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Article

The Explanatory Factors of Risk Disclosure in the Integrated Reports of Listed Entities in Brazil

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Abstract: The gaps observed in entities' traditional reports and accounts led to the emergence of the integrated report (IR), which includes several content elements, namely the component relating to risks and opportunities. Within this scope, the specific risks that may affect an organization's capacity to create value are disclosed, among others, which is information of interest to the different stakeholders. This paper aims to identify the explanatory factors that influence the disclosure of risks in IRs. For this purpose, the IRs of entities listed on the Brazilian stock exchange for the year 2020 were assessed. The study was based on the explanatory theories of risk disclosure usually found in the literature, namely, the legitimacy, the agency, the signaling, and the upper echelon theories. Linear regression models were used with the disclosure rates of different types of risk as dependent variables. The size, profitability, indebtedness, independence, and gender diversity in the board of directors (BD), audit, and activity sector comprised the selected explanatory factors. Associations were found between some of the types of risks disclosed and the size of the entity, the existence of an audit, the independence of the BD, and the activity sector. The paper contributes to the literature about the explanatory factors of risk disclosure by exploring its analysis with different typologies and attributes, having the IR as a source of information, which is still little explored. The scientific contribution encompasses proposing a new risk analysis model in the IR. The innovative elements also comprise the classification of risks related to sustainable development (SD), including environmental, social, and governance (ESG) factors.

Keywords: Brazil; disclosure; explanatory factors; integrated reporting; risk

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1. Introduction

The globalization of the economy, technological changes, and the increase in regulations have led to a significant change in the scenario of entities. In addition, the financial crisis has highlighted the shortcomings of traditional financial reporting, which does not correspond to the current information needs felt by users (Adhariani and De Villiers 2019). According to the International Integrated Reporting Council (IIRC 2021a), entities, increasingly inserted in other markets at a global level, have realized the relevance of the dissemination of social responsibility (SR) and sustainable development (SD) information.

In this context, several entities have presented proposals for the elaboration of references for the issuance of non-financial information reports, such as the Global Report Initiative (GRI) and the Institute of Social and Ethical Accountability (ISEA) (Bakarich et al. 2020; Hamad et al. 2020). Considering the limitations and need for improvement in the reporting model, the IIRC also appeared in 2010. The main objective of this institution is to develop a reporting model, called integrated reporting (IR), which contains indicators and principles from which entities can transparently and reliably measure and disclose their economic, social, and environmental performance (IIRC 2021c).

According to the IIRC, IR can be defined as "a concise communication about how an organization's strategy, governance, performance and prospects, in the context of its

external environment, lead to the creation, preservation or erosion of value over the short, medium and long term" IIRC (2021b, p. 10). To ensure the flexibility of the guidelines to different countries' and entities' contexts, the international structure of the IIRC established an approach based on principles, fundamental concepts, and content elements, thus presenting the guidelines for a new reporting model (Hamad et al. 2020). In this sense, the IR structure includes seven guiding principles, three fundamental concepts, and eight content elements, among which are risks and opportunities (IIRC 2021b).

According to the IIRC (2021b), the content regarding element risks and opportunities aims to answer the question of what are the risks and opportunities that affect the ability of an entity to generate value in the short, medium, and long term, as well as how it deals with this risk and these opportunities. Additionally, in this context, the continuous analysis of an entity's external environment, in the context of its mission and vision, allows the identification of risks and opportunities relevant to the entity's strategy and business model.

More broadly, risk can be defined as the possibility that an event occurs and negatively impacts an entity's ability to achieve previously established objectives Committee of Sponsoring Organizations of the Treadway Commission (COSO 2017). In this context, an entity's approach to real risks, whether in the short, medium, or long term, which are essential to its ongoing ability to create value and which can have serious consequences, is usually included in IR, even if the probability of their occurrence is minimal (IIRC 2021b). Thus, it is up to the entities that disclose RI to analyze their business model and identify the external and internal risks that should be disclosed in the report.

In line with the perspective of information users, the disclosure of information about risks and opportunities emerges as the most significant of the content elements (Al Amosh and Mansor 2021). In this context, studies on IR with a focus on risk are found. In these studies, the authors seek to understand the characteristics and level of risk disclosure in IR (Guthrie et al. 2020), analyze the relationship between organizational strategy and risk (Manes-Rossi et al. 2017), or analyze the relationship between risk and disclosure of future perspectives (Lakshan et al. 2021).

In this context, the present study emerges, which starts from the following research question: what are the explanatory factors of the disclosure of the different types of risk in IR by the entities listed in Brazil? To answer this, the main objective of this study is to assess the characteristics of the entities that potentially influence the disclosure of the different types of risk in IRs. In this sense, the present study focused on the disclosure of risk in IR made by Brazilian entities in 2020, and the entities were selected according to the IBX100 stock index of the Brazilian Stock Exchange (B3).

To fulfil the main objective, the study contemplated the following specific objectives:

- Identify and analyze the different typologies and attributes of risks disclosed in IR by the entities in the sample;
- Identify and select theories related to risk disclosure, as well as explanatory factors underlying selected theories that are potentially associated with risk disclosures in IR by the entities analyzed in this study;
- To analyze the existence of associations between explanatory factors and risk disclosure in IR.

In this study, the explanatory theories of risk disclosure usually found in the literature were used as underlying theories, namely the legitimacy, the agency, the signaling, and the higher echelons theories. Linear regression models were used, complemented by descriptive statistical techniques and nonparametric tests of differences, more specifically the Mann–Whitney test. As dependent variables, indices of disclosure of the different risk typologies present in IR were constructed. The size, profitability, indebtedness, weight of independent members, and gender diversity in the board of directors (BD), audit, and activity sector comprised the selected explanatory factors.

The descriptive analysis found a still low level of disclosures of matters related to risk, compared with what was expected, considering the proposal of this study. Furthermore, the findings from the linear regression models indicate an association between some of the

types of risks disclosed and an entity's size, as well as the number of independent members of the BD and the activity sector.

The relevance of this study is based on the discussion in recent years about the need to prepare a comprehensive report which incorporates both financial and non-financial information, with particular emphasis on risk disclosure. It is important to highlight that the disclosure of IRs, by the entity's object of analysis of this study, is carried out voluntarily. In this way, the content analysis of the IR, specifically the risk, contributes to the understanding of the information disclosed by the entities and whether such disclosures comply with the framework proposed by the IIRC. This paper contributes to the literature on the explanatory factors of risk disclosure by exploring its analysis with different typologies and attributes, with IR as a source of information, content that is still little explored. The small number of studies dedicated to the analysis of the disclosure of content elements in IR and, more specifically, on the disclosure of risks (Manes-Rossi et al. 2017), allows this research to be relevant in the context of the literature on the subject. In this context, it is also important to highlight, as a novelty of the present study, the detailed analysis of the different typologies and attributes of the risk disclosed in IRs, using an approach not yet found in the literature. Additionally, it includes the innovative elements related to the classification of risks connected to the SD and the environmental, social, and governance (ESG) factors.

The paper is structured in three further sections in addition to this first one (Section 1). The next section (Section 2) provides the theoretical background, hypotheses, materials, and methods used. In the Section 3 (Findings and Discussion), the findings are presented and discussed according to the defined methodology. Finally, the Section 4 (Conclusions) summarizes the main conclusions of the study carried out, considers the findings, as well as makes suggestions for future research related to the theme of this paper.

