Master Essay

Do CSR pillars have an effect on credit risk?

An empirical comparison between Canadian and Mexican firms

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Abstract

This paper aims to empirically examine the effect, if any, of each Corporate Social Responsibility dimension (i.e., Environmental, Social, and Governance activities) on firms' credit risk for two countries with a different CSR culture, Canada and Mexico. We used Probability of Default and Credit Default Swaps spread, with 1-year and 5-years maturities, as credit risk proxies for a sample of 287 firms from both countries for the period of 2011-2020. This study employs fixed-effects (FE) models to run the regressions on the unbalanced panel data set. The results do not show a statistically significant effect of any of the CSR pillars on credit risk either in Canada or in Mexico; but we do obtain similar results for both countries, despite of their contrasting CSR cultures. Additionally, these findings do not discard a relation between CSR and credit risk in the two countries. Our results keep consistent among different robust tests. Moreover, this publication extends the availability of CSR effects literature with emphasized research in countries outside the US and Europe.

Key words: *CSR, Corporate Social Responsibility, CSR Pillars, ESG, Credit Risk, Probability of Default, Credit Default Swap Spreads*.

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1. Introduction

1.1 Background and Specification of the Problem

Sustainability is the trend of our generation. And while it is true that it is not a new concept, it has gained momentum over the past few years and has been shaping the business world and our way of life. Therefore, now the media, governments and society have more sustainability awareness; they are demanding accountability and exposing companies that fail to externalize their corporate social responsibility (CSR) agenda. Nowadays, CSR activities are not desirable, but necessary.

The global relevance of CSR is exhibited in the 2030 agenda for Sustainable Development promoted by the United Nations, which stipulates a set of 17 Sustainable Development Goals related to CSR activities; these goals are being adopted by all member states since 2015. They are measured yearly and the results are published in the Sustainable Development Report using the SDG Index (Sachs et al., 2021). The SDG Index is an assessment on the overall score of each country towards achieving all 17 SDGs.

Similarly, the OECD Guidelines are directives set by governments to multinational enterprises that operate in member states, with the objective of setting standards for responsible business practices (OECD, 2011). These guidelines are as well consistent with the CSR movement.

Based on the sizeable actions being undertaken by the UN and the OECD upon CSR, one would expect from the countries that are members of both organizations to perform better into developing more solid CSR cultures in their business environment.

Now, is CSR a worldwide phenomenon? Gjølberg (2009, p.10) suggests that "while CSR might be of a global nature, recent research suggests that it is applied differently across different social, economic, cultural, legal and political contexts". Meaning that CSR practices in one country are molded by its own context and differ from CSR practices carried out in other countries. As an example of this, we can see that the results from the 2021 Sustainable Development Report (Sachs et al., 2021), after filtering to obtain the scores from OECD members located in America, appoint Canada as the country achieving the highest progress towards the SDG goals and Mexico as the country with the lowest progress; this implies that Canada has a more predominant CSR culture than Mexico.

Research in the CSR field has been active since the 1950s (Moura-Leite & Padgett, 2011) and while it has surged in the last decade, the focus has been mainly in whether there is a relationship between corporate financial performance and CSR activities. According to a meta-analysis by Friede et al. (2015) where the findings of more than 2000 papers are combined, approximately 90% of studies found a nonnegative relation between CSR and financial performance; furthermore, the majority of the studies found a positive relation.

Consequently, there is a limited amount of research focusing on other potential relations involving CSR, such as the relation between CSR and credit risk. From the limited studies available on this matter, many base their research on agency-based credit risk proxies, such as credit ratings (Jiraporn et al., 2014), even though credit ratings are not the most accurate predictors of corporate defaults (Hilscher & Wilson, 2017). Additionally, previous studies present mixed results and focus on studying this relation in the United States (Oikonomou et al., 2014) and in Europe (Menz, 2010). Nowadays, some academics emphasize the fact that there is still a limited availability of literature attending to emerging countries' perspective of CSR and its effects on corporations (e.g. Duque-Grisales & Aguilera-Caracuel., 2019; Linnenluecke, 2021; Arun et al., 2021; Badayi et al., 2020). This further reinforces the importance of expanding the studies on the relationship between CSR and credit risk, beyond the geographies already studied while using and combining different proxies that could better represent credit risk.

1.2 Purpose

This thesis attempts to investigate if any of the CSR pillars (environmental, social, and governance-based activities) has an effect on firms' credit risk; we focus on studying these potential relations between Canada, which has the highest SDG Index for 2021 among American OECD members, and Mexico, with the lowest SDG Index for 2021 within the same group. Based on the argument proposed by Gjølberg (2009) about the different national patterns of CSR, it is of great interest to study a geographically comparative analysis to further investigate the extent to which different CSR pillar activities can affect credit risk in countries with evidently different CSR cultures. Through this geographical comparison, the publication will contribute to reduce the research gap in CSR's effects on corporations outside the US and Europe. Moreover, the results would provide companies, managers, and

governments of each country the understanding of which individual CSR pillar, if any, has the greatest risk mitigation effect; consequently, the findings would also offer a foundation for adjusting and stipulating a more comprehensive and strategic CSR policy in future work.

This study aims to stand out from previous research on CSR and credit risk by focusing on the use of market-based credit risk proxies (Credit Default Swap spreads and Probability of Default); but also, by comparing two countries different from the US and Europe.

1.3 Delimitations

Some delimitation concerns that affected the scope of this study need to be addressed. The first limitation is the level of securitization activity in the countries selected for the study. Toronto Stock Exchange is the main stock exchange in Canada with more than 1,700 listed firms during 2021 (TSX, 2022), which shows a significant securitization activity in Canada. On the other hand, the Mexican Stock Exchange, also known as BMV, had only 143 listed companies at the beginning of 2022, while during 2021 seven firms delisted from it (Noguez, 2021); these facts display the low securitization activity in the country. The size of the Mexican market limits the size of the sample.

The second limitation is related to the first one given that the low securitization activity translates in less public information available, which in turn reduces the inputs for ESG data providers and discourage a larger geographical coverage. Therefore, there is a reduced availability of ESG scores for Mexico; however, the size of ESG data available for Canada is narrow compared to the number of publicly traded Canadian companies. This could be explained by the ESG data providers' preference for markets with higher trading activity, so most of them cover mainly the US and European markets.

Last but not least, the reason to choose the period from 2011 to 2020 as the time-horizon of this study was delimitated by the fact that the ESG data available in previous years is even more scarce for both countries; thus, including earlier years would have increased the unbalance in the data set and would have not significantly improved the size of the sample.

1.4 Structure of the Paper

The remainder of this paper is structured as follows. Section 2 offers theoretical background of CSR and credit risk in order to introduce CSR pillars and potential credit risk proxies. Section 3 includes previous literature regarding CSR and its effects on firms, which supports the relevance of this study and exhibits the motivation behind our proxies and tests. Section 4 talks over the methodology employed for the research. The data used and descriptive statistics are discussed in section 5. Section 6 provides the results and the discussion of our findings; it also includes robust tests and their corresponding results. The final section concludes the publication.

2. Theoretical Framework

Within this section we would like to give some context of the CSR's concept development trough time and the shaping of CSR pillars. Additionally, we will be providing Credit Risk background and discuss potential risk proxies, such as Distance to Default (DD), Probability of Default (PD), Credit Spreads and Credit Ratings.

2.1 Corporate Social Responsibility (CSR)

According to Chaffee (2017), we can find traces of social responsibility in business since the ancient Rome and the Middle Ages. Afterwards, in the late 1800's and early 1900's, some companies showed actions as a reflection of their social awareness (Heald, 1970); while other businessmen and scholars, such as Henry Ford, George Perkins, Chester I. Barnard, and John Maurice Clark, debated the relationship between corporations and society. However, the CSR concept was still vague and did not attract the attention of most managers and shareholders. Then, Bowen (1953) defined for first time the social responsibilities of corporations in *Social Responsibilities of the Businessman;* it was the first academic work on the doctrine of social responsibility, so Bowen is considered the "father of CSR" (Carroll, 1999).

