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FIRM SIZE, DEBT, AND ESG PERFORMANCE OF INSURANCE COMPANIES: EVIDENCE FROM MENAT REGION

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ABSTRACT

This paper explores the nonlinear relationship between debt and ESG performance of insurance companies in the MENAT region, as well as the moderating effect of firm size on this relationship. The paper analyzes data from 31 insurance companies listed in the MENAT region between 2017 and 2022. The study uses the system GMM method to assess the curvilinear nexus between debt and ESG performance. Results highlight the nonlinear effect of debt on ESG performance. Moreover, company size is an even more important factor, as it conditions the nonlinear relationship between debt and ESG practices. Considering the insurers' condition due to their company size, such research findings will be helpful, hence their standing position in knowing how the practice of ESG would turn to be well and effectively integrated for having better access to credit.

KEYWORDS: Debt, Firm Size, ESG Performance, MENAT Region, SGMM.

1. INTRODUCTION

Debt financing plays a key role in improving company ESG performance by providing them with the resources they need to invest in sustainable and responsible initiatives. With increasing stakeholder demands and tighter regulations, companies need to mobilize significant funds to integrate effective environmental, social, and governance practices.

Debt, particularly in the form of green bonds, sustainable loans, and other responsible financial instruments, enables companies to allocate capital to ESG projects without compromising their liquidity. The scale of external financing, and more specifically debt, is therefore a strategic lever for strengthening the sustainability and competitiveness of companies while meeting the expectations of the market and investors (Han et al., 2024 and Liao & Zhou, 2024).

Although debt is an essential lever for financing ESG investments, its scale raises major issues in terms of governance and the efficient allocation of resources. According to agency theory, debt plays a disciplinary role by limiting the opportunistic behavior of managers and encouraging them to invest more efficiently, particularly in ESG projects with high benefits.

However, too much debt can have a perverse effect, leading to over-investment in poorly targeted or unprofitable ESG initiatives, in the interests of signaling or conforming to market expectations (Jensen & Meckling, 1976; Stilitz, 1990).

Thus, although debt is a driving force behind sustainable transition, it must be rigorously controlled to avoid distortions that could compromise financial performance and the viability of ESG commitments (Nie et al., 2024; Zhang et al., 2024).

Despite the growing importance of debt financing in improving ESG performance, empirical work on its real impact remains limited. The relationship between debt, governance and ESG investment still needs to be explored in greater depth, particularly to gain a better understanding of optimal debt thresholds and the risks of over-investment, leading to financing constraints (e.g., Cao et al. 2023; Yang et al., 2024; Wu, 2024; Zhang & Guo 2024).

Company size also plays a key role in minimizing financing constraints (Khémiri & Noubbigh, 2020b). Larger companies, benefiting from a better reputation, easier access to financial markets, and greater negotiating power, are generally able to raise funds on more advantageous terms to finance their ESG initiatives.

In contrast, small and medium-sized enterprises (SMEs) may face higher financing costs and tighter

restrictions, limiting their commitment to sustainability. These disparities highlight the importance of a differentiated approach when analyzing the link between debt and ESG investment (Akhtar et al., 2023; Shawat et al., 2024; Peng & Zang 2024).

The objectives of this study are twofold. On the one hand, it aims to explore the curvilinear relationship that may exist between debt and ESG practices of insurance companies in the MENAT region. On the other hand, it aims to examine the moderating effect of company size on the non-linear relationship between debt and ESG performance.

This study makes several distinctive contributions to literature. First, it investigates the non-linear relationship between debt and ESG performance within the insurance sector, moving beyond traditional linear approaches to capture the nuanced effects of leverage on sustainability practices. Second, the research introduces the moderating role of firm size in this relationship, highlighting how organizational scale influences the extent to which debt impacts ESG outcomes.

Finally, the analysis is situated within the MENAT region, a context that remains underexplored despite its unique economic, cultural, and regulatory characteristics.

Study of the non-linear impact of debt on ESG performance and the moderating effect of company size in the MENAT insurance sector is justified by several key factors. Firstly, a non-linear relationship is likely, where moderate debt can drive ESG engagement, while excessive debt can lead to inefficient over-investment.

In addition, the size of insurance companies plays a crucial role: larger companies have better access to finance and can more easily absorb the costs associated with ESG initiatives, unlike smaller companies. Furthermore, most of the existing research focuses on the Chinese market, which makes it even more relevant to explore this specific dynamic in the MENAT region, where governance structures and economic challenges are distinct. This analysis will provide a better understanding of the underlying mechanisms and offer strategic perspectives for optimizing ESG investments in this region.

This research paper is structured as follows. Section 2 elaborates on the developed hypotheses in relation to the associated literature. The research model used is explained within Section 3. Section 4 explains, discusses, and presents the main results. In Section 5, a summary of the findings is presented as a conclusion.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Debt and ESG Performance Nexus

Debt is one of the important levers in maximizing ESG performance. Understanding in depth how debt influences the strategic choices of companies is thus fundamental, because ESG practices are regarded as a core sustainable investment. These practices form a core aspect of enhancing companies' resilience, improving their reputation and ability to meet growing stakeholder expectations while maintaining long-term sustainability (Wei & Xu, 2024).

In this respect, debt may play a twofold role: on the one hand, it may foster disciplined management and lead managers toward ESG practices to meet the expectations of creditors and responsible investors (Wei et al., 2024). However, too much debt may reduce financial flexibility and compel the company to focus on short-term goals at the expense of ESG investments, which are often seen as costly but essential for long-term sustainability (Lian et al., 2023; Nie et al., 2024; Zhang et al., 2024). Agency theory, focusing on the conflicts of interest between different stakeholders and the central role of debt in resolving them, sheds light on these contrasting dynamics.

