Environmental Impact-Adjusted Firm Value and Debt: A Multi-Country Analysis

Paolo Saona[1,2]
Saint Louis University, Madrid Campus, Spain
Universidad Pointificia Comilllas, Madrid, Spain
Universidad Católica de la Santísima Concepción, Chile

Antonio Renzi
Sapienza University of Rome, Italy

Gianluca Vagnani
Sapienza University of Rome, Italy

Pietro Taragoni
Sapienza University of Rome, Italy

Abstract

The study finds a non-linear, inverted U-shaped relationship between leverage and environmental impact-adjusted firm value (EIAFV), confirming the Trade-off theory. Firm value increases with leverage up to an optimal point, approximately 58–61% of total assets, after which higher leverage leads to value erosion due to rising default risk and financial distress costs. Our results also reveal that higher leverage is associated with lower environmental impact. Quantile regression analysis highlights that the impact of leverage varies across the distribution of $EIAFV$, with stronger effects observed at higher quantiles. Contextual country-level variables, such as capital market development, positively influence $EIAFV$, while banking system inefficiencies, like higher net interest margins and banking crises, negatively affect it. Despite data limitations for country-specific variables, the findings remain robust, emphasizing the nuanced relationship between leverage and firm value in a multi-country context.

Key Words: Capital structure; environmental adjusted value; Trade-off theory; Generalized method of moments (GMM).

JEL-Classification: G32

1. Introduction

Massive environmental damage, growing income and wealth inequality, and stress and depression within developed economies are examples of how the current value creation and

[1] Corresponding Author (paolo.saona@slu.edu)
[2] The Authors acknowledge the invaluable research assistance of Elisa Giordano. Paolo Saona gratefully acknowledges the research funding received from the Spanish Ministry of Science and Innovation (MICIU/AEI/10.13039/501100011033, ref. PID2020-114797GB-I00), the Saint Louis University – Madrid Campus Internal Research Grant, Universidad Pontificia Comillas Internal Research Grants PP2022_11 and PP2024_3, and the 2023 Research Grant from the European Academy of Management (EURAM).

distribution system is in crisis (Serafeim, Zochowski, & Downing, 2019).[3] In this context, as the planetary boundaries are shrinking due to overconsumption of natural resources and nature degradation, organizations are facing a broad social demand to change the scope of business and doing "business as usual" is no longer an option as recently emphasized by Sjåfjell (2018) and Saona and Muro (2023). Traditional proxies of firm value (e.g., Tobin´s Q) are limited in scope for understanding the processes of value creation and distribution, being driven by shareholder primacy while failing to account for other stakeholders such as the community and the environment. Hence, as argued by Barlett and Partnoy (2020), traditional measures of value can drive misleading behavior and biased decisions. In this vein, one of the deepest challenges from both managers and investors is to understand how different environmental impacts[4] can be measured, compared, and integrated into the decision-making process, thus allowing for a better and more seamless management of risk and return, as well as a more efficient and sustainable resource allocation (Freiberg et al., 2021).

On the other hand, decisions on corporate financial leverage are among the most critical decisions made by corporate executives and have been the focus of intense theoretical research aimed at understanding the composition of capital structure, between debt and equity, that affects the firm value. Since the seminal work of Modigliani and Miller (1958), who hypothesize that in a perfect market, capital structure, analyzed in terms of financial leverage, is irrelevant, than the firm total value (asset value) according to a market logic, there has been a succession of theories on corporate financial policies, focusing primarily on taxes, contracting costs, and information costs (Barclay & Smith, 2020)[5]. Such theories aim to figure out the leverage level which maximizes total firm value.

The empirical literature reveals that traditional models on the relationship between leverage and firm value or performance are fundamentally influenced by how key variables are measured and focus primarily on the relationship between the firm and its financial claimants, without paying attention to other non-financial stakeholders (Graham & Leary, 2011). Several studies examine the positive (e.g., Berger and Bonaccorsi di Patti (2006)), negative (e.g., Cai and Zhang (2011); Le and Phan (2017), and nonlinear (e.g., McConnell and Servaes (1995); Stulz (1990); Lin and Chang (2011)) association between leverage and various measures of firm performance, such as market prices (Black & Khanna, 2007), Tobin's Q (Pratt, Barboza, & Brigida, 2023), profitability (Sweeney, Warga, & Winters, 1997), productivity indicators (Chung & Cox, 1990; González, 2013; Min & Smyth, 2014), and other accounting measures, with empirical support that is far from conclusive. Furthermore, other studies show that the contribution to the firm value of optimal capital structure choices is moderate for most firms (Graham & Leary, 2011), demonstrating that the value importance of capital structure decisions may be modest over wide ranges of leverage choices (e.g., Van Binsbergen, Graham, and Yang (2010); Korteweg (2010)).

[3] See also the World Economic Forum 2024 at https://www.weforum.org/publications/global-risks-report-2024/
[4] "Impact is defined as the change in an outcome. An outcome is the result of an action or event which is an aspect of social, environmental or economic well-being" (Freiberg, Park, Serafeim, & Zochowski, 2021, p. 2).
[5] For a more comprehensive review, see Section 2.

However, the aforementioned studies adopt a "business as usual" perspective, which is characterized by being driven by shareholder supremacy. Hence, as the world is facing serious sustainability challenges, the literature struggles to establish a sound connection between value creation "within the planetary boundaries" and more traditional financial policies. Only recent and isolated attempts seek to reach broader value configurations by linking environmental practices to current firm value (e.g., Faria, Tindall, and Terjesen (2022)). Additionally, research focuses solely on a few stakeholders, such as employees and suppliers (e.g., Titman and Wessels (1988); Berk, Stanton, and Zechner (2010)), without considering the monetization of environmental impact and its integration into the firm value estimates and how such adjusted firm value is subsequently driven by capital structure decisions.

Our paper aims to bridge the gap between traditional financial theories and sustainable finance incorporating the environmental impact in the definition on firm value. Consequently, the joint analysis of leverage and adjusted firm value might shed light on policy makers, managers, business practitioners, and investors on mechanisms to responsibly maximize firm value.

We address these issues by examining the impact of leverage on an expanded value measure that incorporates firms' environmental costs, which we refer to as environmental impact-adjusted firm value ($EIAFV$). In this sense, this study extends the current literature (e.g., Hassan, Ilyas, Jalil, and Ullah (2021)) that mostly focuses on the monetization of environmental damage without integrating it within the corporate value. Among all the possible measures of firm performance, our analysis focuses on an expanded measure incorporating environmental externalities, which markets do not directly price into current firm value. $EIAFV$ is an enhanced metric that modifies the traditional Tobin's Q measure, borrowed from macroeconomics, by incorporating the environmental impact monetized through the Impact-Weighted Accounts (IWA) methodology[6]. Therefore, our starting point for examining the relationship between leverage and $EIAFV$ is the literature on leverage and firm value. Specifically, we build on the Trade-off theory, which explains firms' choice of leverage through a trade-off between debt costs and benefits (Fama & French, 2002). We focus on the trade-off and not on other hypotheses for a fundamental reason. Because we are interested in understanding the leverage that increases a firm value in the presence of environmental costs, we search for an optimal level of debt above which excessive debt also impacts negatively firm's value and externalities.

Consistent with the relevant literature, we do not intend to establish the irrelevance of other capital structure theories in our sample, as most are not mutually exclusive (Barclay & Smith, 2020; Graham & Leary, 2011). Specifically, taking into account benefits and costs of leverage, we verify whether considering $EIAFV$ an inverted U-shaped relationship with leverage exits: at low levels of leverage, as debt increases, firms benefit from the tax deduction of debt and

[6] The Impact-Weighted Accounts (IWA) methodology for the Corporate Environmental Impact developed by Harvard Business School "seeks to understand how to appropriately place an economic value upon the social, environmental, and managerial contributions, as well as the cost, of corporates to society as a function of capital consumption. IWA's Corporate Environmental Impact methodology provides a framework for quantitatively assessing the economic cost in monetary units of corporate capital resource consumption" (Velez Caicedo, 2022, p. 8).

the $EIAFV$ should increase. In contrast, at relatively high levels of leverage, as debt continues to grow, the risk of default increases, which causes the $EIAFV$ to fall. The optimal point is then obtained by equalizing the marginal benefits with marginal costs of debt. Using $EIAFV$, the net benefit coming from financial debt extends to environmental component.

Our sample consists of 14,238 firm-year observations from 2,086 non-financial companies, spanning the period from 2008 to 2022. We enrich the empirical and theoretical discourse on the impact of leverage on $EIAFV$ across diverse economic environments by including in our sample listed firms from 66 countries, focusing on those whose environmental impact monetization data is reported by Impact-Weighted Accounts (IWA) firms.

Our estimates verify that there is a non-linear, inverted U-shaped relationship between leverage and environmental impact-adjusted firm value, extending the Trade-off theory to a new view of firm value. In particular, $EIAFV$ increases with leverage up to an optimal point, approximately 58–61% of total assets, after which higher leverage leads to value erosion due to rising default risk and financial distress costs. Quantile regression analysis highlights that the impact of leverage varies across the distribution of $EIAFV$, with stronger effects observed at higher quantiles. Contextual country-level variables, such as capital market development, positively influence $EIAFV$, while banking system inefficiencies, like higher net interest margins and banking crises, negatively affect it.

This study contributes to the literature in several ways. First, it extends the literature on the relationship between capital structure and value by adopting a more integrative approach to measuring firm value that incorporates the interests of various stakeholders on environmental issues. Second, the study contributes to the Trade-off theory literature by providing additional empirical evidence on the choice of optimal capital structure considering as measure of firm value $EIAFV$. Third, the paper provides a multi-country analysis that allows to draw more general conclusions suitable to fit multiple institutional settings through an appropriate methodology to address endogeneity and individual heterogeneity issues. Fourth, this study contributes to the United Nations Sustainable Development Goals (SDGs) by addressing the intersection of environmental impact and corporate financial strategies. Specifically, it aligns with SDG 12 (Responsible Consumption and Production) by promoting sustainable resource allocation through the integration of environmental impacts into corporate decision-making, and SDG 13 (Climate Action) by emphasizing the reduction of environmental externalities to support climate change mitigation. It also supports SDG 8 (Decent Work and Economic Growth) by examining how capital structure decisions can foster inclusive and sustainable growth, and SDG 9 (Industry, Innovation, and Infrastructure) through its innovative approach to measuring firm value with environmental externalities in mind. Ultimately, these contributions highlight the importance of sustainable economic practices, while filling critical gaps in the literature by integrating environmental costs into corporate value assessments.

The remainder of the paper is structured as follows. Section 2 reviews the relevant empirical research on the relationship between leverage and firm value. Section 3 introduces our model. Section 4 presents the results. Section 5 concludes.

2. Theoretical background

2.1. Theories

Since Modigliani and Miller (1958)´s seminal paper showed for the first time that capital structure is irrelevant in a frictionless economy, financial economists have advanced several theories aimed at identifying what frictions make capital structure decisions so crucial (Berk et al., 2010; Vallelado & Saona, 2011). Over the years, theories have focused primarily on taxes, contracting costs, and information costs (Barclay & Smith, 2020; Beattie, Goodacre, & Thomson, 2006), leading to a consensus on the importance of at least two main frictions: corporate income taxes and bankruptcy costs.

In 1963, Modigliani and Miller (1963) published their "tax correction" study, showing that in the presence of corporate taxes with the ability to deduct interest payable on debt, firm value is maximized by full debt financing. Since Modigliani and Miller (1963)´s "tax correction" paper, modern corporate finance literature has focused mainly on two competing theories to explain firms' financial decisions: Trade-off theory and Pecking Order theory.

Trade-off theory argues that the firm's financial choices reflect managers' attempts to weigh the costs and benefits of debt (Kraus & Litzenberger, 1973). The benefits of debt include, for example, the tax deductibility of borrowing costs and the reduction of free cash flow agency problems. The costs of debt, by contrast, may relate to potential bankruptcy costs and agency conflicts between shareholders and creditors. The Trade-off theory predicts that the net benefits of debt financing increase for companies with low leverage but decrease when leverage increases, implying that these benefits are a non-monotonic function of leverage. At the optimal level of leverage, the benefit of the last dollar of debt offsets the cost.

The leading alternative theory on financial decisions is the Pecking Order theory (Myers, 1984a, 1984b)[7]. Although the underlying logic is not so different from the Trade-off model (i.e., that all economic decisions involve trade-offs between costs and benefits), the model differs in the frictions that are considered most relevant. The pecking order emerges when the associated costs of equity issuance are so significant that they outweigh all other considerations, i.e., the costs and benefits of debt. The financing costs that produce pecking order behavior include the transaction costs associated with issuing new securities and the costs arising from management's superior information about the firm's prospects and the value of risky assets. According to the Pecking Order model, because of these costs, a hierarchical preference system exists for financing new investments: retained earnings are used first, then safe debt, then risky debt, and finally equity (Frank & Goyal, 2003, 2008). This implies that changes in leverage are not driven by the trade-off between costs and benefits of debt but by the firm's financial slack, which is valuable and predicts a hierarchy in financing sources.

