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Impact of internationalization on the financial risk of companies listed on B3: analysis of the moderating effects of ESG performance and periods of crisis

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Abstract

Objective: Analyze the relationship between international expansion and financial risk of publicly traded non-financial Brazilian companies, considering the moderating effects of ESG performance and periods of crisis.
Method: Brazilian non-financial companies listed on B3 were used as a sample from 2010 to 2020. Multiple linear regressions were performed with fixed or random effects and panel data, and corporate and macroeconomic variables controlled the results.
Results: Companies with more international expansion tend to present a higher total risk but lower systematic risk. It was also found that ESG performance negatively moderates the relationship between international expansion and financial risk. Furthermore, more internationalized companies with higher ESG performance tend to reduce their total risk in times of crisis. Thus, although internationalization can increase financial risk, ESG performance can be used to mitigate it, especially in times of crisis.
Contributions: The study contributes to the theory by indicating that international expansion is distinctly related to total and systematic risks in the context of Brazilian companies. Furthermore, research indicates that ESG performance and periods of crisis have a moderating effect on the relationship between internationalization and financial risk. It also has practical implications, as it can help managers whose companies are in the process of internationalization to use ESG performance as a strategy to mitigate the financial risk of these companies, especially in times of crisis.

Keywords: International expansion; Financial risk; ESG performance; Crisis periods.

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Introduction

The international expansion allows companies to have access to new consumer markets, thus making it possible for them to expand their potential for earning revenue, as well as to increase their economy of scale and scope and, with that, obtain competitive advantages. (Jain et al., 2019; Jana et al., 2018). Although it brings benefits, internationalization involves challenges for its implementation, such as the costs associated with this process that are necessary to maintain activities in the foreign market and agency conflicts, for example (Buckley & Strange, 2011; Jain et al., 2019).

In this sense, the process of international expansion is related to the financial risk of companies, given the favorable and unfavorable factors of operating in the foreign market (Jain et al., 2019; Kwok & Reeb, 2000; Saito & Hiramoto, 2010). However, the relationship between internationalization and financial risk is uncertain, as it can reduce or increase the company's risk, depending, for example, on the characteristics of the market for which it is internationalizing concerning the domestic market, mainly as regards to their level of development and the degree of correlation between these economies (Kwok & Reeb, 2000; Ribeiro et al., 2017). A better understanding of this relationship allows managers to maximize shareholder wealth and firm value, in addition to, for example, optimizing the process of obtaining loans (Ribeiro et al., 2017; Saito & Hiramoto, 2010).

On the other hand, based on the development of studies on corporate sustainability (Dyllick & Hockerts, 2002; Elkington, 1998), the performance of companies in the Environmental, Social and Governance (ESG) pillars is a theme that gained notoriety, mainly after the definition of the Sustainable Development Goals (SDGs), since it can contribute to achieving these goals (Ceballos et al., 2023). Therefore, for the company to have a positive ESG performance, it must carry out practices that contribute to environmental, social, and economic aspects (Shakil, 2020; Tang et al., 2012). In this sense, in addition to the benefits for society and the environment, companies that adopt good sustainability practices also tend to obtain an improvement in their institutional image, being able to reduce costs and increase their market value (Aboud & Diab, 2018; Shakil, 2020; Tang et al., 2012).

Studies indicate that the ESG performance of companies may be related to their financial risk, which represents an increase in risk for companies that have a lower ESG performance and a decrease in risk for those with a superior ESG performance (Mishra & Modi, 2013; Shakil, 2021). When internationalizing, companies face challenges of legitimacy in the foreign market when faced with new demands from stakeholders regarding sustainability (Aray et al., 2021; Suchman, 1995). In this sense, sustainable practices can help companies overcome the legitimacy problem when internationalizing (Aray et al., 2021; Park, 2018; Suchman, 1995).

Therefore, sustainability is expected to be a moderating effect on the relationship between internationalization and financial risk. In this sense, sustainability could contribute to the internationalization process by reducing the company's risk (Chakraborty et al., 2019; Shakil, 2021). This expectation occurs because more internationalized companies, which increase their ESG performance, can obtain benefits from sustainability, such as reducing operational costs, improving their risk management, improving their institutional image, as well as increasing legitimacy in the foreign market, which contributes to reducing risk (Chakraborty et al., 2019; Freeman, 2010; Jo & Na, 2012; Shakil, 2021).

During periods of crisis, it is expected that the benefits obtained from international expansion, added to the advantages of better ESG performance, allow companies that have higher levels of these characteristics to have advantages over others in terms of risk (Barney & Hesterly, 2011; Shakil, 2021). This relationship is expected due to the moral capital obtained by companies that carry out sustainable practices and, thus, tend to stand out concerning others in periods of instability (Chakraborty et al., 2019; Godfrey, 2005). In addition, due to the possibility of diversifying revenues and the benefits presented, internationalization can also help companies obtain advantages in periods of economic crisis, allowing them to reduce the risk in these periods (Barney & Hesterly, 2011; Godfrey, 2005).

In this sense, regarding the main relationship investigated in this study, it should be noted that there is a lack of research in the national and international literature that investigates the relationship between internationalization and financial risk and that there is still no consensus in the literature on the relationship between these variables, given the factors of international expansion that may contribute to the increase or decrease of risk, according to Boso et al. (2019) and Jain et al. (2019). As a result, ESG performance and periods of instability are expected to moderate the relationship between international expansion and financial risk. Thus, this study aims to analyze the relationship between international expansion and financial risk of publicly traded non-financial Brazilian companies and, based on this, to analyze the moderating effects of ESG performance and periods of instability in this relationship, considering the period from 2010 to 2020.