More specifically, agency theory provides a relevant framework for analyzing the impacts of debt on ESG performance through the angle of agency costs management. Agency costs are incurred due to potential conflicts of interest between managers acting as agents, responsible for the use of the corporation's resources, and shareholders acting as principals, having a goal to maximize their personal wealth. In this context, debt has an ambivalent role: positively or negatively influencing strategic decisions, including those related to ESG criteria (Jensen & Meckling (1976)). Debt reduces agency costs through debt discipline on the management. Firms that incur debt attract creditor interest, demanding them to be very transparent and diligent in their utilization of resources. This creates the pressure of restricting the opportunistic behavior of management, like over-investment in risky or wasteful projects. It forces managers to act in the best interest of shareholders as well as other stakeholders. What this means for ESG performance is that sustainability issues are given more consideration, as creditors and institutional investors include the same in their evaluation. However, too much debt may be detrimental because excessive debt increases agency costs related to creditors. In such an environment with a high debt, management has pressure to meet

the creditors' demand; thus, there is the possibility of emphasizing short-term financial objectives at the expense of ESG initiatives that are often considered investments.

The threat of liquidation costs and higher default risk confines a firm's strategic flexibility, so it cannot reallocate resources to ESG projects. Jensen (1986) introduces the concept that, under a high debt constraint, managers mainly focus on maximizing the cash flow that can be available to meet their financial obligations and, therefore, pay little attention to projects that do not yield benefits immediately. As Stilitz (1990) pointed out, debt could create a strategic dilemma for firms through the concepts of overinvestment and underinvestment. Overinvestment is a situation where companies, forced by creditors, invest in projects that are too risky or unprofitable, usually to meet some short-term expectations that may hurt their sustainable performance. On the other hand, over-investment is interpreted as a business's tendency to under-invest in long-term, relatively discretionary projects, like ESG initiatives, where financial constraint due to debt is a major factor. This inability is then tied to economic challenges that hinder their response to environmental and social problems, thus delaying the adoption of sustainable practices despite their importance to long-term sustainability. This is why a balanced debt policy must be resorted to, so that under- and over-investment problems may be avoided (Khémiri & Noubbigh, 2019a).

In practice, there remains an unexplored impact of debt on ESG practices. Indeed, recent literature focuses typically on the impact that ESG performance has on the level of debt (e.g., Cao et al. 2023; Yang et al., 2024; Wu, 2024). For instance, Cao et al. (2023) demonstrate how the increase in local debt imposes financing constraints on firms, leading them to under-invest, especially for companies highly capitalized in terms of fixed assets and non-state companies. A kind of crowding-out effect that the public debt absorbs the resources that could have been used by either private companies or sectors that would have gone uninvested. In addition, Yang et al. (2024) established that the ESG performance has a significant negative effect on excessive debt, with variations depending on geographical location, the growth in turnover, and the concentration of ownership. Agency cost and debt financing cost alleviate the intermediate effect of ESG performance, while the double threshold effect is from company size and age. Furthermore, institutional attention and the cost of equity capital strengthen its suppressive

impact. In this regard, the study concludes that Chinese companies should adjust their ESG performance to constrain the risks of excessive debt and improve their sustainable competitiveness.

In the same vein, Wu (2024) makes an econometric analysis on how ESG performance affects the debt financing cost of listed Chinese firms. The main result proves that the ESG performance of companies is negatively affecting these costs. Mechanism analysis shows that the level of risk positively moderates the aforementioned effect and the cost of financing constraints. Li et al. (2024) explain that the rise in local government debt strongly decreases the ESG performance of firms, especially the ones not owned by the state, through crowding out credit resources and reduction of tax subsidies, with lower cash flows, affecting mainly social and environmental responsibilities. Zhang & Guo (2024) find that ESG performance reduces short-term debt for long-term use by improving transparency and reducing financing constraints and excessive investment. This effect is more pronounced among private companies that are heavy polluters and located in underdeveloped regions.

However, few studies have discovered the impact of debt on ESG performance. For example, Liao & Zhou (2024) prove that the 2012 green credit policy significantly has a crowding-out effect on the ESG performance of the polluting companies, whereby its effects are more pronounced in non-state companies. From this context, the authors conclude that avoiding the perverse effects of green credit in China requires strategies proposed to optimize both economic and environmental benefits of the policy. In addition, Accordingly, Han et al. (2024) also find that green credit policy effectively enhances the ESG performance for the regulated industrial firm by improving their attention on environmental issues and green innovation. The same effect is pronounced with greater vigor on private firms or those in a less developed area of the country. In addition, some previous studies have explored the nonlinear nexus between debt and firm performance or between other variables and ESG performance (e.g., Khémiri & Noubbigh, 2020; Attia et al., 2023; Bagh et al., 2024; Jin, 2025). However, the nonlinear nexus between debt and ESG performance is not explored, especially in the insurance sector. The first hypothesis will then be:

Hypothesis 1. The nexus between debt and ESG performance is nonlinear.

H1 (a). Debt significantly enhances the ESG performance of insurance companies.

H1 (b). Debt significantly reduces the ESG

performance of insurance companies.

2.2. Moderating Role of Firm Size

The size of the company can be considered a critical determinant for the maximization of shareholders' wealth and the reduction in financial constraints. Indeed, larger firms benefit more because of economies of scale, having greater market power and better access to capital markets to generate higher shareholder returns. Such diversified activities and a well-established reputation can reduce perceived risks, lowering borrowing costs and improving financial flexibility (Rajan & Zingales, 1996). On the other hand, small firms may be more financially constrained, given limited access to credit and equity markets, which renders effective financial management a major determinant of their growth and sustainability (Beck et al., 2005; Khémiri & Noubbigh, 2019b). It is important to understand the implications of firm size in devising strategies that reconcile firm growth with the creation of shareholder value.