[7] For a detailed review on Trade-off and Pecking order hypothesis see, among others, Frank and Goyal (2008).

The Pecking Order model constitutes an evolution of another theory, the Signaling theory (Barclay & Smith, 2020). According to Signaling theory (Ross, 1977), corporate executives often have better information about firm value than investors. In this sense, financial decisions are based on managers' perceptions of the "fairness" of the market's assessment of firm value. Thus, the Signaling theory suggests increased debt is a credible signal of higher future cash flows. To minimize the informational costs of issuing securities, a firm is more likely to issue debt (stock) if the firm appears undervalued (overvalued).

So far, the theories examined assume that the interests of the firm's financial managers and shareholders are perfectly aligned and that economic decisions are made in the best interest of shareholders. However, several sources of agency conflicts such as separation of ownership and control can cause managers to fail to maximize the firm's value. According to Agency theory (Jensen & Meckling, 1976), high leverage or a low equity/net asset ratio reduces the agency costs of outside capital. It increases the firm's value by constraining or encouraging managers to act more in the interests of shareholders.[8]

Therefore, although the traditional views contain "elements of truth that help explain some aspects of financing decisions" (Fama & French, 2005, p. 581), the literature points out that these theories are not mutually exclusive. Each is likely to help understand at least particular aspects of corporate financing (Barclay & Smith, 2020). As such, we focus on Trade-off theory rather than other theories. In particular, we are interested in understanding the existence of excessive leverage such that the indirect costs of debt negatively impact $EIAFV$, thus assuming a non-monotonic relationship between the latter and leverage. Excessiveness must be assessed concerning an optimal level of capital (Coricelli, Driffield, Pal, & Roland, 2012). Indeed, in the Pecking Order theory, or the other theories recalled, there is no optimal leverage ratio in the sense that firms do not aim for a particular target leverage ratio.

2.2. Empirical evidence

Empirical evidence on the relationship between leverage and value is mixed. The literature employs several measures of firm performance, such as market prices (Datta, Iskandar-Datta, & Raman, 2000), Tobin's Q (D'Mello & Gruskin, 2014; McConnell & Servaes, 1995), profit efficiency (Berger & Bonaccorsi di Patti, 2006), or productivity indicators (González, 2013), as well as other accounting measures.

Many studies show a positive relationship between leverage and firm value, consistent with part of the theories previously reviewed. McConnell and Servaes (1995), using a sample of non-financial firms listed on the New York Stock Exchange and American Stock Exchange, use Tobin's Q as a measure of a firm's performance to understand the relationship between leverage and firm value. Specifically, the study shows a strong positive relationship between leverage and firm value for low-growth firms. However, this relationship does not hold for high-growth firms, for which a strong negative relationship between leverage and firm value is observed, consistent with the pecking order hypothesis. Berger and Bonaccorsi di Patti (2006), using data from a sample of U.S. commercial banks from 1990 to 1995, test the agency

[8] For detailed reviews, see, among others, Harris and Raviv (1991) and Myers (2001).

cost hypothesis. They show that increasing leverage or decreasing the equity/asset ratio is associated with reduced external capital agency costs and improved firm performance. The Authors use profit efficiency –i.e., frontier efficiency calculated with a profit function– to measure firm performance and regress it on the equity ratio and control variables. The results show that an increase in leverage represented by a 1% decrease in the equity ratio produces an expected increase in standard earnings efficiency of about 16% at the sample mean in the main results. Margaritis and Psillaki (2010), using a sample of French manufacturing firms from low- and high-growth industries, estimate production efficiency to measure firm performance to test the effect of leverage on performance. The Authors support the central prediction of the agency cost hypothesis, as higher leverage is associated with better efficiency across the full range of observed data. Abor (2005), considering a sample of all firms listed on the Ghana Stock Exchange over 1998-2002, investigate the relationship between leverage and profitability as measured by return on equity (ROE). The results demonstrate a significant positive relationship between ROE and capital structure, the latter measured by short-term debt to total assets and total debt to total assets.

Other studies find a negative relationship between leverage and firm value. Cai and Zhang (2011), based on a sample of firms from 1975 to 2002, document a significant and negative effect of variation in a firm's leverage ratio on its stock prices. The negative impact is more pronounced for firms with a higher leverage ratio, a higher probability of default, and tighter financial constraints. Giroud, Mueller, Stomper, and Westerkamp (2012), using a sample of highly leveraged Austrian ski hotels undergoing debt restructuring, confirm Myers (1977)´s arguments that excessive debt compromises firm performance. Specifically, the results find that reducing leverage leads to a statistically and economically significant increase in operating performance for highly leveraged borrowers as measured by Return on Assets (ROA). Similarly to the previous two studies, Zeitun and Tian (2014), using a sample of firms listed on the Amman Stock Exchange during 1989-2003, examine the impact of capital structure on firm performance in both accounting measures (e.g., ROA, ROE, earnings before interest and tax plus depreciation to total assets) and market values (e.g., Tobin's Q and market value of equity to the book value of equity). The results show a significant and negative impact of leverage on both measures. Other studies in developing markets confirm this relationship (e.g., Vithessonthi and Tongurai (2015); Le and Phan (2017); Vo and Ellis (2017)). Hossain (2021), based on a cross-country panel test from 2004 to 2018 for high and low-capitalization firms, shows that the overall performance of firms – measured as Tobin's Q, price-earnings ratio, price per share, ROA, ROE, and earnings per share – at high capitalization is significantly lower than that of low-capitalization firms.

Finally, another part of the empirical literature finds results consistent with the Trade-off hypothesis. Lin and Chang (2011), using a panel of Taiwanese companies listed during 1993-2005, use a panel threshold regression model to test whether there is a "threshold" debt ratio that causes asymmetric relationships between debt ratio and firm value. Using Tobin's Q as a proxy for firm value, the results reveal two thresholds. Tobin's Q increases by 0.0546%, with a 1% increase in the debt ratio. When the debt ratio is between 9.86% and 33.33%, Tobin's Q increases by only 0.0057%, with a 1% increase in the debt ratio. However, above 33.33%, there is no relationship between debt ratio and firm value. Coricelli et al. (2012), examining observations from a panel of firms from Central and Eastern European (CEE) countries during 1999-2008, use a threshold regression to demonstrate the non-monotonic relationship between leverage and a particular measure of firm performance borrowed from macroeconomics, namely total factor productivity (TFP) growth. The results reveal the existence of an optimal leverage ratio in which the net productivity-enhancing benefits of debt are exhausted. The Authors show that leverage has similar non-monotonic effects on ROA and ROE.

With the objective of the analysis to search for the association between leverage and $EIAFV$, we hypothesize the existence of an excessive level of debt that reverses the relationship between leverage and our expanded value measure by making it non-monotonic. As noted, a similar relationship has been hypothesized between leverage and any index of firm value. As leverage increases, the costs of debt erode the net benefits to leverage. For instance, it has been shown that highly leveraged firms not only suffer from a debt overhang problem, which reduces their incentives to invest in productive investments, but their attention is also diverted from productivity improvements by the need to generate cash flows to pay off their debts (e.g., Coricelli et al. (2012)). Consistent with the logic adopted by the empirical literature on the Trade-off hypothesis, we hypothesize that at low levels of leverage, as debt increases, firms benefit from the tax deduction of debt and the $EIAFV$ should increase. In contrast, at relatively high levels of leverage, as debt continues to grow, the risk of default and financial distress costs increase, which leads to $EIAFV$ erosion. The optimal point is then obtained by equalizing the marginal benefits of debt with marginal costs.

3. Methodology

3.1. Background on Calculation of Corporate Environmental Impact Using the Impact-Weighted Accounts (IWA) Methodology

The corporate environmental impact valuation metric from the Impact-Weighted Accounts Project (IWA), developed by Harvard Business School, follows a structured process rooted in life cycle assessment (LCA) and monetary valuation of environmental damages (Freiberg et al., 2021). This approach quantifies the societal costs of a firm's environmental footprint, specifically targeting emissions and natural resource consumption. The IWA methodology transforms corporate environmental outputs (such as carbon emissions, air pollutants, and water consumption) into monetary values using scientific models and environmental damage coefficients. The Impact-Weighted Accounts corporate environmental impact metric represents a pioneering approach to integrating environmental externalities into the financial reporting of corporate activities. It transforms the environmental consequences of business operations—specifically emissions, resource usage, and waste—into monetary terms, offering a new dimension of transparency and accountability for firms. The key objective of this methodology is to quantify the environmental impacts of a firm's activities, making them comparable across companies, sectors, and geographies. This section details the components, data requirements, and computational processes behind this innovative measure, detailed in the document Practitioner Guide to Calculating Corporate Environmental Impact.[9]

3.1.1. Conceptual Framework of the IWA Methodology

[9] https://ifvi.org/wp-content/uploads/2023/10/Practitioner-Guide-To-Calculating-Corporate-Environmental-Impact.pdf

The IWA methodology is rooted in Life Cycle Assessment (LCA) and Monetary Valuation of Environmental Impact. It traces the environmental outputs (emissions, resource use, water consumption, etc.) of corporate activities and translates them into economic outcomes based on scientifically derived coefficients. By monetizing environmental impacts, firms are able to reflect their environmental footprint in financial terms, which can then be integrated into conventional financial metrics to enhance decision-making.

The methodology primarily focuses on the following key environmental outputs: i) Air emissions, including greenhouse gases (GHGs) such as carbon dioxide (CO2), methane (CH4), nitrogen oxides (NOx), and sulfur oxides (SOx); ii) Water consumption, focusing on the amount of freshwater used by corporate operations, and iii) Abiotic resource consumption, which includes the use of non-renewable resources such as metals and minerals.

3.1.2. Data Collection and Pre-Processing

The foundation of the IWA methodology is corporate disclosure. The system relies heavily on firms providing accurate data on their environmental impacts through sustainability reporting. Key data sources include: i) Scope 1, 2, and 3 emissions (direct, indirect, and value chain emissions); ii) Water usage and discharge; and iii) Consumption of abiotic resources, such as minerals and raw materials.

Data are typically extracted from financial databases such as Bloomberg, Refinitiv, and S&P Capital IQ, as well as through environmental disclosures made to platforms like CDP (Carbon Disclosure Project). In cases where data are incomplete, the methodology employs imputation techniques. This involves filling in missing values using machine learning algorithms and sector averages based on datasets like EXIOBASE, a detailed multi-regional supply-use input-output table covering emissions and resource use.

3.1.3. Monetization of Environmental Outputs

The central innovation of the IWA methodology is its ability to transform environmental data into monetary values. This process is achieved by applying specific monetization coefficients to the environmental outputs, which estimate the economic cost of environmental damage. The coefficients used are derived from scientific research and models such as the Environmental Priorities Strategies (EPS), which was developed in collaboration with the Swedish Environmental Research Institute and Volvo, and follows the principles of the ISO 14008:2019 standard for monetary valuation of environmental impacts.

3.1.3.1. Air Emissions

Monetizing air emissions involves calculating the societal cost of pollutants such as CO2, NOx, SOx, and particulate matter (PM2.5). These pollutants are responsible for climate change, health impacts, and environmental degradation, and their economic impact is measured by the following steps:

- Greenhouse Gases (GHGs): Emissions of CO2 and other GHGs are monetized using a Social Cost of Carbon (SCC), which estimates the long-term economic damage caused by one ton of CO2 emitted into the atmosphere. For example, the IWA methodology uses global parameters to calculate the damage to productivity, infrastructure, and health caused by climate change-induced by GHGs.

- NOx and SOx: These pollutants contribute to smog, acid rain, and respiratory diseases. Their monetization is based on the cost of health care, productivity losses, and environmental remediation associated with air quality degradation.

3.1.3.2. Water Consumption

Water scarcity poses a significant risk to businesses and society. The IWA methodology accounts for this by monetizing water usage based on its geographical scarcity. The Waterfund Global Water Price Index and AWARE (Available Water Remaining) model are applied to adjust the cost of water use depending on the location and scarcity of freshwater resources. Water-intensive industries in regions facing high water stress bear a higher economic cost for their water use, reflecting the broader societal impact of their operations on water availability.

3.1.3.3. Abiotic Resource Use

The depletion of non-renewable resources, such as metals and minerals, is quantified based on the cost of replacing these resources with sustainable alternatives. The economic impact is measured as the cost of restoration or substitution. This is particularly relevant for industries like mining, steel production, and construction, where resource extraction plays a significant role in operations.

3.1.4. Aggregation and Output Interpretation

Once the environmental outputs are monetized, the next step is to aggregate these costs to determine the Total Corporate Environmental Impact. This aggregate figure represents the total economic damage caused by a firm's environmental activities in monetary terms. The outputs are not just useful for internal decision-making but can be communicated externally to stakeholders as a reflection of the company's environmental performance.

The aggregation process results in a single monetary value that can be integrated into financial reporting and used for comparative benchmarking. In this sense, the monetary impact can be reported alongside traditional financial metrics, such as operating income or net revenue, allowing firms and investors to consider both risk-return and risk-return-impact profiles. Additionally, since the metric translates environmental impacts into comparable monetary units, it allows firms to benchmark their environmental performance against peers within and across industries.