In this sense, the research contributes to the advancement of theory by analyzing variables that can moderate the

relationship between internationalization and financial risk, allowing empirical verification and the relationship of internationalization theories with the themes of sustainability and periods of instability. In addition, the research uses a time series model to estimate volatility, which considers the asymmetry of conditional variance, a variable used as a proxy for financial risk, unlike what Shakil (2021) proposed. The study also used the Degree of Internationalization (DOI) as a proxy for internationalization and a continuous variable for ESG performance.

The research also contributes practically, mainly to the management process of companies' international expansion, considering that the results allow managers to strategically plan the internationalization process, considering the financial risk and maximizing the company's value for shareholders. The results also allow managers to manage the company's ESG performance to enhance the effect of internationalization on reducing financial risk and obtain advantages in periods of crisis, allowing the company's survival in scenarios of uncertainties. Thus, increased ESG practices can benefit the environment, society, and the company.

2 Theoretical framework and hypotheses

2.1 International expansion and financial risk

In the process of internationalization of companies, in addition to the costs involved, for example, to maintain facilities abroad, the company's performance in a market other than the domestic one presents itself as a challenge given the characteristics of the new environment. In this sense, for them to internationalize, according to the Uppsala Internationalization Model, it is necessary that companies first seek to consolidate their activities in the domestic market, exploring it to the limit of its potential to allow business expansion (Johanson & Paul, 1975; Johanson & Vahlne, 1977). With this, these companies will get to know their market more intensely, acquiring experiences that will help them adapt to the new operating environment (Jain et al., 2019; Johanson & Paul, 1975; Johanson & Vahlne, 1977).

Still, according to the Uppsala Model, to facilitate this adaptation process, companies should expand their activities to international markets gradually, according to a plan carried out, considering the new information flows (Johanson & Paul, 1975; Johanson & Vahlne, 1977). In addition, companies should only start the internationalization process after securing a sufficient amount of internal resources that will allow them to operationalize it in line with the Pecking Order theory, which indicates a preference for using their resources to the detriment of third-party resources (Johanson & Wiedersheim-Paul, 1975; Myers & Majluf, 1984; Oliveira & Kayo, 2020; Pamplona et al., 2020). As a result, companies tend to have greater security during the international expansion process (Johanson & Paul, 1975; Johanson & Vahlne, 1977; Jain et al., 2019).

The Upstream-Downstream theory, proposed by Kwok and Reeb (2000), considers the effects of the internationalization of companies on the company's risk. According to the Downstream effect, companies located in developed markets, with greater levels of stability, and that expand their activities to less developed markets tend to increase their risk; this occurs due to the greater insecurity of the company starting to operate in markets that are less stable than the domestic one and which are associated, for example, with greater variations in market consumption (Kwok & Reeb, 2000; Saito & Hiramoto, 2010).

In addition, this insecurity is also related to the costs necessary for the international expansion process, which, when associated with internationalization to less stable markets, contribute to an increase in the company's risk (Kwok & Reeb, 2000; Saito & Hiramoto, 2010). These companies still tend to lower their debt levels, as lending rates will be higher due to increased risk. According to the Upstream effect, companies from emerging countries that expand their activities to more developed markets tend to reduce business risk due to less dependence on the domestic market since they will also operate in a market with greater stability (Kwok & Reeb, 2000; Saito & Hiramoto, 2010; Ribeiro et al., 2017).

Saito and Hiramoto (2010) confirmed the applicability of the Upstream-Downstream theory in Brazil and indicated that more internationalized Brazilian companies have higher levels of debt concerning companies with predominantly local activities. In turn, Ribeiro, Pereira and Ribeiro (2017) confirm that in the Brazilian context, there is a positive association between the degree of internationalization of these companies and their level of indebtedness, considering the macroeconomic and institutional effects. The stability of countries, however, did not prove to be relevant for explaining indebtedness, which differs from what was pointed out by Kwok and Reeb (2000).

In this sense, the internationalization of companies is used as a strategy to obtain competitive advantage since studies indicate that a company's performance in different countries from the domestic one can promote economies of scale and scope, increasing the firm's performance. However, it is emphasized that this view is not a consensus in the literature, considering that some studies indicate that the internationalization process is complex and involves increased costs, as well as an increase in agency conflicts, which can thus present a negative relationship

with performance (Buckley & Strange, 2011; Cardoso et al., 2018; Jana et al., 2018).

In addition to the relationship between internationalization and the performance of organizations, another factor associated with a competitive advantage is its relationship with systematic risk. In this sense, companies with higher levels of internationalization can mitigate their financial risk by diversifying the markets in which they operate, given that the economies are not perfectly related, including concerning their instabilities (Barney & Hesterly, 2011; Kim et al., 1993).

One of the risks related to the internationalization process is that the company may lose focus on the home market since its internal resources, such as organizational and financial ones, tend to be more overloaded. Furthermore, when the planning of the internationalization process and the risk management itself do not occur properly, there is also a risk of excessive internationalization; this can occur, for example, when companies try to take advantage of pioneering opportunities in a given market, which contributes to increased risk (Boso et al., 2019; Forsgren & Hagström, 2007; O'Reilly & Tushman, 2004).