In practice, several studies have explored the moderating effect of company size (or other variables) on the relationship between ESG (or other variables) and financial performance (e.g., Khémiri & Noubbigh, 2019b; Akhtar et al., 2023; Shawat et al., 2024; Peng & Zang, 2024; Karki & Seth, 2025; Binesh et al., 2025). For example, Akhtar et al. (2023) show that company size and age moderate the relationship between ESG practices and financial performance. In the same vein, Shawat et al. (2024) find that company size moderates the ESG-financial performance relationship of firms operating in the MENA region. The study by Peng & Zang (2024) demonstrates that individual and global ESG measures do not individually influence Tobin's Q, but their interaction with firm size might dampen the positive effect of ESG measures on market value with size. Cost of debt acts as a significant mediator negatively influencing Tobin's Q. These results emphasize the need for support in efforts by small companies to adopt ESG practices if maximum valuation is to be attained in the marketplace. In addition, Uyar et al. (2024) show that the tangibility of assets has a negative and significant moderating effect on the CSR-access to debt nexus, authorizing a substitutive association. However, company performance positively moderates this nexus, approving a complementary link. Mansour et al. (2024) indicate that company size acts as a mediator in the relationship between eco-innovation and company performance. The authors identify that giving priority to eco-innovation can bring several

advantages to large companies, enabling them to enhance productivity, avoid fines, access new markets, improve their ecological image, gain a competitive advantage, and thereby improve overall performance. Moreover, a profound stakeholder evaluation allows these businesses to maximize their profits while adhering to increasing expectations in terms of sustainability. More recently, Karki & Seth (2025) find evidence of a positive relationship between the ESG performance and dividend payout ratio. Similarly, individual components of ESG performance also indicate a positive relationship, which might suggest that sustainable companies prefer higher dividend payouts. However, with the inclusion of company size as a moderating factor, the findings indicated that larger sustainable companies pay lower dividends. Most of the recent literature seems to focus on the company size factor as a moderator between ESG performance and overall company performance, or some other variables. Research has greatly overlooked how company size affects the relationship between leverage and ESG performance while mostly excluding the insurance sector. Based on this, my study will investigate the firm size as a moderating effect of the debt-ESG performance relationship in insurance companies. Thus, the second hypothesis is as follows:

Hypothesis 2. Firm size moderates the nexus between debt and the ESG performance of insurance companies.

3. RESEARCH DESIGN

3.1. Sample and Data

I selected a sample of 31 insurance companies operating in seven countries in the MENAT region, namely Bahrain, Kuwait, Morocco, Qatar, Saudi Arabia, Turkey, and the United Arab Emirates, for the period 2017-2022. Financial data is obtained from the annual balance sheets of individual insurance companies published in the Refinitiv Eikon database (<https://eikon.refinitiv.com/>). Country-specific data (i.e., macroeconomic variables) are also taken from the World Bank database. The selection of the sample is largely based on the availability of ESG data.

3.2. Econometric Models

Following Khémiri & Noubbigh (2019a, b) and Alghafes et al. (2024), I investigate the nonlinear nexus between debt and ESG performance of insurance companies of the MENAT region and the moderating role of size in this nexus. The basic model tries to check the inverted U-shaped nexus between debt and ESG performance related to the first hypothesis. To this end, I applied the GMM

technique in a system suggested by Blundell and Bond (1998). The functional form of the insurance performance model can be specified as follows:

$$ESG_{cit} = \alpha_i + \beta_1 ESG_{cit-1} + \beta_2 Debt_{cit} + \beta_3 Debt_{cit}^2 + \sum_{n=4}^5 \beta_n X_{cit} + \sum_{n=6}^7 \beta_n M_{ct} + \varepsilon_{it} \quad (1)$$

where, ESG_{cit} is the ESG score for country, firm i at time t ; ESG_{cit-1} is the lag on one year of ESG_{cit} ; $Debt_{cit}$ is the return on assets; $Debt_{cit}^2$ is the quadratic term of $Debt_{cit}$; X_{cit} is the vector of control variables; M_{ct} is the vector of macroeconomic variables.

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3.2. Variables

3.2.1. Dependent Variable

Following several previous studies (e.g., Peng & Zang, 2024; Jin, 2025 and Alghafes et al., 2024), the ESG performance is the overall score showing the extent to which the companies are committed to sustainability and responsibility. The score will range from a wide set of dimensions, from environmental initiatives on carbon emission reduction to social responsibilities related to diversity policy and management transparency. This score was constructed based on 178 indicators grouped into three main dimensions, namely CSR, covering issues associated with ten main themes. The economic dimension focuses on three main themes: resource use (20 indicators), emissions (22 indicators) and innovation (19 indicators). The environmental dimension is based on four themes, namely workforce (29 indicators), human rights (8 indicators), community (14 indicators) and product responsibility (12 indicators). The governance dimension is based on three main themes: management (34 indicators), shareholders (12 indicators) and CSR strategy (8 indicators). Higher scores indicate stronger commitment to sustainability and responsible business conduct, while lower scores reflect limited engagement. In this study, the ESG score is measured as a continuous variable ranging from 0 to 100 (Tobar, 2025). These scores were collected from the Refinitiv database.

3.2.2. Main Independent Variable

To measure Debt Company, I use the ratio of total

debt to total assets (Debt), which enables us to indicate the extent of indebtedness of insurance companies and their capability to meet financial liabilities.

3.2.3. Moderator Variable

To analyze the moderating effect of size on the debt and ESG performance nexus, I used firm Size. Firm size is expressed as the natural logarithm of total assets; this transformation captures the scale of activities of the firm and reduces the impact of extreme values.

3.2.4. Control Variables

We employ several control variables that affect ESG performance. These control variables include Revenue, interest coverage ratio, inflation, and GDP growth. Table 1 summarizes the definition of variables. As for revenue, the introduction of this variable can be based on resource allocation theory (RAT) (Barney, 1991). Indeed, firms face trade-offs when allocating limited resources between financial performance and non-financial objectives such as ESG.

Table 1: Definition of Variables.

