with EBITDA. However, when considering environmental consciousness as a moderating effect, the interaction term between environmental consciousness and pipeline accidents and incidents (i.e., ACCxE) has a significant positive relationship with EBITDA. The surprising result may be inferred from the fact that the measure for the accidents and incidents alone is not significant across all other models observed. However, the pipeline accidents and incidents weighted by the industry’s environmental consciousness, the interaction term, have an unexpected significant positive effect on EBITDA.

The results obtained from the nested models are not quite as expected, and they do partially support the hypotheses in question. In all four models tested, the accidents and incidents are not significant; therefore, the terms “stronger” or “weaker” assumed from Hypothesis 3 cannot be supported from Model 4, and the direction also cannot be corroborated by the result from Model 4. However, the strong significance of the result in Hypothesis 3, as well as the potential causes for such possible suppressing effect and the positive relationship with EBITDA, would be interesting to study further. In addition, while pipeline accidents and incidents don’t have a significant relationship with EBITDA, the significant positive result of the interaction term (ACCxE) suggests the consideration of external factors when exploring the effect of negative events on financial performance, which will be further discussed in the discussion section.

5. Discussion

To provide better understanding for the effect of CSIR on corporate financial performance, this study attempted to explore whether environmental consciousness as an overarching environmental
context moderates the relationship between pipeline accidents, incidents, and financial performance. The results across the nested models show that pipeline accidents and incidents in the Canadian energy sector have no significant negative effect on financial performance. The following plausible explanations for this unexpected result could be considered. First, the negative actions do not represent the environmental non-performance of a firm and therefore do not negatively impact a social shareholder and, by extension, a firm’s financial performance. Since the accidents or incidents are recorded, the level of media attention received, damages caused, or other factors could mediate the supposed negative effect. An incident causing almost no damage and receiving no media attention, for example, would still be recorded but could be considered internally as either a preemptive or learning event that could help prevent future ones or simply a un-impactful event. Second, the overall negative events might show signs of non-performance due to the presentation and uneven level of media attention received for each accident or incident. This could lead to the overall number of negative events available to the social stakeholders. Alternatively, the accidents and incidents covered in the database of Statistics Canada having no statistically proven impact on indicators of financial performance might be due to unscrutinized media coverage and therefore may not negatively affect the shareholder enough. Finally, when referring to the accidents and incidents as positive actions, these positive actions, when using environmental consciousness as a moderating effect, do represent the environmental performance of a firm and therefore do positively impact a social shareholder and a firm’s financial performance. Furthermore, another possible outcome that should be considered is the rise of environmental capital expenditures between 2007 and 2016.

The results in Model 3 of Table 3 show that, when taken independently, there was an expected significant negative effect of environmental consciousness on financial performance, whereas the results in Model 2 show that there is no significant effect of pipeline accidents and incidents on financial performance. When weighted by the industry’s current level of environmental consciousness, however, the results in Model 4 show that the interaction term (ACCxEC) shows a positive effect on financial performance, environmental consciousness (EC) has a consistent expected negative effect on financial performance, pipeline accidents and incidents (ACC) have no significant effect. The seemingly surprising results from Model 4 do not support the hypothesized relationship between environmental performance and financial performance. The results, however, should not be considered as a refutation or contradiction of previous studies’ findings; rather they suggest new observations when studying the industry’s environmental capital expenditures. This surprising finding may shed a new light on potential issues with the attempt to generalize the negative relationship between environmental non-performance and financial performance. If compared to the theory of CSR or CSIR [2], it can be inferred from the findings across all nested models that the recorded pipeline accidents and incidents in the Canadian energy sector provide multiple possible interpretations that should be taken into consideration for future studies. First, it can be assumed that the events, when considered independent of the current level of environmental consciousness, remove the impact that a single negative event will negatively affect a social shareholder’s claim. With the inclusion of this level of environmental consciousness, the observed relationship is positive with financial performance, at least in the Canadian energy sector. This surprising conclusion was also suggested by some past studies for further investigation [2]. Second, on a broader scale, the results showing that pipeline accidents and incidents do not have a significant relationship with financial performance—even when weighted by the environmental consciousness level—suggest that pipeline accidents and incidents need to be considered with external contextual variables such as environmental consciousness.

