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Research Article

Sustainable Business Models in the Automotive Sector: A Perspective from the Relationship of Financial Statements with ESG Criteria

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ABSTRACT

Nowadays, there are numerous studies about the implementation of sustainable practices and their impact to evaluate the performance of a company in three key sustainability areas: environmental, social and corporate governance, better known as ESG criteria (ESG). In the automotive sector, several approaches and methodologies stand out, some of them focus on identifying barriers to sustainable manufacturing in small and medium-sized businesses, others use models to evaluate automotive sustainability based on design attributes and some others focuses on the standardization of financial and sustainability reporting. The purpose of this work is to establish relationships between the Total ESG Risk Index, its environmental, social and corporate governance components and four of the most important variables taken from the financial statements (income by sales, profit or net profit, total assets and market value). To achieve this goal, it was used a multiple regression model in a database for the twenty largest companies in the automotive sector around the world.

Keywords: ESG criteria, financial statements, regression models.

INTRODUCTION

It is a fact that the automotive sector has been one of the main pillars of the global economy, driving industrial and technological development, but it is also being recognized for its environmental, social and economic impacts. Likewise, climate change, scarcity of natural resources, and high regulatory and consumer expectations have forced automotive companies to rethink their business models in terms of sustainability. Deloitte's research in late 2022, for example, looked at critical issues affecting the industry, including interest in buying electric and, especially, hybrid cars (Deloitte, 2023).

The automotive industry is essential to global economy, generating a significant portion of GDP and employing millions of people worldwide. Besides car manufacturing, it is engaged in component production, research and development of new technologies, and an extensive distribution and after-sales service network. Despite fostering innovation and international competitiveness, the industry faces challenges due to its environmental impact, with vehicle production and use, contributing significantly to greenhouse gas emissions and climate change. As such, automotive industry is making progress towards more sustainable mobility, with investment in clean technologies and more environmentally friendly production methods.

Sustainability in companies has been gaining importance and has become a trend; forcing companies to consider sustainable practices in their business model that were not used a few years ago. The task is not easy due to implementing mechanisms that promote sustainability such as development, energy efficiency, conservation of natural resources, environmental regulation, innovations in clean and sustainable technologies; and environmentally responsible business practices complicates the identification of mechanisms to promote sustainability (Linnenluecke et al., 2017).

In the globalized world, consumers are increasingly demanding, which has forced companies to incorporate sustainable practices. That is the reason why companies must combine economic, social and environmental aspects to remain in the market and use innovation to promote improvement and creation of new products and services accompanied by sustainable and comprehensive actions in their organization following the example of large companies (Dangelico et al., 2017).

In this scenario, environmental, social and governance criteria (ESG) have become an important tool to evaluate sustainability and Corporate Social Responsibility (CSR) in this industry. Environmental criteria focus on the management of natural resources and the reduction of CO2 emissions. Social criteria, on the other hand, refer to working conditions, community involvement and diversity. While governance criteria consider transparency, ethics and the corporate governance system.

This article aims to investigate the importance and implementation of ESG criteria within the automotive industry, through data-driven analysis using statistics and scientific literature. To achieve this, the work starts by examining the relationship of the most relevant accounts of the financial statements with the ESG criteria in the business models of the companies under study and, subsequently, measuring the impact on the performance of the same companies.

LITERATURE REVIEW

As already mentioned, many studies have been conducted to measure the impact of implementing ESG criteria in the automotive sector. The one performed by Perello et al. (2021) focused on identifying the various barriers that hinder the implementation of sustainable manufacturing for small and medium-sized enterprises. To this end, it aimed to measure the magnitude of the obstacles and the scope of the variables studied. The study collected information from 150 companies using questionnaires and then performed data processing using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), and next classifying the barriers according to the graph theory and matrix approach (GTMA) (Perello-Marin et al., 2022; Virmani et al., 2021).