Variable	Acronyms	Definition	Source
ESG performance	ESG	Economic, social, and governance score	Refinitiv Eikon
Debt company	Debt	Total debt to total assets	Refinitiv Eikon
Firm size	Size	Natural logarithms of total assets	Refinitiv Eikon
Revenue	RBA	Revenue of business activities to total assets	Refinitiv Eikon
Interest coverage ratio	ICR	Earnings before interest and taxes (EBIT) to interest expense	Refinitiv Eikon
GDP growth	GDP	GDP growth rate (annual %) (gross domestic product growth rate (at constant 2015 prices))	WDI, Word Bank
Inflation rate	INF	Consumer prices index (annual %)	WDI, Word Bank

A considerable number of investigations have utilized the System Generalized Method of Moments (SGMM) technique to evaluate firm performance (e.g., Khémiri & Noubbigh, 2019 a, b); Alghafes et al., 2024). The SGMM approach presents several notable benefits. Foremost among them is its capability to mitigate issues such as omitted variable bias, inaccuracies in measurement, dynamic variations within panels, and potential endogeneity linking independent variables to the error term. This methodological framework is especially pertinent in contexts where the time aspect of a panel is somewhat restricted—our analysis, for instance, considers a temporal dimension (T) of 6, contrasting with a cross-sectional dimension (N) of 31. Additionally, the evaluation of second-order autocorrelation, as performed by Arellano & Bond (1991), produced non-significant results for the AR model (2), suggesting that autocorrelation is not present. This outcome indicates a well-specified model, implying that a singular offset for the insurance performance variable suffices. Furthermore, the robustness of the GMM approach within the system can be enhanced by suitably conditioning the values at times t-1 and t-2 for the difference equation, along with a single lag in the level equation. The reliability of the instruments utilized is supported by Hansen's J statistics, which assesses the limitations on over-identification.

Furthermore, I examine the moderating effect of firm size on the association between debt and ESG performance of insurance companies. To evaluate the second hypothesis, the baseline model is modified. Specifically, equation 2 is augmented by incorporating additional interaction terms:

$$\begin{aligned}
 ESG_{cit} = & \alpha_i + \beta_1 ESG_{cit-1} + \beta_2 Debt_{cit} + \beta_3 Debt_{cit}^2 + \beta_4 Size_{cit} \\
 & + \beta_5 Debt_{cit} \times Size_{cit} + \beta_6 Debt_{cit}^2 \times Size_{cit} \\
 & + \sum_{n=7}^8 \beta_n X_{cit} + \sum_{n=9}^{10} \beta_n M_{cit} + \varepsilon_{it}
 \end{aligned}
 \tag{2}$$

4. EMPIRICAL RESULTS AND DISCUSSION

Table 2 depicts some interesting features of the data through descriptive statistics. The average ESG score is 0.162, indicating a medium commitment by insurance companies to environmental, social, and governance practices, while values range from 0 to 0.81, reflecting the heterogeneity of their adherence to such principles. The Debt indicates that insurance companies hardly use debt, with an average of 3% of premiums collected to finance the activities. A low minimum value of 0.021 reflects prudence in the management, while the maximum value of 0.417 indicates the fact that at a certain point, some companies make more use of debt to meet specific needs, such as expansion or long-term projects. The

average firm size equals 20.099-logarithm of assets, and the statistical differences were significant between a minimum of 17.934 and a maximum of 23.208, which points to a heterogeneous structure. The ICR indicates, on average, a very low capacity to cover the interest with its profit, obtaining an average of 0.016, although companies present deficits (-0.001) or get considerably better results (0.085). RBA has an average high of 56.1%, oscillating between -0.012 and 0.632, hence it is generally well managed for the generation of returns, with some losses that occurred in certain instances. Considering inflation (INF), the average stands at a moderate 2.8%, entailing serious fluctuation from -0.025 to 0.723, and further on, probably affecting economic stability. Lastly, economic growth (GDP) with an average of 2.2% (min: -0.072; max: 0.114) reveals very different economic contexts from one country to another.

Table 2: Descriptive Statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
ESG	186	0.162	0.212	0	0.810
Debt	186	0.030	0.069	0.021	0.417
SIZE	186	20.099	1.237	17.934	23.208
ICR	186	0.016	0.010	-0.001	0.085
RBA	186	0.561	0.101	-0.012	0.632
INF	186	0.028	0.008	-0.025	0.723
GDP	186	0.022	0.038	-0.072	0.114

Table 3 approves that multicollinearity problem does not plague the empirical models studied here (Gujarati (2002)). Furthermore, as shown in table 4, the exogenous variable correlation coefficients are less than 0.80, an indication of a low correlation among such variables. Most importantly, VIF results are less than 10, hence implying that the multicollinearity is not afflictive to the variables.

Table 3: Correlation Matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ESG	1.000						
(2) Debt	-0.061*	1.000					
(3) SIZE	0.323*	-0.088	1.000				
(4) ICR	0.200*	0.211*	0.183*	1.000			
(5) RBA	-0.059	0.037	-0.233*	-0.084	1.000		
(6) INF	0.375*	-0.085	0.088	-0.035	-0.061	1.000	
(7) GDP	0.287*	-0.066	-0.023	0.026	-0.025	0.245*	1.000

Table 4: VIF Correlation.