Therefore, the fact that a company operates in more than one competitive environment can contribute, for example, to reducing its susceptibility to oscillations in supply and demand and even in the prices of raw materials, thus mitigating its risk. (Barney & Hesterly, 2011; Kim et al., 1993). However, the relationship between internationalization and risk is also not a consensus, as studies have found evidence that the international expansion process involves risks, such as political and exchange rate risks, which can outweigh the benefits of internationalization and, thus, increase its risk. (Jain et al., 2019; Reeb et al., 1998). Given the above, the following hypothesis was formulated:

Hypothesis 1: More internationalized companies tend to have a lower financial risk.

2.2 International expansion, ESG performance and financial risk in periods of instability

A company's ESG performance is determined based on three factors: economic, social, and environmental, and can be estimated using scores, which allows for a comparison between companies regarding this indicator (Díaz & Sedano, 2018; Shakil, 2020). In this way, this performance denotes that the company has responsibility concerning the environment, society, and its ability to remain economically profitable over time (Díaz & Sedano, 2018; Elkington, 1998).

A better ESG performance is associated with a decrease in information asymmetry, and, as a result, stock volatility tends to decrease in the face of increases in the performance of sustainable practices (Lueg et al., 2019; Shakil, 2020). This issue is also related to stakeholder theory, as it points out that greater investments in ESG practices motivate stakeholders to collaborate with the company's future, encouraging them to contribute with their resources, thus increasing shareholder wealth (Freeman, 2010).

Furthermore, companies with higher levels of ESG performance, in addition to contributing to the environment and the well-being of society and its employees, can also collaborate to improve their institutional image and reduce costs and, consequently, for better organizational performance (Tang et al., 2012). Moreover, there is evidence that ESG performance increases firm value (Aboud & Diab, 2018; Husted, 2005). However, the relationship between ESG performance and organizational performance can also be negative, given that the resources used to increase ESG performance could be used in activities that could add greater value to shareholders (Peloza, 2006).

Furthermore, there is evidence that companies with a positive ESG performance tend to present a lower unsystematic risk, while companies with a negative ESG performance tend to present a higher risk (Mishra & Modi, 2013). Systematic risk also tends to decrease when there is a positive ESG performance due to the company's risk management advantages, greater transparency, and easier access to the capital market (Jo & Na, 2012; Shakil, 2021).

According to stakeholder theory, as companies develop favorable environmental and social practices, developing their moral and ethical values intensifies, promoting their moral capital (Freeman, 2010; Godfrey, 2005). In this sense, faced with moments of instability in the market, companies that have superior ESG performance tend to stand out compared to the others and present a lower financial risk, according to the theory of risk management (Benlelih & Girerd-Potin, 2017; Chakraborty et al., 2019). Given this, the second hypothesis was established:

Hypothesis 2: There is a negative relationship between ESG performance and the company's financial risk.

When companies expand their activities to international markets, legitimacy is one of the challenges they face. This problem consists of differences in the perception of the stakeholders present where the company is internationalizing due to differences in customs and values between the domestic and international markets (Suchman, 1995). In this sense, the pursuit of internationalized companies for better sustainable performance, meeting stakeholders' requirements abroad, allows the problem of legitimacy to be mitigated (Aray et al., 2021; Ocasio, 1997; Park, 2018). With this, it is expected that, by minimizing the legitimacy problem through sustainability, the company can increase

the magnitude of its risk reduction when operating in a foreign market.

In this sense, the company's ESG performance is expected to affect the relationship between international expansion and financial risk negatively. In this way, ESG performance could be presented as a factor that would enhance the ability of the degree of internationalization to reduce the company's financial risk. This relationship would occur since companies that carry out more sustainable practices tend to lower their costs, be more transparent, have easier access to the capital market, and reduce legitimacy problems (Aray et al., 2021; Barney & Hesterly, 2011; Chakraborty et al., 2019; Jo & Na, 2012; Mishra & Modi, 2013; Shakil, 2021; Suchman, 1995). Given the above, Hypothesis 3 of the study was formulated:

Hypothesis 3: ESG performance negatively moderates the relationship between international expansion and financial risk.

The periods of the economic crisis are characterized by presenting a decrease in the demand of the consumer market, as well as greater uncertainty about the consolidation of the accounts receivable of the companies (Tsuruta, 2019). In this sense, it is expected that, in periods of crisis, companies tend to present a higher financial risk due to the uncertainties related to these periods of instabilities, as well as the greater insecurity of investors about the future of the companies and the greater volatility of the assets (Barney & Hesterly, 2011; Rizwan et al., 2020; Tsuruta, 2019). Then, Hypothesis 4 is formulated:
Hipótese 4: A positive relationship exists between crisis periods and companies' financial risk.

During periods of crisis, the most internationalized companies are expected to have advantages over the others in terms of risk. This advantage of more internationalized companies would occur due to their greater diversification of income obtained from operations in other markets. Therefore, these companies could use this benefit to help them overcome periods of instability in the market, such as greater uncertainties regarding demand and unpredictability regarding receivables (Barney & Hesterly, 2011; Jain et al., 2019; Jana et al. al., 2018). On this aspect, there is Hypothesis 5 of the study:

Hypothesis 5: Crisis periods negatively affect the relationship between international expansion and financial risk.