There are also models that have been developed to assess and manage sustainability in the automotive sector in order to comply with current regulations. Jasiński et al. (2021) developed a model called Automotive Sustainability Assessment (A-SAM), wich is recommended to promote sustainable decision making in the automotive industry. The A-SAM model is based on four design attributes: internal sustainable impacts (such as energy use, water and waste generation) and external sustainable impacts (the damage caused by internal factors); the life cycle of the automotive industry (including the ecological and environmental consequences it produces); the Triple Bottom Line (TBL) theory (which provides measurement results on the economic, environmental and social factors of a company); and the measurement of sustainability through the emission tons of carbon dioxide, sulfur and nitrogen (assessing the relevance of each of these pollutants) (Jasiński et al., 2021).

Additionally, sustainable practices have been implemented through Sustainable Supply Chain Management (SSCM) to improve the social and environmental performance of companies, without compromising economic returns; to mention, the research conducted by Mathivathanan et al. (2022). In this research the process began with the identification of influential pressures in a list of common pressures to develop a hierarchical knowledge-based model, which considered both the drivers and dependencies of each of the previously identified pressures (Mathivathanan et al., 2022). The culminating phase of the research was the creation of a pressure model, based on the interpretative logic of SSCM, aiming to implement this model in the Indian automotive manufacturing industries (Mathivathanan et al., 2022).

The research approach of Beretta et al. (2021) focused on measuring the affinity between profitability and non-financial disclosures, considering the relationship between ESG performance in companies and non-financial disclosures in the automotive industry. This study provided an insight into the various barriers to the implementation of sustainable practices in Micro, Small and Medium-sized Enterprises (MSMEs) by implementing questionnaires in

one hundred and fifty MSMEs in the automotive sector in India (Beretta et al., 2021). The data collected were processed with exploratory and confirmatory factor analysis that allow classifying the barriers with the graph theory and matrix approach to observe the interaction between them, revealing twenty-two barriers in sustainable manufacturing. The factor models ratified four distinct categories of barriers: production and operation, organization, normative collaboration and state regulation (Beretta et al., 2021).

Financial and sustainability reports are typically used to compare or evaluate the performance of companies in these areas. Therefore, a study in Europe on financial and sustainability reporting in automotive companies showed that financial reporting follows established reporting and verification standards, while sustainability reporting lacks standardization to effectively correlate and evaluate company performance. The study ccarried out by Tóth et al. (2022) aimed to explore the connection between sustainability and financial reporting in major European automakers, for which it was based on the analysis of European Sustainability and Financial Reports (ESEFs), assessing the information content and purpose of their publication (Tóth et al., 2022). The most recent reports of the three major automotive manufacturers (BMW, Daimler, and Volkswagen) were reviewed, and the research was organized around five stages of sustainability: external compliance, internal compliance, stakeholder cooperation, regenerative actions and co-evolutionary actions, to understand how sustainability is integrated and interests are balanced within organizations. The results showed that sustainability reports are not uniformly standardized and can't be reproduced in a machine-readable format, despite advances in natural language processing that enable automation of problem identification in data sets. In reviewing the automated analyses of the three automotive companies, it was observed that the higher the sustainability score, the lower the frequency of coded sustainability keywords and phases in their reports, indicating divergent results among them (Tóth et al., 2022).

Authors such as Munten et al. (2021) focused their research on the challenges of environmental conservation with the participation of different companies, industries and regulators; promoting change through coopetition, an element that combines cooperation and competition to create value. They used a qualitative methodology through multiple case studies, including semi-structured interviews (Munten et al., 2021). These interviews provided historical and contemporary narratives of marketing and sustainability concerns such as air quality, climate change and human health impacts, as well as evidence of the exponential growth in vehicle purchases and the fact that government pressure on the automotive sector has encouraged the production of more sustainable vehicles (Munten et al., 2021). The results point to two alternatives in sustainable innovation (SI): electric vehicles, which significantly reduce CO_2 emissions, and autonomous or connected vehicles, which move towards more sustainable transport practices in the automotive sector (Munten et al., 2021).