Variable	VIF	1/VIF
size	1.12	0.896
ICR	1.10	0.908
INF	1.08	0.924
Debt	1.07	0.930
GDP	1.07	0.932
RBA	1.06	0.941
Mean VIF	1.08	

4.2. Baseline Results

4.2.1. The Nonlinear Nexus between Debt and ESG Performance

The subsection describes the result of the curvilinear nexus between debt and the ESG performance of companies in the MENAT region. Other results are underlined in the following Table 5. Two models of evidence that GMM could be an appropriate estimator for this study. The corresponding J-Hansen statistics accept the null hypothesis of significantly different instruments from each other. Additionally, the AR (1) and AR (2) results support the null hypothesis of first and second order correlation. Model (1) is for the linear relationship between debt and ESG performance, while Model (2) reflects the nonlinear nexus between the two variables. More precisely, the results indicate that in both models, at 1%, the coefficient of the

lagged variable of ESG performance, i.e., ESGt-1, is positive and statistically significant, showing an increase in the current year's ESG performance compared to that of the previous year. This result implies that, economically, an improved ESG performance from one year to another strengthens the sustainable and responsible practices of companies, which could have several positive economic consequences. The attractiveness of companies for investors, mainly those focused on socially responsible investment, might increase while simultaneously reducing financial risks associated with environmental or social factors. In such a way, it could give more competitiveness to firms on the international markets too, especially where the ESG standards have already been put into practice. Above all, it enables the sustainable development of the region, answering the challenges of environmental sustainability and social inequity and governance to favor an inclusive and more resistant economic growth. Regarding debt, from model 1, the estimates show that debt negatively and significantly influences ESG performance, implying increased financial strain imposed by high levels of debt on those companies. Faced with large obligations of repayment, insurance companies may focus on short-term objectives, such as managing liquidity and

cutting costs, rather than investing strategically in ESG initiatives.

This might reduce their ability to transition towards more sustainable practices, such as greening their operations, making their products more inclusive, or enhancing internal governance. The problem is that this could exacerbate these short-term priorities when there are binding economic constraints and institutional challenges, hence slowing down ESG performance improvement efforts in the regional context. Liao & Zhou (2024) show that green credit policy reduces ESG performance of the polluting companies in China. Furthermore, Li et al., (2024) show that the deterioration in ESG performance is conditioned by the increase in the level of debt and the ownership structure of Chinese companies.

This result could be better explained by the U-shaped relationship that exists between debt and ESG performance. In addition, I applied for the U-shaped relationship test proposed by Lind & Mehlum (2010). According to Table 5, in model 2, it appears that the association between debt and ESG performance is non-linear - the inflection point for debt is estimated at 0.155, which is U-shaped and therefore confirms the predictions of agency theory and hypothesis 1. Figure 1 summarizes the U-shaped relationship between debt and ESG performance. This result might be better explained through the U-shaped relationship between debt and ESG performance. In further discussion, the author will apply the test of a U-shaped relationship as put forth by Lind & Mehlum (2010).

From Table 5, model 2 shows that the relation between leverage and ESG performance is not linear; further, the turning point for leverage is estimated at 0.312, U-shaped, hence confirming hypothesis 1. The U-shaped relation of debt and ESG performance of the insurance firms in the MENAT region suggests that for low levels, the effect is negative, since the firms are constrained by their financial obligations; this pushes them towards favoring short-term goals at the expense of ESG investments.

It therefore confirms hypothesis H1 (a). However, beyond a certain threshold, debt has a positive effect, likely because very high leverage would force companies to strengthen their governance to appease creditors and investors. It may also reflect the strategic use of debt to finance far-reaching ESG projects, such as large-scale environmental or social programs that then go on to boost overall performance. Thus, the non-linear relationship suggests that at an initial stage, debt could impede ESG performance and later act as a lever for

sustainable and responsible practices.

This finding supports the H1 (b) hypothesis. The result is like that found by Khémiri & Noubbigh (2020), as the authors show that the nexus between debt and firm performance is non-linear. In the same vein, Bagh et al. (2024) demonstrate that this is a nonlinear association between ESG performance and sustainable growth. As for the control variables, models (1) and (2) report that, on average, the coefficient on the ICR variable is positive and significant at the 1% level.

This suggests that insurance companies in the MENAT region enjoy higher interest cover, reflecting their strong ability to generate profits to cover the cost of interest and enabling them to focus on long-term initiatives, including sustainable ESG practices. A good interest cover ratio reduces the financial pressure of having to service debt, thereby providing resources that can be used by companies for various initiatives aimed at enhancing their ESG performance, investing in clean technologies, social programs, or adopting transparent and ethical governance practices. This, in turn, improves their reputation and makes them increasingly attractive to ESG-sensitive investors, thus contributing to more sustainable and resilient growth.

Results across models (1) and (2) depict the coefficient on the RBA variable, which is negative and statistically significant at 1%. The obtained outcome-that negative performances exist in relation to revenues-means that one cannot totally separate such the fact that companies in the MENAT economies tend to favor short-term financial goals at the cost of sustainable activities that positively relate to sustainable performance.

In an environment where companies often seek to maximize revenues quickly, they may neglect the investments needed to improve their environmental, social, and governance performance. For example, some companies would resort to unsustainable practices for quick profits, such as over-exploitation of natural resources or precarious working conditions, which may undermine their ESG performance. Significant dependence on revenues from sectors with large ecological footprints or less responsible business models may reduce a company's investment potential in ESG strategies in the long term.

This would make them less attractive to sustainability investors, affecting their reputation and long-term financial performance. In addition, theoretically, according to RAT theory (Barney, 1991), firms face trade-offs when allocating limited resources between financial performance and non-

financial objectives such as ESG. RBA, which measures operational efficiency and revenue generation relative to asset base, often reflects a strong emphasis on short-term profitability. This focus can reduce the resources available for sustainability initiatives, leading to a potential negative association between RBA and ESG performance.

However, it seems that the macroeconomic variables inflation (INF) and GDP growth have a positive effect on ESG performance. More specifically, the positive inflation effects on ESG performance for the insurers in the MENAT region could be explained by the fact that inflation, by increasing the cost of production and prices of goods and services, very often encourages companies to look for alternatives that are more viable or sustainable to optimize their operations. It follows that insurance companies may be compelled to invest in green and social solutions with which to protect themselves against long-run costs and even shelter themselves from the ups and downs of economic fortune.

Examples are green investments or sustainability-focused insurance products that improve their performance regarding ESG factors. Moreover, companies with high inflation take into consideration long-term risks like climate or social risks and adjust their strategy in a corresponding way, yielding

increasing pressure for sustainability from both investors and consumers. Such steps surely help improve their ESG performance.