2. Hypotheses and Methodology

This section is divided into three subsections dedicated to the presentation of theories, hypotheses, and materials and methods proposed.

2.1. Underlying Theories

In the literature, there is a set of theories that seek to justify the motivations for voluntary disclosure by entities, but none of them can explain the phenomenon of reporting (Leventis and Weetman 2000). For better contextualization and justification of the hypotheses addressed in this paper, four theories were relevant in the study as justifications of voluntary reporting (De Lima e Silva et al. 2015): the legitimacy theory, the agency theory, the theory of signaling, and the theory of higher echelons.

Considering legitimacy theory, business disclosures are made as reactions to the environment and to legitimize business actions (Guthrie and Parker 1989). This theory is based on the notion that an entity operates in society through a social contract, where it agrees to perform various socially accepted actions in exchange for approval (Guthrie and Parker 1989). To this end, it needs to disseminate sufficient social information for society to assess its good social performance. By legitimizing its actions through disclosure, an entity ultimately hopes to legitimize its existence (Guthrie and Parker 1989).

Legitimacy is a condition or status that exists when an entity's value system is congruent with the value of the social system of which the entity is a part. When there is a disparity, actual or potential, between the two value systems, there is a threat to the legitimacy of the entity (Lindblom 1994).

Currently, entities need to do more than just provide economic benefits and comply with the law to be considered legitimate in the society in which they operate, and it is necessary to act within the limits of what is considered acceptable according to the values and norms of society (Castelo Branco and Rodriques 2007). The legitimacy theory appears in this context as a justification of the report, because the entities feel somehow persuaded by this social contract to make a voluntary report of their activities (Ereira 2007).

On the other hand, the agency theory, developed by Jensen and Meckling (1976), is based on the conflict of interests between the principals (owners of the entities) and the agents (managers of the same). The authors define the agency relationship as a contract under which one or more persons (principals) hire another person (the agent) to perform some service on their behalf, which involves the delegation of authority in the agent's decision making.

According to Morris (1987), agency theory is concerned with the problem between the principal and the agent concerning the difference between the ownership and control of an entity, between different suppliers of capital, as well as in the separation between the assumption of risks, decision making, and the functions of control in the entity. If individuals act in self-interest, these separations produce conflicts. The author further describes that such conflicts incur agency costs that are, first and foremost, the decline in an entity's value when owners realize that managers are not pursuing their interests (the interests of shareholders) or when they act inefficiently. Second, the costs of monitoring and linking managers' interest are relevant, so that they meet the interests of the owners. There is a trade-off between these two sets of agency costs. The first agency costs are the loss of a manager's opportunity if it is not reduced by monitoring and linkage, since their acts of self-interest precipitate the costs and shareholders incorporate them into the entity's share price (Morris 1987).

Finally, signaling theory focuses on issues related to information asymmetry problems (Morris 1987). According to Cotter et al. (2011), this signaling involves the communication of an entity's value using the available channels. The authors further add that managers can also provide additional information to investors through voluntary disclosures to assist them in making investment decisions. According to Ereira (2007), entities' managers are those with the duty of transmitting to investors signals that evidence it, since they have a higher level of the entity's specific information in comparison to other market agents.

Signaling theory suggests that managers tend to reveal good news to the market to avoid any undervaluation of their shares (Elzahar and Hussainey 2012). However, an entity's management may tend to hide or postpone the release of bad news because the magnitude of the market's reaction to bad news is greater than that to good news (Kothari et al. 2009). On the other hand, according to those authors, entities also have an incentive to report their bad news, to avoid litigation costs for non-disclosure, and to maintain the equity value of the entities. Based on Cotter et al. (2011), managers of entities with neutral news have the incentive to report positive news so that they are not suspected of having bad results. In this sense, signaling theory seems to indicate that entities will disclose more information than required (Morris 1987).

Additionally, in the present study, the upper echelons theory is pertinent to explain the influence of the BD on strategic decisions, among them, the decision on the disclosure of information. According to Michelon et al. (2019), the upper echelons theory proposes that organizational strategic results and processes are a consequence of the characteristics of the top or top managers. According to the authors, the main notion of the theory is that strategic choices, unlike operational decisions, originate in behavioral factors and not in the mechanical calculation for economic optimization.

Based on Pacheco et al. (2019), this theory addresses two strands: observable characteristics (such as gender, education, and age) and psychological characteristics. Then, according to such characteristics, executives base their decisions in ways that influence their strategies, since these characteristics end up influencing the way they interpret the situation.

The following subsection proposes the hypotheses based on these theories.

2.2. Hypotheses

Potentially explanatory factors of the level of risk disclosure by entities arise from the influence of the theories referred to in the previous subsection.

According to the literature, it has been found that the size is usually explained by the agency theory (Kongprajya 2010; Glaum and Street 2003; Alkababji 2016) and the

legitimacy theory (Kongprajya 2010). The theories cited are consensual regarding the positive association between the size of an entity and the level of risk disclosure.

Several factors may justify that the size of an entity may impact information disclosure practices. The cost of disseminating more detailed information is lower for larger entities since this information is often also produced for internal purposes and companies of larger size and with a higher growth rate have significant mandatory compliance (Singhvi and Desai 1971).

According to both agency theory and legitimacy theory, larger entities have a greater public interest and, as such, have additional disclosure needs, supporting the existence of a positive association between the size of the entities and the disclosure of risk (De Lima e Silva et al. 2015). In addition, Kongprajya (2010) justifies that, according to these two theories, larger entities tend to have a greater impact on society. As such, larger entities tend to disclose more risk than smaller entities (Ereira 2007).

From the literature review carried out, several studies found a positive association between the size of the entity and the disclosure of risk (Linsley and Shrives 2006; Ereira 2007; Vandemaele et al. 2009; Elzahar and Hussainey 2012; Elshandidy et al. 2013, 2021; Kılıç and Kuzey 2018; Serrasqueiro and Mineiro 2018; Iredele 2019; Rizzi et al. 2019). As such, the first hypothesis (H1) of this study emerged as follows:

H1. *The level of disclosure of risk-related matters in RI is positively associated with the size of the entity.*

Regarding profitability, some theories intend to explain the relationship between the profitability of entities and the level of disclosure, among them the agency theory (Guerreiro 2006; Elzahar and Hussainey 2012) and signaling theory (Owusu-Ansah 1998; Tsalavoutas 2011). The theories cited generally point to a positive association between this factor and the level of disclosure.

According to agency theory, managers of entities with high profitability tend to provide more information about risk in intermediate reports to justify their current performance to shareholders (Elzahar and Hussainey 2012).

Since profitability is a measure to evaluate management performance, and in the light of signaling theory, a profitable entity will tend to disclose more information to justify the continuity of management and the possible advantages for its managers (Owusu-Ansah 1998). In this sense, signaling theory justifies that entities with good news tend to disclose more detailed and accurate information than entities that intend to present bad news to the market (Singhvi and Desai 1971).