Still, those companies that have better ESG performance may also present a lower risk during periods of crisis than those that have lower sustainable performance, which contributes to international expansion in terms of reduced risk in periods of instability (Godfrey, 2005; Mishra & Modi, 2013; Shakil, 2021). The moral capital developed by companies with higher levels of sustainability may also allow them to have greater security during economic downturns (Chakraborty et al., 2019; Godfrey, 2005). In this sense, Hypothesis 6 is formulated:

Hypothesis 6: In periods of crisis, companies with higher levels of international expansion and ESG performance tend to present a lower financial risk.

3 Methods

3.1 Data and sample

The research objective required collecting data from Brazilian companies that are publicly traded, both active and inactive. The data source was the Thomson Reuters Refinitiv Eikon platform. Economic and financial data were collected quarterly, and stock closing prices were daily. The macroeconomic variables Gross Domestic Product (GDP) and inflation (INF) were collected from the Brazilian Institute of Geography and Statistics (IBGE).

The data analysis covered the period from 2010's first quarter to 2020's fourth quarter. The choice of this interval was based on the adaptation of the Brazilian accounting legislation to the International Financial Reporting Standards (IFRS) in 2009 and the latest release of the Degree of Internationalization (DOI) data by Fundação Dom Cabral (FDC) in 2020. The initial sample consisted of 603 publicly traded Brazilian companies, both active and inactive. Then, companies from the financial sector were excluded due to their specificities, such as their revenues, which would represent outliers in the sample concerning other sectors, which could affect the results obtained, and the sample was composed of 326 companies. Due to the availability of ESG index data, the final sample consisted of 68 companies whose index is made available by Thomson Reuters.

3.2 Method

The outliers of the sample were treated using the Winsorizing technique at the 2% level, except for the variables total risk (stock volatility) and Crisis (periods of crisis). In these cases, it was decided not to treat the outliers since, regarding the total risk, the extreme values of the price series are of interest to the research, and the Crisis variable consists of a dummy variable. For data analysis, a multiple linear regression (MLR) was used with the data arranged in a panel through the Stata software to verify the relationship between internationalization and risk and the moderating effects of sustainability and periods of crisis.

The moderation between variables was tested by multiplying between the internationalization and sustainability variables and then multiplying between the internationalization and crisis variables. Finally, the multiplication between internationalization, sustainability,

and crisis was carried out, which allows verifying the joint effects of these variables on the dependent variable. To define the most appropriate model of MLR between Fixed Effects, Random Effects, or Pooled, the Breusch-Pagan, Chow and Hausman tests were performed (Wooldridge, 2016).

The presence of multicollinearity between the regression variables was tested using the Variance Inflation Factor (VIF), while the Wald test was used to verify the presence of heteroscedasticity and the Wooldridge test to verify the presence of autocorrelation. As a result, it was found that there is no multicollinearity between the model variables, considering that, both for the linear models and for the interaction models between variables, the VIF presented values lower than 10, meeting the criteria of Gujarati (2011). In addition, it was found that the models showed autocorrelation and heteroscedasticity. However, the problems were treated using the technique of clustered robust standard errors (Gujarati, 2011; Stock & Watson, 2003; Wooldridge, 2016).

3.3 Study variables

3.3.1 Dependent variables

This study used two dependent variables as proxies for financial risk. The first variable is the total risk, which consists of a certain company's specific risk, represented by the volatility of the price of the company i's shares, whose estimation already contemplates the unsystematic risk. Moreover, the second variable consists of the company's systematic risk (the non-diversifiable risk).

In addition, stock price volatility was estimated using the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. Stock quotations were used daily to carry out this estimation, first checking whether the price series used were stationary. For this, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were performed, and, in case of divergence between the test results, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test was performed, which confirmed that the series is stationary.

After verifying the stationarity of the price series, the model adjustment for each was defined based on the autoregression of stock returns, and then, the volatility was estimated using EGARCH. Subsequently, it was verified, using the ARCH-type test, with ten lags, whether the heteroscedasticity was solved by applying the conditional variance model. The volatility was converted from a daily to a quarterly basis to match the quarterly frequency of the corporate variables by taking the average for each quarter; this was done after solving the heteroskedasticity problem. Notably, the data were used at the highest frequency available on the Eikon platform due to the considerable fluctuations over time of the dependent variables.

The EGARCH model was selected for estimating the conditional variance since it manages to capture asymmetries in volatility; that is, unlike the other models of the GARCH family, the EGARCH does not restrict that its equation coefficients are exclusively positive (Bollerslev, 1986; Engle, 1982; Nelson, 1991; Thampanya et al., 2020). It is also noteworthy that the fact of capturing volatility and leptokurtosis clusters, this model allows greater suitability for this research, which considers the analysis of the influences of periods of instabilities on risk. The second proxy variable for financial risk is the market beta variable, collected in Economática quarterly.

3.3.2 Variables of Interest

Three variables are of research interest in this study: internationalization, sustainability, and periods of crisis. For internationalization, the Degree of Internationalization (DOI) was used as a proxy, which considers the degree of internationalization of companies based on the number of assets, employees, and revenues abroad. The variable was collected from the Ranking of Brazilian Multinationals reports published by the FDC in the annual frequency and converted to the quarterly frequency through the use of the respective value for the quarters of the period.

The Refinitiv Eikon ESG index was used for sustainability, consisting of a scale from 0 to 100, according to each evaluated company's environmental, social, and governance (ESG) performance. Data are available in annual frequency and were converted to quarterly by using the respective value for the quarters of the period, as performed by Brandon et al. (2021). The index was selected because it uses three factors that reflect the company's sustainability performance and also because it presents itself as the most reliable metric of ESG performance (Bătae et al., 2021; Shakil, 2021; Refinitiv Eikon Datastream, 2022).