While the IWA methodology is a breakthrough in linking environmental and financial performance, there are inherent challenges. One limitation is the availability and quality of data. Many firms still lack comprehensive environmental reporting, particularly for Scope 3 emissions, which represent a significant share of a company's environmental footprint. To address this, the methodology relies on imputation techniques using machine learning to predict missing data, which introduces some uncertainty into the valuation process.

Another challenge lies in biodiversity impact assessment. Due to the difficulty in assigning monetary values to biodiversity loss, the IWA methodology currently excludes this from its calculations. This results in an underestimation of the true environmental impact, particularly for firms operating in sectors such as agriculture, forestry, and land development.

Briefly, according to Freiberg et al. (2021), the IWA methodology offers an innovative and practical approach to monetizing corporate environmental impacts. By transforming environmental outputs into economic terms, it provides firms with a powerful tool to integrate sustainability into their financial and strategic planning. Despite certain limitations, it represents a significant advancement towards a future where environmental externalities are fully accounted for in corporate decision-making. This methodology has the potential to reshape how businesses and investors evaluate long-term corporate performance, aligning financial success with environmental sustainability. Hence, due these advantages we consider this USD-monetized measure to compute our environmental impact-firm value adjusted metric for the dependent variable as described below.

3.2. Sample and Variables Definition

Our sample consists of 14,238 firm-year observations from 2,086 non-financial companies, spanning the period from 2008 to 2022. This dataset provides an average of 6.82 continuous observations per company. The sample includes listed firms from 66 countries, focusing on those whose environmental impact monetization data is reported by Impact-Weighted Accounts (IWA) firms. The selected firms represent the following industry sectors according to Thomson Reuters classification: academic and educational services (1.44%), basic materials (15.16%), consumer cyclicals (16.49%), consumer non-cyclicals (10.58%), energy (5.24%), healthcare (5.08%), industrials (17.61%), real estate (6.41%), technology (16.89%) and utilities (5.10%). Financial firms (SIC 6000–6999) were excluded due to their regulated status and the distinct nature of their financial statements, which are incompatible with those of non-financial firms. Companies in technical bankruptcy or those with missing data for key variables were also excluded (Saona & San Martín, 2016).

To complement the IWA dataset, we integrated financial and market-based information, including multiple ESG scores, sourced from the Thomson Reuters Refinitiv Eikon platform. We also employed country-level contextual variables obtained from the Structure and Development of the Financial Sector, originally developed by Beck, Demirgüç-Kunt, and Levine (2000), and publicly available in its updated form from the World Bank.[10]

The dependent variable in this study is the proposed environmental impact-adjusted firm value ($EIAFV1$), an enhanced metric that modifies the traditional Tobin's Q measure, borrowed from macroeconomics, by incorporating monetized environmental impact. Tobin's Q, initially introduced by economist James Tobin, is defined as the market value of a firm's assets divided by their replacement cost. Since this measure is typically unobservable to external analysts, finance and law literature often rely on proxy variables. In our study, Tobin's Q is approximated as the sum of the firm's market capitalization and total liabilities, divided by total assets (Barlett & Partnoy, 2020; Perfect & Wiles, 1994). The environmental impact-adjusted firm value ($EIAFV1$) refines this metric by adding the monetized environmental impact to the numerator. Thus, $EIAFV1$ is computed as the sum of the firm's market capitalization, total liabilities, and subtracts monetized environmental impact, divided by total assets. By construction, this measure incorporates the interests of not only shareholders seeking risk-adjusted returns but also those of creditors, the community, and the environment. Since the monetization of

[10] The data is available at https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database

environmental impact is subtracted in the numerator, higher environmental damage directly reduces the firm's value.

For robustness, alternative metrics were employed, including the firm's market capitalization plus total financial debt minus monetization of environmental impact, divided by total assets ($EIAFV2$); the firm's market capitalization minus monetization of environmental impact, divided by total assets ($EIAFV3$); the firm's market capitalization minus monetization of environmental impact, divided by total common equity ($EIAFV4$); and the firm's market capitalization plus the debt including preferred stocks and minority interests minus cash, short-term investments, and monetization of environmental impact, divided by total assets ($EIAFV6$). These variations ensure that the findings remain consistent across different definitions of environmental impact-adjusted firm value. Finally, there is also a measure only focused on the environmental impact computed as the monetization of the environmental impact over the company´s total assets ($EIAFV5$). Differently from the previous metrics, $EIAFV5$ does not measure firm value but the negative externality cause on the environment from normal operating activities. This metric takes negative values as there is a damage to the environment, and positive values as instead there is no damage but contribution to the environment. Table 1 supplies a description of all variables used in the study.

Leverage (Lev) was measured using the ratio of total financial debt to total assets. To capture non-linear relationships, squared values of the leverage ratio was also included in the analysis.

Control variables include firm size ($Size$), measured as the natural log of the firm's total assets (Frank & Goyal, 2009); capital expenditure ($CAPEX$), defined as the percentage change in gross property, plant, and equipment (Choi & Park, 2022); and asset tangibility ($Tangible$), used as a proxy of collateral, calculated as net property, plant, and equipment divided by total assets (Almeida & Campello, 2007). Firm profitability (ROA) is measured as the net income divided by total assets (Öztekin, 2015). Additionally, research and development expenses divided by revenues ($RDSales$) is also included as control variable. Following Faccio and Xu (2015), when research and development expenses are unavailable, missing values are replaced with 0. To account for this data censoring, an indicator variable ($RDSalesIndicator$) is added to the regression which takes a value of 1 when research and development expenditure data are available and 0 if they are missing.

Default risk was measured with the Altman (1968)´s Z-score, a widely recognized predictor of financial distress. The Z-score is calculated as $ZScore = 1.2WK + 1.4RE + 0.6MKBV + 0.999SALES + 3.3EBIT$; where WK is the company's working capital over total assets, RE is the retained earnings over total assets, $MKBV$ is the market value of equity over the book value of total liabilities, $SALES$ corresponds to the company's sales as a share of total assets, and $EBIT$ is the earnings before interest and taxes over total assets. To align this measure with increasing default risk, we multiplied it by -1, making higher values indicative of greater risk (Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2017; Habermann & Fischer, 2023; Vivel-Búa, Lado-Sestayo, & Otero-González, 2018). To prevent outliers from biasing the results, when convenient, variables were winsorized at 0.5% or 1%.

The time-varying country-level variables used in the robustness analysis include market capitalization as a percentage of the country's GDP ($MktCapGDP$) calculated as the total value of all listed shares in a stock market as a percentage of GDP; banks´ net interest margin

($BankNIM$) which corresponds to the accounting value of bank's net interest revenue as a share of its average interest-bearing (total earnings) assets; the bank lending-deposit spread ($Spread$) defined as the difference between lending rate and deposit rate. Lending rate is the rate charged by banks on loans to the private sector and deposit interest rate is the rate offered by commercial banks on three-month deposits. It was also introduced a banking crisis dummy ($BankCrisis$) variable, which equals 1 during a banking crisis and 0 otherwise;[11] and the stock market return year-on-year in percentage terms ($StockMktReturn$) defined as the growth rate of annual average stock market index in the corresponding country.

3.3. Generalized Method of Moments System Estimator (GMM-SE) Approach

Our analysis begins with a linear exploration, followed by an investigation of whether an optimal leverage level maximizes firm value. Finally, we assess the leverage impact across the entire $EIAFV$ distribution spectrum. To our knowledge, no other study in this field offers such a comprehensive analysis of the leverage-firm value relationship.

The study employs the Generalized Method of Moments system estimator (GMM-SE), as developed by Blundell and Bond (1998), an enhancement of the Arellano and Bond (1991) estimator. This method, with robust standard errors to address potential heteroskedasticity, is well-suited for addressing issues such as unobserved firm-specific heterogeneity, endogeneity of explanatory variables, and omitted variable bias (Windmeijer, 2005).

While Adams (2016) recommends the use of instrumental variables or quasi-experimental techniques to mitigate endogeneity in variables that are not strictly exogenous (e.g., boardroom characteristics), identifying valid instruments remains a critical challenge. Valid instruments must correlate with endogenous variables but remain uncorrelated with both the dependent variable and error term (Antonakis, Bastardoz, & Rönkkö, 2021). This challenge is further compounded by the unverifiable assumption that instruments and endogenous regressors are uncorrelated with the error term.

Despite these challenges, the GMM-SE approach is well-validated in the literature for panel data. As highlighted by Barros, Bergmann, Castro, and Di Medici da Silveira (2019), GMM-based models effectively address endogeneity by leveraging lagged values of independent variables as instruments. These instruments are both relevant and uncorrelated with the error term. Empirical comparisons by Barros et al. (2019), Kiviet, Pleus, and Poldermans (2017) and Antonakis et al. (2021) demonstrate that GMM-SE delivers parameter estimates closer to true values compared to alternative panel regression methods. Consequently, this approach has been widely adopted in similar studies (e.g., Saona, Muro, San Martín, and McWay (2024)).

The baseline model, incorporating robust standard errors, is specified as:

[11] This variable follows Beck et al. (2000) definition of banking crisis. According to the Authors, a country will be in systemic banking crisis if the following two conditions are met: first, if there are significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations), second, if significant banking policy intervention measures in response to significant losses in the banking system are put in place. The first year that both criteria are met is considered as the year when the crisis start becoming systemic. The end of a crisis is defined the year before both real GDP growth and real credit growth are positive for at least two consecutive years.

$$EIAFV_{itc} = \beta_0 + \beta_1 Lev_{itc} + \beta_2 CV_{itc} + \sum_{q=1}^{15} \beta_q YEAR_{qic} + \sum_{h=1}^{66} \beta_h Country_{hit} + \sum_{j=1}^{6} \beta_j Industry_{jit} + \varepsilon_{it} \quad (1)$$

Where $EIAFV_{itc}$ represents the environmental impact-adjusted firm value for firm i in period t and country c. Independent variables are as previously defined where CV_{itc} denotes control variables. The model incorporates time, industry, and country fixed effects in addition to the individual firm effects, and the stochastic error term, ε_{it}.

Several diagnostic tests are used. Given the absence of a specific specification test for the GMM-SE technique comparable to the Ramsey (1969) regression specification error test, a similar approach was employed. Fixed-effects panel regressions were augmented by adding powers of both the predicted dependent variable and the independent variables as covariates. None of the additional terms were jointly significant, supporting the absence of specification error.

Multicollinearity was assessed using the variance inflation factor (VIF), with a threshold of 4 adopted per O'Brien (2007). The D'Agostino, Belanger, and D'Agostino Jr (1990) test was used to evaluate residual normality.[12] Although normality was rejected at the 1% level, this assumption is not strictly necessary for panel regression, particularly in large samples. This is because even if the error terms are not normally distributed, the estimated coefficients may be still normally distributed as long as the sample size is significant (Bailey, 2017). With 14,238 firm-year observations across 2,086 firms (averaging 6.82 observations per firm), the sample size exceeds the threshold of four observations per firm recommended by Baltagi (2013).

Instrument validity was confirmed through the Hansen test of overidentifying restrictions, which indicated no correlation between the instruments and omitted variables. The Arellano–Bond test for autocorrelation verified the absence of second-order serial autocorrelation (AR(2)), ensuring consistency in the GMM-SE estimations (Arellano & Bond, 1991). While first-order serial autocorrelation (AR(1)) was detected, this does not compromise the validity of the results (Alonso-Borrego & Arellano, 1999; Vallelado, Saona, & San Martín, 2017).

As outlined in Equation (1), the models include time and country fixed effects, in addition to individual fixed effects.

For non-linear analysis, we extend the model to include squared leverage terms:

$$EIAFV_{itc} = \beta_0 + \beta_1 Lev_{itc} + \beta_2 Lev_{itc}^2 + \beta_3 CV_{itc} + \sum_{q=1}^{15} \beta_q YEAR_{qic} + \sum_{h=1}^{66} Country_{hit} + \sum_{j=1}^{6} \beta_j Industry_{jit} + \varepsilon_{it} \quad (2)$$

To confirm the existence of an inverse U-shaped relationship, we apply the Lind and Mehlum (2010) test, which identifies the extrema point of the function and provides its Fieller (1954) confidence interval.

3.4. Quantile Panel Regression Approach

A further exploration in this study examines the impact of leverage on the extreme tails of the distribution of environmental impact-adjusted firm value ($EIAFV$). To achieve this, we employ quantile panel data regression, a novel econometric technique that provides a more

[12] D´Agostino K^2 test checks skewness and kurtosis separately first, and then runs a joint test of the null hypothesis that skewness is zero and the kurtosis is 3, which would be consistent with normality.

comprehensive understanding than traditional ordinary least squares (OLS) regressions, which focus solely on the relationship between independent variables and the conditional mean of the dependent variable. Prior research in capital structure has typically relied on standard linear regression methods that assume the average effect of leverage is constant across firms (Conyon & He, 2017). In contrast, quantile regression captures the relationship between independent variables and any specified percentile of the dependent variable's conditional distribution, offering a more nuanced view.