Through the 60s, social movements, protests and environmental campaigns put pressure not only on the government, but on corporations as well; as a result, the decade's approaches of CSR focused on an answer to the demands of society, some influential scholars of the time were Keith Davis, William Frederick and Clarence Walton. Nevertheless, firms

used CSR mostly as a public relations strategy (Burt, 1983) and practical activities remained mainly philanthropical (Carroll, 2008). In addition, the increasing talk about CSR made way for opposite perspectives and controversy around it, such as Friedman (1962) economic point of view; Friedman argued that CSR threatened a company's role to only seek for financial benefits. Later, Friedman (1970) released *The Social Responsibility of Business is to Increase its Profits*, providing further arguments against the use of a corporation's resources in CSR activities.

In 1970, the Committee for Economic Development (CED) of the United States published *A New Rationale for Corporate Social Policy*. This release was a step forward in the development of CSR concept mainly because this new rationale contributed for an agreement between social and economic interests of corporations, which relationship had been previously controversial; the contribution illustrated that it is in a corporation's best interest to support their surroundings because there would not be profit without customers. During the 1970s, the growing popularity of the CSR term and its use in diverse contexts made the concept ambiguous (Baumol et al., 1970). Years later, Votaw (1972, p.25) wrote that corporate social responsibility "means something, but not always the same thing, to everybody". There was a lack of a widely accepted model until the end of the decade, when Carroll (1979, p. 500) proposed an integral definition for CSR in his article: "The social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time". Carroll introduced a three-dimensional model of corporate social performance (CSP) and its dimensions were CSR, social issues and corporate social responsiveness. The model integrated previous work of other academics to unify the concept, but his contribution relies in combining economic and social objectives as part of one common framework for a corporation's total social responsibility.

The events happening within the 80s, like the creation of World Commission on Environment and Development (WCED), the Montreal Protocol adoption by the United Nations, and the founding of the Intergovernmental Panel on Climate Change, exhibited the world's rising concern about sustainable development. The concept definition was provided in *Our Common Future* report, also known as Brundtland Report. Sustainable development was defined as "development that meets the needs of the present without compromising the

ability of future generations to meet their own need" (WCED, 1987, p.16). Even when these circumstances were not directly related to CSR, they did pressure corporate behavior. Additionally, the stakeholder term was developed by Freeman (1984) in his book called *Strategic Management: A Stakeholder Approach*. The publication addressed business ethics and indicated that for a business to succeed, it had to create value for its stakeholders (i.e. customers, suppliers, employees, communities, and every individual or group who is influenced by the firm); hence, economic and social interests became closer, but there was still a lack of measure and of empirical test for CSR.

During the 90s, several international organizations like the United Nations (UN), the World Bank (WB), the Organization of Economic Co-operation and Development (OECD) and the International Labor Organization (ILO) were already strong advocates of CSR, incorporating guidelines and departments to research and sponsor CSR (Lee, 2008). These actions displayed the relevance of CSR at the time. Moreover, around 90% of the Fortune 500 firms considered CSR fundamental in their organizational goals and advertised their engagement in CSR activities in annual reports.

Simultaneously, the CSR concept kept evolving, particularly with Wood (1991) academic contribution, which integrated the models of Carroll (1979) and Wartick and Cochran (1985), resulting in a comprehensive model of corporate social performance that defined the principles of CSR, the processes of social responsiveness and the outcomes of corporate behavior. In 1994, John Elkington significantly contributed to CSR with the "Triple Bottom Line" (TBL) approach, delivering a framework under which corporates could achieve a balance between their economic, social and environmental performance (Henriques & Richardson, 2004). The TBL approach remains present because it leads companies to sustainable development by giving them a thorough list of objectives other than profit, while integrating stakeholders; as result, the TBL helps to measure and report a firm's performance within the three dimensions (UNIDO, 2022). Another key contribution to CSR's concept came in 1996, when Burke and Logsdon were some of the first ones to assess the benefits of CSR implementation; they looked for evidence that associated a company's CSR with a favorable financial performance (Agudelo et al., 2019).

Among the 90s, there was a geographical expansion of the CSR concept driven by the globalization process. In 1999, Kofi Annan (Secretary-General of the UN between 1997

and 2006) proposed an agreement of shared principles between business leaders and the UN, at the World Economic Forum in Davos; this resulted in the creation of the United Nations Global Compact (UNGC) in 2000 (UNGC, 2022). Nowadays, the UNGC is the world's largest corporate sustainability initiative and its mission is to promote a global movement of sustainable companies and stakeholders by encouraging companies to: a) Do business with responsibility by aligning their operations and strategies to the Ten Principles, which are related to human rights, labor, environment and anti-corruption. And b) Undertake actions to make progress on the 17 Sustainable Development Goals (SDGs); the SDGs are included in the *2030 Agenda for Sustainable Development* and were adopted by all UN members in 2015 (UNGC, 2022). Although in the beginning the UNGC was not directly related to CSR, it aimed to lead corporate behavior towards social responsibility.

At the same time, Smith (2000) contribution to CSR concept was related to the scope of social responsibility from a firm's perspective, denoting that firms should consider a larger set of stakeholders; also, Smith indicated that corporate's fulfillment of obligations would maximize firms' long-term favorable impact on society. In 2001, Geoffrey Lantos linked CSR and the term "strategic", by explaining that CSR could be strategic to accomplish business goals; this meant that companies were embracing good actions towards society because they believed that it was in their financial best interests (Lantos, 2001). Some years later, Porter and Kramer (2011) explained that given the interdependence between corporates and society, business and social activities should follow the same goal, shared value, which benefits both sides; finally, they concluded that strategic CSR could be a sustainable competitive advantage for firms.

In the third edition of the book *Strategic Corporate Social Responsibility* by Chandler and Werther (2014), the authors recognized the significance of shared value creation; they held that strategic CSR could create sustainable value, so they suggested an approach for its effective implementation. In the fourth edition of the book, Chandler (2016) modified slightly their previous definition of strategic CSR by changing the fundamental goal; instead of focusing a firm's strategic CSR plan to maximize profit, the new objective was to optimize value.

Throughout the 2010s, international organizations promoted agreements and policies in order to increase the CSR reporting; these actions have helped the development of CSR in terms of conceptualization, measurement, and implementation.

2.2 CSR pillars

As we have seen, the concept of CSR has constantly evolved and broadened over time, boosted by its moderate but increasing relevance for business. After reviewing the evolution of the concept, we would like to engage in the TBL approach given that it integrates CSR, CSR's pillars, stakeholders, and sustainable development in one model. The TBL, as mentioned before, is a corporate's outline to balance economic, social, and environmental concerns, while meeting the expectations of shareholders and stakeholders (every individual impacted by the firm's operations), to achieve a sustainable development as an ultimate goal. For the purpose of this study, we assume that the three fundamental pillars of CSR are social, environmental and governance (ESG) activities given that corporates can address TBL's concerns through these activities; moreover, through the three dimensions, we have a practical approach for CSR's implementation and reporting.

Individual scores for each pillar provide meaningful information to detect weaknesses, set objectives, track trends, interpret results, and recognize best policy practices. Nevertheless, there has been a limited availability of ESG ratings outside of developed markets, such as the US and Europe; consequently, there is still a reduced amount of literature with a real international outlook of ESG activity and performance. During the 2010's, the accelerated ESG agenda promoted by international organizations (United Nations Principles of Responsible Investment and Global Reporting Initiative), in addition to new market trends such as sustainable responsible investing, have pressured ESG score providers to increase their ratings universe to inform about others markets apart from the US and Europe (Linnenluecke, 2021).

2.2.1 Environmental

The activities in the environmental dimension are related to the impact of a firm on the environment. In order to measure a company's environmental activities, Refinitiv (one of the most extensive ESG databases in the global market) assesses the firm's resource use,

emissions, and innovation in products and greener technologies used during its operations and supply chain (REFINITIV, 2021).

2.2.2 Social

Social dimension encompasses all the corporate activities that have a social impact into the communities they are involved with; also, the firm's promotion of social good and advocacy of human rights. REFINITIV (2021) determines a firm's social score by evaluating its actions within four categories: community, human rights, product responsibility and workforce.