In addition, the positive impact of GDP growth on ESG performance for insurers in the MENAT region could perhaps be explained by the fact that the growing economy gave more resources and stability to invest in sustainable initiatives. In most countries where GDP is showing continued growth, there is a resulting rise in revenues and profit margins among companies, enabling them to have more funds available to invest in environmental, social, and governance projects. The former might be to incentivize insurers to adopt environmentally friendlier approaches, such as the integration of ESG into investment portfolios, or, more interestingly, to improve quality in governance levels as a means of making investors and customers more confident in the company.

Besides, economic growth is usually accompanied by increased social and regulatory pressures toward sustainability, raising the bar and setting greater expectations for companies by adopting more responsible and transparent practices. Therefore, GDP growth provides the means and incentives for such companies to improve their ESG performance while strengthening their competitiveness and reputation in the market.

Table 5: Nonlinear Association between Debt and ESG Performance.

	(1)	(2)
VARIABLES	ROA Linear	ROA Curvilinear
ESG _{t-1}	0.764*** (0.065)	0.765*** (0.061)
DEBT	-0.114*** (0.006)	-0.821*** (0.197)
DEBT ²		2.655*** (0.603)
ICR	0.001*** (0.0001)	0.001** (0.0001)
RBA	-0.051*** (0.013)	-0.063*** (0.021)
INF	0.003*** (0.001)	0.003*** (0.001)
GDP	0.007*** (0.002)	0.008*** (0.002)
Constant	0.093*** (0.008)	0.103*** (0.012)
Observations	154	154
Number of companies	31	31
Number of instruments	24	24
AR (1) (p-value)	0.014	0.013
AR (2) (p-value)	0.351	0.229
Hansen test (p-value)	0.239	0.206

Inflexion point	0.155
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Notes: Standard errors are displayed in brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

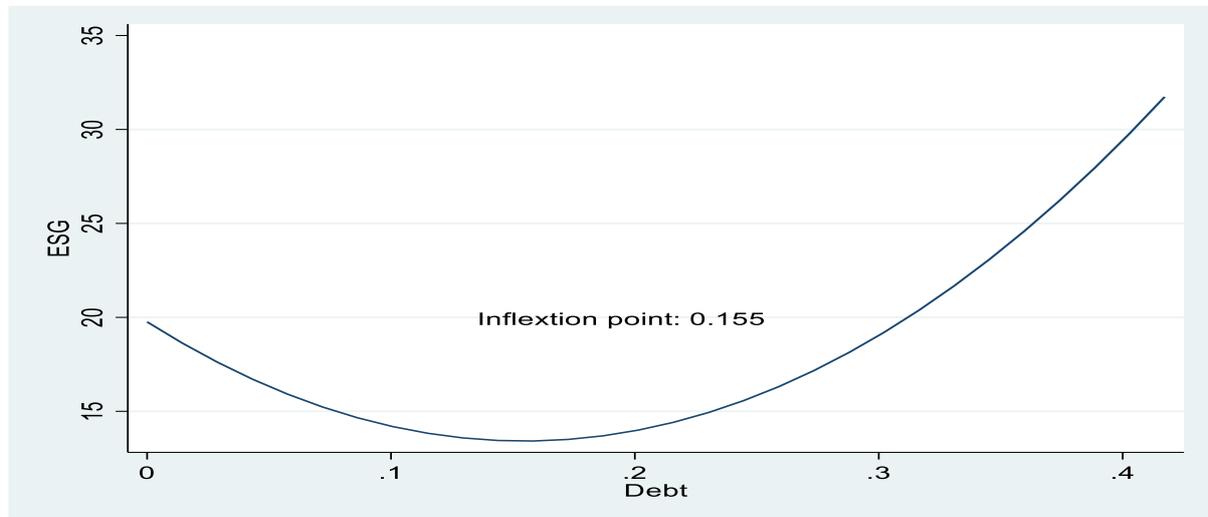


Figure 1: U-Shaped Relationship between Debt and ESG (Marginal Effects Plots).

4.2.2. The Moderating Effect of Firm Size

In this subsection, I will assess the moderating effect of firm size on the debt-ESG performance link. The main results are also presented in Table 6, such that the direct effect of firm size on ESG performance is also positive and statistically significant at the 1% level in both Models (1) and (2). This would suggest that, all things being equal, the larger the company, the more financial, human, and technological resources it is likely to have to devote to sustainable initiatives.

They also tend to be more exposed to investors, regulators, and customer expectations about social and environmental responsibility, and the perceived need to adopt best ESG practices. In addition, larger companies often have economies of scale that facilitate lower costs for implementing ESG strategies.

By contrast, the more limited resources for smaller firms mean that such approaches to sustainability, even when there may be greater ability at times to nimbly begin new responsible practices-frequently inhibit sustainability-type approaches. In fact, by introducing the variable Size in the model, from some analyses run afterward, the relation of debt with good ESG performance still holds; now it has become inverted U-shaped.

This shows the fact that due to capacity and making use of all economies of large scale, large firms use debt in strengthening their ESG performance up to a certain threshold. Beyond that, the negative effects even for these big companies reduce ESG

performance by the high cost of debt. While considering the interaction term between debt and company size, it might be mentioned that the indicated interaction exerts a non-linear influence on ESG performance existence of a non-linear relationship between the coefficient of the DEBT*SIZE interaction and ESG performance.

It may also be reconciled economically with the fact that, in the MENAT area, the joint impact of debt and size on ESG performance follows a U-shaped inverted shape. Initially, the interaction between debt and size negatively influences ESG performance, since large firms with high levels of indebtedness may experience increased financial constraints and short-termist priorities, which can limit their investment in ESG initiatives.

However, the interaction of $[[DEBT]]^2 * Size$ is positive when the debt level increases, reflecting that large companies, due to their robust structure and economies of scale, can absorb the cost of debt and channel their resources in a sustainable and responsible investment that improves their ESG performance. In this context, it can be noted that Khémiri & Noubbigh (2020) demonstrate that the association between debt and the firm performance of African firms is nonlinear.