Huarng and Yu (2014) emphasize the limitations of focusing exclusively on central tendencies, arguing that conditional mean models may overlook key patterns at non-central locations in the response distribution. They note that "a set of quality-spaced conditional quantities can characterize the shape of the conditional distribution in addition to its central location." This approach enables a granular analysis of leverage, revealing heterogeneity in effects across the firm value distribution, as emphasized by Armstrong, Blouin, Jagolinzer, and Larcker (2015).

For instance, Rios-Avila and Maroto (2024) demonstrate that quantile regression, coupled with controls for high-dimensional fixed effects, allows for more reliable causal interpretations by accounting for unobservable heterogeneity. In the present study, quantile regression complements the GMM-SE analysis, elucidating and allowing granular understanding of how leverage influences the shape of the environmental impact-adjusted firm value distribution rather than merely shifting its central location.

Quantile regression offers several methodological advantages. It allows predictions at any percentile of the outcome variable's distribution (e.g., 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} percentiles), extending beyond the central tendency captured by ordinary least squares (OLS) regression. This ensures that variations in the leverage are accurately assessed, minimizing the risk of misinterpreting their true impact on firm value.

Although this technique has been relatively underutilized in finance research, there are notable applications in the literature. For example, Conyon and He (2017) examined the relationship between firm performance and boardroom gender diversity in a sample of U.S. firms and found that the presence of women directors had a disproportionately positive effect on high-performing firms compared to low-performing ones. This finding illustrates how quantile regression reveals non-homogeneous effects that standard regression methods might overlook. Similarly, Huarng and Yu (2014) employed a novel quantile information criterion (NQIC) to assess variable predictability, demonstrating how quantile regression provides richer insights and broader interpretative value than conventional mean regression. They argue that managers gain more actionable insights for decision-making through the nuanced understanding provided by this technique.

The quantile regression method used in this study follows Machado and Santos Silva (2019), whose approach improves on traditional quantile methods (e.g., bootstrap) by effectively handling panel data and accounting for individual effects. This advanced estimator ensures robust and precise quantile estimates, overcoming challenges inherent to standard regression techniques.

4. Results

4.1. Descriptive Statistics

Table 1 presents the construction and descriptive statistics of the variables. Several measures of environmental impact-adjusted firm value exhibit average values above unity (e.g., $EIAFV1$, $EIAFV2$, $EIAFV4$, and $EIAFV6$), suggesting a positive market perception. $EIAFV3$ which represents a firm's market capitalization adjusted by its negative environmental impact, shows an average value of 85.7% of the company's total assets. This figure reflects the extent to which a company's environmental impact reduces the market value of its stock. Similarly, $EIAFV5$ reveals that the average environmental impact amounts to 7.1% of total assets, indicating the scale of environmental damage relative to firm size. These observations emphasize the necessity of including potential negative environmental impacts when measuring firm value to offer a more comprehensive reflection of the value generated by corporate activities.

The descriptive statistics also reveal that the average firm in the sample finances 26.9% of its investments with debt (Lev). Additionally, on average, more than 30% of total assets are fixed assets ($Tangible$).

The $ZScore$, which measures of default risk, demonstrates that most firms in the sample operate within a safety zone with a low likelihood of bankruptcy. According to Altman (1968), a score below 1.81 signals a high bankruptcy risk, whereas a score above 2.99 indicates financial stability. The sample's average $ZScore$ of 12.82 indicates a robust financial position, as higher scores correspond to lower bankruptcy risk.

Regarding investment in new physical assets, companies in the sample allocate approximately 5% of total assets to capital expenditures ($CapEx$), as reflected by the capital expenditure ratio. Similarly, the research and development expenses account for about 1.7% of a firm´s revenues.[13]

Table 2 presents the correlation matrix, showing no extreme correlations among the variables, except in one case: between $CapEx$ and $Tangible$, where correlations slightly exceed 0.5. These moderate correlations suggest potential multicollinearity issues. However, the uncentered variance inflation factor (VIF) test confirms that multicollinearity is not a concern, as all VIF values fall below the critical threshold of 4 according to O'Brien (2007).

4.2. Multivariate Analysis

4.2.1. Linear and Non-Linear Relationship between Leverage and Environmental Impact-Adjusted Firm Value

The multivariate analysis summarized in Table 3 examines the linear relationship between leverage and environmental impact-adjusted firm value. The first five models, which include alternative measures of $EIAFV$, show a positive and statistically significant relationship with the Lev variable after controlling for company size ($Size$), asset tangibility ($Tangible$), profitability (ROA), default risk ($ZScore$), capital expenditures ($CapEx$), and research and development expenses ($RDSales$). This finding suggests that as financial debt relative to total assets increases, firm value also rises. For instance, in Model 1, a one standard deviation increase in leverage (0.149) leads to an increase in $EIAFV1$ by 0.345, equivalent to 24.09% of

[13] It is important to note that, by construction, missing values of research and development expenses are recoded as zero in the dataset, which reduces the actual, unobservable mean value of this variable.

its mean value, *ceteris paribus*.[14] This represents an economically significant result. Similar findings are observed across the other four models, with all estimated parameters statistically significant at the 1% confidence level, confirming the robustness of our measure of firm value.

In contrast, the last model in Table 3 does not measure firm value but rather monetized environmental impact as a share of total assets. Here, the way to read the variable is that it increases in value as environmental impact decreases. The estimated coefficient of 0.026 for Lev is significant at the 10% level (*p-value = 0.059*), indicating that higher leverage is associated with lower environmental impact. This suggests that creditors monitor corporate operations, granting loans to firms with more sustainable practices and lower negative environmental impacts. This observation aligns with earlier findings where adjusted firm value increases through the dual mechanisms of debt as a monitoring tool and tax deductions on interest payments.

Regarding the control variables, little evidence is found to suggest that firm size ($Size$) significantly affects adjusted firm value as observed in the first model. Likewise, the last model, which measures monetized environmental impact ($EIAFV5$), shows that larger firms tend to have lower monetized environmental impacts. This could be attributed to larger firms facing stricter regulatory constraints and accounting with the necessary capital to invest in sustainable projects that reduce their environmental footprint.

The results also show that physical assets ($Tangible$) are not a significant source of firm value, as evidenced by the negative estimated coefficients in the first three models. In contrast, profitability (ROA) has a positive and statistically significant effect on adjusted firm value, consistent with existing literature that associates profitability with higher firm value. Similarly, lower default risk, reflected by higher $ZScore$, is associated with increased firm value across various $EIAFV$ metrics. Capital expenditure ($CapEx$) is also positively correlated with improvements in adjusted firm value, as shown in the first 5 models of the table. Furthermore, research and development expenses ($RDSales$) significantly influence multiple metrics of adjusted firm value. On the one hand, investment in intangible assets such research and development enhances firm value, as evidenced in the first five models. On the other hand, it also reduces the monetized environmental impact ($EIAFV5$), as demonstrated in the last model.

The results further suggest that monetized environmental impact decreases as firms rely more on debt but increases with higher asset tangibility. In other works, companies operating with a greater proportion of physical capital relative to total assets tend to cause more significant negative environmental impact.

The subsequent part of the analysis explores the non-linear relationship between leverage and adjusted firm value, as presented in Table 4. The key parameters are the coefficients for Lev and Lev^2. In the first 5 models, Lev has a positive and statistically significant coefficient, while Lev^2 has a negative and statistically significant coefficient –except in model 4 in which the coefficient of the squared variable is not significant. This establishes a non-monotonic, inverse U-shaped relationship between leverage and adjusted firm value. Firm value increases with

[14] Such impact was computed as the standard deviation of Lev (0.149 as shown in Table 1) multiplied by the estimated coefficient of leverage ratio Lev (2.314 as shown in Table 3) and divided by the mean of $EIAFV1$ variable (1.431 as shown in Table 1).

leverage up to an optimal point, beyond which further increases in leverage lead to value erosion. This result aligns with the Trade-off theory, which posits that firms initially benefit from tax deductions and creditor monitoring at low debt levels. However, at higher debt levels, default risk and financial distress costs outweigh these benefits, reducing firm value.

The Lind-Mehlum test, applied to identify the extreme point of leverage where $EIAFV1$ is maximized, indicates that the optimal leverage ratio (Lev) is 61.3%. The null hypothesis of a monotonic or U-shaped relationship is rejected at the 1% confidence level (*p-value = 0.000*). The Fieller confidence intervals further confirm that, with 95% confidence, this extreme point lies between a debt level of 54.70% and 72.20% of total assets. The analysis also reveals that the average slope at the lower bound is positive (4.644), while it is negative (-2.508) at the upper bound, with both slopes statistically significant. This analysis provides robustness to the non-linear relationship between $EIAFV1$ and Lev.

Model 4, which uses $EIAFV4$ (market capitalization minus environmental impact divided by total equity) as the dependent variable, does not exhibit the expected umbrella-shaped relationship with Lev. The extreme point lies outside the observed range of Lev, making the test results trivial in this case. Nevertheless, the other models (2, 3, and 5) in the table provide consistent results. For instance, the optimal leverage ratios for maximizing $EIAFV2$, $EIAFV3$, and $EIAFV6$ are 64.40%, 51.20%, and 49.20%, respectively, lending robustness to our findings, as exhibited at the bottom of the table.

Figure 1 provides a graphical representation of Model 1 from Table 4, illustrating the relationship between Lev and $EIAFV1$. The plot shows that most firms in the sample operate at leverage levels below the optimal range, indicating significant potential for these firms to use debt more effectively to maximize their adjusted firm value.

The last model in Table 4 examines the relationship between leverage and monetized environmental impact $EIAFV5$. A U-shaped relationship is observed (*p-value = 0.014*), as shown in Figure 2, where the null hypothesis in this case is monotone or inverse U-shaped relationship. At debt levels below 27.70% of total assets, increasing leverage is associated with a rise in environmental impact. Beyond this threshold, however, higher leverage reduces negative environmental impacts. These findings suggest that most firms operate at or near this critical threshold (as the average leverage ratio, Lev, is 26.90%, according to Table 1). This implies significant room for reducing environmental impacts by leveraging sustainable debt financing strategies. The benefits arise from creditor scrutiny and tax deductions, further reinforcing the linear modelling explains partially the relationship between leverage and firm value.

4.2.2. Quantile Panel Regressions

To further investigate the relationship between leverage and environmental impact-adjusted firm value, we employed a novel quantile panel regression approach developed by Machado and Santos Silva (2019). This method allows us to assess how leverage influences firm value across different levels of the dependent variable's distribution. For comparison, pooled regressions were also included. Unlike quantile panel regressions, pooled regressions focus only on the relationship between independent variables and the conditional mean of the dependent variable. Moreover, they do not account for unobservable individual heterogeneity across firms, making pooled models more susceptible to biased results. The findings from these analyses are presented in Table 5. Panels A and B use $EIAFV1$ and $EIAFV6$ as dependent variables, respectively, and report results for the 10th, 25th, 50th, 75th, and 90th quantiles of these variables.

Across all quantiles and both panels, the Lev variable exhibits a statistically significant coefficient at the 95% confidence level. Furthermore, these coefficients increase progressively from the 10th to the 90th quantile. For example, in Panel A, the coefficient for Lev rises from 1.790 at the 10th quantile to 2.194 at the 90th quantile of $EIAFV1$. This is a particularly appealing result, as it demonstrates that the effect of leverage on firm value is not uniform across the distribution. Instead, firm value responds more strongly to marginal increases in leverage at higher levels of adjusted firm value compared to lower levels.

When compared to the pooled regression results in the first column of Panel A, the limitations of the pooled model become evident. The pooled regression indicates that Lev has a marginal effect of 1.845 on the conditional mean of $EIAFV1$. However, this average effect fails to capture the variations in leverage's impact across different quantiles, emphasizing the limitations of pooled models in identifying patterns outside the central tendencies of the dependent variable's distribution.

Figure 2, Panel A, offers a graphical representation of these results. It illustrates the behavior of Lev's impact on $EIAFV1$ across different quantiles. The dark blue line represents the estimated impact of Lev, showing a clear upward trend as quantiles of the dependent variable increase. The light blue shaded region denotes the confidence intervals, which are consistently above zero, confirming the statistical significance of Lev at all quantiles of $EIAFV1$. Additionally, the continuous black line represents the pooled regression result, capturing the conditional mean impact of Lev on $EIAFV1$ at 1.845, as previously discussed. The graph further highlights the advantages of quantile regression, which provides richer insights into the heterogeneity of leverage's effects compared to the pooled model.

The findings also extend to other control variables. Particularly, a company´s default risk ($ZScore$) has the greatest impact on firms with relatively high environmental-adjusted firm value. In these cases, when default risk decreases, firms with higher adjusted firm value experience a greater increase in firm value compared to firms with lower adjusted firm value.

Panel B of Table 5 and Panel B of Figure 2 are included to ensure the robustness of the results. While there is some loss of significance for certain control variables at specific quantiles (e.g., ROA and $CapEx$), the main findings concerning the impact of Lev on the adjusted firm value remain both qualitatively and quantitatively consistent with those observed in Panel A of the table.