Studies also indicate a positive relationship between profitability and the level of risk disclosure (Elshandidy et al. 2013; Iredele 2019; Elshandidy et al. 2021). Nevertheless, other studies suggest that there is no association between the disclosures made and the profitability of the entities (Ereira 2007; Elzahar and Hussainey 2012; Serrasqueiro and Mineiro 2018), or even a negative association with it (Vandemaele et al. 2009; Coulmont et al. 2020). Thus, considering the associations within the theories of agency and signaling, as well as the majority evidence in the literature on the subject (theories), the second hypothesis (H2) of this study was formulated in the following terms:

H2. *The level of disclosure of risk-related matters in RI is positively associated with the entity's profitability.*

The indebtedness of entities also finds support in the agency theory (Guerreiro 2006), generally pointed out with a positive association, contrary to that in the signaling theory (Owusu-Ansah 1998; Tsalavoutas 2011).

According to agency theory, agency costs are higher in highly leveraged entities, and to mitigate them, entities need to disclose more information to meet the needs of lenders (Jensen and Meckling 1976). In addition, entities with higher levels of indebtedness have a greater incentive to disclose information and to respond to the demands of their shareholders because of the high financial risk (Elzahar and Hussainey 2012).

However, according to De Lima e Silva et al. (2015), the signaling theory points out that less indebted entities are encouraged to send signals to the market about their position, causing higher levels of disclosure. Then, according to Guerreiro (2006), the entities with lower indebtedness disclose more information.

Studies have not found an association between indebtedness and the level of disclosure (Linsley and Shrives 2006; Ereira 2007; Serrasqueiro and Mineiro 2018; Iredele 2019). However, other studies have identified a negative association (Elshandidy et al. 2013). According to the agency theory, however, a positive association between indebtedness and the level of risk disclosure is expected (Deumes and Knechel 2008; Höring and Gründl 2011; Lee and Yeo 2016; Elshandidy et al. 2021), which underlies the hypothesis developed in this study as follows:

H3. *The level of disclosure of risk-related matters in RI is positively associated with the entity's indebtedness*.

The structure of an entity's BD, namely the explanatory factor number of non-executive members, is supported by agency theory. According to such a theory, an entity with a more concentrated ownership structure tends to have lower agency costs compared with entities in which the management structure involves people external to the entity itself, due to the separation of ownership and control (Jensen and Meckling 1976).

In more diffuse structures, agency problems increase, as members with lower levels of participation in the entity may have difficulty monitoring management activities, and a higher level of disclosure is expected (Barako et al. 2006). In this sense, a positive association is expected between the number of non-executive members on the BD and the level of risk disclosure.

In the literature, a positive association has been found between the size and independence of the BD and the level of risk disclosure (Elshandidy et al. 2013, 2021). Regarding the quality of disclosure in RI, the educational level of the members of the BD has more influence on the quality of RI reporting, compared with the number of executive and/or non-executive members (Songini et al. 2021). This also demonstrates a positive relationship between the level of education of the members and the quality of the dissemination in IRs. Having said that, the fourth hypothesis (H4) of this study was defined as follows:

H4. *The level of disclosure of risk-related matters in IR is positively associated with the weight of non-executive directors on the BD*.

According to Adams and Ferreira (2009), the diversity of members on the BD can affect the decision-making process. In addition, women play an important role in positions related to the monitoring and risk management of entities. The upper echelons theory advocates that the strategic results and processes of entities are influenced by the characteristics or management styles of senior managers or top managers (Michelon et al. 2019). The theory argues that such characteristics, such as gender, can influence strategic decision making (Mineiro 2016).

In the literature, a positive association has been proposed between risk disclosure and BD diversity (Ntim et al. 2013; Allini et al. 2014; Mineiro 2016). As for the type of disclosure, particularly on prospects and the quality of information, studies show a positive association between the gender of the board and the level of disclosure (Kılıç and Kuzey 2018; Iredele 2019). In this sense, the fifth hypothesis (H5) was defined as follows:

H5. *The level of disclosure of risk-related matters in IR is positively associated with gender diversity in the BD*.

The audit is associated with the theory of the agency, with a positive relationship between this explanatory factor and the level of risk disclosure (Tsalavoutas 2011). From the perspective of the agency's policy, to reduce high agency costs, entities would be motivated to hire audit firms. In addition to reducing costs, auditing also increases the credibility of disclosures (Jensen and Meckling 1976).

In this sense, Elshandidy et al. (2021) found a positive association between the size of the audit committee and risk disclosure. According to the authors, larger entities, with high dividend levels, greater board independence, and an effective audit environment, tend to have higher levels of risk disclosure than other entities. Other studies have found no evidence of an association between risk disclosure and auditor fees and audit size (especially those designated as the Big 4) (Serrasqueiro and Mineiro 2018; Kılıç and Kuzey 2018).

Thus, considering the studies that conclude the existence of a positive association between the audit and the level of risk disclosure, the sixth hypothesis (H6) of this study was formulated in the following terms:

H6. *The level of disclosure of risk-related matters in IR is positively associated with the assurance of reliability by external audit*.

Finally, the activity sector finds support in the signaling theory, to the extent that entities in the same activity sector are more likely to adopt the same level of disclosure (Khlif and Hussainey 2016). In this sense, if an entity in the same sector fails to follow the same disclosure practices, this can be interpreted as a sign of news concealment (Khlif and Hussainey 2016).

Therefore, entities in certain sectors tend to disclose more information than others (Elzahar and Hussainey 2012; Coulmont et al. 2020). Some studies found a positive association between certain sectors and the level of disclosure of risk stories (Elzahar and Hussainey 2012). However, there is no evidence of the influence of the sector on disclosure rates (Coulmont et al. 2020). Having said that, the seventh hypothesis (H7) was defined with an undefined sign of association, as follows:

H7. *The level of disclosure of risk-related matters in RI is associated with the entity's activity sector*.

Table 1 presents a summary of the explanatory factors, the related theories, the signs of association underlying the hypotheses, as well as the main results found in previous research.

Table 1. Explanatory factors and related theories.

Authors/Year	Associated Theory	Explanatory Factors	Proposed Association	Main Findings (Relationship with Risk Disclosure)
Linsley and Shrives (2006); Ereira (2007); Vandemaele et al. (2009); Elzahar and Hussainey (2012); Elshandidy et al. (2013, 2021); Kılıç and Kuzey (2018); Serrasqueiro and Mineiro (2018); Iredele (2019); Rizzi et al. (2019)	Agency and legitimacy	Size	(+)	Positive relationship
Elshandidy et al. (2013, 2021); Iredele (2019)	Agency and signaling	Profitability	(+)	Positive relationship
Ereira (2007); Elzahar and Hussainey (2012); Serrasqueiro and Mineiro (2018)				No relationship found
Vandemaele et al. (2009); Coulmont et al. (2020)	NA			Negative relationship
Deumes and Knechel (2008); Höring and Gründl (2011); Lee and Yeo (2016); Elshandidy et al. (2021)	Agency and signaling	Indebtedness	(+)	Positive relationship
Elshandidy et al. (2013)				Negative relationship
Linsley and Shrives (2006); Ereira (2007); Serrasqueiro and Mineiro (2018); Iredele (2019)				No relationship found
Elshandidy et al. (2013, 2021)	Agency	Weight of non-executive directors on the BD	(+)	Positive relationship

Table 1. *Cont.*

Authors/Year	Associated Theory	Explanatory Factors	Proposed Association	Main Findings (Relationship with Risk Disclosure)
Ntim et al. (2013); Allini et al. (2014); Mineiro (2016); Kılıç and Kuzey (2018); Iredele (2019)	Upper echelons	BD gender	(+)	Positive relationship
Serrasqueiro and Mineiro (2018); Kılıç and Kuzey (2018)	Agency	Audit	(+)	No relationship found
Elshandidy et al. (2021)				Positive relationship between audit committee size and risk disclosure
Coulmont et al. (2020)	Signaling	Activity sector	(?)	No relationship found
Elzahar and Hussainey (2012)				Relationships dependent on the sector

The next subsection presents the material and methods used.