This association is conditioned by firm size. Other studies showed that the relationship between ESG and firm performance could be moderated by firm size (Akhtar et al., 2023; Peng & Zang, 2024; and Shawat et al., 2024).

**Table 6: Debt and ESG Performance Nexus:
Moderating effect of Size.**

	(1)	(2)	(3)
VARIABLES	ESG	ESG	ESG
ESG _{t-1}	0.734*** (0.061)	0.559*** (0.065)	0.498*** (0.030)
DEBT		0.137*** (0.027)	0.267*** (0.051)
DEBT ²			-0.876** (0.321)
SIZE	0.015*** (0.004)	0.056*** (0.012)	0.104*** (0.004)
DEBT*SIZE		-0.703*** (0.142)	-0.138*** (0.026)
DEBT ² *SIZE			0.458** (0.168)
ICR	0.097*** (0.001)	0.099** (0.004)	-0.013 (0.060)
RBA	-0.037*** (0.009)	-0.052*** (0.015)	-0.011* (0.006)
INF	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.000)
GDP	0.008*** (0.001)	0.009*** (0.001)	0.010*** (0.002)
Constant	-0.220** (0.081)	-0.099*** (0.023)	-0.197*** (0.007)
Observations	154	154	154
Number of companies	31	31	31
Number of instruments	24	24	22
AR (1) (p-value)	0.012	0.029	0.023
AR (2) (p-value)	0.360	0.280	0.289
Hansen test (p-value)	0.166	0.220	0.164

Notes: Standard errors are displayed in brackets. *** ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.4. Robustness Analysis

4.4.1. Change in Dependent Variable

According to Peng & Zang (2024 and Jin 2025, I replace my overall ESG variable of interest with its three dimensions: environment, social, and governance. Each of these is more specific in setting out aspects related to the sustainability and responsibility of a firm.

This will yield a better understanding of the general impact of business practices while providing a detailed and comprehensive analysis of factors that influence performance in these three key areas. In Table 7, it can be illustrated that the same findings

were observed in the impact of debt on ESG criteria. In a similar vein, the impact of the interaction term between DEBT*Size on ESG dimensions presents further evidence on the existence of a non-linear relationship.

The result indicates that, economically, the joint effect of debt and company size is U-shaped on various dimensions of ESG performance in the MENAT region. This could be explained by the complex interaction between companies' ability to manage their debt and their size.

First, highly leveraged companies may not be able to allocate adequate resources allocation for ESG initiatives. This could mean, for instance, less investment in employee welfare programs or community projects as big companies are looking for debt repayment. Too much pressure due to indebtedness can result in decisions made for short-term gain, with limited concern for transparency, accountability, and risk management.

Finally, regarding the environmental dimension, high levels of debt may also act to dampen investment in ecological and sustainable technologies, as companies would wish to use whatever available funds were at hand for immediate needs rather than on long-term projects to reduce carbon dioxide. However, at higher levels of debt and beyond the optimum threshold, the interaction term of $[(DEBT)]^2 * Size$ becomes positive.

This reflects the fact that large companies are in a better position to manage their debt, taking advantage of their size and access to greater financial and human resources. In this context, they can absorb not only the costs related to debt but also invest strategically in ESG initiatives. On the social front, this translates into higher devotion to employees, diversity, and human rights thanks to internal policy reinforcements.

On the corporate governance front, highly indebted firms can embrace more strict practices in terms of transparency, auditing, and risk management since they would have the wherewithal to formulate strong mechanisms for governance. Finally, from the environmental perspective, investment in clean technologies and sustainable practices allows these companies to obtain economies of scale in unit cost reduction while reaping maximum environmental benefits, responding to the increased stakeholder expectations of ecological responsibility.

Therefore, these dynamic reveals that while debt can initially have a negative impact on ESG performance, optimal management of indebtedness,

along with size, enables large companies to overcome such challenges and maximize their positive impact

on social, governance, and environmental dimensions.

Table 7: Debt and ESG Dimensions.

	(1)	(2)	(3)	(4)	(5)	(6)
	ESGS		ESGG		ESGE	
VARIABLES	Curvilinear	Moderating effect	Curvilinear	Moderating effect	Curvilinear	Moderating effect
ESG _{t-1}	0.865*** (0.038)	0.517*** (0.022)	0.818*** (0.032)	0.482*** (0.036)	0.099*** (0.002)	0.041*** (0.003)
DEBT	-0.644** (0.264)	0.296*** (0.038)	-0.837** (0.356)	0.617*** (0.065)	-0.199*** (0.065)	0.192*** (0.167)
DEBT ²	0.239*** (0.079)	-0.913*** (0.026)	0.330*** (0.011)	-0.235*** (0.036)	0.711*** (0.018)	-0.750*** (0.084)
SIZE		0.113*** (0.046)		0.223*** (0.088)		0.636*** (0.062)
DEBT*SIZE		-0.153*** (0.020)		-0.319*** (0.034)		-0.992*** (0.087)
DEBT ² *SIZE		0.483*** (0.139)		0.124*** (0.190)		0.394*** (0.441)
ICR	-0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000 (0.000)	-0.000*** (0.000)
RBA	-0.645*** (0.016)	-0.206*** (0.057)	-0.125*** (0.023)	0.365 (0.507)	-0.231*** (0.063)	-0.725** (0.321)
INF	0.278*** (0.041)	0.446*** (0.018)	0.015 (0.076)	-0.051 (0.043)	0.412*** (0.019)	0.390*** (0.016)
GDP	0.508** (0.185)	0.100*** (0.007)	0.153 (0.226)	0.979*** (0.167)	0.274*** (0.051)	0.432*** (0.017)
Constant	0.819*** (0.014)	-0.218*** (0.096)	0.189*** (0.022)	-0.429*** (0.018)	0.141* (0.073)	-0.125*** (0.012)
Observations	154	154	154	154	154	154
Number of companies	31	31	31	31	31	31
Number of instruments	24	22	24	22	23	22
AR (1) (p-value)	0.015	0.008	0.005	0.007	0.029	0.029
AR (2) (p-value)	0.242	0.357	0.419	0.481	0.182	0.190
Hansen test (p-value)	0.168	0.180	0.142	0.186	0.136	0.137

Notes: Standard errors are displayed in brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.4.2. Change in Econometric techniques

The results obtained from the random effects model in the static panel framework show quite a good agreement, save for a few exceptions, with the ones obtained previously using the GMM method in a system (see Table 8).