2.2.3 Governance

The governance dimension comprises the activities associated to managing the company. A firm's governance score by Refinitiv is approached by taking into consideration the activities under three categories: management, shareholders and CSR strategy (REFINITIV, 2021).

2.3 Credit risk

The risk of financial losses that a creditor bears resulting from the failure of the borrower to meet its contractual obligations is defined as credit risk. When the obligor, in this case a company, cannot fulfill its contractual obligations, it defaults on its debt; so, credit risk can be referred as default risk. There are different measures of default risk: Distance to Default (DD), Probability of Default (PD), Credit Spreads, and Credit Ratings.

2.3.1 Distance to Default and Probability of Default

Merton (1974) proposed a structural model of credit risk known as Merton model; this model is the most renowned approach to estimate probability of default using equity prices (Byström, 2005). The insight of Merton model is an option-based approach to assess the credit risk of a debt issuer, in this case a company.

   The starting point is the fundamental identity of accounting explaining that the value of assets today is equal to today's value of debt and equity ($A_0 = D_0 + E_0$). A basic assumption is that the firm's debt is a zero-coupon bond that matures at time T with a nominal value of D. Merton model suggests that a company's value of equity (E_T) at time T is a long

call option on the value of the assets (A_T) at the same time with a strike price equal to the debt amount (D) required to be repaid at time T (Merton, 1974):

$$E_T = \max\,[A_T - D, 0] \tag{1}$$

Therefore, a company defaults when the option is not exercised $(A_T < D)$, since this would indicate that the value of the company's assets at time T is below the nominal value of debt. Considering the option insight of Merton model, Black-Scholes option pricing model (also known as Black Scholes Merton model, BSM) is used to express a firm's value of equity as a function of the assets value (firm's value) in order to estimate the probabilities of a default scenario (Merton, 1973). The essential assumption of BSM model is that the firm's asset value (A_T) follows geometric Brownian motion (GBM):

$$dA_0 = \mu A_0 dt + \sigma_A A_0 dW \tag{2}$$

Where μ_A is the expected return on assets, σ_A is the standard deviation of the asset returns, and dW is a standard Wiener process. The GBM implies that the asset value at time T is lognormally distributed:

$$\ln A_T \sim \mathrm{N}\left(\ln A_0 + \left(\mu_A - \frac{\sigma_A^2}{2}\right)T, \sigma_A\sqrt{T}\right) \tag{3}$$

Continuing with Merton model, it is fundamental to know that the value of equity today (E_0) is given by Black-Scholes formula:

$$E_0 = A_0 \mathrm{N}(d_1) - De^{-rT}\mathrm{N}(d_2) \tag{4}$$

Where:

$$d_1 = \frac{\ln\left(\frac{A_0}{D}\right) + \left(r + \frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}} \tag{5}$$

and

$$d_2 = \frac{\ln\left(\frac{A_0}{D}\right) + \left(r - \frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}} \tag{6}$$

Also, r is the risk-free interest rate, and N( ) is the cumulative normal distribution function. Since BSM model uses risk-free rate as r, the default probability estimated by the model is risk-neutral, which is higher than a real-world default probability; in the real-world scenario the growth rate of a company's assets (μ_A) is generally higher than the risk-free rate because it is reflecting the risk premium required by the market.

To calculate d_2 (or Distance to Default), the market value of assets (A_0) and asset volatility (σ_A) are required, but they are unobservable. Nevertheless, we can observe E_0 if the company is publicly traded, and we can estimate σ_E with a stochastic process known as Ito's lemma:

$$\sigma_E E_O = \frac{\partial E}{\partial A}\sigma_A A_O \tag{7}$$

BSM model shows that $\frac{\partial E}{\partial A} = N(d_1)$; so, under assumptions of the Merton model, we can calculate equity volatility by:

$$\sigma_E = \frac{A_O}{E_O}N(d_1)\sigma_A \tag{8}$$

Then, Merton model uses equations (7) and (8) to solve for A_0 and σ_A; and finally, calculate Distance to Default (DD). DD is Merton model's direct output. It indicates the number of

standard deviations that firm's asset value would have to drop for default to happen (default scenario = $A_T < D$). Moreover, due to the standardization, DD is comparable across firms which makes possible to rank them according to their default risk.

The Probability of Default (PD) measures the default ($A_T < D$) likelihood of a firm over a certain period of time (T). Now, recalling that the logarithm asset value follows a normal distribution, to estimate the PD we substitute DD in a cumulative standard normal distribution:

$$PD = \Pr(A_T < D) = \text{N}(-DD) = \text{N}(-d_2) \tag{9}$$

Then, PD is the probability that a firm's asset value falls more than the number of standard deviations appointed by the DD. Consequently, the larger the DD, the lower the PD.

Merton model has several extensions (e.g. Black-Cox model), while other risk models (Moody's KMV model) have tried to implement a monotonic transformation of Merton model's default assessment. Both, extensions and transformations, aim to improve the performance of the original model, and consequently calculate a more accurate PD.

2.3.2 Credit Spreads

The credit spread is the excess annual rate of interest demanded by investors and debtholders for enduring a specific credit risk (Hull, 2018). Therefore, a larger credit spread shows a higher default risk. Corporate Bond Yield spreads and Credit Default Swaps spreads are measures of credit spread.

Firstly, we would like to discuss Credit Default Swaps (CDS). A CDS is a swap contract that provides protection to the buyer part against the risk of the occurrence of a credit event; a credit event can be defined as the default of a particular company. In a CDS contract, the buyer of protection makes periodical payments to the seller of protection until a credit event takes place or the contract matures, whichever occurs first. The CDS works as an insurance for the buyer; it pays off if the underlying financial instrument defaults. When this happens, the buyer gets a compensation for the loss incurred, and the compensation can vary depending on the settlement agreed on the contract, which can be a cash or a physical settlement. The derivative offers an instrument for market participants to trade credit risk;

thus, the buyer can be an investor wanting to hedge a position in a corporate bond or loan, but it also can be a speculator because it is not necessary to hold the underlying asset to claim the compensation in case of a credit event.

Accordingly, the CDS spread is the periodic payment paid by the buyer but expressed as a percentage (basis points) of the CDS notional value. Hence, CDS spread represents the compensation amount required by the seller when bearing the underlying default risk of the position.

A relevant distinction of CDS from other over-the-counter derivatives is that CDS spreads depend on the probability of default of a particular firm during a particular period, while the other derivatives are determined by interest rates, exchange rates, equity indices, commodity prices, and others.

On the other hand, a Corporate Bond Yield spread is the extra yield of a corporate bond over the yield on a risk-free bond with the same maturity. To calculate a bond yield, it is imperative to choose a reference risk-free asset; this can create misspecification consequences in the calculation. While CDS spreads provide a direct estimate of the credit spreads since they are already spreads.

2.3.3 Credit Ratings

Credit ratings assess credit-related risks of financial obligations and measure the creditworthiness of debt issuers. Credit ratings are considered an agency-based measure due to the fact that these are provided by credit rating agencies. The credit ratings are assigned to obligations or issuers according to their credit risk; agencies define credit risk as the risk of an entity's failure to meet its contractual financial commitments at due date, plus any financial loss associated to default or impairment (Moody's, 2022).

It is relevant to mention that credit ratings offer a rank ordering of credit risk related to default; however, they do not specify a probability of default. Moreover, a feature of this credit measure is that they express agencies' evaluation of credit risk across sectors and regions using the same rating scale, which is intended to ease comparability among them (FitchRatings, 2021).

Credit ratings are not updated frequently according to agencies because they are aiming to achieve stability; so, their analysis is forward-looking, which means it does not

focus on cyclical or temporary shocks to credit quality. The rating only fluctuates when there is a substantial change in the obligation/issuer fundamentals or a change affecting it long-term in terms of cash flows, reserves, funding or capital (FitchRatings, 2021).

3. Previous Literature

The academic literature regarding Corporate Social Responsibility keeps expanding in the number of publications. According to a straightforward search at Lund University Libraries Database for all the materials with a publication date between 2010 and 2021, we found 82,388 publications as result. Most of the recent work addresses CSR's implementation and its effect on certain features of a firm, such as financial performance, credit risk, cost of capital, among others. Despite the increasing research, some authors state that CSR's effects on corporations are not completely understood so far (e.g. Jiraporn et al., 2014; Rizwan et al., 2017), so the research continues to surge. Furthermore, the majority of existing literature focuses in studying CSR's effects in the US or in Europe, which creates a research gap in other markets.