2.3. Material and Methods

For the selection of the sample for the present study, the entities of the Brazilian stock exchange that were part of the IBX100 on 31 December 2020 were initially selected. The IBX 100, or Brazil Index, is an index that includes the 100 equity securities (shares) of entities with greater negotiability and representativeness of the B3 (Brasil 2021). This choice considered this characteristic, as well as the public accessibility of the reports and accounts of such entities. The identification of the entities was obtained by consulting the B3 website. It should be noted, however, that from the IBX100 listing, it was observed that two types of shares belonged to the same entity and, consequently, a total of 98 entities were previously selected.

After this selection, the second criterion used for the sample selection consisted of the entities that had disclosed an IR for the year 2020. Once this criterion was applied, 49 entities were found that did not issue an IR or that did not refer in their annual report or sustainability report to the IIRC guidelines. The entity's website was used for collecting its reporting.

Thus, after applying the proposed criteria, a total of 49 entities that are members of the IBX100 were selected as the research sample of this study for the year 2020.

Table 2 summarizes the criteria applied for the selection of the study entities.

Table 2. Sample research.

Selection Criteria	Number of Entities
Total entities represented by shares listed on B3's IBX 100 as of 31 December 2020	98
Entities excluded due to non-issuance of an integrated report in the year under review	49
Total entities included in the study	49

Subsequently, and after consulting the sectoral classification of each entity, available on the website of the Brazilian stock exchange, the entities in the sample were grouped into four sectors of economic activity, presented and coded as follows: trade, services, and others (sector 1); energy (sector 2); financial (sector 3); and industry (sector 4).

Industry and commerce, services, and others are the sectors with the highest predominance in the total number of entities (16 entities in each sector), followed by the financial sector (10 entities) and, finally, the energy sector (7 entities).

Table 3 provides more in-depth information on the entities and the activity sector to which they belong.

Table 3. Entities listed in the IBX 100 by activity sector.

Share	Entity	Industry Classification	Activity Sector
ASAI3	ASSAI (Sendas Distribuidora SA)	1	Trade, Services, and Others
BLUE4	BLUE		
BRFS3	BDRREFOUR BR		
CCRO3	CCR SA		
DXCO3	ECOHIGHWAYS		
PBDR4	SOMA GROUP		
JBSS3	RENNER STORES		
MDIA3	MAGAZ LUIZA		
MRFG3	MOVED		
MOVI3	P. SUGAR—CBD		
NTCO3	QUALICORP		
QUAL3	RAIADROGASIL		
SULA11	SOUTH AMERIBD		
VIVT3	TELEF BRAZIL		
TOTS3	TOTVS		
VAMO3	LET'S GO		
AURE3	AUREN	2	Energy
CMIG4	CEMIG		
CBAV3	COPEL		
ECOR3	ELETROBRAS		
ENBR3	ENERGIES BR_EDP		
ELET3	ENEVA		
ENEV3	ENGIE BRAZIL		
B3SA3	B3	3	Financial
BBDC4	PAN BANK		
BPBD11	BBSECURITY		
BBAS3	BRADESCO		
BPAN4	BRASIL_BANCO OF BRAZIL		
BRKM5	BTGP BANK		
CIEL3	CIELO		
SUM3	ITAÚSA		
ITUB4	ITAUUNIBANCO		
RADL3	SANTANDER BR		
ABEV3	AMBEV S/A	4	Industry
SAN	BRASKEM		
BBSE3	BRF SA		
CRFB3	CBA: Companhia Brasileira de Alumínio		
CPLE6	CSNMINERAO		
CMIN3	DEXCO (Duratex)		
EGIE3	GERDAU		
GGBR4	NATURA GROUP		
ITSA4	JBS		
LREN3	M.DIASBRANCO		
MGLU3	MARFRIG		
CSNA3	NATIONAL SID		
SUZB3	SUZANO S.A.		
UGPA3	ULTRAPAR		
VALE3	VALLEY		
WEGE3	WEG		

To identify the types of risks disclosed by the entities in the IRs, this research used content analysis as a technique. For collecting the dependent variables proposed for this study, key issues were initially proposed. The issues were based on RI's international framework, where the IIRC describes what entities need to respond to when reporting "risks".

Then, the study selected a set of seven dependent variables associated with the level of disclosure of each of the (six) types of risk, to which was added the total risks (TR) resulting from the grouping of individual risks. At stake, the following risk typologies are proposed: financial risk (FR), operational risk (OR), leadership and management risk (LMR), integrity risk (IR_), information and technological risk (ITR), and strategic risk (SR). Each type of risk is associated with certain attributes for which different individual items of analysis have been proposed. It is worth stressing that the IR_ includes issues related to environmental and social matters, while SR includes governance issues. Therefore, these proposed categories of risks can be seen as related to sustainable development since they comprise the ESG factors.

For this classification, it became important to find out what are the specific risks that affect an entity's ability to generate value in the short, medium, and long term, in addition to the actions to deal with them. For the definition of the type of risk, as well as the attribute disclosed by the entities, the IIRC definitions for the item were considered as well as the categorization of the type of risks carried out in the studies by Linsley and Shrives (2006), Ereira (2007), and De Lima e Silva et al. (2015).

According to The Institute of Chartered Accountants in England and Wales (ICAEW 1997), the FR results from the possibility of financial means not being adequately managed from money availability, the uncertainty of the exchange rate, the interest rate, credit, and other financial risks. It also comes from the possibility of losses caused by failures, deficiencies or inadequacy of internal processes, people, systems, and external events. Its management includes the identification of weaknesses or inadequacies in the activities to enable the correct and timely action for mitigation (Banco do Brasil 2020). In turn, the LMR is related to the strategic decisions of the management of the entities that may jeopardize their performance and communication with related parties (Linsley and Shrives 2006). In this follow-up, ITR comes from cyber-attacks against technology and information infrastructure or corporate systems that may affect data integrity, confidentiality, and availability (BB Seguridade 2020). The IR_ is associated with inadequacy or deficiency in signed contracts, as well as sanctions due to non-compliance with legal provisions and compensation for damages to third parties arising from the activities developed (Banco Pan 2020). Finally, SR is related to the adversities that can affect entities and interfere with their ability to execute their strategy. Among them, for example, are environmental, social, and political risks (Linsley and Shrives 2006).

Table 4 presents the types of risks selected for the study and their disclosure attributes.

Table 4. Types of risk disclosure attributes.