More precisely, the non-linear relationship of the interaction of debt and size (debt*Size) with ESG performance got transformed into an inverted-U curve. This means that, in the initial stage, an increase in debt, along with large firm size, has a positive impact on ESG performance. Beyond the threshold

level of debt, however, this positive impact turns out to be negative.

Indeed, this change of form can be explained by large companies' skills to manage their indebtedness better, but beyond a level of indebtedness, the surge of pressure might become a sort of brake on investment in the ESG directions.

Therefore, the GMM method applied to the system, by considering **endogeneity** and simultaneity problems, allows confirmation of these robust results and nuances in the dynamics of the relationship among debt, size, and ESG performance.

Table 8: Debt and ESG Performance: Results of the FGLS Method.

Dependent variable: ESG	(1)	(2)
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VARIABLES	Curvilinear	Moderating effect
DEBT	-2.508** (1.099)	-0.462*** (0.016)
DEBT ²	0.515*** (0.030)	0.211*** (0.081)
SIZE		0.149*** (0.032)
DEBT*SIZE		0.241*** (0.086)
DEBT ² *SIZE		-0.110*** (0.042)
ICR	0.233*** (0.001)	0.149** (0.001)
RBA	0.010 (0.009)	0.017 (0.017)
INF	0.006*** (0.002)	0.010*** (0.002)
GDP	0.004** (0.002)	0.012*** (0.002)
Constant	0.055*** (0.010)	-0.282*** (0.072)
Observations	186	186
Number of companies	31	31
Hausman test (p-value)	0.281	
Wald test (p-value)	0.000	0.000
Hetero test (p-value)	0.000	0.000
Autocorrelation test (p-value)	0.000	0.000

Notes: Standard errors are displayed in brackets. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

5. CONCLUSIONS AND POLICY IMPLICATIONS

The purpose of this paper, therefore, is to analyze the non-linear relationship between debt and ESG performance of insurance companies listed in the MENAT region and the moderating role of company size on this relationship. The results show a U-shaped relationship between leverage and ESG performance. In other words, low levels of debt are associated with lower ESG performance. Debt reduces ESG performance to the optimum level at 15.50%. In other words, it infers that 15.50% is an optimal level that insurance companies within the MENAT region should engage in debt levels for investment in ESG initiatives to be improved.

For low levels of debt, it would be harder for firms to invest in ESG initiatives, and the latter hurts their performance. However, at a certain threshold, its effect is positive, probably because a firm uses borrowed resources for financing green or social projects, thereby improving its ESG performance. This may be one of those situations where debt has contributed to overcoming the financial barrier to invest in sustainability initiatives, but beyond that level, too much exposure to debt contributes

negatively due to management of financial risks or problems of solvency. Such a relationship brings to the fore the importance of balance between investment capability generated by indebtedness and risks pertaining to over-exposure to indebtedness. The latter result confirms the predictions of the agency theory, and thus, the hypotheses of H1 (a) and H1(b) are correct.

Moreover, the result also indicates that firm size has significantly moderated the non-linear relationship between debt and ESG performance. This effect indicates that the improvement in debt, accompanied by the size of the company, still positively improves the ESG performance of insurance companies, hence confirming hypothesis 2. In other words, the moderating effect of size on the nonlinear relationship between debt and ESG performance means large insurance companies are more capable of relying on debt to improve their ESG initiatives. If the size is large, then insurance companies can optimize their ESG strategy by mitigating risks and enhancing transparency and governance. This would be because the commitment of financial resources and ESG practices are conditioned by firm size.

It finds that the proper balance between debt and ESG in insurance firms in the MENAT region lies at the fulcrum of regulatory policy. On one hand, regulators should incentivize debt management prudently to prevent excessive dependence on external financing by companies at the cost of their long-run solvency. On the other hand, other policies to encourage investment in ESG projects, such as those on tax incentives or green financing, can be provided to make use of corporate debt potential sustainably. Insurance company managers, particularly for large ones, should optimize the use of debt to finance ESG initiatives, if such critical thresholds that could risk their financial stability are not reached. The same goal can also be pursued by increased transparency and governance strengthening to reduce the risk of excessive indebtedness and to maximize the benefits of investment in sustainability.

The following study has some limitations that are worth considering for future research. First, the non-linear relationship observed may be affected by other external factors such as market conditions and economic policies, which were not integrated into the model. Besides, though firm size is an important

moderator, the variability of ESG investment strategies across specific sectors within the MENAT region has not been explored adequately. It would be similarly interesting to investigate the influence of other factors, such as organizational culture or pressure from stakeholders, on this relation. The period of analysis extends from 2017 to 2022, a period that may not disclose the long-lasting effects of leverage in changing the global economic context on the ESG performance of insurance firms. In addition, a key limitation of this study is the relatively small sample size, which may reduce statistical power and limit the generalizability of the findings. Small samples are more sensitive to outliers and firm-specific characteristics, potentially biasing the estimated relationships. This constraint also restricts the ability to conduct more granular analyses, such as country-level or firm-size sub-samples, which could provide deeper insights. To address this limitation, future research should expand the dataset across a broader time horizon or include additional firms. Moreover, robustness checks, such as sub-sample analysis by country or firm size quartiles, could help validate the consistency of the results.

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