3.1 CSR and financial performance

The relation among CSR and corporate financial performance (CFP) has been the most explored so far by scholars. Today, there are several publications linking CSR and CFP with conclusive results; Friede et al. (2015) analyzed in his article more than 2,000 empirical studies related to CSR and financial performance, finding a positive relation in 62% of the sample vs 8% of negative findings. Consistently, Whelan et al. (2021) in a more recent meta-analysis of over 1,000 research papers, from 2015 to 2020, examined the ESG-financial performance relation; he found out a positive relation for 58% of the sample and just 8% with a negative one.

Despite these positive findings, a study from Duque-Grisales and Aguilera-Caracuel (2019) examined the connection among ESG scores and financial performance of Latin American multinationals located in 5 different countries, and found a negative association between them; the authors explained that the opposite results might be related to the implementation's process and costs of ESG initiatives, to agency problems, but also to the effect of financial slack and geographical international diversification. Furthermore, a

revealing observation included in the paper is the fact of the scarce attention to research and advances towards ESG and CFP in emerging markets, especially in Latin America.

3.2 CSR and Equity Risk

There are earlier publications discussing the CSR impact on a firm's equity risk, with positive results. First, Godfrey et al. (2009) found evidence that the participation in CSR activities creates a goodwill which, in turn, provides an insurance-like protection for firms. Later, the results from Kim et al. (2014) indicated that CSR mitigates the stock price crash risk. Also, Lins et al. (2017) concluded that firms with a large investment in CSR activities get a payoff when there is a shock to overall trust in the market, similar to an insurance. Summarizing, CSR is seen as an insurance policy in case of negative circumstances affecting the market.

3.3 CSR and Credit Risk

Following the same general idea of CSR and equity risk relation, that firms engaged in CSR activities are less risky, some prior literature has analyzed the impact of CSR on a firm's credit risk. We consider among the main precedents to the CSR and credit risk research the publications of Jiraporn et al. (2014), Oikonomou et al. (2014), Menz (2010), Bannier et al. (2021); since each of these publications uses a different credit risk proxy that we are elaborately analyzing here below.

3.3.1 CSR and Credit Ratings

By using US zip codes to measure the variation in CSR policies across geographic locations, CSR scores from KLD database and Standard & Poor's credit ratings of 2,516 US firms from 1995 to 2007, Jiraporn et al. (2014) concluded that CSR improves credit ratings, and by considering that credit ratings importantly influence a firm's cost of debt, it was the first publication to explore the impact of CSR in the cost of debt. Additionally, they found empirical evidence of the geographical influence in a firm's CSR policy.

Nevertheless, the use of credit ratings as credit risk proxy is disputed by Hilscher and Wilson (2017); the authors explained that a valuable credit risk measure should be able to capture raw default probability and systematic risk. They found that credit ratings are not accurate predictors of corporate failure and poorly explain the variation in probabilities of

default across firms and over the business cycle; finally, the writers concluded that it is not feasible to capture credit risk in just one measure.

In parallel, several researchers have expressed their position against the use of credit ratings to assess credit risk due to their failure to anticipate corporate default during the 2008 financial crisis; but also because of the positive ratings that boosted the securitization of subprime mortgages, which originated the crisis (e.g. Rösch and Scheule, (2013); Harper, (2011); Rizwan et al., 2017). Credit agencies have been criticized as well for slowly reacting to market events and their aversion to downgrading (Katz et al., 2009). Even after the adoption of the Dodd-Frank Wall Street Reform and Consumer Protection Act (also known as Dodd-Frank Act), Dimitrov et al. (2014) could not find any evidence that Credit Rating Agencies were issuing more accurate and informative credit ratings.

3.3.2 CSR and PD

Considering credit ratings shortfalls as credit proxy and the quicker response to market information of a company's probability of default, Rizwan et al. (2017) investigated the credit risk mitigation effects of CSR activities using probability of default as credit risk proxy. The authors used a sample of US firms between 2000 and 2012. The findings showed that firms engaging in CSR activities presented a smaller probability of default; so, the authors concluded that CSR mitigates credit risk.

More recently, Badayi et al. (2021) looked for the influence of CSR in a firm's probability of default in developing countries; they used a sample of firms from 17 emerging countries from Asia, Africa and Middle East, Latin America, and Europe. The authors emphasized the little research on the relation of CSR and probability of default. Results exhibited strong evidence that a large CSR participation reduces default probability in all regions except in Africa and Middle East. Finally, they summarized their contribution by suggesting that CSR should be considered as a non-financial variable for determining probability of default.

3.3.3 CSR and Corporate Bonds

The study taken by Oikonomou et al. (2014) aimed to investigate the impact of individual and aggregated dimensions of corporate social performance (CSP) on the cost of debt

(corporate bonds spreads) and to assess the credit quality (bond ratings). It had a sample of 3,240 bonds issued by 742 US firms, the data was from 1992 to 2008, and it used 5 KLD database dimensions (community issues, diversity issues, employee relations, environmental issues, and product safety and quality), separating concerns and strengths, as disaggregated measures of CSP. As result, empirical evidence suggested that a good CSP is rewarded with lower spreads and favorable ratings, while companies with a weak CSP are punished with larger corporate bond yield spreads and worse ratings.

Similarly, Menz (2010) studied the relationship between the valuation of corporate bonds and CSR of European firms, and by doing so it was the first article focusing on a European data set. The sample included 498 bonds with observations over 38 months between 2004 and 2007; he did not use KLD database for CSR measures given that it mainly contains information about US firms, so he used the Corporate Sustainability Assessment of Sustainable Asset Management Research (SAM) as CSR quality measure. The results showed that socially responsible firms face higher spreads than non-socially responsible firms; however, from the different investigated models, only one was weakly significant. Hence, the relationship between CSR and credit spreads was rejected.

3.3.4 CSR and CDS Spreads

According to earlier research, credit default swap (CDS) spreads show superiority as a measure of credit risk compared to corporate bond yield spreads due to relevant advantages such as:

a) CDS spreads do not need the specification of a benchmark risk-free yield curve, since they are already spreads; whereas for calculating the spread from a bond yield, it is required to make a choice of the risk-free rate. So, CDS spreads prevent any noise that might appear from an inaccurate model of the risk-free yield curve (Ericsson et al., 2009).

b) CDS spreads can be faster and more accurate in reflecting changes in credit risk because they exhibit less contamination of non-default risk components (Blanco et al., 2005).

c) CDS facilitate investors to trade credit risk, whereas the secondary market liquidity for bonds is low (Blanco et al., 2005). Also, the higher tradability of CDS allows to collect

daily data, while studies using bonds have to work regularly with monthly observations (Ericsson et al., 2009).

d) The effectiveness of structural models of credit risk diverges between CDS and corporate bonds data. Bonds spreads show underestimation and large pricing errors by different structural models; however, CDS spreads exhibit smaller pricing errors and some models can even approximate the CDS spread (Ericsson et al., 2015).

Coherently with the dominance of CDS spreads, Barth et al. (2021) explored the relation of ESG activities and credit risk, using CDS spreads as the credit risk proxy and a sample of US and European firms from 2007 to 2019. The results indicated a significant and negative relationship, meaning ESG mitigates credit risk; consequently, the authors suggested that analysts can enhance their credit risk models when incorporating ESG ratings and that portfolio managers can improve risk management by considering ESG ratings to anticipate credit rating modifications. The findings also showed a stronger risk mitigation effect of ESG in Europe compared to US; the authors concluded that this was consistent with theories that associate financial benefits of ESG to regions with a higher country-level ESG.