On the other hand, the crisis consists of a dummy variable for periods of economic instability, that is, periods that tend to present a reduction in GDP and uncertainties regarding the macroeconomic environment and the activities of companies, especially concerning their receivables (Tsuruta, 2019). Therefore, the value 1 was attributed to the crisis quarters and 0 to the periods not characterized as crises. The definition of crisis periods was based on the quarters in which the country's Gross Domestic Product (GDP) was negative, as well as based on the World Bank (2022) and studies by Amorim Neto (2016), Barbosa Filho (2017) and Franzotti and Valle (2020).

Thus, the fourth quarter of 2014, the four quarters of 2015, and the first quarter of 2016 were considered periods of crisis, which are periods related to the reduction of Brazilian economic activity due to shocks between supply and demand in the market and the crisis political

and economic. The first and second quarters of 2020 were also considered periods of crisis, which are related to the impacts of the SARS-CoV-2 virus pandemic on the economy (Amorim Neto, 2016; Barbosa Filho, 2017; Franzotti & Valle, 2020; World Bank, 2022).

3.3.3 Control variables

In the econometric model, corporate (accounting and financial) and macroeconomic variables were added to control possible influences of factors that can also be related to financial risk, which were collected quarterly. Table 1 presents the summary of the variables used in the study, in addition to the presentation of the acronyms, calculation method, expected relationship with the dependent variable, and the authors who used these variables in the econometric model.

Table 1 – Description of study variables

Acronym	Variable	Calculation	Expected relationship	Authors
Dependent variables				
TR	Total risk	Stock return volatility by the EGARCH method: (EGARCH)*100		Engle (1982); Bollerslev (1986); Nelson (1991); Thampanya et al. (2020)
SR	Systematic risk	Market beta: $\beta_i = \frac{COV(R_i, R_m)}{VAR(R_m)}$ *		Benlemlih et al. (2018); Shakil (2021)
Variables of interest				
DOI	Degree of Internationalization	[(Overseas Assets / Total Assets) + (Overseas Revenues / Total Revenues) + (Overseas Employees / Total Employees)] / 3	-	Ietto-Gillies (1998); Andrade e Galina (2013)
ESG	ESG performance	Thomson Reuters Environmental, Social and Governance (ESG) Index	-	Bae et al. (2021); Shakil (2021).
CR	Periods of crisis	Dummy variable: 1 for crisis periods.	+	Amorin Neto (2016); Barbosa Filho (2017); Franzotti e Valle (2020); World Bank (2022)
Control variables				
SIZE	Company size	ln(total assets)	-	Shakil (2020); Shakil (2021)
IND	Indebtedness	(Current liabilities + non-current liabilities) / total assets	+	Alaoui et al. (2017); Shakil (2021).
ROE	Return on equity	Net income after tax/equity	-	Alaoui et al., 2017; Thampanya et al., 2020
SMR	Stock market return	Ibovespa quarterly return	-	Mittnik et al. (2015); Alaoui et al. (2017)
GDP	Gross Domestic Product	Quarterly GDP growth rate	-	Alaoui et al. (2017); Thampanya et al. (2020)
INF	Inflation	The quarterly growth rate of the Consumer Price Index	+	Mittnik et al. (2015); Thampanya et al. (2020)

Note: * β_i: beta coefficient of asset i; COV(R_i, R_m covariance between the return on asset i and the market return; VAR(R_m): market return variance.

Source: Prepared by the authors.

Below, the econometric models used in this study are presented, in which: i represents the company; t represents the quarter; β_0, the intercept; β_n, the angular coefficients; ω represents the control by sector; ∂ symbolizes control for time; and ε, the error.

$$FR_{it} = \beta_0 + \beta_1(DOI_{it}) + \beta_2(ESG_{it}) + \beta_3(CR_t) + \beta_4(SIZE_{it}) + \beta_5(IND_{it}) + \beta_6(ROE_{it}) + \beta_7(RMA_t) + \beta_8(GDP_t) + \beta_9(INF_t) + \omega + \partial + \varepsilon_{it} \quad \text{(Model 1)}$$

$$FR_{it} = \beta_0 + \beta_1(DOI_{it}) + \beta_2(ESG_{it}) + \beta_3(CR_t) + \beta_4(DOI * ESG_{it}) + \beta_5(SIZE_{it}) + \beta_6(IND_{it}) + \beta_7(ROE_{it}) + \beta_8(RMA_t) + \beta_9(GDP_t) + \beta_{10}(INF_t) + \omega + \partial + \varepsilon_{it} \quad \text{(Model 2)}$$

$$FR_{it} = \beta_0 + \beta_1(DOI_{it}) + \beta_2(ESG_{it}) + \beta_3(CR_t) + \beta_4(DOI * CR_{it}) + \beta_5(SIZE_{it}) + \beta_6(IND_{it}) + \beta_7(ROE_{it}) + \beta_8(RMA_t) + \beta_9(GDP_t) + \beta_{10}(INF_t) + \omega + \partial + \varepsilon_{it} \quad \text{(Model 3)}$$

$$FR_{it} = \beta_0 + \beta_1(DOI_{it}) + \beta_2(ESG_{it}) + \beta_3(CR_t) + \beta_4(DOI * ESG * CR_{it}) + \beta_5(SIZE_{it}) + \beta_6(IND_{it}) + \beta_7(ROE_{it}) + \beta_8(RMA_t) + \beta_9(GDP_t) + \beta_{10}(INF_t) + \omega + \partial + \varepsilon_{it} \quad \text{(Model 4)}$$

Still, regarding the econometric models, concerning the variables, there are the following acronyms: SIZE: Size of the company; IND: Indebtedness; ROE: Return on Equity; SMR: Stock Market Return; GDP: Gross Domestic Product; INF: Inflation. The acronym FR indicates the Financial Risk, represented by the proxies' volatility and market beta, while the DOI indicates the degree of internationalization. The acronyms DOI*ESG, DOI*CR, and DOI*ESG*CR represent the multiplication between the variables internationalization and sustainability; internationalization and crisis; and internationalization, sustainability, and crisis, respectively, to test the moderation of the variables.