Risk Type	Attribute
FR	Credit risk Liquidity risk Market risk Exchange rate Interest rate
OR	Product development Efficiency and performance Product or service failure Obsolescence of inventories Customer satisfaction Health and safety

Table 4. *Cont.*

Risk Type	Attribute
LMR	Leadership and management risk Performance risk Communication failure
ITR	Integrity Access/availability Infrastructure
IR_	Fraud Illegal acts Reputation
SR	National/regional economic problems Environmental risk Competition risk Planning risk Political risk/adverse government policy Social risk

Source: Adapted from Linsley and Shrives (2006).

After defining the type of risk and the respective attributes to be disclosed, five issues (Q) were proposed, that is, individual items of analysis to be analyzed for the set composed of risk and attribute, from the reading and assessment of the IR by each entity, as shown in Table 5.

Table 5. Issues and objectives.

Issues	Goal
I1 (Refer): Does the entity provide specific references to the type of risk?	Identify the reference as a particular type of risk
I2 (Actions): Does the entity indicate actions to prevent/mitigate risk?	Identify the actions taken to prevent such risk
I3 (Timing): Does the entity mention whether the risk is for the short, medium, or long term?	Identify the deadline for compliance with a given action
I4 (Quali): What is the format of risk disclosure: is there qualitative information?	Identify the risk disclosure format
I5 (Quanti): What is the format of risk disclosure: is there quantitative information?	Identify the risk disclosure format

Subsequently, an evaluation matrix (risk/attribute/issue) was proposed for recording the items disclosed by an entity, as shown in Table 6.

Table 6. Evaluation matrix.

	I1	I2	I3	I4	I5
1. FR					
Credit risk					
Market risk					
Liquidity Risk					
Interest rate					
Exchange rate					
Total 1					

Table 6. *Cont.*

	I1	I2	I3	I4	I5
2. OR					
Customer satisfaction					
Product development					
Efficiency and performance					
Obsolescence of inventories					
Product or service failure					
Health and safety					
Total 2					
3. LMR					
Leadership and management risk					
Performance risk					
Communication failure					
Total 3					
4. ITR					
Integrity					
Access/availability					
Infrastructure					
Total 4					
5. IR_					
Fraud					
Illegal acts					
Reputation					
Total 5					
6. SR					
Planning risk					
Economic problems					
Environmental risk					
Political risk					
Competition risk					
Social risk					
Total 6					
7. TR = (1) + (2) + (3) + (4) + (5) + (6)					

Subsequently, the IR from each entity was read to find information about the disclosure of the risk, as performed in previous studies (Linsley and Shrives 2006; Ereira 2007; De Lima e Silva et al. 2015). Then, the analysis was performed using an evaluation matrix per entity, with the data organized to collect each type of risk, according to the different attributes and respective issues under analysis. For each positive response to the item under assessment, the values "1" and "0" were assigned otherwise, which allowed us to identify the entities' risk disclosure level at the end of this process.

Therefore, Table 7 shows the maximum number of items for each proposed risk and disclosure attribute per entity.

Table 7. Total number of items by risk and attribute.

Risk Type	Disclosure Attribute	Total Items
(1) FR	Credit risk	5
	Liquidity risk	5
	Market risk	5
	Exchange rate	5
	Interest rate	5
Total items disclosed (1)		25
(2) OR	Product development	5
	Efficiency and performance	5
	Product or service failure	5
	Obsolescence of inventories	5
	Customer satisfaction	5
	Health and safety	5
Total items disclosed (2)		30
(3) LMR	Leadership and management risk	5
	Performance risk	5
	Communication failure	5
Total items disclosed (3)		15
(4) ITR	Integrity	5
	Access/availability	5
	Infrastructure	5
Total items disclosed (4)		15
(5) IR_	Fraud	5
	Illegal acts	5
	Reputation	5
Total items disclosed (5)		15
(6) SR	National/regional economic problems	5
	Environmental risk	5
	Competition risk	5
	Planning risk	5
	Political risk/adverse government policy	5
	Social risk	5
Total items disclosed (6)		30
(7) TR = (1) + (2) + (3) + (4) + (5) + (6)		130

To assess the levels of risk disclosure of the entities in the sample, disclosure indices were computed, which were later used as dependent variables in the seven regression models proposed, namely FR, OR, LMR, ITR, IR_, SR, and the TR. The disclosure indexes were developed based on other studies that adopted this methodology (Ereira 2007). Therefore, the DIX of each entity can be obtained as presented in the following expression:

$$IDX = \frac{\sum_{i=1}^{m} \mathrm{d}i}{\sum_{i=1}^{n} \mathrm{d}_P} \quad (1)$$

where *ID* = disclosure index; *X* = typology of the risk under assessment, which may represent, inter alia, financial risk (FR), operational risk (OR), leadership and management risk (LMR), information and technological risk (ITR), integrity risk (IR_), strategic risk (SR) and, finally, the total risks (TR); *d* = 1 when the element is disclosed and 0 when it is not disclosed by an entity; *m* = number of items disclosed; *n* = number of items susceptible to the disclosure; *i* = observed disclosures; and *p* = total disclosures that can be observed.

Following, Table 8 summarizes the independent variables used as proxies for the explanatory factors proposed in this research from the literature, with those selected for this study highlighted in gray.

Table 8. Independent variables used as proxies for the explanatory factors.

Explanatory Factors	Independent Variables	Reference Studies
Size	Total assets (Assets)	Beretta and Bozzolan (2004); Linsley and Shrives (2006); Vandemaele et al. (2009); Elzahar and Hussainey (2012); Lee and Yeo (2016); Kılıç and Kuzey (2018); Serrasqueiro and Mineiro (2018); Iredele (2019); Coulmont et al. (2020); Elshandidy et al. (2021)
	Turnover	Ereira (2007)
	Market value	Elshandidy et al. (2013)
Profitability	Net income/equity (ROE)	Serrasqueiro and Mineiro (2018); Coulmont et al. (2020); Elzahar and Hussainey (2012); Elshandidy et al. (2013, 2021); Vandemaele et al. (2009)
	Net income/assets (ROA)	Lee and Yeo (2016); Kılıç and Kuzey (2018)
	EBITDA and EBIT	Ereira (2007)
Indebtedness	Total liabilities/total assets	Lee and Yeo (2016); Serrasqueiro and Mineiro (2018); Coulmont et al. (2020)
	Total liabilities/equity (Debt)	Elshandidy et al. (2013, 2021); Iredele (2019)
	Loans/total assets	Ereira (2007)
Members of the BD	Weight of non-executive members (Independence of the BD)	Elshandidy et al. (2013, 2021)
	Total number of members on the BD	Elshandidy et al. (2021)
Gender diversity in the BD	Weight of females on the BD (Gender of the BD)	Ntim et al. (2013); Allini et al. (2014); Mineiro (2016); Kılıç and Kuzey (2018); Iredele (2019).
Audit	Existence of external audit (Audit)	Kılıç and Kuzey (2018)
	Size of the audit committee	Elshandidy et al. (2021)
	Auditor's fees and the size of the audit firm (Big 4)	Serrasqueiro and Mineiro (2018)
Sector of Activity	Main activity sector (Sector)	Elzahar and Hussainey (2012); Coulmont et al. (2020)

Concerning the size, proposed in H1, some studies have chosen to use the variable market value (Elshandidy et al. 2013) or the turnover (Ereira 2007). However, the use of total assets, as proposed for this study, is the majority (Beretta and Bozzolan 2004; Linsley and Shrives 2006; Vandemaele et al. 2009; Elzahar and Hussainey 2012; Lee and Yeo 2016; Serrasqueiro and Mineiro 2018; Kılıç and Kuzey 2018; Iredele 2019; Coulmont et al. 2020; Elshandidy et al. 2021).