As mentioned earlier, both the RBV and NRBV have argued that firms doing better environmentally are likely to perform better in the following years [19], given that current corporate strategic actions are likely to be depending on the past capability. As seen in Kim’s research on U.S. heavily polluting industries [7], current toxic releases are more likely to be influenced by past toxic releases, supporting the argument of the NRBV that either good or weak environmental performance tends to continue because of the development of firm capabilities over time. This study also executed a robustness
test to examine whether the one-year and two-year time lagged primary variables such as pipeline accidents and incidents (ACC) and environmental consciousness (EC) (i.e., ACC, ACC, EC, and EC) have effects on EBIDTA. The results of this study also provide evidence to support the existing argument. The results from the robustness test suggest why investors should pay attention to current corporate environmental performance for better future investment consideration.

Regarding a theoretical contribution, the findings of this study can suggest that the easy conclusion from the existing empirical studies showing the negative relationship between negative events and financial performance [2,23] should be carefully qualified, because, when weighted by the current level of the industry’s environmental consciousness, the anticipated relationship between accidents, incidents, and financial performance is different from the expected negative relationship; rather, it may result in the positive impact of the negative accidents and incidents on financial performance, as shown in Model 4 of Table 3.

The findings also provide practical implications. It can be seen that pipeline accidents or incidents do not seem to present a threat to financial performance, at least in the Canadian energy sector. Namely, a take-away should be that as environmental consciousness rises, the impact of these accidents and incidents will vary, possibly leaning towards a positive relationship. Despite these claims, practitioners need to look at negative events such as pipeline accidents and incidents, given the argument that CSIR can be complementary corporate actions that would have a long-lasting negative effect on an identifiable social shareholder’s legitimate claims [2]. In addition, practitioners need to consider the potential effect of overarching environmental contexts like environmental consciousness because, when weighted by the industry’s current level of environmental consciousness, pipeline accidents and incidents could result in unexpected financial performance. As some studies argue that corporate environmental strategy needs to be at the center of corporate decisions [6,7], the results of this study could recommend that managers need to bring CSIR, as well as CSR, into the forefront of the decision-making because CSIR activities such as negative pipeline events with poor environmental performance may have a negative effect on identifiable social stakeholder’s financial performance, as well as unexpected positive effect on financial performance.