On the other hand, Stefanoni & Voltes-Dorta (2021) focused their study on the evaluation of sustainable performance in the automotive sector using the Data Envelopment Analysis (DEA)-Malmquist method in several automotive manufacturers. The authors compared the technical efficiency of thirty-three automakers worldwide during the period from 2014 to 2017, with the aim of determining whether efficient automakers show improvement under ESG sustainable pressures. Automakers from thirteen countries were categorized by region: Asia-Pacific, Middle East, Europe, and North America, and parent companies managing multiple vehicle brands were included in the analysis (Stefanoni & Voltes-Dorta, 2021). The results suggested that efficiency measured by the DEA method in 2017 showed improvements in efficient car models and manufacturers when sustainable measures were integrated (Stefanoni & Voltes-Dorta, 2021).

A key factor in the sustainable development of the automotive sector is the measurement of greenhouse gas (GHG) emissions through comparisons between internal combustion engines (ICE) and electric vehicles in the U.S., considering a useful life of fifteen years (Jing et al., 2020). It is important to know the GHG emissions at key moments of pollution and to know the rates of occurrence of the process throughout the life cycle of the vehicle, within the limits established by the system (Jing et al., 2020). In the methodological process, the GHG analysis was integrated with industrial automotive emergy, which involves adding up all types of energy used to produce another, in order to promote sustainability in automotive engineering (Jing et al., 2020). The results showed that the emissions of ICE vehicles are up to 320 times higher than those of electric vehicles. In addition, the emergy analysis showed that electric vehicles are more sustainable over their life cycle than ICE vehicles (Jing et al., 2020).

One of the most interesting research papers on the automotive industry and its environmental and social impacts is that of Williams and Blyth (2023), which analyzes the pollution generated by the automotive industry in the United Kingdom from 1950 to 2019. The research began with the collection of information, noting that there were no

statistics on the automotive industry before the First World War and that the source of data for this sector was the Society of Motor Manufacturers and Traders (SMMT), which was considered to be the only reliable source (Williams & Blyth, 2023). The information gathered was used to analyze the evolution of the industry, using the data to determine the number of motor vehicles and implementing methods to evaluate gasoline consumption, estimate CO_2 emissions and calculate the number of traffic fatalities in the United Kingdom (Williams & Blyth, 2023). Similarly, data sources were used to estimate the dimensions of the UK's roads over the period studied. Finally, the results indicated an increase in the number of cars and fuel consumption over the period studied (Williams & Blyth, 2023). They also suggested that the growth of the vehicle fleet would lead to an increase in traffic that would be unsustainable and would have a negative impact on the environment, so it was concluded that a higher level of environmental awareness is required from producers and consumers of the automotive industry in order to protect the planet (Williams & Blyth, 2023).

THEORETICAL FRAMEWORK

Environmental, Social and Governance Impacts in the Automotive Industry

To meet the challenges of climate change, resource scarcity, and increasingly demanding customers and still be environmentally responsible, automotive companies are seeking to implement sustainability-based models through a combination of ESG criteria. Below is a brief explanation of how the automotive industry affects each of these approaches and how it offers solutions to address the issue.

Enviromental Criteria (E).

The environmental issue is one of the biggest sustainability challenges facing the automotive sector. According to the International Energy Agency's (IEA) 2021 report, the automotive industry is responsible for approximately 20% of global carbon dioxide (CO2) emissions, not to mention the fact that the production and use of vehicles consumes many natural resources and generates significant amounts of waste (International Energy Agency (IEA), 2021).

In response to the above and to help the environment, some companies in the automotive sector are investing in electric vehicles (EVs) and hybrid technologies to reduce emissions (International Energy Agency (IEA), 2021). Studies have identified Tesla, Nissan and General Motors as leading companies in this technological shift (International Energy Agency (IEA), 2021). According to the IEA, there were more than 10 million EVs on the road worldwide in 2020, and the number is expected to reach 145 million by 2030 (International Energy Agency (IEA), 2021).

Social Criteria (S).

The automotive industry employs millions of workers worldwide, so it is important to ensure working conditions and fair and safe employability, some automotive companies such as Ford and Toyota have worker welfare and diversity programs (Ford, 2022; Toyota, 2025). Similarly, a positive impact on communities has been observed through Corporate Social Responsibility (CSR) practices, where investments have been made in the infrastructure of manufacturing plants and training programs for employees and communities where manufacturing takes place, benefiting thousands of people.