4.2.3. Non-Linear Relationship between Leverage and Environmental Impact-Adjusted Firm Value Controlled by Contextual Variables

The final part of the robustness analysis introduces contextual variables at the country level. While country-level, time-invariant effects were already accounted for in the preliminary estimations, there remains a concern about potential country-specific, time-variant effects that might influence the results. To address this, the primary results presented in Table 4 are re-estimated, incorporating a set of contextual variables linked to the development of the financial system that may affect adjusted firm value. These variables include market capitalization as a percentage of the country's GDP ($MktCapGDP$), banks´ net interest margin ($BankNIM$), the bank lending-deposit spread ($Spread$), a banking crisis dummy ($BankCrisis$), which equals 1 during a banking crisis and 0 otherwise, and the stock market return year-on-year in percentage terms ($StockMktReturn$). Model 1 of Table 4, augmented with these new variables, is reported in Table 6. Although all other models were also re-estimated, they are not shown for space considerations. Nonetheless, the findings across these models remain qualitatively and quantitatively consistent with those in Table 4.

A significant reduction in the number of observations is observed in Table 6 compared to Table 4. This is primarily due to the unavailability of data for the newly introduced variables across countries. Despite this limitation, the statistical significance of the key variables of interest remains unchanged. For instance, the Lev and Lev^2 variables remain statistically significant across all the models, with positive and negative estimated coefficients, respectively. Furthermore, the Lind-Melhum test consistently confirms the presence of an inverted U-shape (umbrella-shaped) relationship between Lev and $EIAVF1$ across all five models, reinforcing the main research hypothesis. The leverage point at which the adjusted firm value is maximized corresponds to 58.48% of total assets, calculated as the average estimate across the five regressions shown at the bottom of Table 6. This result is comparable to those reported in Table 4.

As for the time-varying country-level variables, the analysis reveals important insights. Variables associated with the development of capital markets, such as the market capitalization as share of GDP ($MktCapGDP$) and stock market return ($StockMktReturn$), are statistically significant and positively influence adjusted firm value. These findings suggest that greater capital market development enables firms to capitalize on favourable market conditions and reduced frictions to enhance firm value. Conversely, variables linked to the banking system, such as banks´ net interest margin ($BankNIM$), show a negative effect on adjusted firm value. This erosion of firm value can be attributed to the wealth extraction imposed by financial intermediaries as they maximize their interest margins. Although not statistically significant, the bank lending-deposit spread ($Spread$) shows a similar trend; as the spread widens, indicating reduced competitiveness in the banking sector, firm value declines. Additionally, the banking crisis variable ($BankCrisis$) indicates that during banking crises, adjusted firm value is approximately 8.9% lower than in non-crisis periods.

Although omitted from the tables for space considerations, the results remain robust across different timeframes, such as the pre-2020 period to exclude COVID-19 effects, and across industry classifications, following Saona and Muro (2023), who categorized firms into primary, secondary, and tertiary sectors and distinguished between high- and low-impact industries. These robustness checks yield results that are qualitatively and quantitatively consistent with those presented in earlier tables.

In summary, while the introduction of contextual country-level variables results in some data loss due to unavailability, the findings remain robust and consistent with those presented in Table 4. This comprehensive analysis underlines the robustness of the leverage-adjusted firm value relationship across a multi-country framework.

5. Conclusions

Our paper aims to bridge the gap between the literature on capital structure puzzle and sustainable finance incorporating the environmental impact in the definition on firm value.

Building on the Trade-off theory of capital structure, we verified a non-linear, inverted U-shaped relationship between leverage and $EIAFV$. The latter increases with leverage up to an optimal point, approximately 58–61% of total assets, after which higher leverage leads to value erosion due to rising default risk and financial distress costs. In addition, our results reveal that higher leverage is associated with lower environmental impact. Quantile regression analysis highlights that the impact of leverage varies across the distribution of $EIAFV$, with stronger effects observed at higher quantiles. Contextual country-level variables, such as capital market development, positively influence $EIAFV$, while banking system inefficiencies, like higher net interest margins and banking crises, negatively affect it.

Our pioneering approach based on a more integrative methodology to measuring firm value and incorporating the interests of different stakeholders is well suited to be applied to multiple institutional contexts and research areas. For instance, the proposed study might be examined with respect to specific countries to derive more specific conclusions to each institutional context. Hence, in countries where attention to environmental issues is higher, debt is expected to have a more predominant role in monitoring corporate operations. In addition, the study offers considerable insights into researching the impact of other strategic corporate decisions, including other corporate financial policies and investment decisions, on the expanded value measure.

The joint analysis of leverage and $EIAFV$ could have significant implications for both managers, investors, creditors, and policy makers. For corporate managers, the study provides a valuable tool to understand how different environmental impacts can be integrated into decision making to responsibly maximize firm value. Indeed, recent studies have shown that as companies increasingly invest resources in corporate social responsibility and integrate environmental, social and governance practices into corporate decision-making and investment strategies, financial markets are reflecting investor preferences, which collectively place a positive value on sustainability (Mollinger-Sahba, Flatau, Schepis, & Purchase, 2020; Roundy, 2019). In addition, the proposed framework can enable managers to increase or decrease leverage to maximize firm value while complying with environmental constraints. Second, the study is also a valuable tool for investors to transparently understand firm value net of environmental impacts so that results can be compared and evaluated within market and industry classifications, therefore favoring investment decisions. Third, the results suggest implications for creditors as well, who can monitor corporate operations, granting loans to firms with more sustainable practices and lower negative environmental impact. This observation is in line with previous findings that firm value increases due to the dual mechanism of debt acting as an external governance mechanism to monitor corporate operations and through tax deductions on interest payments (Lin & Chang, 2011). Finally, the study also has implications for policy makers to develop policies to incentivize corporate sustainable practices and social responsibility while enabling firms to responsibly maximize their value.

Table 1: Descriptive Statistics

Acronym	Definition	Reference	Mean	Std. dev.	Min	Max
EIAFV1	Environmental impact-adjusted firm value: (Market Capitalization +Total Liabilities - Environmental Impact) / Total Assets	Authors´ definition	1.431	0.793	0.016	8.092
EIAFV2	Environmental impact-adjusted firm value: (Market Capitalization +Total Debt - Environmental Impact) / Total Assets	Authors´ definition	1.125	0.790	-0.306	7.777
EIAFV3	Environmental impact-adjusted firm value: (Market Capitalization - Environmental Impact) / Total Assets	Authors´ definition	0.857	0.802	-0.580	7.569
EIAFV4	Environmental impact-adjusted firm value: (Market Capitalization - Environmental Impact) / Total Equity	Authors´ definition	2.451	4.028	-2.618	50.822
EIAFV5	Environmental impact: Environmental Impact / Total Assets	Authors´ definition	-0.071	0.151	-1.133	0.129
EIAFV6	Environmental impact-adjusted firm value: (Market Capitalization + Debt including Preferred Stocks & Minority Interest - Cash & Short-Term Investments - Environmental Impact) / Total Assets	Authors´ definition	1.020	0.808	-0.110	6.445
Size	Firm Size: Logarithmic transformation of the firm´s total assets	Frank and Goyal (2009)	22.733	1.456	16.971	27.340
Lev	Leverage: Total Debt / Total Assets	Saona et al. (2014)	0.269	0.149	0.000	0.913
Tangible	Tangible: Gross Property Plant and Equipment / Total Assets	Almeida and Campello (2007)	0.311	0.217	0.000	1.000
ROA	Profitability: Net Income / Total Assets		0.045	0.047	-0.212	0.243
ZScore	Default Risk: (1.2*Working Capital / Total Assets) + (1.4*Retained Earnings / Total Assets) + (0.6*Market Capitalization / Total Liabilities) + (0.999*Sales / Total Assets) + (3.3*EBIT / Total Assets)	Altman (1968)	12.821	11.122	1.511	62.148
CAPEX	Capital Expenditure: Percentage Change in Gross Property Plant & Equipment	Öztekin (2015)	0.049	0.037	0.000	0.230
R&DSales	Research and Development: Research and Development Expenditure / Sales	Faccio and Xu (2015)	0.017	0.038	0.000	0.216
R&DSalesIndicator	Research and Development: 1 if Research and Development Expenditure exists and zero otherwise	Faccio and Xu (2015)	0.419	0.493	0.000	1.000
MktCapGDP (%)	Structure and Development of Financial Sector: Market capitalization / GDP	Beck et al. (2000)	128.285	166.802	2.274	1,777.540
BankNIM (%)	Structure and Development of Financial Sector: Banks´ Net Interest Margin	Beck et al. (2000)	1.853	1.192	0.368	11.486
Spread (%)	Structure and Development of Financial Sector: Banks´ Lending-deposit Spread	Beck et al. (2000)	3.060	4.939	-2.596	39.654
BankCrisis	Structure and Development of Financial Sector: 1 if banking crises and zero otherwise	Beck et al. (2000)	0.074	0.245	0.000	1.000
StockMktReturn (%)	Structure and Development of Financial Sector: Growth Rate of Annual Average Stock Market Index	Beck et al. (2000)	8.047	12.678	-40.490	114.265

Note: The variables used in the study are defined, their measures specified according to the primary references, and summary statistics (mean, standard deviation, minimum, and maximum) are reported.

Table 2: Correlation Matrix

	EIAFV1	EIAFV2	EIAFV3	EIAFV4	EIAFV5	EIAFV6	Lev	Size	Tangible	ROA	ZScore	CAPEX	RDSales
EIAFV1	1.000												
EIAFV2	0.985***	1.000											
EIAFV3	0.976***	0.982***	1.000										
EIAFV4	0.757***	0.727***	0.685***	1.000									
EIAFV5	0.242***	0.232***	0.243***	0.188***	1.000								
EIAFV6	0.910***	0.928***	0.901***	0.676***	0.219***	1.000							
Lev	-0.055***	-0.006	-0.196***	0.144***	-0.081***	0.049***	1.000						
Size	-0.102***	-0.131***	-0.162***	-0.035***	0.001	-0.103***	0.178***	1.000					
Tangible	-0.114***	-0.085***	-0.103***	-0.074***	-0.235***	-0.055***	0.101***	-0.003	1.000				
ROA	0.485***	0.490***	0.525***	0.309***	0.003	0.471***	-0.236***	-0.058***	-0.069***	1.000			
ZScore	0.732***	0.768***	0.839***	0.379***	0.078***	0.685***	-0.450***	-0.248***	-0.053***	0.527***	1.000		
CAPEX	0.022**	0.033***	0.029***	0.002	-0.130***	0.046***	0.0158	0.0104	0.535***	0.084***	0.058***	1.000	
R&DSales	0.206***	0.212***	0.238***	0.122***	0.127***	0.171***	-0.162***	0.073***	-0.134***	0.044***	0.251***	-0.009	1.000
R&DSalesIndiccator	0.004	0.006	0.041***	-0.034***	0.029***	-0.021*	-0.184***	0.011	0.036***	0.004	0.112***	0.077***	0.537***

Note: The Table reports the pairwise Pearson correlations between variables used in the following study. We noticed that our different measures of firm values are strongly correlated, suggesting that they tend to capture the same underlying dimension of a firm’s value. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Panel Data Linear Regression Model

VARIABLES	(1) EIAFV1	(2) EIAFV2	(3) EIAFV3	(4) EIAFV4	(5) EIAFV6	(6) EIAFV5
Lev	2.314***	2.592***	1.596***	9.856***	1.964***	0.026*
	(24.174)	(31.531)	(19.394)	(17.888)	(18.107)	(1.889)
Size	0.027*	0.015	0.015	-0.041	-0.004	0.004*
	(1.747)	(1.150)	(1.101)	(-0.501)	(-0.206)	(1.682)
Tangible	-0.123*	-0.117*	-0.123*	-0.298	0.019	-0.053***
	(-1.652)	(-1.843)	(-1.934)	(-0.753)	(0.218)	(-4.078)
ROA	0.434***	0.282***	0.271***	2.046***	1.192***	-0.005
	(4.482)	(3.323)	(3.198)	(4.121)	(10.070)	(-0.462)
ZScore	0.074***	0.076***	0.076***	0.163***	0.052***	0.000
	(69.321)	(76.042)	(76.077)	(32.204)	(37.735)	(1.445)
CAPEX	0.366**	0.283**	0.277**	2.291***	0.369**	0.003
	(2.507)	(2.167)	(2.120)	(3.041)	(2.198)	(0.137)
RDSales	3.188***	3.183***	3.153***	10.413***	4.856***	0.396***
	(4.311)	(4.923)	(4.869)	(2.580)	(4.927)	(3.386)
RDSalesIndicator	-0.162***	-0.125**	-0.121**	-0.326	-0.187***	-0.018**
	(-2.691)	(-2.456)	(-2.378)	(-1.049)	(-2.833)	(-2.023)
Constant	-0.727**	-0.869***	-0.855***	-1.767	-0.193	-0.140**
	(-2.087)	(-2.877)	(-2.826)	(-0.967)	(-0.455)	(-2.320)
Observations	14,238	14,238	14,238	14,237	13,572	14,238
Number of iden	2,086	2,086	2,086	2,086	2,086	2,086
Industry Dummy	YES	YES	YES	YES	YES	YES
Country Dummy	YES	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES	YES
Instruments	271	271	271	271	271	271
Avrg. Obs. per Group	6.826	6.825	6.826	6.825	6.826	6.825
AR(1)	-6.009	-5.644	-5.646	-1.074	-10.45	-2.112
p-value	0.000	0.000	0.000	0.283	0.000	0.225
AR(2)	-1.534	-1.615	-1.621	0.372	-4.353	-0.138
p-value	0.125	0.106	0.105	0.710	0.201	0.347
Hansen	430.3	452	452.3	336	438.6	312.4
F-test	797.6	998.1	942.9	167.6	316.1	5.909