Similarly, Truong and Kim (2019) looked at the effect of CSR dimensions on credit risk but focusing on the term structure, short and long-term, so they used the slope of CDS spreads with different maturities as proxy for the credit risk term structure. The results showed that the overall CSR score is negatively related to the CDS slope, and that investing in CSR activities can reduce credit risk in both terms. After the individual assessment of CSR dimensions, the findings exposed that even when some CSR activities may reduce credit risk in the short and long-term, other CSR activities can increase the short-term credit risk; these findings are valuable for managers to make strategic investments in particular CSR activities. Moreover, the authors recalled that according to Han and Zhou (2015) the term structure slope of CDS spreads can advise about the future financial health of firms because flatter slopes are associated with higher profitability and earnings. Thus, they concluded that a firm can potentially improve its future financial health by engaging in CSR activities.

3.3.5 CSR and Multiple Credit Risk Proxies

In a newer study, Bannier et al. (2021) analyzed the relationship between CSR and credit risk; the novelties of the publication were: (i) it compared US and European firms; (ii) it used

three market-based credit proxies (credit default swap spreads, probabilities of default and distance to default) plus one agency-based credit proxy (ratings) as credit risk measures; and (iii) it assessed each credit proxy relation with each CSR pillar (environmental, social and governance activities). The US sample was integrated by 11,124 firms and the EU sample by 9,682 firms over a time period from 2003 to 2018; whilst the scores for each ESG dimension were obtained from the Thomson Reuters database. The findings were that not all the ESG elements are equally relevant when comparing US and European firms; moreover, the results indicated that in both samples the market-based credit risk is negatively associated with environmental activities, and European firms also showed a negative association between market-based credit risk and social activities. Simultaneously, results regarding credit ratings association with credit risk were not significant for the US sample, while in the case of European sample the results were contrary to the expectation.

4. Methodology

4.1 Panel Data and Fixed Effects

Our data comprises a combination of cross-sections and time-series elements, hence a panel data regression model is used to investigate the effect of CSR pillars (ESG activities) on firm's credit risk. Panel data is an option to deal with information across time and space, so it contains n units that are observed over T periods of time. According to Brooks (2019), it is better than other methods such as: a pooled regression, individual time-series regressions for each, separate cross-sectional regressions for each of the time periods, and seemingly unrelated regressions (SUR). Some of the panel data advantages are:

- It contains more information than just time-series data or cross-sectional data.
- The power of the test is higher because it has an increased number of degrees of freedom because panel data allows to examine the dynamic behavior of several units over time. Also, this property can mitigate multicollinearity problems arising from separate time-series regressions.
- It can remove some forms of the omitted variables bias in the regression results.
- It allows to remove time-specific events affecting equally all the cross-sectional units.

The basic panel data model formula is:

$$y_{it} = \alpha + \beta X_{it} + u_{it}, \quad \text{with } i = 1, \dots, n \text{ and } t = 1, \dots, T$$

where y_{it} is the dependent variable, α is the intercept term, β is a $k \times 1$ vector of parameters to be estimated, X_{it} is a $1 \times k$ vector of observations on the explanatory variables, and u_i is known as the composite error. Breaking down the composite error, we have $u_{it} = \mu_i + v_{it}$ where μ_i represents the unobservable entity-specific effect and v_{it} represents the disturbance, with $v_{it} \sim$ i.i.d.$(0, \theta_v^2)$; μ_i is time invariant, whereas v_{it} varies over time and entities, and captures everything that is left unexplained about y_{it} in the model. The structure of our panel data is built by yearly observations, between 2011 and 2020, of 287 firms in total from Mexico and Canada. Our panel data is an unbalanced panel, since it does not have the same number of yearly observations for each firm.

The Fixed Effects (FE) model and the Random Effects (RE) model are the two main panel data estimation methods. RE model produces a more efficient estimation than FE model; nevertheless, for the parameter estimates to be unbiased and consistent, the RE model needs to fulfill the following requirements: a) the individual effect (μ_i) is independent of the disturbance (v_{it}); b) the composite error term (u_{it}) is uncorrelated with all the explanatory variables (X_{it}); which means that individual effects and disturbances should be independent of the explanatory variables (COV$(X_{it}, \mu_i) = 0$ and COV$(X_{it}, v_{it}) = 0$ for all i and t). If these strict assumptions are not met, FE model is preferable (Álvarez et al., 2017). A Hausman test is used to identify the more appropriate model for a panel data set; this test proposed by Hausman (1978) evaluates the consistency of estimates obtained through FE and RE, so under H_0: individual effects are uncorrelated with the explanatory variables; if the null hypothesis is rejected, then a FE model selected. Therefore, we started by performing a Hausman specification test to select whether a Fixed Effects model or a Random Effects model best fitted our study. We obtained a significant p-value of 0.000 for the four models and thus rejected the null hypothesis; consequently, FE model was the optimal choice for our panel data set in order to get consistent and unbiased estimators. Additionally, this result was coherent with the FE approach followed in some popular previous research (Attig et al., 2013; Oikonomou et al., 2014; Menz, 2010).

FE models capture the effect of variables that vary over time. Since individual effects do not vary over time, a FE model can eliminate the endogeneity caused by μ_i, and also it removes the bias of time-invariant unobserved heterogeneity and omitted variables. "Within transformation" is a method to estimate a FE model. The within method eliminates the individual effects before the estimation to generate unbiased and consistent estimators. According to Baltagi (2008), the correlation between individual effects and explanatory variables is a motivation to use within fixed-effects. Then, we decided to estimate a within FE model, which is also in line with past publications studying CSR's effects on debt-related features (e.g. Menz, (2010); Erragragui, (2017)).

The specification of our within FE model for the regressions is the following:

$$CR_{it} = \beta_1 E_{it} + \beta_2 S_{it} + \beta_3 G_{it} + \beta_4 Controls_{it} + u_{it}$$

Where CR_{it} represents a different Credit Risk proxy in each regression (i.e., Probability of Default and Credit Default Swap spread for 2 different maturities, 1-year and 5-years) for i firm in year t. While E_{it}, S_{it}, G_{it} represent CSR's pillars scores, which are Environmental, Social and Governance activities, respectively. The $Controls_{it}$ account for natural logarithm of Total Assets, ratio of Total Debt/Total Assets, and ROA. The FE estimation approach removes the endogeneity effects caused by time-constant omitted variables, like industry effect, which could be relevant for our case. The purpose of our model is to measure the effect of each CSR pillars (ESG) on Mexican and Canadian firms' credit risk. The model does not include the intercept term given that CR_{it} has a zero mean by construction of the within transformation. Since we have an unbalanced data panel, we are not using lagged variables.

4.2 Pre-estimation Tests

Before running our regressions, we performed a series of pre-estimation tests. First, a Breusch-Pagan Test to validate the presence of heteroscedasticity (Breusch & Pagan, 1979) is used. Heteroscedasticity means that the variance of the error term is not constant, which produces unbiased estimators. We obtained very high Chi-squared values and p-values of

0.000 for all four models, which led us to reject the null hypothesis, which states that the error term is normally distributed and confirms the presence of heteroscedasticity. To deal with this problem robust standard errors will be used in our fixed effects regressions, based on Woolridge (2018).

Afterwards, we needed to test for the presence of serial correlation, which occurs when the error term and a lagged version of itself are correlated over time, this effect causes inefficient estimators and biased standard errors. The Woolridge test for autocorrelation in panel data (Woolridge, 2002) was run for all the models; as result, we got lower than 0.05 p-values, so the null hypothesis of no first-order autocorrelation was rejected. The robust standard errors that will be used in the fixed effects regressions to deal with heteroscedasticity, also will correct for autocorrelation.

5. Data

To study the relationship between CSR pillars (ESG) and credit risk, we obtained relevant data from three main sources. Individual ESG scores were obtained from Eikon Refinitiv (Thomson Reuters Eikon), while market-based credit risk proxies were obtained from the Credit Research Initiative founded by the National University of Singapore. Finally, the data concerning control variables, mainly accounting data, was obtained from the Bloomberg Terminal.

To construct the sample, we screened to obtain all public companies listed in the Toronto Stock Exchange and Mexican Stock Exchange with individual ESG scores available from 2011 to 2020. Another requirement was that the firms needed to be headquartered in Canada and Mexico, respectively. In order to be considered for our sample, each company should have received an ESG pillar score at least one year from the original period. After applying these filters, our final sample consists of 259 Canadian companies and 28 Mexican companies, a total of 287 companies and an unbalanced panel data set of 2,190 firm-year observations.