Corporate Governance (G)

Strong corporate governance is essential for sustainable development, but also supply chain transparency and ethical decision-making. According to the Price Waterhouse Coopers Transparency Report (2021), 72% of automotive companies have improved their transparency measures over the past five years. Automotive companies such as BMW and Daimler have adopted practices that include employee, community and customer representatives on sustainability boards. This participation is fundamental to sustainable practices and improves the relationship between the customers and the company. (Márquez 2024)

The automotive sector faces both challenges and opportunities from sustainability. Challenges include the high costs associated with transitioning to sustainable technologies, the implementation of some ESG measures that may require large investments, and even, in many cases, compliance with environmental and labor regulations, depending on where each company operates (Martinuzzi et al., 2011). An example of this is the technological innovation that the industry has made with electric batteries, a renewable energy source, to reduce fuel costs and improve the efficiency of automobiles (Martinuzzi et al., 2011). This innovation involved a large capital investment for the companies during

the development phase, but at the same time it helps the environment and the companies involved to improve their sustainable practices (Martinuzzi et al., 2011). This, in turn, achieves brand reputation and customer loyalty towards practices that promote sustainability (Martinuzzi et al., 2011).

Applying ESG criteria is important for automotive companies to move towards a more sustainable future. Despite significant challenges, innovation and improved corporate reputation will provide strong incentives for companies to find new solutions. Some studies, such as the one conducted by Lukin et al. (2022), show that the adoption of ESG practices not only responds positively to environmental and social needs, but also benefits long-term financial performance of the companies (Lukin et al., 2022).

METHODOLOGY

This is a quantitative, descriptive and transactional research with a non-experimental design and statistical scope based on the multiple linear regression model. This model allows the study with more than one variable and works as an extension of the simple linear regression model, since it allows the analysis of the relationship between a dependent variable or response Y and two or more independent or predictor variables $X_{1,}, X_2$, … X_k. The population regression function is expressed Equation (1) as follows:

$$Y = \beta_0 + \beta_1 X_{1,} + \beta_2 X_{2,} + \cdots \beta_n X_{n,} + \varepsilon_i \ , i = 1,2, \dots , n \quad (1)$$

Where Y is the observed response or the variable to be predicted; the coefficients $\beta_0, \beta_1, \dots , \beta_n$ are determined using the data sample obtained; β_0 is the ordinate at the origin or intercept; β_j is the partial regression coefficient of the j-th regressor variable; $X_{1,}, X_2$, … X_n are the independent or predictor variables; and ε_i is the error term or associated random disturbance not explained in the model (Granados 2016).

Since β_0 is the intercept or value of the dependent variable when all the independent variables take the value of zero, it makes no sense to interpret it. Now, if the value of the variable X_i is increased by one unit, holding the others constant, the regressed variable is expected to increase or decrease by β_j units. Thus, β_j is the partial effect of X_i on the variable Y_i , holding the other variables fixed.

The multiple linear regression model is based on the following assumptions: (I) the model is linear in the parameters and these remain constant throughout the sample, (II) the regressor variables are not random variables, (III) the errors are normally distributed with zero mean and constant variance, (IV) the errors are uncorrelated, and (V) the regressor variables are linearly independent, i.e. there should be no relationship between them (Llauce 2024).

Subsequently, the selection of the companies to be included in the study was made, considering the 50 largest companies in the automotive industry, according to the classification presented by Forbes magazine in 2023, a magazine specialized in the world of business and finance published in the United States (Forbes, 2023). The next step was to verify, using Yahoo! Finance, which of these 50 companies measure the Total ESG Risk Index as well as the Social, Environmental, And Corporate Governance Risk factors. This review identified 20 companies that met these characteristics, which are presented in Table 1.