Regarding the profitability, associated with H2, we chose to use the return on equity (ROE) indicator, as it is more widely used (namely, by Vandemaele et al. 2009; Elzahar and Hussainey 2012; Elshandidy et al. 2013, 2021; Serrasqueiro and Mineiro 2018; Coulmont et al. 2020), although it can be also seen in literature the use other measures, such as the return on assets (ROA) (Lee and Yeo 2016; Kılıç and Kuzey 2018), earnings before interest and taxes (EBIT) and earnings before interest, taxes, depreciation, and amortization (EBITDA) (Ereira 2007).

For indebtedness, underlying H3, we opted for the use of the PCT indicator (participation of third-party capital), calculated using the ratio between total liabilities and equity (Elshandidy et al. 2013, 2021; Iredele 2019), although it is also possible to identify the use of the variable DEBT, calculated as the ratio between total liabilities and total assets (Lee and Yeo 2016; Serrasqueiro and Mineiro 2018; Coulmont et al. 2020) and the weight of loans in the total assets (Ereira 2007).

Regarding the non-executive members of the BD, underlying H4, the percentage of these in the total number of directors (executive and non-executive) was considered, as proposed by the literature (Elshandidy et al. 2013, 2021).

Gender diversity, underlying H5, was calculated using the total number of male or female members who make up the board (Ntim et al. 2013; Allini et al. 2014; Mineiro 2016; Kılıç and Kuzey 2018; Iredele 2019). However, the variable proposed for this study consisted of a dummy variable, calculated from the median of the sample in what concerned the weight of women, in which "0" corresponded to the entities with a lower weight of men on the BD and "1" if otherwise.

In the present study, the audit was also a dummy variable, with a value of "1" if the entity had an external audit and "0" if otherwise (Kılıç and Kuzey 2018). In the literature, other proposals can be found, such as the study by Elshandidy et al. (2021), which used the size of the audit committee as a reference. Serrasqueiro and Mineiro (2018) used the auditor's fees and the size of the audit firm (Big 4).

Finally, the study also used the sector of economic activity (sector) as an explanatory factor, proposed as a categorical variable (Elzahar and Hussainey 2012; Coulmont et al. 2020). For this purpose, the entities were previously grouped into four sectors, as referred to in the subsection on the characterization of the sample, namely: trade, services, and others (sector 1); energy (sector 2); financial (sector 3); and industry (sector 4).

Data on size, indebtedness, and profitability were obtained by consulting the financial data, while information on the audit, the number of non-executive members, and the gender of the members of the BD were obtained from other sources of RI available on each entity's website in the investor relations section.

The analysis began with the presentation of descriptive statistics. Additionally, a nonparametric Mann–Whitney U test was performed to study the differences between the mean values of the risk disclosures for the different explanatory factors. To perform the test, the subgroups related to the explanatory factors that use continuous variables as proxies, namely size, indebtedness, profitability, audit, and members of the BD, were divided according to the median of the sample for each of these factors. For the remaining explanatory factors, namely the gender diversity in the BD, audit, and the sector, the subgroups were represented by the values "0" and "1", associated with the dichotomous variables already proposed for these factors.

Finally, to assess the explanatory factors that potentially influence the disclosure of each of the types of risk in IRs, seven multiple linear regression models were proposed and executed, having as dependent variables the constructed disclosure indices and as

independent variables the proposed explanatory factors, namely the size, the profitability, indebtedness, auditing, the number of non-executive members on the BD, the gender of the BD, and the activity sector. In the specific case of the size variable, the total assets were logarithmized, as proposed, for instance, by Saraswatia and Bernawatib (2020).

Multiple linear regression models are intended to identify the characteristics of entities (independent variables) that can explain the number of risk disclosures (dependent variables) (Mineiro 2016). Therefore, considering the hypotheses and variables proposed for this study, the regression model was defined as follows:

$$IDX = \beta_0 + \beta_1 Asset + \beta_2\ ROE + \beta_3\ Debt + \beta_4\ Independence\ of\ the\ BD + \beta_5\ Gender\ of\ the\ BD + \beta_6 \text{Audit} + \beta_7\ Sector1 + \beta_8\ Sector2 + \beta_9 Sector33 + \varepsilon \quad (2)$$

where IDX = dependent variable; β = model parameters, with β_0 representing the constant; and ε = standard error.

It should be noted that the inclusion of the categorical variable sector requires the prior transformation of each of the four sectors into distinct dichotomous variables (sector 1 to sector 4), in which "1" indicates, for each of these variables, the sector concerned and "0" if otherwise (entities from other sectors). In addition, the inclusion of these variables necessarily leads to the elimination of one of the existing variables, used as a reference variable for the analysis. Thus, this study excluded sector 4 (industry).

Before the regression analysis, some of the main assumptions used to validate the quality and usefulness of the model were analyzed. To identify the possible existence of autocorrelation in the regression residuals, the Durbin–Watson test was performed, assuming that there was no such evidence when the values were between 1.5 and 2.5 (Mohammadi et al. 2021).

In turn, the F test ANOVA allowed us to simultaneously test for the effect of each independent variable on the dependent variable and identify any interaction effect (Pallant 2010). To assess any issues associated with collinearity between the proposed continuous independent variables, Pearson's correlation was previously performed. According to Pallant (2010), collinearity occurs when the independent variables are strongly correlated with each other, considering that this occurs for values above 0.7 (in absolute value), which can result in a meaningless regression model. Thus, it is an important assumption to be validated in the linear regression model (Maroco 2007).

It is also noteworthy that, in the linear regression model, the adjusted R square (or R^2) determines the extent of the variance of the dependent variable that can be explained by the independent variables proposed (Tulcanaza-Prieto et al. 2020). Therefore, the higher the adjusted R^2, the better the regression model, since it implies a higher explanatory power of the independent variable chosen.

Finally, to validate the non-existence of multicollinearity among the independent variables, the variance inflation factor (VIF) was used. According to Ferré (2009), the VIF is commonly used to assess multicollinearity in a regression model and indicates the increase in the variance of a regression coefficient because of collinearity. With multicollinearity, the regression coefficients are still consistent, but they are no longer reliable, which means that the predictive power of the model is not reduced, but the coefficients may not be statistically significant (Ferré 2009). According to Maroco (2007), if VIF values higher than 5 are obtained, we are facing problems with the estimation of the coefficients due to the presence of multicollinearity in the independent variables. For Kalyar et al. (2013), a VIF greater than 10 indicated that multicollinearity may be influencing least squares estimates. As such, if there are divergences in the literature in this regard, VIF values greater than 5 should be prudently avoided.

The results of the regression models are analyzed considering a significance level associated with each proposed independent variable of 5%.

The following section presents and discusses the findings from this research.

3. Findings and Discussion

This section aims to analyze and discuss the findings, and is divided into two subsections.

3.1. Findings

Table 9 provides the level of disclosure found, considering the different types of risks proposed as well as the respective issues being assessed and their attributes.

Table 9. Risk disclosures by typologies, issues, and attributes.