5.1 Dependent Variables – Market-based credit risk proxies

In previous research such as Jiraporn et al. (2014) and Oikonomou et al. (2014), the proxy used for credit risk has been credit ratings, an agency-based proxy. Hilscher and Wilson

(2017) studied the accuracy of using credit ratings as a measure for credit risk and found that credit ratings are a poor predictor of corporate failure, suggesting probability of default (PD) as a better suited option. Similarly, credit default swaps (CDS) have also been used as credit risk proxies since they usually reflect changes in credit risk more accurately and faster than other measures of risk, such as credit ratings and corporate bond yield spreads (Ericsson et al., 2009). Moreover, it is not feasible to capture credit risk in just one measure due to its multidimensional nature (Hilscher & Wilson, 2017).

Therefore, we are making use of two key variables as market-based credit risk proxies. We defined our dependent variables as PD, for 1-year and for 5-years, and the CDS spread, for 1-year and for 5-years, since CSR activities may affect credit risk differently in the short-term and in the long-term. The data for our four dependent variables is obtained from the Credit Research Initiative, which is part of the National University of Singapore (Singapore, 2022). It is a renowned research initiative that generates credit risk measures for publicly listed companies around the world. The unit of measure for CDS are basis points (bps).

We are using daily updated market-based measures of credit risk which are quicker in responding to market information; furthermore, by engaging in these two proxies, we are turning to two different markets to assess the level of credit risk, the equity market (to estimate PD) and the credit derivatives market (Byström, 2021).

5.2 Explanatory Variables – CSR Pillar Scores

One of the challenges for CSR research is the measurement of CSR. In the past, a number of alternatives have been used, but most studies focusing on the United States have used the MSCI ESG Stats (formerly known as KLD ratings). Alternatively, Eikon Refinitiv offers one of the most comprehensive ESG databases in the industry covering over 70% of the global market capitalization, which translates into 9,000 companies globally. It is a reputable and well-known source of ESG ratings; it is also one of the few that covers companies outside the US. The availability of data for Canadian and Mexican companies was a key point for selecting it, as well as the fact that similar studies on geographies different than the United States have also used this database, aiming for wider standardization.

The explanatory variables for our regression model are the individual CSR pillar scores: social, environmental and governance. Since our intention is to observe which dimension of CSR will most significantly affect credit risk, if there is any effect.

Refinitiv's ESG scores measure a firm's relative performance, commitment, and effectiveness towards ESG, based on verifiable data reported by the firm; Refinitiv stimulates the disclosure of information by negatively affecting a company's score for not reporting on "highly material" data points.

The environmental and social scores are benchmarked against the company's sector, while the governance score is based on relative performance of the country of incorporation. These benchmarks ease comparability among peer groups by industry or by country.

Refinitiv captures and estimates over 450 company-level ESG metrics; each metric is processed to standardize the information and ensure the comparability across industries and countries. From the original set of more than 450 ESG measures, a subset of 186 metrics (which are the most comparable and material per sector) boosts the company assessment and scoring model. The metrics are sorted into 10 categories, which in turn are grouped within the three ESG pillars. ESG Pillars are formed by the following categories:

- Environmental: Emissions, Resource use and Innovation
- Social: Workforce, Human rights, Community and Product responsibility
- Governance: Management, Shareholders and CSR Strategy

The pillar score is the sum of the category weights multiplied by the category scores of each pillar. For the environmental and social categories, the weights fluctuate per industry according to their relevance for each particular sector; meanwhile, the weights remain the same among all industries for governance categories. The category weights are normalized to percentages in a range between 0 and 100; firms with an ESG pillar score of 0 are considered to have the lowest performance on that pillar, whilst firms with a pillar score of 100 have the highest possible performance on that area. Then, the ESG score is built by aggregating the 10 category-weighted scores from the three pillars (REFINITIV, 2021).

5.3 Control Variables

A selection of additional explanatory variables was included in our regression model based on the existing literature in relation to the effect of CSR on credit risk. These variables relate

to size, leverage (risk) and profitability, in order to control firm characteristics. We follow Jiraporn et al. (2014) for our control variables selection.

Firm size is used because, in general, larger firms tend to experience lower financial and business risk; so, they face less probability of default and lower costs of financing. The natural logarithm of total assets is used as proxy to control for size. Since the total assets were obtained in the home currency of the companies, we first had to convert it to a base currency (in this case USD) for both Canadian and Mexican companies, so it could become comparable. The currency conversion was made on December 31st for each year because it is the most common fiscal year end. We expect that firms' size is negatively associated with our credit risk proxies.

To account for differences in firms' capital structures a financial leverage control variable is used. According to Merton (1974), firms with higher financial leverage tend to have a higher probability of default. The ratio of total debt to total assets is used for this purpose. We anticipate the relationship between leverage and our dependent variables to be positive.

Further, the return on assets (ROA) is used to control for a firm's profitability. It is calculated by dividing EBIT by the total assets. Profitable firms are perceived as less risky since they do not face difficulties to meet their obligations, and thus they are expected to have lower credit risk; this would translate into a lower probability of default, which usually gives them access to better financing terms. We expect a negative return on assets coefficient. All control variables were obtained from the Bloomberg Terminal.

5.4 Descriptive Statistics

As mentioned before, our sample consists of 287 firms, each represented by one CDS spread and one PD for two maturities, one-year and five-years. The sample comprises 2,190 firm-year observations, where 89% of observations are from Canadian firms and the remaining 11% are observations from Mexican firms. Table 1 shows the descriptive statistics for the variables applied in our empirical analysis for the complete sample, and Table 2 shows the information for the Mexico and Canada subsamples.

Table 1. Complete Sample Descriptive Statistics

	Complete Sample					
	Obs	Mean	Median	Std. dev.	Min	Max
Panel A: Credit Risk Proxies						
PD 1Y	2,190	0.0024	0.0002	0.0143	0	0.5116
PD 5Y	2,190	0.0182	0.0095	0.0279	0.000005	0.5989
CDS 1Y (bps)	2,190	17.6367	1.8886	112.569	0.000000	4377.514
CDS 5Y (bps)	2,190	26.9566	13.3836	55.0046	0.008824	1787.899
Panel B: CSR Pillars						
Social	2,190	42.3999	40.2365	22.8083	0.4791	96.2259
Environmental	2,190	35.1690	28.8039	29.0166	0	97.0702
Governance	2,190	52.2758	54.3215	21.4249	2.0084	98.4218
Panel C: Control Variables						
Total Assets (N. Log)	2,190	22.1276	21.9652	1.9078	13.7943	28.1709
Total Debt to Total Assets	2,190	0.2547	0.2387	0.1740	0	0.9826
ROA (%)	2,190	1.2649	2.9580	23.0128	-884.577	56.0530

Table 2. Mexico and Canada Subsamples Descriptive Statistics

	Mexico						Canada					
	Obs	Mean	Median	Std. dev.	Min	Max	Obs	Mean	Median	Std. dev.	Min	Max
Panel A: Credit Risk Proxies												
PD 1Y	231	0.0014	0.00065	0.0022	0.000002	0.0179	1,959	0.0025	0.00017	0.0151	0	0.5116
PD 5Y	231	0.0201	0.0145	0.0183	0.000350	0.1054	1,959	0.0180	0.0087	0.0289	0.000005	0.5989
CDS 1Y (bps)	231	9.7655	4.6328	14.6998	0.016630	114.6611	1,959	18.5649	1.6514	118.883	0.000000	4377.5140
CDS 5Y (bps)	231	26.3274	18.7625	23.9002	0.495132	139.6686	1,959	27.0308	12.6028	57.5787	0.008824	1787.8990
Panel B: CSR Pillars												
Social	231	48.4449	55.0193	28.1391	0.7818	94.1050	1,959	41.6871	39.1706	21.9946	0.4791	96.2259
Environmental	231	45.9330	48.1986	30.0780	0	96.2591	1,959	33.8997	27.1522	28.6311	0	97.0702
Governance	231	50.0743	50.7778	22.8142	2.6543	95.1282	1,959	52.5354	54.5829	21.2463	2.0084	98.4218
Panel C: Control Variables												
Total Assets (N. Log)	231	22.2369	21.8324	1.5827	18.3862	25.2201	1,959	22.1147	21.9658	1.9425	13.7943	28.1709
Total Debt to Total Assets	231	0.2831	0.2941	0.1571	0	0.6276	1,959	0.2513	0.2335	0.1757	0	0.9826
ROA (%)	231	5.8920	4.8508	5.3515	-11.1432	20.3728	1,959	0.7192	2.6714	24.2050	-884.577	56.0530