4 Analysis of results

Table 2 presents the descriptive statistics of the study variables before the treatment of outliers. The dependent variables, total and systematic risks, have 3,036 and 1,357 observations, respectively. The variable of interest DOI, whose data were collected at FDC, is the one that presents the lowest number of observations in the sample.

Table 2 - Descriptive statistics of variables

Variable	Comments	Average	Median	Standard deviation	Minimum	Maximum
TR	3,036	0.0777087	0.0500274	0.2155065	0.0004653	11.09515
SR	1,357	0.9156315	0.8504626	0.3860825	0.101097	2.301118
DOI	760	0.2328647	0.223	0.1904156	0.0001	0.76
ESG	2,388	51.68626	52.91757	19.50426	2.469258	89.93303
CRISIS	3,036	0.1818182	0	0.3857581	0	1
IND	3,036	0.6428969	0.5939445	0.4513476	0.0753201	7.457941
ROE	3,031	0.0382423	0.0289785	0.4307983	-4.408585	19.71479
SMR	2,967	0.0201811	0.0293475	0.1225074	-0.3687554	0.301967
GDP	3,036	0.2446632	0.4410979	2.117345	-8.960978	7.714445
INF	3,036	0.4646934	0.4366468	0.2748215	-0.1433253	1.259974

Source: Prepared by the authors.

Regarding the proxy variable for internationalization, it is observed that the average value of the degree of internationalization of the Brazilian companies that make up the sample is approximately 0.2 on a scale of 0 to 1. In addition, there is a considerable variation in the degree of internationalization of Brazilian companies when analyzing the coefficient of variation (81.77%) from the standard deviation and the average of their values and observing the difference between their minimum and maximum values.

Regarding the ESG variable, which presented 2,388 observations, it is noted that Brazilian companies have, on average, 52 points on a scale from 0 to 100. This variable also presents a considerable variation between Brazilian companies (coefficient of variation of 37.77%).

Table 3 presents the Spearman correlation matrix between the variables. It is observed that the DOI variable did not present a statistically significant correlation with the total risk and systematic risk variables, indicating the rejection of Hypothesis 1. The ESG variable, on the other hand, presented a negative correlation between the total risk and the systematic risk, showing greater strength with systematic risk. Both relationships have statistical significance at the 5% level, which indicates that Hypothesis 2 is not rejected. In turn, the crisis variable showed a positive correlation, with statistical significance, with the total risk variable, although its correlation with the systematic risk did not show significance.

Table 4 presents the research results regarding using multiple linear regression with panel data, with the analyses performed under the ceteris paribus condition.

Table 3 - Spearman correlation matrix

	TR	SR	DOI	ESG	CRISIS	IND	ROE	SMR	GDP	INF
TR	1.0000									
SR	0.1844*	1.0000								
DOI	0.0497	0.0401	1.0000							
ESG	-0.1127*	-0.3825*	-0.1198*	1.0000						
CRISIS	0.0965*	-0.0049	0.0227	-0.0183	1.0000					
IND	0.3861*	0.3414*	0.1652*	-0.1919*	0.0324	1.0000				
ROE	0.0068	0.0276	0.0133	-0.0053	0.0436*	0.0172	1.0000			
SMR	0.0154	0.0191	0.0588	0.0071	-0.1351*	0.0424*	0.0102	1.0000		
GDP	-0.0581*	0.0210	-0.0392	0.0049	-0.5537*	-0.0158	-0.0166	-0.1611*	1.0000	
INF	0.0185	-0.0166	-0.0548	-0.0167	0.2464*	-0.0354	0.0243	-0.0544*	0.2209*	1.0000

Note: * indicates statistical significance level at 5%.
Source: Prepared by the authors.

Table 4 – Moderating effects on the relationship between internationalization and financial risk