	I1 Refer		I2 Actions		I3 Timing		I4 Quali		I5 Quant		Total	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
TR	578	45	470	37	21	2	564	44	28	2	1661	26
FR												
Credit risk	26	53	24	49	2	4	26	53	1	2	79	32
Market risk	38	78	29	59	1	2	37	76	2	4	107	44
Risk of liquidity	31	63	27	55	1	2	31	63	3	6	93	38
Interest rate	20	41	18	37	1	2	20	41	3	6	62	25
Exchange rate	20	41	18	37	1	2	20	41	2	4	61	25
Total	135	55	116	47	6	2	134	55	11	4	402	33
OR												
Customer satisfaction	6	12	5	10	0	0	6	12	1	2	18	7
Product development	7	14	7	14	0	0	7	14	0	0	21	9
Efficiency and performance	34	69	28	57	1	2	34	69	1	2	98	40
Obsolescence of inventories	1	2	0	0	0	0	1	2	0	0	2	1
Product or service failure	32	65	27	55	1	2	32	65	1	2	93	38
Health and safety	22	45	19	39	0	0	22	45	2	4	65	27
Total	102	35	86	29	2	1	102	35	5	2	297	20
LMR												
Leadership and management risk	12	24	12	24	1	2	12	24	0	0	37	15
Performance risk	12	24	7	14	0	0	10	20	0	0	29	12
Communication failure	5	10	5	10	1	2	5	10	0	0	16	7
Total	29	20	24	16	2	1	27	18	0	0	82	11
ITR												
Integrity	32	65	27	55	2	4	32	65	1	2	94	38
Access/availability	32	65	26	53	1	2	32	65	2	4	93	38
Infrastructure	17	35	14	29	0	0	17	35	1	2	49	20
Total	81	55	67	46	3	2	81	55	4	3	236	32
IR_												
Fraud	30	61	24	49	1	2	30	61	1	2	86	35
Illegal acts	38	78	29	59	1	2	38	78	1	2	107	44
Reputation	28	57	21	43	1	2	28	57	0	0	78	32
Total	96	65	74	50	3	2	96	65	2	1	271	37
SR												
Planning risk	27	55	23	47	2	4	27	55	0	0	79	32
Economic problems	21	43	18	37	1	2	21	43	1	2	62	25
Environmental risk	41	84	32	65	1	2	41	84	4	8	119	49
Political risk	17	35	15	31	1	2	17	35	1	2	51	21
Competition risk	5	10	1	2	0	0	2	4	0	0	8	3
Social risk	24	49	14	29	0	0	16	33	0	0	54	22
Total	135	46	103	35	5	2	124	42	6	2	373	25

Table 9 shows that the entities disclosed only 26% of the total items selected as subject to disclosure. Through an analysis using risk typology, entities disclosed more information related to IR_, which reached 37% of cases, followed by disclosures related to FR and ITR,

with 33% and 32%, respectively. This was followed by disclosures relating to the SR (25%), the OR (20%) and, finally, the LMR (with only 11% of cases).

Considering the issues, it is also possible to find a higher level of disclosures of a qualitative nature (I4), which reached 44% of the comments, compared with the quantitative (I5), with only 2%. It was also found that the entities referred 45% of the risks in IR_ (I1), as well as reported evaluating actions for the prevention and mitigation of such risks (I2) in 37% of cases. Finally, information about actions in the short, medium, and long term (I3) was referenced in only 2%.

Regarding the attributes of disclosure, there was a greater number of disclosures on market risk under the FR, which reached 44% of the observations, a figure that compares with the lower levels found for interest rate and exchange rate risks, with 25% by case. This was followed by disclosures on liquidity and credit risk, with 38% and 32% of the comments, respectively.

According to the data in Table 9, and concerning the attributes of the OR, entities disclosed 40% of the efficiency and performance risk, a value that compares with the lowest level found for the risk of obsolescence of inventories, with only 1% of cases. This was followed by disclosures regarding the risk of failure in the product or service, with 38% of cases, the risk in the development of the product (9%), and, finally, the risk to customer satisfaction (7%).

Regarding the LMR, it was observed that the entities disclosed 15% of items related to leadership and management risk, a value that compares with the lowest level found for the risk of communication failure (7%). This was followed by performance risk, with 12% of items disclosed.

Concerning ITR, it was possible to observe that the entities also disclosed 38% of the possible items for integrity and access/availability risks, while infrastructure risk was recorded in only 20% of the cases.

As for the IR_, it was possible to see a higher level of disclosures on the risk of illegal acts, with 44% of cases. This was followed by disclosures on the risk of fraud (35%) and reputational risk (32%).

Finally, it was possible to observe, for SR, that the entities disclosed 49% of the expected items for environmental risk, which compares with the lowest value, of only 3% of the observed disclosures, for the competitive risk. This was followed by the disclosure of planning risk (32%), the risk of economic problems (25%), social risk (22%) and, finally, political risk (21%).

Table 10 presents, in turn, the average level of risk disclosures by typologies of risks and explanatory factors proposed. It also provides the cases in which the Mann–Whitney test found statistically significant differences between the subgroups proposed by each explanatory factor.

Table 10. Risk disclosures by typologies and explanatory factors.

		Average Levels of Disclosure by Type of Risk, as a Percentage						
Explanatory Factor	**Subgroup**	**FR**	**OR**	**LMR**	**ITR**	**IR_**	**SR**	**TR**
Total	IN	33	20	11	32	37	25	26
Size	0	32	19	9	25 **	33	24	24
	1	34	21	13	39 **	41	27	28
Profitability	0	36	23	12	36	37	27	28
	1	29	18	11	27	36	24	24
Indebtedness	0	33	20	11	27	37	23	25
	1	33	21	12	38	37	28	27

Table 10. *Cont.*

		Average Levels of Disclosure by Type of Risk, as a Percentage						
Explanatory Factor	**Subgroup**	**FR**	**OR**	**LMR**	**ITR**	**IR_**	**SR**	**TR**
Independence of the BD	0	38	22	12	36	41	29	29
	1	27	18	10	27	32	22	22
Gender of the BD	0	36	19	12	31	38	23	25
	1	30	22	10	34	35	28	28
Audit	0	31	15	06	22	29	17 **	20
	1	33	22	13	36	40	29 **	28
Sector 1	0	40 **	23	15 **	37 **	40	31 **	31 **
	1	18 **	15	4 **	21 **	30	15 **	17 **
Sector 2	0	32	19	9 **	30	37	24	25
	1	38	30	25 **	43	38	36	35
Sector 3	0	27 **	19	9 **	27 **	33 **	24	23 **
	1	57 **	24	21 **	53 **	51 **	32	38 **
Sector 4	0	34	21	14 **	36	38	25	27
	1	30	19	6 **	25	35	27	24

Note: Significant differences between the mean values of subgroups at ** 5% levels.

The findings in Table 10 show statistically significant differences for the different typologies or risks within three explanatory factors, namely size, audit, and sector.

Regarding size, there was a higher average level of FR disclosure in the context of larger entities, reporting, on average, 39% of this type of risk, which can be compared with 25% observable for smaller entities. In what concerns the explanatory factor audit, there was a higher number of SR disclosures for the entities with audited reporting, reporting, on average, 29% of this type of risk, which can be compared with 17% for entities with unaudited reporting.