As expected, the average value of PD and CDS increases with the length of maturity for both countries. Surprisingly, PD and CDS average values for each maturity, except for the 5 year PD, are higher for Canada. Also, Mexican companies show a much better environmental average score and a slightly better social average score than Canadian companies, only the Governance pillar average score is higher for Canada. Taking into account that Mexico is a country with a higher risk profile compared to Canada, we suspect the reason of these findings is the sizable difference in the population sample; considering that the observations in the sample for Mexican companies correspond to the biggest companies in the country, they usually have a significantly better credit risk profile than smaller companies that are not even listed in the Mexican stock exchange (in the beginning of 2022, only 143 companies

were listed on the Mexican stock exchange). On the other hand, Canada has thousands of companies listed on its stock exchange, which consequently leads to a broader spectrum of companies with contrasting characteristics, and thus having a wider scope of credit profiles represented.

For the aggregated sample, the average values are 17.59 bps for the one-year CDS spread and 26.90 bps for the five-year CDS spread; the one-year PD is 0.24%, ranging from 0% to 51.16%, and the five-year PD is 1.82%, ranging from 0.0005% to 59.89%.

On average, the firms in the sample have a social pillar score of 42.45, an environmental pillar score of 35.24 and a governance pillar score of 52.25, close to the middle of the rating scale (0-100). The average leverage, calculated as total debt divided by total assets is 0.25x and the average profitability, proxied by ROA, is 1.27%.

5.5 Correlation Matrix

The correlation matrix is constructed with the variables included in the regression model in order to check for multicollinearity issues. Correlations are scaled between -1 and 1, the limits imply perfect negative and positive correlation, respectively. Multicollinearity problems arise when an explanatory variable is a perfect linear function of another explanatory variable, this problem leads to inadequate variable estimates. Table 3 shows the correlation matrix.

Table 3. Correlation Matrix

	PD1Y	PD5Y	CDS1Y	CDS5Y	Social	Environmental	Governance	Log(Total Assets)	Total Debt to Total Assets
PD5Y	0.82 *	1							
CDS1Y	0.99 *	0.78 *	1						
CDS5Y	0.94 *	0.94 *	0.93 *	1					
Social	-0.04 **	-0.03	-0.04 **	-0.04 **	1				
Environmental	-0.03	0.04	-0.03	0.00	0.80 *	1			
Governance	-0.04 **	-0.03	-0.04 **	-0.04 **	0.37 *	0.34 *	1		
Log(Total Assets)	-0.07 *	-0.12 *	-0.07 *	-0.12 *	0.50 *	0.54 *	0.20 *	1	
Total Debt to Total Assets	0.07 *	0.11 *	0.07 *	0.09 *	0.03	0.02	0.13 *	0.14 *	1
ROA	-0.10 *	-0.19 *	-0.09 *	-0.16 *	0.03	0.05 *	0.03	0.18 *	0.04 **

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

A high and positive correlation is expected within the different credit risk proxies. Both proxies, PD and CDS spread, for the two different maturities reflect a negative correlation with each of the CSR pillars, as expected. This is a first indicator of the risk mitigation effect of CSR activities.

CSR pillars are positively correlated with our three control variables; however, the magnitude of the correlations is weak. The correlation signs of control variables are in line with expectations, the size and profitability control variables are negative correlated with our credit risk proxies, while the leverage control variable is positively correlated. The correlation among CSR pillars is naturally positive and high. No potential problems for multicollinearity are identified.

6. Results

Four models, each with a different credit risk proxy, were estimated on the complete sample. Their results are presented in Table 4.

Table 4. Complete Sample - Fixed Effects with Robust Standard Errors

VARIABLES	(1) PD1Y	(2) PD5Y	(3) CDS1Y	(4) CDS5Y
Environmental_Pillar_Score	-1.27e-05	2.57e-05	-0.121	7.84e-05
	(2.06e-05)	(4.86e-05)	(0.164)	(0.0865)
Social_Pillar_Score	2.18e-05	3.33e-05	0.130	0.0591
	(2.65e-05)	(7.57e-05)	(0.173)	(0.117)
Governance_Pillar_Score	-1.68e-05	-4.49e-05	-0.0969	-0.0614
	(1.86e-05)	(4.99e-05)	(0.114)	(0.0754)
Total Assets	-0.00161*	-0.00106	-9.348	-2.465
	(0.000966)	(0.00245)	(5.853)	(3.801)
Total_Debt_to_Total_Assets	0.0258***	0.0776***	180.8***	126.3***
	(0.00904)	(0.0150)	(67.05)	(29.50)
ROA	-0.00620	-0.0169	-42.23	-27.42
	(0.00546)	(0.0130)	(37.39)	(21.46)
Constant	0.0320	0.0221	182.7	50.37
	(0.0195)	(0.0510)	(116.6)	(78.40)
Firm year obs	2,190	2,190	2,190	2,190
R-squared	0.030	0.092	0.023	0.054
Number of Firms	287	287	287	287

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To examine the potential effects of CSR pillars on credit risk, our regressions are run with a fixed effects model using robust standard errors. Our empirical findings suggest that CSR pillars, our variables of interest, are not statistically significant in any model. Therefore, CSR activities would not help explain changes in credit risk. For the two models with short-term credit risk proxies, PD1Y and CDS1Y, the Environmental and Governance pillars have a risk mitigation direction because of their negative sign. And for the two models with longer term credit risk proxies, PD5Y and CDS5Y, only the Governance pillar has a risk mitigation direction.

On the other hand, all the control variables despite of not being all statistically significant, they show the expected sign. The natural logarithm of Total Assets, representing firm size, is significant only in the PD1Y model; together with ROA, representing firm profitability, have a negative sign since both are known to mitigate risk when they increase. The total debt over total assets ratio, representing firm leverage, is statistically significant for

all models and positively related to credit risk, also in line with expectations because an increase in leverage jointly increases credit risk.

An advantage of the fixed effects model is that it only captures variation over time, easing the impact of omitted variables bias and unobserved heterogeneity over time. Nevertheless, the issue of reverse causality may also be present. Our approach in order to investigate the robustness of our findings to reverse causality and omitted variable bias, is to include the lagged dependent variable as an extra independent variable and estimate a dynamic panel model with a two-step GMM approach following Arellano and Bond (1991). Results for these estimations for the four models are presented in Table 5.

Table 5. Two-Step GMM Approach

VARIABLES	(1) PD1Y	(2) PD5Y	(3) CDS1Y	(4) CDS5Y
Environmental_Pillar_Score	-1.74e-05	7.38e-05	-0.173	0.0420
	(3.90e-05)	(5.18e-05)	(0.281)	(0.123)
Social_Pillar_Score	-1.07e-05	-0.000113	-0.00866	-0.122
	(6.26e-05)	(7.93e-05)	(0.448)	(0.175)
Governance_Pillar_Score	6.85e-06	5.76e-05	0.0529	0.0313
	(2.34e-05)	(5.32e-05)	(0.181)	(0.0937)
Total Assets	0.000613	0.00831**	2.097	6.906
	(0.00189)	(0.00391)	(14.84)	(6.784)
Total_Debt_to_Total_Assets	0.0368	0.0556***	306.8	122.7
	(0.0336)	(0.0145)	(307.9)	(95.18)
ROA	-0.0329**	-0.0460*	-238.1**	-117.0*
	(0.0144)	(0.0239)	(102.7)	(61.80)
lagPD1Y	-0.116***			
	(0.0283)			
lagPD5Y		-0.00937		
		(0.0723)		
lagCDS1Y			-0.115***	
			(0.0154)	
lagCDS5Y				-0.0884***
				(0.0276)
Firm year obs	1,630	1,630	1,630	1,630
Number of Firms	234	234	234	234

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results deliver the same main findings comparing to the fixed effects with robust errors models, none of the individual CSR pillars are statistically significant for any credit risk proxy. Also, ROA is the only control variable statistically significant with the expected negative relation for all four models, making our results robust.