Table 1 *Automotive companies with ESG risk index.*

Forbes Global 2000	Company	Total ESG Risk Index	Percentile	Environmental Risk Score	Social Risk Score	Corporate Governance Risk Score
29	Volkswagen AG	30	62	8,2	10,2	11,4
46	BMW AG	23	37	6,5	7,5	9,2
69	Tesla, Inc.	29	58	2,8	16,2	9,6
70	General Motors	31	66	10,3	12,9	7,7
109	Honda Motor Co., Ltd	29	59	8,2	12,4	8,4
124	Ford Motor Company	30	63	9,3	11,3	9,4
256	Kia Motors Corporation	25	45	6,6	9,4	8,9

424	Nissan Motor Co., Ltd	32	69	9,4	13,3	9,1
521	Suzuki Motor Corporation	25	44	6,2	8	10,5
667	Subaru Corporation	25	45	7,9	8,7	8,5
722	Mahindra & Mahindra Limited	29	52	7,7	14,3	6,9
725	Tata Motors Limited	30	56	8,1	14,2	7,5
737	Renault SA	23	36	7	9	6,9
833	Dongfeng Motor Corporation	21	29	6,8	5,9	8,3
843	Great Wall Motors Company Limited	26	48	6,3	11,1	8,2
859	Geely Automobile Holdings Limited	18	19	5,4	6	6,5
912	Mazda Motor Corporation	28	57	7,1	11,8	9,2
976	Guangzhou Automobile Industry Group Co., Ltd	30	67	8,6	13,7	8,1
1158	Mitsubishi Motors Corporation	29	62	6,2	13,8	9,2
1512	Brilliance China Automotive Holdings Limited	31	70	8,5	13	9,9

Note. Note. Elaborated by authors using the data colleted from "The Global 2000" list published by Forbes (2023) and Yaho finance

Table 1 shows that the Total ESG Risk Index scores range from 18 (Geely) to 32 (Nissan). The majority of companies fall between 25 and 32, indicating moderate to high levels of ESG risk. Companies with the highest Total ESG Risk Index scores include Nissan (32), Brilliance China (31), General Motors (31), Ford (30) and Volkswagen (30), while companies with the lowest risk scores include Geely (18), followed by Dongfeng (21) and Renault (23).

Analysing risk scores by ESG category, the following findings were observed: General Motors has the highest environmental risk score of 10.3, while Tesla has the lowest score (2.8), suggesting that it has a lower environmental impact. However, Tesla faces significant challenges in the field of social responsibility, as it has the highest risk score in this area (16.2), closely followed by Mahindra (14.3) and Tata Motors (14.2). Finally, corporate governance is clearly a challenge for Brilliance China and Suzuki, whose scores of 9.9 and 10.5 respectively are the highest in the ranking.

Table 2 shows, in billions of dollars, the construction of a database with the financial variables that define company size, such as: sales, profits or earnings, total assets and market value.

Table 2 *Financial variables of automotive companies with ESG risk index.*

Company	Sales (US billions)	Profits (US billions)	Assets (US billions)	Market value (US billions)
Volkswagen AG	293,47	15,63	633,78	70,16
BMW AG	154,25	11,67	262,98	75,77
Tesla, Inc.	86,03	11,79	86,83	539
General Motors	160,74	9,39	267	46,23
Honda Motor Co., Ltd	124,68	5,38	182,97	44,94
Ford Motor Company	165,06	2,89	256,8	47,79
Kia Motors Corporation	70,17	4,96	58,29	26,04
Nissan Motor Co., Ltd	74,28	0,9826	128,5	14,52
Suzuki Motor Corporation	33,51	1,58	33,17	17,22

Subaru Corporation	26,95	1,23	29,16	12,57
Mahindra & Mahindra Limited	14,61	1,26	23,61	18,43
Tata Motors Limited	40,5	-0,5121	38,8	22,49
Renault SA	48,76	-0,3552	126,28	10,45
Dongfeng Motor Corporation	13,76	1,53	47,48	4,08
Great Wall Motors Company Limited	18,59	1,01	25,92	9,85
Geely Automobile Holdings Limited	21,84	0,7503	22,7	12,38
Mazda Motor Corporation	27,78	1,18	24,15	5,74
Guangzhou Automobile Industry Group Co., Ltd	16,3	1,21	27,39	6,36
Mitsubishi Motors Corporation	18,46	1,22	15,59	5,71
Brilliance China Automotive Holdings Limited	21,09	0,1154	18,55	2,52

Note. Elaborated by authors using the data colleted from "The Global 2000" list published by Forbes (2023).