Model	1	2	3	4	5	6	7	8
Y	Total risk				Systematic risk			
DOI	0.0097*	0.0266***	0.0100*	0.0099*	-0.2695	0.1585	-0.4835*	-0.4840*
ESG	-0.0006	-0.0014**	-0.0007	-0.0007*	-0.0045*	-0.0098***	-0.0088**	-0.0088**
CR	0.1994***	0.1883***	0.1789***	0.1781***	0.3180**	0.1027	0.4552*	0.4543*
DOI*ESG		-0.0003**				-0.0019**		
DOI*CR			-0.0066				-0.0015	
DOI*ESG*CR				-0.0001*				-0.0000
SIZE	-0.0104	-0.0070	-0.0075	-0.0068	-0.0514	0.0067	-0.1681	-0.1678
IND	0.1846***	0.1877***	0.1881***	0.1878***	-0.0359	-0.0276	-0.0578	-0.0577
ROE	-0.0033	-0.0038	-0.0044	-0.0033	0.0728	0.0456	0.1601***	0.1604***
SMR	0.0430	0.0342	0.0380	0.0367	0.2684**	0.1000	0.3781*	0.3774*
GDP	0.0046	0.0038	0.0042	0.0041	0.0241**	0.0093	0.0331*	0.0330*
INF	0.0062	0.0044	0.0052	0.0050	0.0315	-0.0067	0.0550	0.0548
Constant	0.2328	0.1928	0.1657	0.1516	2.2429**	0.9833	5.5172	5.5112
Dummy for time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dummy for the sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Effect	Fixed	Fixed	Fixed	Fixed	Random	Random	Fixed	Fixed
Comments	599	599	599	599	359	359	359	359
R^2 within	0.6338	0.6442	0.6402	0.6415	0.2272	0.1982	0.3644	0.3644
R^2 between	0.1118	0.1429	0.1358	0.1417	0.5647	0.6561	0.1089	0.1089
Breusch-Pagan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Chow	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hausman	0.0000	0.0000	0.0000	0.0000	0.2087	0.7047	0.0001	0.0221
VIF Medium	3.15	3.93	3.20	3.18	3.69	4.23	3.76	3.74
Wooldridge	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels.
Source: Prepared by the authors.

The DOI variable, a proxy for internationalization, showed a positive relationship with total risk; this relationship showed statistical significance for an alpha of 10% in models 1, 3, and 4 and at the 1% level in model 2. Thus, based on model 1, for example, for each unit that the DOI increases, the total risk will tend to increase, on average, 0.0097 units, while the systematic risk will tend to decrease, on average, 0.4835 units, based on model 7. Thus, Hypothesis 1 of the study is partially confirmed, indicating a negative relationship between the variables. A possible explanation for the companies' total risk tending to increase as internationalization increases is that, when expanding internationally with strategies related to assets abroad, employees abroad, and revenues abroad, they are subject to increased costs to maintain international activities. Furthermore, these companies are more exposed to political and currency risks, as Reeb et al. (1998) and Kwok and Reeb (2000) pointed out.

According to the Downstream theory, another possible justification for this relationship is that Brazilian companies are expanding their activities to markets that are less developed than Brazil and have less stability and greater fluctuation in demand concerning the domestic market. Also, when companies go international without carrying out adequate planning, the risk of international expansion tends to be greater, as stated by Boso et al. (2019) and Jain et al. (2019). As a result, investors may become insecure about the ability of companies to overcome the challenges involved in the internationalization process, and, therefore, stock price volatility will tend to increase.

However, when observing the DOI relationship with the systematic risk, it is noted that the relationship was negative in models 7 and 8 with statistical significance at the 10% level. This difference concerning the total risk is probably because the total risk considers explicitly each company's risk. Systematic risk, on the other hand, considers the company's risk, which increases its degree of internationalization concerning other companies in the market, according to the covariance of assets.

Thus, by increasing the degree of internationalization, the systematic risk of Brazilian companies tends to decrease. This relationship is possibly due to the advantages that the most internationalized companies have concerning the other assets in the market, which have a lower level of international expansion. Among the benefits of internationalization that can contribute to reducing systematic risk are less dependence on the domestic market, economies of scale and scope, as well as possible better performance and competitive advantage, as asserted by Barney and Hesterly (2011) and Cardoso et al. al. (2018).

Regarding the ESG performance variable, it is observed that it presented a negative and statistically significant relationship with the total risk, in models 2 and 4, and with the systematic risk, in models 5 to 8, confirming Hypothesis 2 of the study. According to model 2, for example, for each unit that the company's ESG increases, the total risk will tend to decrease, on average, by 0.0014 units. On the other hand, with model 5, the systematic risk will tend to decrease, on average, by 0.0045 units. A possible reason why total risk and systematic risk tend to decrease in the face of increases in companies' ESG performance is that, by increasing the performance of sustainable practices, the company can reduce its operating costs and information asymmetry, in addition to obtaining gains institutional image, as explained by Tang et al. (2012), Shakil (2020) and Shakil (2021). In this way, the volatility of the shares and the market Beta will tend to decrease, considering that investors expect the company to obtain the benefits arising from the higher ESG performance.

The crisis variable showed a positive relationship with the total and systematic risks, so model 6 was the only one that did not show statistical significance, thus confirming Hypothesis 4. In this sense, when the country is in periods of economic crisis, total risk and systematic risk will tend to increase, on average, by 0.1994 and 0.3180, respectively, according to models 1 and 5, thus confirming Hypothesis 4. Thus, in periods of crisis, the financial risk of companies, whether total or systematic, tends to increase. Possibly, the relationship occurs since, in negative periods, there is a tendency to reduce market demand and increase uncertainties regarding the macroeconomic environment, as pointed out by Tsuruta (2019), and therefore, the financial risk of companies tends to increase.

As for the variable DOI*ESG, which refers to the interaction between internationalization and sustainability, it is observed that it presented a negative relationship with the total risk and the systematic risk, finding both relationships with significance at the level of 5 %. In this case, Hypothesis 3 of the study is confirmed since the negative moderating effect of ESG performance on the relationship between internationalization and financial risk was verified. Total risk and systematic risk decrease, on average, by 0.0003 and 0.0019, respectively, for each unit that the DOI*ESG variable increases, it appears that, although more internationalized companies tend to increase their total risk when the international expansion process is carried out in conjunction with increases in ESG performance, the total risk will tend to decrease.