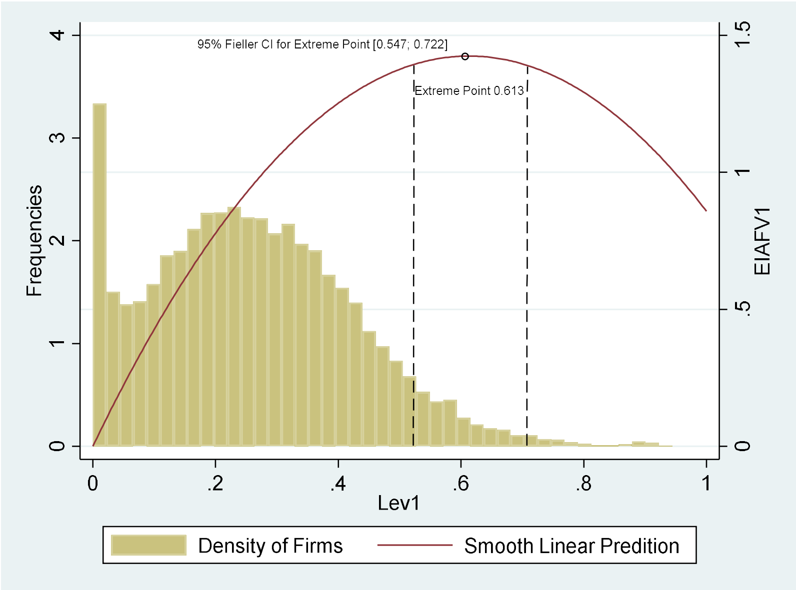
Note: Columns include different specifications for the dependent variables and the corresponding independent variables as described in Table 1. The estimation method is based on the generalized method of moments with robust standard errors (GMM-SE) and t-statistics are in parentheses. Industry, country, and year dummies are included in all specifications. Instruments refer to the number of instruments used in the system GMM. Arellano-Bond AR(1) and AR(2) is an autocorrelation test of first and second order, respectively, using residuals in differences, asymptotically distributes as an N(0.1) and under the null hypothesis of no autocorrelation. Although AR(1) is expected in first differences, it does not invalidate the results. Hansen test is a contrast of overidentifying restrictions or whether the instruments, as a group, appear exogenous, asymptotically distributed as a X^2 and robust to heteroskedasticity. Endogenous variables were instrumentalized with up to three years lagged according to Jara et al. (2008), and the number of instruments were kept below the number of cross-sections as suggested by Roodman (1995). F-test contrasts the joint nullity of the estimated parameters. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Panel Data Non-Linear Regression Model

VARIABLES	(1) EIAFV1	(2) EIAFV2	(3) EIAFV3	(4) EIAFV4	(5) EIAFV6	(6) EIAFV5
Lev	4.644***	4.868***	3.877***	9.993***	4.995***	-0.220**
	(14.632)	(17.290)	(13.734)	(5.752)	(12.644)	(-2.191)
Lev^2	-3.787***	-3.781***	-3.783***	-0.322	-5.072***	0.396**
	(-7.666)	(-8.611)	(-8.601)	(-0.109)	(-8.064)	(2.538)
Size	0.012	-0.000	-0.001	-0.033	-0.026	0.021***
	(0.800)	(-0.029)	(-0.106)	(-0.406)	(-1.390)	(3.779)
Tangible	-0.113	-0.093	-0.102*	-0.267	0.105	-0.038*
	(-1.600)	(-1.536)	(-1.683)	(-0.664)	(1.184)	(-1.728)
ROA	0.441***	0.283***	0.273***	2.053***	1.102***	-0.081*
	(4.753)	(3.483)	(3.360)	(4.086)	(9.554)	(-1.672)
ZScore	0.075***	0.077***	0.077***	0.162***	0.054***	0.000
	(72.117)	(78.840)	(78.921)	(32.014)	(37.919)	(0.467)
CAPEX	0.208	0.121	0.112	2.366***	0.414**	-0.007
	(1.489)	(0.987)	(0.909)	(3.102)	(2.557)	(-0.161)
RDSales	2.913***	2.780***	2.722***	11.742***	4.192***	0.279
	(3.977)	(4.352)	(4.254)	(2.856)	(4.243)	(0.952)
RDSalesIndicator	-0.108*	-0.078	-0.073	-0.393	-0.148**	-0.043**
	(-1.859)	(-1.604)	(-1.491)	(-1.241)	(-2.245)	(-2.200)
Constant	-0.686**	-0.796***	-0.774***	-1.937	-0.078	-0.485***
	(-2.062)	(-2.761)	(-2.682)	(-1.053)	(-0.183)	(-3.874)
Observations	14,238	14,238	14,238	14,237	13,572	14,238
Number of iden	2,086	2,086	2,086	2,086	1,986	2,086
Industry Dummy	YES	YES	YES	YES	YES	YES
Country Dummy	YES	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES	YES
Instruments	271	271	271	271	271	271
Avrg. Obs. per Group	6.826	6.826	6.826	6.825	6.834	6.826
AR(1)	-6.349	-6.116	-6.125	-1.075	-10.42	-2.240
p-value	0.000	0.000	0.085	0.282	0.000	0.244
AR(2)	-1.575	-1.600	-1.422	0.370	-1.339	-1.166
p-value	0.115	0.289	0.184	0.711	0.166	0.125
Hansen	435	456.2	457.5	339.6	424.1	149.2
F-test	644.5	789.1	773.4	132	244.8	3.671
Extreme point	0.613	0.644	0.512	15.530	0.492	0.277
H0: Monotone or U shape (p-value)	0.000	0.000	0.000	Trivial Rjct	0.000	0.014
95% Fieller	0.547	0.578	0.498	-	0.450	0.103
95% Fieller	0.722	0.746	0.577	-	0.559	0.369
Slope Lower bound	4.644	4.868	3.877	-	4.995	-0.220
p-value	0.000	0.000	0.000	-	0.000	0.143
Slope Upper bound	-2.508	-2.274	-3.269	-	-4.585	0.529
p-value	0.000	0.000	0.000	-	0.000	0.004

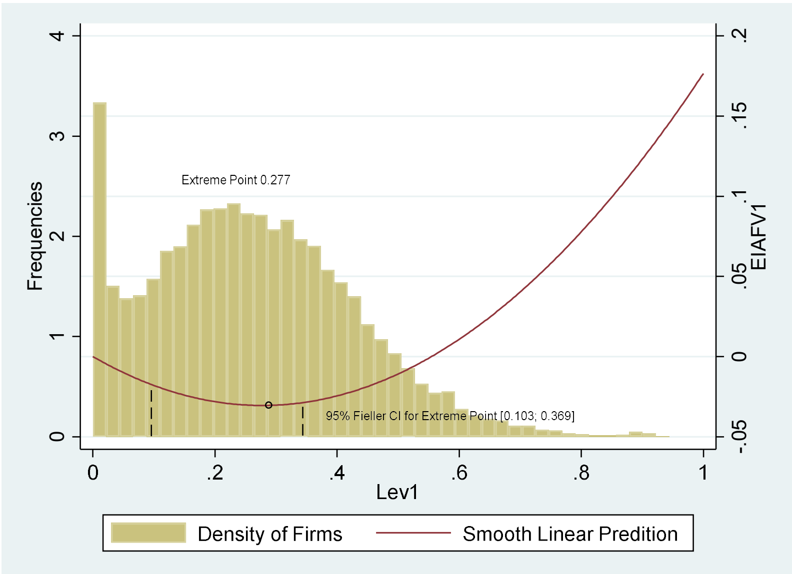
Note: Columns include different specifications for the dependent variables and the corresponding independent variables as described in Table 1. The estimation method is based on the generalized method of moments with robust standard errors (GMM-SE) and t-statistics are in parentheses. Industry, country, and year dummies are included in all specifications. Instruments refer to the number of instruments used in the system GMM. Arellano-Bond AR(1) and AR(2) is an autocorrelation test of first and second order, respectively, using residuals in differences, asymptotically distributes as an N(0.1) and under the null hypothesis of no autocorrelation. Although AR(1) is expected in first differences, it does not invalidate the results. Hansen test is a contrast of overidentifying restrictions or whether the instruments, as a group, appear exogenous, asymptotically distributed as a X^2 and robust to heteroskedasticity. Endogenous variables were instrumentalized with up to three years lagged according to Jara et al. (2008), and the number of instruments were kept below the number of cross-sections as suggested by Roodman (1995). F-test contrasts the joint nullity of the estimated parameters. Nonlinearity of Lev is assessed with the Lind-Mehlum test that provides the exact test of the presence of a Monotone or U-shaped (or inverse U-shaped) relationship on an interval. The Fieller (1954) confidence interval was used to find the interval for the extreme point. Slopes in lower and upper bounds of Lev are reported as well as the testing of the null hypothesis that such slopes individually are equal to zero. *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: First Model in Table 4



Note: The figure illustrates the graphical representation of the first model in Table 4. It includes the histogram of Lev variable, the smoothed linear prediction of the first moder in Table 4, the extreme point of Lev at which $EIAFV1$ is maximized, and the Fieller (1954) confidence interval at 95% confidence level.

Figure 2: Fourth Model in Table 4



Note: The figure illustrates the graphical representation of the fourth model in Table 4. It includes the histogram of Lev variable, the smoothed linear prediction of the fourth moder in Table 4, the extreme point of Lev at which $EIAFV5$ is maximized, and the Fieller (1954) confidence interval at 95% confidence level.