Additionally, we run the same four original regressions with fixed effects and robust standard errors, now replacing individual CSR pillar scores with the aggregated CSR score (ESG score) for further robustness. The CSR score was obtained from the same source as the individual CSR pillar scores, Eikon Refinitiv. Results for these estimations are shown in Table 6.

Table 6. ESG Score Robust Test - Complete Sample - Fixed Effects with Robust Standard Errors

VARIABLES	(1) PD1Y	(2) PD5Y	(3) CDS1Y	(4) CDS5Y
ESG_Score	-7.05e-06	2.06e-05	-0.0869	0.00541
	(1.90e-05)	(5.69e-05)	(0.150)	(0.0933)
Total Assets	-0.00161	-0.000896	-9.455	-2.347
	(0.000993)	(0.00250)	(6.105)	(3.888)
Total_Debt_to_Total_Assets	0.0255***	0.0770***	179.4***	125.5***
	(0.00892)	(0.0149)	(66.36)	(29.25)
ROA	-0.00611	-0.0167	-41.66	-27.18
	(0.00548)	(0.0130)	(37.46)	(21.54)
Constant	0.0319	0.0177	185.4	47.03
	(0.0201)	(0.0520)	(122.8)	(80.54)
Firm year obs	2,190	2,190	2,190	2,190
R-squared	0.030	0.091	0.022	0.053
Number of Firms	287	287	287	287

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results also indicate that CSR score is not statistically significant for any model. These results are consistent with Barth et al. (2021) findings that there is not a significant relationship between CSR and CDS spreads in the US. Moreover, all control variables show the expected relation towards credit risk, only the total debt over total assets ratio being statistically significant, implying that higher leverage increases credit risk. All of these results are in line with our base regressions results.

Since our aim is to compare the effect of individual CSR pillars on credit risk for Mexico and Canada, we split the sample into Mexican and Canadian companies and run a fixed effects with robust standard errors regression for each subsample. Table 7 and Table 8 show the results from such regressions.

Table 7. Mexico Subsample - Fixed Effects with Robust Standard Errors

VARIABLES	(1) PD1Y	(2) PD5Y	(3) CDS1Y	(4) CDS5Y
Environmental_Pillar_Score	4.58e-06	0.000100	0.0351	0.131
	(1.35e-05)	(8.66e-05)	(0.0876)	(0.112)
Social_Pillar_Score	-3.52e-06	-8.72e-05	-0.0241	-0.120
	(9.24e-06)	(6.86e-05)	(0.0606)	(0.0894)
Governance_Pillar_Score	-5.89e-06	-1.87e-05	-0.0376	-0.0242
	(1.26e-05)	(7.36e-05)	(0.0824)	(0.0955)
Total Assets	0.000262	0.00240	1.613	3.281
	(0.000657)	(0.00366)	(4.221)	(4.815)
Total_Debt_to_Total_Assets	0.00643**	0.0560***	42.60**	73.24***
	(0.00306)	(0.0167)	(19.72)	(22.02)
ROA	-0.0121***	-0.108***	-80.93***	-140.1***
	(0.00345)	(0.0278)	(22.68)	(36.82)
Constant	-0.00525	-0.0421	-31.96	-58.08
	(0.0147)	(0.0818)	(94.46)	(107.7)
Firm year obs	231	231	231	231
R-squared	0.191	0.302	0.200	0.299
Number of Firms	28	28	28	28

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8. Canada Subsample - Fixed Effects with Robust Standard Errors

VARIABLES	(1) PD1Y	(2) PD5Y	(3) CDS1Y	(4) CDS5Y
Environmental_Pillar_Score	-1.37e-05	1.89e-05	-0.133	-0.0114
	(2.25e-05)	(5.24e-05)	(0.179)	(0.0942)
Social_Pillar_Score	2.64e-05	4.66e-05	0.158	0.0811
	(3.07e-05)	(8.69e-05)	(0.201)	(0.135)
Governance_Pillar_Score	-1.62e-05	-4.18e-05	-0.0925	-0.0566
	(1.96e-05)	(5.27e-05)	(0.121)	(0.0798)
Total Assets	-0.00177*	-0.00137	-10.31	-3.006
	(0.00103)	(0.00261)	(6.283)	(4.057)
Total_Debt_to_Total_Assets	0.0276***	0.0786***	194.0***	130.2***
	(0.00990)	(0.0164)	(73.48)	(32.24)
ROA	-0.00606	-0.0163	-41.29	-26.53
	(0.00541)	(0.0126)	(37.04)	(21.03)
Constant	0.0350*	0.0283	200.9	60.95
	(0.0207)	(0.0539)	(124.2)	(83.00)
Firm year obs	1,959	1,959	1,959	1,959
R-squared	0.031	0.088	0.023	0.052
Number of Firms	259	259	259	259

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As expected, after analyzing the results from the complete sample, we do not find evidence for a significant relationship between individual CSR pillars and credit risk for Mexico or Canada. For Mexico, we find the total debt to total assets ratio and ROA statistically significant for all models. Interestingly, Social and Governance pillars have a negative sign for all models in the Mexico subsample. For Canada the total debt to total assets ratio is also significant for all models and the natural logarithm of total assets is significant for the PD1Y model. The Environmental and Governance pillars are the ones with the negative sign for the Canada subsample.

7. Conclusion

This thesis examines whether individual pillars of corporate social responsibility activities affect a firms' credit risk in Canada and in Mexico. There are a limited number of studies

focusing on the effect of CSR on credit risk outside the US and Europe. Additionally, findings from these studies remain inconclusive.

Using a sample of 2,190 firm-year observations from 2011 to 2020, 89% of the sample being from Canadian firms and the remaining 11% from Mexican firms, our findings suggest that none of the CSR pillars has a significant impact on the probability of default or on the CDS spread of a firm. After using fixed effects regressions with standard robust errors, we did not obtain statistically significant relations between individual CSR pillars and credit risk. Then we substituted the individual CSR pillar scores for an aggregated CSR score to search for a more general relation, but we got consistent results, where CSR was not a significant determinant of credit risk. While results for this study do not show a sizeable relationship, it does not mean that such a relationship does not exist. It means that a weaker relationship could still be present.

Moreover, after splitting the sample into Canadian and Mexican firms, we did not find a significant relationship among any individual CSR pillar score and credit risk, for any country. Concerning CDS spreads as credit risk proxy, the results are in line with those obtained by Barth et al. (2021) with a US sample. Nevertheless, concerning PD as credit risk proxy, our findings are contrary to those reported on Badayi et al. (2021) for Latin America.

Our empirical findings do not support a risk mitigation effect of CSR activities in Mexico or Canada, which suggests that geographical differences in CSR effects on credit risk are not completely understood yet. Even though firms in Canada and Mexico have different CSR cultures and CSR scores availability is different, we yet obtain similar results.

The findings in this paper are a starting point for future research when CSR scores become more widely available in additional geographies and when reporting of CSR performance becomes a standardized practice for all firms.

However, current findings should not discourage managers to invest in CSR activities. In the future, when more CSR data is available, if research results support a risk mitigating effect of CSR on credit risk, then investments on CSR activities would have a strong strategic motivation. Nonetheless, if results still do not support a risk mitigation effect, there are plenty of different reasons, besides economic ones, why firms and managers should invest in CSR. Starting with the implicit responsibility of firms, due to their influence and reach, to make a difference; furthermore, they can operate optimally, while fighting climate

change, working towards a sustainable use of resources, and advocating for more ethical business practices.

The World Economic Forum's Annual Meeting of 2022, taking place as we write, has an agenda revolving around 8 critical themes, each one of them is related at least with one of the UN Sustainable Development Goals (SDGs). Remembering that SDGs are strongly associated with CSR activities, the agenda clearly exhibits today's relevance of CSR for the world and implies that global leaders' agenda must be also around CSR activities.

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