This study has some limitations to apply the findings into other industry arenas. First, this study had the limited scope of the data available because the government agency Statistics Canada is not obliged to record all accidents. On the other hand, even though this agency does filter the number of accidents and incidents recorded, the number of negative events presented with uneven possible impacts on a social shareholder makes every event difficult to attribute an even weight. Second, to investigate the effect of pipeline accidents and incidents on financial performance, this study only considered the total number of pipeline accidents and incidents that occurred in a year because the primary databases, Statistics Canada and annual statistics collections, provide only the total number of pipeline incidents and accidents. However, this study admits that the absolute size of accident or incident might be another influential proxy for the effect of environmental event on financial performance, because the size itself may do a lot of harm to the natural environment. For example, Chilcott [56] argues that only small toxic releases of deleterious chemicals can seriously affect humans. This study neglecting the absolute size of accident or incident may fail to consider the relative effect of event on the quality of environmental performance. The absolute size of accident or incident needs to be studied to explore whether the pure size can better represent a sort of bad management of the infrastructure of the Canadian energy sector. Third, the heavy dependence of the Canadian economy’s performance on its energy sector could be part of the desensitization from social shareholders that are affected by such pipeline accidents and incidents. Therefore, even though the measure itself is a case-specific variable that cannot be easily generalized to other studies in different industries, it could be used in different markets or countries to corroborate if pipeline accidents and incidents weighted by environmental consciousness also have a positive relationship with financial performance. For future research, it would be beneficial to obtain firm-specific environmental capital expenditures, as well as pro-environment specific R&D investments as better control variables. Fourth, this study employed
the environmental capital expenditures to measure environmental consciousness (EC) in the Canadian pipeline transportation industry, as recommended by the existing studies [29,30]. However, it could be possible that firms are likely to continuously invest to keep the infrastructure. While admitting this possible interpretation, this study could not conduct a robustness test to examine if a firm continues to invest a lot of capital to maintain infrastructure, given that the primary financial database, EIKON from Thomson Reuters, does not provide detail information about corporate financial measures. It has yet to be studied to better understand whether such capital expenditures represent either environmental consciousness or maintenance expenditures. Fifth, Margolis et al. [19] found from thirty-five years of meta-analytic research that there is a considerable positive relationship between corporate social performance (CSP) and corporate financial performance (CFP). They also found that there is a reversal causality between CSP and CFP, whereas this study more focused on the one directional causality, the effect of environmental consciousness on financial performance. Consistent with this meta-analytic research, this study admits that firms with good financial performance in the Canadian energy sector are more likely to engage in environmental consciousness investment, suggesting that it has yet to be studied under which context the reversal causality can be more convincing. Sixth, even though EBITDA is a valid proxy for financial performance empirically tested with CSR, this study does not represent the entire scope of financial performance. Therefore, future research should continue to evaluate financial performance with alternative measures such as ROE, ROS, and Tobin’s Q. Seventh, due to the lack of data for primary variables in question, the sample dataset consisted of only 19 out of 90 firms in a single pipeline sector. Though empirical studies applying only single industry may provide stronger result [57], studies applying samples covering diverse industry sectors may provide comparable findings if the studies intend to investigate how the overarching environmental context such as environmental consciousness moderates the relationship between corporate social performance and financial performance across diverse industry sectors. Margolis et al. [19] suggested that future studies on the relationship between corporate social performance and financial performance need to examine under which context firms are more likely to do better for the natural environment. Though the findings of this research provide weak statistical evidence to generalize the results in other industry sectors, this study suggests that it has yet to be tested in diverse heavy polluting industries how external expectations such environmental consciousness propel environment-friendly activities of a firm. Last, waste intensity and carbon emissions, as two major factors for environmental performance [58], have been often considered in interpreting corporate environmental performance, but the interpretation of each event collected from the studied dataset of Statistics Canada was less differentiated. Carbon emissions would be a valuable measure to add to the interpretation of pipeline accidents and incidents because it would indicate the presence of a fire, creating a more negative atmospheric impact. As for waste intensity, the amount of resource released by these accidents and incidents does not measure the relationship between environmental and financial performance because the losses in resources directly influence losses in profits in the context of the study. A dataset including all reported accidents and incidents that occurred during the observation period would be beneficial for future research because each separate negative event would be weighed differently and more accurately, with more appropriate impacts on a social shareholder.

In summation, by applying the theory of CSR and CSIR developed by Bateman and Snell [1] and reiterated by Strike et al. [2], this study attempted to take a closer look at the moderating role of environmental consciousness on the relationship between pipeline accidents, incidents, and financial performance in the Canadian energy sector. The results from the analysis of 1281 pipelines accidents and incidents reported by the government agency Statistics Canada from 2007 to 2016 provide a careful conclusion that, even though environmental consciousness has a significant negative relationship with financial performance, the weighted pipeline accidents and incidents present a significant positive relationship. The effect of these negative events on financial performance was not supported in this study. However, due to the possible reasons described in the discussion section, this study opens
the way to future research studying the impact of environmental consciousness on the relationship between negative environmental events and financial performance in a similar high polluting industry.

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