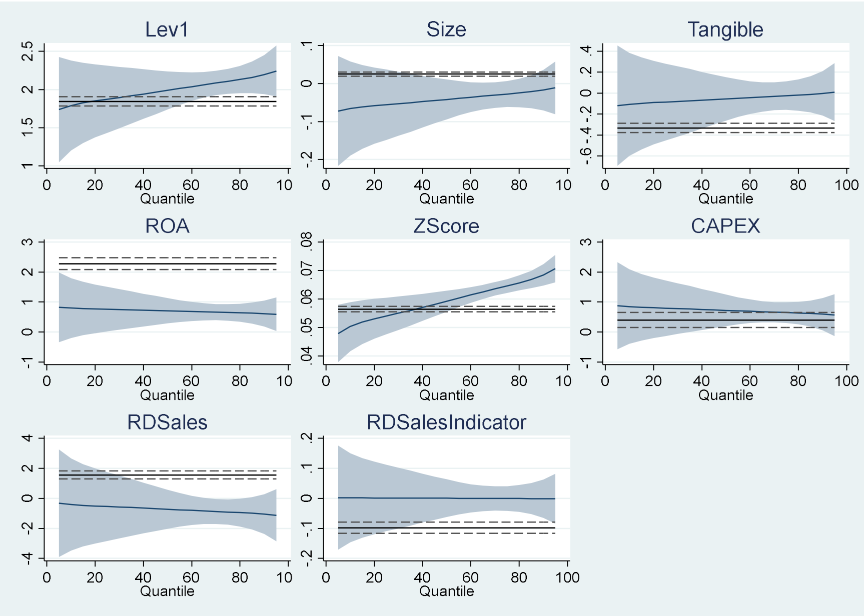
Table 5: Panel Quantile Regressions

	Panel A						Panel B					
	Pool	(1)	(2)	(3)	(4)	(5)	Pool	(6)	(7)	(8)	(9)	(10)
VARIABLES	EIAFV1	EIAFV1Q10	EIAFV1Q25	EIAFV1Q50	EIAFV1Q75	EIAFV1Q90	EIAFV6	EIAFV6Q10	EIAFV6Q25	EIAFV6Q50	EIAFV6Q75	EIAFV6Q90
Lev	1.845***	1.790***	1.873***	1.988***	2.108***	2.194***	2.363***	1.668***	1.753***	1.875***	2.004***	2.097***
	(60.844)	(5.938)	(8.336)	(15.557)	(25.277)	(16.869)	(69.907)	(9.932)	(16.331)	(10.805)	(6.200)	(4.777)
Size	0.025***	-0.066	-0.056	-0.042	-0.027	-0.017	0.009***	-0.017	-0.004	0.015	0.035	0.050
	(8.698)	(-1.038)	(-1.180)	(-1.563)	(-1.573)	(-0.627)	(2.879)	(-0.433)	(-0.158)	(0.359)	(0.454)	(0.472)
Tangible	-0.332***	-0.106	-0.085	-0.056	-0.025	-0.003	-0.166***	0.092	0.112	0.141	0.171	0.193
	(-14.990)	(-0.424)	(-0.454)	(-0.523)	(-0.360)	(-0.027)	(-6.650)	(0.649)	(1.235)	(0.957)	(0.624)	(0.518)
ROA	2.274***	0.799	0.761**	0.708***	0.653***	0.613***	2.446***	1.244***	1.286***	1.345***	1.408**	1.454*
	(22.461)	(1.574)	(2.010)	(3.291)	(4.653)	(2.800)	(21.749)	(4.105)	(6.639)	(4.296)	(2.414)	(1.835)
ZScore	0.056***	0.050***	0.054***	0.059***	0.065***	0.068***	0.055***	0.038***	0.042***	0.047***	0.053***	0.057***
	(116.812)	(11.461)	(16.513)	(31.682)	(52.737)	(35.981)	(102.560)	(14.168)	(24.271)	(16.949)	(10.202)	(8.087)
CAPEX	0.400***	0.845	0.794*	0.723***	0.648***	0.595**	0.296**	0.884**	0.826***	0.743*	0.656	0.592
	(3.108)	(1.335)	(1.682)	(2.694)	(3.707)	(2.179)	(2.073)	(2.310)	(3.377)	(1.880)	(0.890)	(0.592)
RDSales	1.556***	-0.412	-0.543	-0.724	-0.912**	-1.048	1.354***	-0.265	-0.303	-0.356	-0.412	-0.453
	(11.710)	(-0.263)	(-0.465)	(-1.090)	(-2.107)	(-1.551)	(9.330)	(-0.265)	(-0.473)	(-0.344)	(-0.214)	(-0.173)
RDSalesIndicator	-0.098***	0.002	0.001	0.000	-0.001	-0.001	-0.111***	-0.001	-0.002	-0.003	-0.004	-0.005
	(-10.011)	(0.023)	(0.020)	(0.009)	(-0.028)	(-0.037)	(-10.304)	(-0.025)	(-0.067)	(-0.065)	(-0.049)	(-0.043)
Constant	-0.361***						-0.578***					
	(-5.406)						(-7.778)					
Observations	14,403	14,403	14,403	14,403	14,403	14,403	13,572	13,572	13,572	13,572	13,572	13,572
Industry Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.643						0.600					

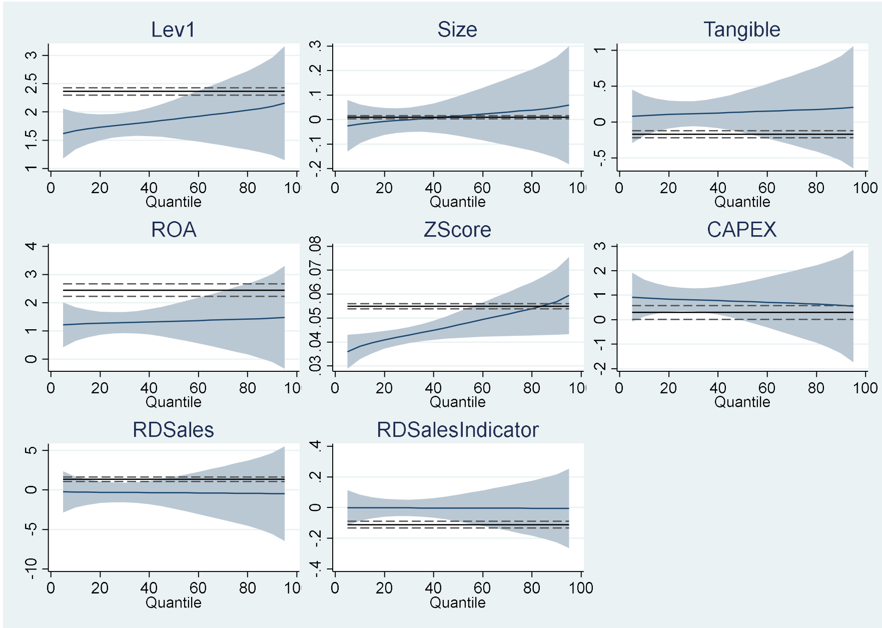
Note: Columns from (1) to (5) and from (6) to (10) are considered dependent variables in the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} quantiles of $EIAFV1$ (Panel A) and $EIAFV6$ (Panel B), respectively. Columns marked as Pool reported the pooled estimation for $EIAFV1$ and $EIAFV6$. T-tests are shown in parenthesis. Industry, Country, and year dummies are included in all models. All estimations but Pool are based on panel quantile regressions according to Machado and Santos Silva (2019)´s approach. *** p<0.01, ** p<0.05, * p<0.1.

Figure 2: Models Table 5

Panel A



Panel B



Note: The figure illustrates the graphical representation of Panels A and B reported in Table 5. For each variable, the dark blue line represents the estimated impact of the variable on the measure of EIAFV. The light blue region denotes the confidence intervals, the black colour lines represent the pooled regression results, whereas the dashed lines indicate their confidence intervals.

Table 6: Panel Data Non-Linear Regression Model with Contextual Variables

VARIABLES	(1) EIAFV1	(3) EIAFV1	(4) EIAFV1	(7) EIAFV1	(8) EIAFV1
Lev	4.936***	4.652***	4.283***	5.103***	4.479***
	(13.368)	(13.769)	(18.774)	(9.213)	(14.029)
Lev^2	-4.586***	-3.679***	-3.737***	-4.816***	-3.439***
	(-7.844)	(-7.106)	(-11.066)	(-5.137)	(-7.086)
Size	-0.057***	0.007	-0.014	0.024	-0.015
	(-2.860)	(0.413)	(-0.867)	(1.203)	(-0.933)
Tangible	-0.070	-0.025	-0.405***	-0.252**	-0.017
	(-0.847)	(-0.300)	(-5.395)	(-2.484)	(-0.238)
ROA	0.629***	0.526***	0.889***	0.809***	0.433***
	(5.674)	(5.354)	(8.877)	(4.941)	(4.745)
ZScore	0.069***	0.074***	0.061***	0.072***	0.074***
	(47.454)	(67.359)	(58.035)	(47.805)	(62.043)
CAPEX	0.472***	0.332**	0.159	0.199	0.381**
	(2.688)	(2.232)	(1.005)	(1.001)	(2.407)
RDSales	4.245***	3.470***	3.259***	1.732*	3.735***
	(5.342)	(4.242)	(4.377)	(1.698)	(5.142)
RDSalesIndicator	-0.131**	-0.131**	-0.181***	0.010	-0.169***
	(-2.224)	(-2.126)	(-4.061)	(0.134)	(-3.195)
MktCapGDP	0.001***				
	(6.594)				
BankNIM		-0.023*			
		(-1.900)			
Spread			-0.001		
			(-0.419)		
BankCrisis				-0.089***	
				(-4.380)	
StockMktReturn					0.001***
					(5.454)
Constant	0.818*	-0.561	0.231	-0.947**	-0.069
	(1.808)	(-1.576)	(0.631)	(-2.135)	(-0.189)
Observations	10,287	13,731	4,884	9,023	12,836
Number of iden	1,855	2,003	899	1,893	1,834
Industry Dummy	YES	YES	YES	YES	YES
Country Dummy	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES
Instruments	226	271	226	151	271
Avrg. Obs. per Group	5.546	6.855	5.433	4.767	6.999
AR(1)	-4.948	-6.525	-3.958	-3.707	-6.180
p-value	0.000	0.144	0.000	0.230	0.000
AR(2)	-1.038	-1.462	0.688	-1.200	-1.321
p-value	0.299	0.678	0.492	0.210	0.186
Hansen	276.7	425.6	269.9	183.4	408.9
F-test	2396	2843	2135	2447	2955
Extreme point	0.538	0.632	0.573	0.530	0.651
H0: Monotone or U shape (p-value)	0.000	0.000	0.000	0.001	0.001
95% Fieller	0.485	0.558	0.527	0.458	0.574
95% Fieller	0.623	0.759	0.636	0.685	0.784
Slope Lower bound	4.936	4.652	4.283	5.103	4.479
p-value	0.000	0.000	0.000	0.000	0.000
Slope Upper bound	-3.726	-2.296	-2.776	-3.993	-2.016
p-value	0.000	0.000	0.000	0.001	0.001

Note: Columns include different specifications for $EIAFV1$ as dependent variable, the firm-specific as well as the country-specific variables described in Table 1. The estimation method is based on the generalized method of moments with robust standard errors (GMM-SE) and t-statistics are in parentheses. Industry, country, and year dummies are included in all specifications. Instruments refer to the number of instruments used in the system GMM. Arellano-Bond AR(1) and AR(2) is an autocorrelation test of first and second order, respectively, using residuals in differences, asymptotically distributes as an N(0.1) and under the null hypothesis of no autocorrelation. Although AR(1) is expected in first differences, it does not invalidate the results. Hansen test is a contrast of overidentifying restrictions or whether the instruments, as a group, appear exogenous, asymptotically distributed as a X^2 and robust to heteroskedasticity. Endogenous variables were instrumentalized with up to three years lagged according to Jara et al. (2008), and the number of instruments were kept below the number of cross-sections as suggested by Roodman (1995). F-test contrasts the joint nullity of the estimated parameters. Nonlinearity of Lev is assessed with the Lind-Mehlum test that provides the exact test of the presence of a Monotone or U-shaped (or inverse U-shaped) relationship on an interval. The Fieller (1954) confidence interval was used to find the interval for the extreme point. Slopes in lower and upper bounds of Lev are reported as well as the testing of the null hypothesis that such slopes individually are equal to zero. *** p<0.01, ** p<0.05, * p<0.1.

References

Abor, J. (2005). The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana. *The Journal of Risk Finance, 6*(5), 438-445. doi:10.1108/15265940510633505

Adams, R. B. (2016). Women on boards: The superheroes of tomorrow? *The Leadership Quarterly, 27*(3), 371-386. doi:https://doi.org/10.1016/j.leaqua.2015.11.001

Almeida, H., & Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *The Review of Financial Studies, 20*(5), 1429-1460.

Alonso-Borrego, C., & Arellano, M. (1999). Symmetrically Normalized Instrumental-Variable Estimation Using Panel Data. *Journal of Business & Economic Statistics, 17*(1), 36-49. doi:10.1080/07350015.1999.10524795

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance, 23*(4), 589-609.

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's Z-Score Model. *Journal of International Financial Management & Accounting, 28*(2), 131-171. doi:doi:10.1111/jifm.12053

Antonakis, J., Bastardoz, N., & Rönkkö, M. (2021). On Ignoring the Random Effects Assumption in Multilevel Models: Review, Critique, and Recommendations. *Organizational Research Methods, 24*(2), 443-483. doi:10.1177/1094428119877457

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies, 58*(2), 277-297. doi:10.2307/2297968

Armstrong, C. S., Blouin, J. L., Jagolinzer, A. D., & Larcker, D. F. (2015). Corporate governance, incentives, and tax avoidance. *Journal of Accounting and Economics, 60*(1), 1-17. doi:https://doi.org/10.1016/j.jacceco.2015.02.003

Bailey, M. A. (2017). *Real econometrics: The right tools to answer important questions* (First edition ed.): New York, NY : Oxford University Press.

Baltagi, B. H. (2013). *Econometric analysis of panel data* (5th ed.). Chichester, UK: John Wiley & Sons Ltd.

Barclay, M. J., & Smith, C. (2020). The Capital Structure Puzzle: Another Look at the Evidence. *Journal of Applied Corporate Finance, 32*(1), 80-91. doi:https://doi.org/10.1111/jacf.12390

Barlett, R., & Partnoy, F. (2020). The Misuse of Tobin´s q. *Vanderbilt Law Review, 73*(2), 353-424.

Barros, L. A. B. C., Bergmann, D. R., Castro, F. H., & Di Medici da Silveira, A. (2019). Endogeneity in panel data regressions: methodological guidance for corporate finance researchers. *Revista Brasileira de Gestão de Negócios, 22*(1), 437-461.

Beattie, V., Goodacre, A., & Thomson, S. J. (2006). Corporate Financing Decisions: UK Survey Evidence. *Journal of Business Finance & Accounting, 33*(9-10), 1402-1434. doi:10.1111/j.1468-5957.2006.00640.x

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2000). A New Database on the Structure and Development of the Financial Sector. *World Bank Economic Review, 14*(3), 597-605.

Berger, A. N., & Bonaccorsi di Patti, E. (2006). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. *Journal of Banking & Finance, 30*(4), 1065-1102.