In terms of financial analysis, the three companies with the highest sales are Volkswagen AG, which leads with $293.47 billion, followed by BMW AG with $154.25 billion and General Motors with $160.74 billion, while Tesla has relatively low sales ($86.03 billion) but a high market valuation ($70.16 billion). In matters of profitability, Volkswagen AG again leads ($15.63 billion), followed by Tesla ($11.79 billion), while Tata Motors (-0.5121 billion) and Renault (-0.3552 billion) posted losses. Finally, with $633.78 billion in assets, Volkswagen AG is in first place, almost twice as much as BMW ($262.98).

Based on the above information, and taking the total ESG risk index as a starting point, three areas of interest were identified for each of the three variables that determine the total score: Environmental Risk Score, Social Risk Score and Corporate Governance Risk Score. These scores are used to fit a multiple linear regression model to identify the effect of the variables sales, earnings or profits, total assets and market value on each of the sustainability criteria (environmental, social and corporate governance) used to calculate the total ESG risk index. The initial model is based on the expressions shown in Equations *(2)*, *(3)* and *(4)* below:

$$Enviromental\ Risk\ Score = \beta_0 + \beta_1 \times sales + \beta_2 \times profits + \beta_3 \times assets + \beta_2 \times\ market\ value + \varepsilon_i \quad (2)$$

$$Social\ Risk\ Score = \beta_0 + \beta_1 \times sales + \beta_2 \times profits + \beta_3 \times assets + \beta_2 \times market\ value + \varepsilon_i \quad (3)$$

$$Corporate\ Governance\ Risk\ Score = \beta_0 + \beta_1 \times sales + \beta_2 \times profits + \beta_3 \times assets + \beta_2 \times market\ value + \varepsilon_i \quad (4)$$

This model is based on a 90% confidence level.

The first step is to validate the assumptions of the multiple linear regression model. For the normality assumption, the Jarque and Bera (Toro et al.,2010) statistic was used and it was found that the p-value is greater than the 5% significance level, which fulfils the normality of the model; the Breusch-Pagan test was also run with a 95% confidence level, which found that the model is homoscedastic. The Durbin-Watson test was performed with a 95% confidence level to determine that the errors are not correlated (Villicana, 2007). Finally, multicollinearity was checked using the correlation matrix and scatter plots, which showed that the variables included in the model had sufficient correlations, allowing the model to be fitted with the selected variables.

Next, the following hypothesis tests H_0 and H_1 are used to determine whether the explanatory variables sales, profit, total assets and market value are significant in each of the sustainability criteria (environmental, social and corporate governance risk):

$H_0: \beta_1 = \beta_2 = \cdots \beta_n$ There is no variable explaining the response variable Y

$H_1: \beta_1 \neq \beta_2 \neq \cdots \beta_n$ There is at least one variable that explains the response variable Y

If the null hypothesis H_0 is accepted, the model is not explanatory, suggesting that none of the explanatory variables influence the response variable Y. However, if the null hypothesis H_0 is rejected, the model is explanatory, meaning that at least one of the explanatory variables influences the response variable Y. As a decision threshold to evaluate the null hypothesis and determine whether the variable is significant, p-values less than or equal to 10% are used.That

is, if the p-value is less than or equal to 10%, the null hypothesis is rejected, indicating that the variable is significant within the predicted sustainability score.

RESULTS

The multiple linear regression model explained in the previous section was run for each of the ESG Total Risk Index variables to find the corresponding coefficients for each of Equations (2), (3) and (4).

Table 3 shows the results obtained for the Environmental Risk Score variable with each of the explanatory variables.

Table 3 *Regression model results for the Environmental Risk Score variable.*

	Coefficients (β_i)	Standard error	T-statistic	Probability
Intercept	7.014	0.368	19.064	0.000
Sales	0.021	0.007	2.797	0.013
Profits	-0.233	0.137	-1.698	0.099
Market value	-0.006	0.003	-1.963	0.067

Note. Elaborated by authors, results obtained using EViews software.