It is important to highlight that the benefits of increased ESG performance, such as improvements in corporate image and reduction of information asymmetry, can allow the company to reduce its total risk, despite the difficulties faced due to the increase in the degree of internationalization, such as the increase in costs and increase in exchange rate risks, which are associated with a trend towards an increase in total risk. Although increases in DOI tend to reduce systematic risk, increasing ESG performance makes the potential for reducing systematic

risk even more evident since the significance level of this relationship is 5% due to the benefits of sustainability.

The DOI*CR variable, which indicates the interaction between the DOI variables and periods of crisis, did not show statistical significance in the relationships with total risk and systematic risk, indicating that more internationalized companies do not stand out concerning others in periods of crisis, and Hypothesis 5 is rejected. Concerning the variable DOI*ESG*CR, which refers to the interaction between internationalization, ESG performance, and periods of crisis, there is a negative relationship with the company's risk, presenting statistical significance at the level of 10%, thus confirming Hypothesis 6. Thus, for each unit that the DOI*ESG*CR variable increases, the total risk will decrease, on average, by 0.0001 units.

Although internationalization does not allow companies to gain advantages in periods of crisis, when international expansion is associated with higher levels of ESG performance, they tend to stand out compared to others in terms of reducing total risk during these periods. Thus, the benefits promoted by sustainability can contribute to the internationalization process so that, during periods of crisis and with greater instabilities regarding the consumption pattern, these companies can stand out through institutional image gains and less dependence on the domestic market, for example, contributing to reduce the volatility of stocks.

The interaction between the three variables was not significant in the models in which the explained variable represented the systematic risk. Regarding the control variables, it is observed that leverage presented a positive relationship with total risk. Return on equity (ROE), stock market return (SMR), and Gross Domestic Product (GDP) showed a positive relationship with total risk. Notably, the results were controlled by the effects of time and the sector of activity of the companies.

Table 5 summarizes the hypotheses investigated in this study and the empirical results obtained regarding their confirmation or rejection.

Table 5. Summary of hypotheses.

Assumptions	Empirical results
H1: More internationalized companies tend to have a lower financial risk	Partially confirmed
H2: There is a negative relationship between ESG performance and the company's financial risk	Confirmed
H3: ESG performance has a negative moderating effect on the relationship between international expansion and financial risk	Confirmed
H4: There is a positive relationship between periods of crisis and the financial risk of companies	Confirmed
H5: Crisis periods have a negative moderating effect on the relationship between international expansion and financial risk	Rejected
H6: In times of crisis, companies with higher levels of international expansion and ESG performance tend to have lower financial risk	Confirmed for full risk

Source: Prepared by the author.

Therefore, the results indicate that, although internationalization can increase the company's total risk, developing sustainability practices can reduce total and systematic risks due to its benefits. In this way, when developed jointly, sustainability and internationalization can provide advantages for companies concerning reducing financial risk. In addition, the development of both practices simultaneously can contribute to the reduction of total risk even during periods of economic crisis, characterized by increasing financial risk, highlighting the contributions of internationalization and sustainability for companies, such as revenue diversification and improvement of the institutional image.

5 Conclusions

This research aimed to analyze the relationship between internationalization and the financial risk of Brazilian companies listed on B3, as well as the moderating effects of ESG performance and periods of crisis. For this, multiple linear regression with fixed or random effects and with panel data was used. The results indicate that the degree of internationalization of companies has a positive relationship with the company's total risk. However, it has a negative relationship with its systematic risk. A negative relationship was also found between ESG performance and financial risk, and a positive relationship between periods of crisis and financial risk.

Regarding the moderating effects, the results showed that although internationalization increases the total risk due to the challenges related to activities abroad, the total risk tends to decrease when the international expansion process is associated with sustainability practices. In addition, it was found that Brazilian companies with a greater degree of internationalization and higher levels of ESG performance have advantages over others concerning reducing their total risk during periods of economic crisis.

This study contributes to the theory by exploring the relationship between internationalization based on a multidimensional proxy, the Degree of Internationalization (DOI), financial risk, the results controlled by corporate and macroeconomic variables, and the effects of time and sector. As for financial risk, two proxies were used, the volatility of stock returns, estimated by EGARCH, representing the company's total risk, and the market Beta, which represents the systematic risk. In addition, the moderating effects of ESG performance and periods of the economic crisis on the relationship between internationalization and financial risk were analyzed for the first time.

The study also makes a practical contribution, for example, to investors who can benefit from the results presented, as they can use the company's degree of

internationalization or ESG performance to obtain greater alignment concerning the risk of the asset and the desired return. Credit agencies can also use the results to optimize the companies' risk classification process.

Thus, in addition to contributing to this process, better development of sustainable practices promotes benefits for society, the environment, and the company's profitability over time, in addition to reducing risk in periods of economic crisis. Therefore, internationalization and sustainability can help companies overcome environmental instabilities due to their benefits in these periods when companies are more vulnerable.

From the limitations identified in this research, it is suggested that future studies analyze the relationships that were the target of this study, using other proxies for internationalization, such as external debt and issuance of American Depositary Receipt (ADR), which are not contemplated by the DOI. The application of the Diff-in-Diff methodology is also suggested, based on the issuance of ADRs, for example, to investigate the relationship between internationalization and financial risk. In addition, since measurement errors can occur in ESG indices, it is suggested to use other proxies for this variable, such as those from Bloomberg and Sustainalytics.

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