Berk, J. B., Stanton, R., & Zechner, J. (2010). Human Capital, Bankruptcy, and Capital Structure. *The Journal of Finance, 65*(3), 891-926. doi:https://doi.org/10.1111/j.1540-6261.2010.01556.x

Black, B., & Khanna, V. S. (2007). Can Corporate Governance Reforms Increase Firm Market Values? Event Study Evidence from India. *Journal of Empirical Legal Studies, 4*(4), 749-796. doi:10.1111/j.1740-1461.2007.00106.x

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115-143. doi:https://doi.org/10.1016/S0304-4076(98)00009-8

Cai, J., & Zhang, Z. (2011). Leverage change, debt overhang, and stock prices. *Journal of Corporate Finance, 17*(3), 391-402. doi:https://doi.org/10.1016/j.jcorpfin.2010.12.003

Choi, Y. M., & Park, K. (2022). Zero-leverage policy and stock price crash risk: Evidence from Korea. *International Review of Financial Analysis, 81*. doi:10.1016/j.irfa.2022.102102

Chung, K. H., & Cox, R. A. K. (1990). Patterns of Productivity in the Finance Literature: A Study of the Bibliometric Distributions. *The Journal of Finance, 45*(1), 301-309. doi:10.1111/j.1540-6261.1990.tb05095.x

Conyon, M. J., & He, L. R. (2017). Firm performance and boardroom gender diversity: A quantile regression approach. *Journal of Business Research, 79*, 198-211. doi:10.1016/j.jbusres.2017.02.006

Coricelli, F., Driffield, N., Pal, S., & Roland, I. (2012). When does leverage hurt productivity growth? A firm-level analysis. *Journal of International Money and Finance, 31*(6), 1674-1694. doi:https://doi.org/10.1016/j.jimonfin.2012.03.006

D'Agostino, R. B., Belanger, A., & D'Agostino Jr, R. B. (1990). A Suggestion for Using Powerful and Informative Tests of Normality. *The American Statistician, 44*(4), 316-321. doi:10.1080/00031305.1990.10475751

D'Mello, R., & Gruskin, M. (2014). Are the benefits of debt declining? The decreasing propensity of firms to be adequately levered. *Journal of Corporate Finance, 29*, 327-350. doi:https://doi.org/10.1016/j.jcorpfin.2014.09.008

Datta, S., Iskandar-Datta, M., & Raman, K. (2000). Debt structure adjustments and long-run stock price performance. *Journal of Financial Intermediation, 9*(4), 427-453.

Faccio, M., & Xu, J. (2015). Taxes and Capital Structure. *Journal of Financial and Quantitative Analysis, 50*(03), 277-300. doi:doi:10.1017/S0022109015000174

Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividend and debt. *The Review of Financial Studies, 15*(1), 1-33.

Fama, E. F., & French, K. R. (2005). Financing decisions: who issues stock? *Journal of Financial Economics, 76*(3), 549-582. doi:https://doi.org/10.1016/j.jfineco.2004.10.003

Faria, J. R., Tindall, G., & Terjesen, S. (2022). The Green Tobin's q: theory and evidence. *Energy Economics, 110*, 106033. doi:https://doi.org/10.1016/j.eneco.2022.106033

Fieller, E. C. (1954). Some Problems in Interval Estimation. *Journal of the Royal Statistical Society. Series B (Methodological), 16*(2), 175-185. Retrieved from http://www.jstor.org/stable/2984043

Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. *Journal of Financial Economics, 67*(2), 217-248.

Frank, M. Z., & Goyal, V. K. (2008). Trade-Off and Pecking Order Theories of Debt. In B. E. Eckbo (Ed.), *Handbook of Empirical Corporate Finance* (Vol. 2, pp. 135-202). San Diego: Elsevier.

Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management, 38*(1), 1-37. doi:10.1111/j.1755-053X.2009.01026.x

Freiberg, D., Park, D., Serafeim, G., & Zochowski, T. R. (2021). *Corporate Environmental Impact: Measurement, Data and Information*. Harvard Business School Accounting & Management Unit Working Paper, (20-098).

Giroud, X., Mueller, H. M., Stomper, A., & Westerkamp, A. (2012). Snow and Leverage. *The Review of Financial Studies, 25*(3), 680-710. doi:10.1093/rfs/hhr113

González, V. M. (2013). Leverage and corporate performance: International evidence. *International Review of Economics & Finance, 25*(0), 169-184. doi:http://dx.doi.org/10.1016/j.iref.2012.07.005

Graham, J. R., & Leary, M. T. (2011). A Review of Empirical Capital Structure Research and Directions for the Future. *Annual Review of Financial Economics, 3*(1), 309-345. doi:doi:10.1146/annurev-financial-102710-144821

Habermann, F., & Fischer, F. B. (2023). Corporate Social Performance and the Likelihood of Bankruptcy: Evidence from a Period of Economic Upswing. *Journal of Business Ethics, 182*(1), 243-259. doi:10.1007/s10551-021-04956-4

Harris, M., & Raviv, A. (1991). The theory of capital structure. *The Journal of Finance, 46*(1), 297-355.

Hassan, A., Ilyas, S. Z., Jalil, A., & Ullah, Z. (2021). Monetization of the environmental damage caused by fossil fuels. *Environmental Science & Pollution Research, 28*(17), 21204-21211. doi:10.1007/s11356-020-12205-w

Hossain, M. S. (2021). A revisit of capital structure puzzle: Global evidence and analysis. *International Review of Economics & Finance, 75*, 657-678. doi:https://doi.org/10.1016/j.iref.2021.05.001

Huarng, K.-H., & Yu, T. H.-K. (2014). A new quantile regression forecasting model. *Journal of Business Research, 67*(5), 779-784. doi:https://doi.org/10.1016/j.jbusres.2013.11.044

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305-360. doi:https://doi.org/10.1016/0304-405X(76)90026-X

Kiviet, J., Pleus, M., & Poldermans, R. (2017). Accuracy and Efficiency of Various GMM Inference Techniques in Dynamic Micro Panel Data Models. *Econometrics, 5*(14), 1-54.

Korteweg, A. (2010). The Net Benefits to Leverage. *The Journal of Finance, 65*(6), 2137-2170. Retrieved from http://www.jstor.org/stable/23324407

Kraus, A., & Litzenberger, R. H. (1973). A State-Preference Model of Optimal Financial Leverage. *The Journal of Finance, 28*(4), 911-922. doi:10.2307/2978343

Le, T. P. V., & Phan, T. B. N. (2017). Capital structure and firm performance: Empirical evidence from a small transition country. *Research in International Business and Finance, 42*, 710-726. doi:https://doi.org/10.1016/j.ribaf.2017.07.012

Lin, F.-L., & Chang, T. (2011). Does debt affect firm value in Taiwan? A panel threshold regression analysis. *Applied Economics, 43*(1), 117-128. doi:10.1080/00036840802360310

Lind, J. T., & Mehlum, H. (2010). With or Without U? The Appropriate Test for a U-Shaped Relationship. *Oxford Bulletin of Economics and Statistics, 72*(1), 109-118. doi:10.1111/j.1468-0084.2009.00569.x

Machado, J. A. F., & Santos Silva, J. M. C. (2019). Quantiles via moments. *Journal of Econometrics, 213*(1), 145-173. doi:https://doi.org/10.1016/j.jeconom.2019.04.009

Margaritis, D., & Psillaki, M. (2010). Capital structure, equity ownership and firm performance. *Journal of Banking & Finance, 34*(3), 621-632. doi:https://doi.org/10.1016/j.jbankfin.2009.08.023

McConnell, J. J., & Servaes, H. (1995). Equity ownership and the two faces of debt. *Journal of Financial Economics, 39*(1), 131-157. doi:http://dx.doi.org/10.1016/0304-405X(95)00824-X

Min, B. S., & Smyth, R. (2014). Corporate governance, globalization and firm productivity. *Journal of World Business, 49*(3), 372-385. doi:http://dx.doi.org/10.1016/j.jwb.2013.07.004

Modigliani, F., & Miller, M. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review, 48*(3), 261-297.

Modigliani, F., & Miller, M. (1963). Corporate income taxes and the cost of capital: A correction. *The American Economic Review, 53*(3), 433-443.

Mollinger-Sahba, A., Flatau, P., Schepis, D., & Purchase, S. (2020). New development: Complexity and rhetoric in social impact investment. *Public Money & Management, 40*(3), 250-254. doi:10.1080/09540962.2020.1714318

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147-175.

Myers, S. C. (1984a). The capital structure puzzle. *The Journal of Finance, 39*(3), 575-593.

Myers, S. C. (1984b). Finance theory and financial strategy. *Interfaces, 14*(1), 126-137.

Myers, S. C. (2001). Capital structure. *Journal of Economic Perspectives, 15*(2), 81-102.

O'Brien, R. M. (2007). A Caution Regarding Rules of Thumb for Variance Inflation Factors. *Quality & Quantity, 41*(5), 673-690. doi:10.1007/s11135-006-9018-6

Öztekin, Ö. (2015). Capital structure decisions around the world: Which factors are reliably important? *Journal of Financial and Quantitative Analysis, 50*(03), 301-323. doi:doi:10.1017/S0022109014000660

Perfect, S., & Wiles, K. (1994). Alternative constructions of Tobin's Q: An empirical comparison. *Journal of Empirical Finance, 1*(3-4), 313-341.

Pratt, W. R., Barboza, G. A., & Brigida, M. (2023). Leverage and firm value. *Economic Notes, 52*(2), e12218. doi:https://doi.org/10.1111/ecno.12218

Ramsey, J. B. (1969). Tests for Specification Errors in Classical Linear Least-Squares Regression Analysis. *Journal of the Royal Statistical Society. Series B (Methodological), 31*(2), 350-371. Retrieved from http://www.jstor.org/stable/2984219

Rios-Avila, F., & Maroto, M. L. (2024). Moving Beyond Linear Regression: Implementing and Interpreting Quantile Regression Models With Fixed Effects. *Sociological Methods & Research, 53*(2), 639-682. doi:10.1177/00491241211036165

Ross, S. A. (1977). The determinants of financial structure: the incentive signaling approach. *The Bell Journal of Economics, 8*(1), 23-40.

Roundy, P. T. (2019). Regional differences in impact investment: a theory of impact investing ecosystems. *Social Responsibility Journal, 16*(4), 467-485. doi:10.1108/srj-11-2018-0302

Saona, P., & Muro, L. (2023). The Influence of Firms' ESG Initiatives on Firm Value: An Analysis of Select European Firms. In O. M. Lehner, T. Harrer, H. Silvola, & O. Weber (Eds.), *The Routledge Handbook of Green Finance* (1st ed., Vol. 1st, pp. 167-188). London: Routledge.

Saona, P., Muro, L., San Martín, P., & McWay, R. (2024). Do board gender diversity and remuneration impact earnings quality? Evidence from Spanish firms. *Gender in Management: An International Journal, 39*(1), 18-51. doi:10.1108/GM-04-2021-0113

Saona, P., & San Martín, P. (2016). Country level governance variables and ownership concentration as determinants of firm value in Latin America. *International Review of Law and Economics, 47*(1), 84-95. doi:http://dx.doi.org/10.1016/j.irle.2016.06.004

Serafeim, G., Zochowski, T. R., & Downing, J. (2019). *Impact-Weighted Financial Accounts: The Missing Piece for an Impact Economy*. Boston, MA.

Sjåfjell, B. (2018). Redefining the Corporation for a Sustainable New Economy. *Journal of Law and Society, 45*(1), 29-45. doi:10.1111/jols.12077

Stulz, R. M. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics, 26*, 3-27.

Sweeney, R. J., Warga, A. D., & Winters, D. (1997). The Market Value of Debt, Market versus Book Value of Debt, and Returns to Assets. *Financial Management, 26*(1), 5-21. doi:10.2307/3666236

Titman, S., & Wessels, R. (1988). The determinants of capital structure choices. *The Journal of Finance, 43*(1), 1-19.
Vallelado, E., & Saona, P. (2011). An integrated model of capital structure to study the differences in the speed of adjustment to target long term debt ratio among developed countries. *International Journal of Banking, Accounting and Finance, 3*(4), 258-293. doi:10.1504/IJBAAF.2011.043703
Vallelado, E., Saona, P., & San Martín, P. (2017). How regulation affects the relevance of bank-debt maturity as a control mechanism in developed countries. *Journal of Business Economics and Management, 18*(1), 116-130. doi:10.3846/16111699.2016.1149878
Van Binsbergen, J. H., Graham, J. R., & Yang, J. (2010). The Cost of Debt. *The Journal of Finance, 65*(6), 2089-2136. doi:https://doi.org/10.1111/j.1540-6261.2010.01611.x
Velez Caicedo, G. (2022). *Practitioner Guide to Calculating Corporate Environmental Impact*. Impact-Weighted Accounts Project. Practitioner Guide. Harvard Business School.
Vithessonthi, C., & Tongurai, J. (2015). The effect of leverage on performance: Domestically-oriented versus internationally-oriented firms. *Research in International Business and Finance, 34*, 265-280. doi:https://doi.org/10.1016/j.ribaf.2015.02.016
Vivel-Búa, M., Lado-Sestayo, R., & Otero-González, L. (2018). Risk determinants in the hotel sector: Risk credit in MSMEs. *International Journal of Hospitality Management, 70*, 110-119. doi:https://doi.org/10.1016/j.ijhm.2017.11.004
Vo, X. V., & Ellis, C. (2017). An empirical investigation of capital structure and firm value in Vietnam. *Finance Research Letters, 22*, 90-94. doi:https://doi.org/10.1016/j.frl.2016.10.014
Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics, 126*(1), 25-51.
Zeitun, R., & Tian, G. G. (2014). Capital Structure and Corporate Performance: Evidence from Jordan. *Australasian Accounting, Business and Finance Journal, 1*(4), 40-61.