Taking the column of coefficients from Table 3 and replacing it in the expression of Equation *(2)*, which means $\beta_0 = 7.014$, $\beta_1 = 0.021$, $\beta_2 = -0.233$ and $\beta_4 = -0.006$. This leaves Equation *(5)* as the new expression for the Environmental Risk Score.

$$Enviromental\ Risk\ Score = 7.014 + 0.021 \times sales - 0.233 \times profits - 0.006 \times market\ value \qquad (5)$$

A detailed analysis of Equation *(5)* shows that an increase in sales of one billion dollars has the effect of raising the Environmental Risk Score by 0.021, yet the same increase in profits or market value reduces this score by 0.233 and 0.006, respectively.

Similarly, the same procedure was followed for the Social Risk Score variable, running the same model to find the relationship with each of the explanatory variables. The results are presented in Table 4.

Table 4 *Regression model results for the Social Risk Score variable.*

	Coefficients (β_i)	Standard error	T-statistic	Probability
Intercept	10.661	0.678	15.714	0.000
Market value	0.010	0.005	1.756	0.096

Note. Elaborated by authors, results obtained using EViews software.

Again, the values from the column coefficients of Table 4 are replaced in the Equation *(3)*, i.e. $\beta_0 = 10.661$ and $\beta_4 = 0.010$, which finally gives the following expression (see Equation *(6)*):

$$Social\ risk\ score = 10.661 + 0.010 \times market\ value \qquad (6)$$

Looking at the results in Table 4, the first and most striking feature of the social risk component is the absence of three of the explanatory variables (sales, profits and assets), suggesting that they have no effect on the Social Risk Score. In this case, the only explanatory variable in this model is market value, where an increase of one billion dollars has the effect of increasing the Social Risk Score by 0.010.

Last, the regression model was run with the corresponding data for the corporate governance risk score variable, relating each of the financial statement explanatory variables in the same way as for the previous two components of the Total ESG Risk Index, and the results are shown in Table 5:

Table 5 *Regression model results for the Corporate Governance Risk Score variable.*

	Coefficients (β_i)	Standard error	T-statistic	Probability
Intercept	8.212	0.318	25.842	0.000
Profits	0.126	0.054	2.315	0.033

Note. Elaborated by authors, results obtained using EViews software.

The process of replacing the coefficients is repeated, as was done with the previous two components, but in Equation *(4)*, using the values indicated in Table 5 ($\beta_0 = 8.212$ and $\beta_2 = 0.126$) to reformulate the expression of the Corporate Governance Risk Score as shown in Equation *(7)*.

$$Corporate\ Governance\ Risk\ Score = 8.212 + 0.126 \times profits \qquad (7)$$

As in the case of the social risk factor, three of the explanatory variables included in the model have no effect on the corporate governance risk score. According to the results of the model, an increase in profits of one billion dollars raises the Corporate Governance Risk Score by 0.126.

CONCLUSIONS

The implementation of a multiple regression model to establish the relationships between the total ESG risk index, its environmental, social and corporate governance components, and the key financial statement variables (sales, net profit or income, total assets and market value), using information from the twenty largest companies in the world in the automotive sector, showed that the Environmental Risk Score variable rises in response to an increase in the net sales of the companies studied, while an increase in market value has a negative impact, reducing this score. Concerning the social risk variable, it was shown that only increasing market value increases this score. Finally, the corporate governance risk score is only affected by an increase in profits. It is important to note that a company's investment in assets showed no relationship with the criteria used to calculate the total ESG risk index.

Environmental, social and governance (ESG) ratings are closely linked to sales, profits and market value. For this reason, a high score gives a company a better reputation, attracting new customers and retaining existing ones. Similarly, good environmental and corporate governance practices can reduce costs, increase profit margins, and company value. In future research, it would be interesting to examine other financial variables unrelated to company size and the impact they may have on the Total ESG Risk Index and its components.

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