By sector, it was verified that the entities from sector 1 (trade, services, and others) presented, on average, a lower level of disclosure for the different risk types, compared with entities in other sectors. In this context, the following typologies of risk disclosures stood out:

- the FR, with an average value of 18% versus 40% for entities from other sectors;
- the LMR, with an average value of 4% versus 15% for entities from other sectors;
- the ITR, with an average value of 21% versus 37% for entities from other sectors;
- the SR, with an average value of 15% versus 31% for entities from other sectors;
- the TR, with an average value of 17% versus 31% for entities from other sectors.

Furthermore, entities from sector 2 (energy) presented, on average, a higher level of disclosures related to the LMR (25%), which compares with 9% observable for entities from other sectors.

For entities from sector 3 (financial), there was, on average, a higher level of disclosure for the different types of risk, in comparison to entities from other sectors. The following typologies of risk disclosures can be stressed:

- the FR, with an average value of 57% versus 27% for entities from other sectors;
- the LMR, with an average value of 21% versus 9% for entities from other sectors;
- the ITR, with an average value of 53% versus 27% for entities from other sectors;
- the IR_, with an average value of 51% versus 33% for entities from other sectors;
- the TR, with an average value of 38% versus 23% for entities from other sectors.

Finally, it was verified that the entities that belong to sector 4 (industry), presented, on average, a lower level of disclosures related to the LMR, with an average value of 6% for the entities of this sector, which compares with 14% observable for entities from other sectors.

Before providing the results from multiple linear regression models, Table 11 identifies the levels of correlation between the independent variables to assess collinearity issues.

Table 11. Correlation between independent variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Setor_3
Assets	0.08	−0.15	0.09	−0.01	0.11	−0.28	−0.20	0.21
ROE (1)		0.15	0.15	0.03	−0.14	−0.18	0.05	0.06
Debt (2)			−0.05	−0.14	−0.04	−0.02	−0.18	0.55
Independence of the BD (3)				−0.24	0.02	0.16	−0.07	−0.10
Gender of the BD (4)					0.06	−0.10	0.05	−0.04
Audit (5)						−0.17	−0.02	0.19
Setor_1 (6)							−0.28	−0.35
Setor_2 (7)								−0.21

Table 11 shows that there are no high correlation levels (less than or equal to 0.5) and, therefore, the proposed models do not present collinearity problems.

Table 12, in turn, provides the results of the ANOVA and Durbin–Watson tests for the proposed models (M).

Table 12. ANOVA and Durbin–Watson tests.

		ANOVA		Durbin–Watson
Model	**Dependent Variable**	**Z**	**Sig.**	**Result**
M1	FR	2.924	0.008	2.284
M2	OR	1.494	0.179	2.011
M3	LMR	3.917	0.001	2.044
M4	ITR	2.423	0.024	1.727
M5	IR_	1.351	0.240	2.470
M6	SR	2.586	0.017	2.092
M7	TR	3.406	0.003	2.198

From the results of the Durbin–Watson test in Table 12, there was no error in the different models, with no evidence of autocorrelation. The same table also presents the results of the ANOVA test, to indicate whether the models (which included the two blocks of variables) were significant and whether or not they can be used for statistical inference. The proposed models had significance levels equal to or lower than 0.05, which means that linear regression models are appropriate to explain the relationship between dependent variables and independent variables, except for models 2 (OR) and 5 (RIN), whose levels were not statistically significant.

Finally, Table 13 presents the results of the linear regression models, including the coefficients and significance levels of the variables in each model, the adjusted R square, as well as the results of the VIF. As mentioned in the previous section, the VIF is used for assessing one of the assumptions for the inclusion of the independent variables of the regression, namely the diagnosis of multicollinearity. Since the value of the VIF was less than five for all cases, it was possible to affirm that there was no multicollinearity between the independent variables proposed.

Table 13. Linear regression models: M1 to M7.

Model	Independent Variables	Non-Standard Coefficients	Standardized Coefficients	Sig.	VIF Statistics	R Square Adjusted
		B	Beta			
(M1) FR	(Constant)	51.165		0.451		0.29
	Assets	−0.303	−0.019	0.892	1.353	
	ROE	−0.883	−0.042	0.761	1.233	
	Debt	13.444	0.134	0.438	1.957	
	Independence of the BD	−0.351	−0.314	0.025	1.225	
	Gender of the BD	0.121	0.049	0.706	1.13	
	Audit	−2.523	−0.045	0.733	1.142	
	Setor_1	−11.996	−0.226	0.155	1.636	
	Setor_2	4.875	0.069	0.635	1.384	
	Setor_3	20.687	0.335	0.07	2.167	
(M2) OR	(Constant)	−41.487		0.338		0.09
	Assets	2.03	0.229	0.16	1.353	
	ROE	−1.039	−0.087	0.574	1.233	
	Debt	20.821	0.367	0.064	1.957	
	Independence of the BD	−0.145	−0.229	0.14	1.225	
	Gender of the BD	0.098	0.071	0.632	1.13	
	Audit	6.8	0.214	0.154	1.142	
	Setor_1	−1.904	−0.064	0.72	1.636	
	Setor_2	12.479	0.311	0.062	1.384	
	Setor_3	−4.467	−0.128	0.53	2.167	
(M3) LMR	(Constant)	−6.503		0.855		0.38
	Assets	1.57	0.178	0.188	1.353	
	ROE	−2.073	−0.173	0.179	1.233	
	Debt	7.212	0.127	0.429	1.957	
	Independence of the BD	−0.156	−0.247	0.057	1.225	
	Gender of the BD	−0.214	−0.154	0.21	1.13	
	Audit	5.692	0.179	0.149	1.142	
	Setor_1	−0.584	−0.02	0.894	1.636	
	Setor_2	19.549	0.488	0.001	1.384	
	Setor_3	10.421	0.3	0.082	2.167	
(M4) ITR	(Constant)	−109.124		0.123		0.23
	Assets	5.073	0.327	0.033	1.353	
	ROE	−2.595	−0.123	0.387	1.233	
	Debt	17.828	0.179	0.319	1.957	
	Independence of the BD	−0.077	−0.07	0.623	1.225	
	Gender of the BD	−0.022	−0.009	0.947	1.13	
	Audit	8.039	0.144	0.294	1.142	
	Setor_1	0.517	0.01	0.952	1.636	
	Setor_2	24.915	0.354	0.023	1.384	
	Setor_3	19.37	0.317	0.098	2.167	
(M5) IR_	(Constant)	−39.003		0.593		0.07
	Assets	3.945	0.267	0.108	1.353	
	ROE	−3.446	−0.172	0.273	1.233	
	Debt	17.75	0.187	0.343	1.957	
	Independence of the BD	−0.289	−0.274	0.084	1.225	
	Gender of the BD	−0.212	−0.091	0.541	1.13	
	Audit	7.555	0.142	0.345	1.142	
	Setor_1	−1.459	−0.029	0.871	1.636	
	Setor_2	7.454	0.111	0.501	1.384	
	Setor_3	5.998	0.103	0.618	2.167	

Table 13. *Cont.*

Model	Independent Variables	Non-Standard Coefficients	Standardized Coefficients	Sig.	VIF Statistics	R Square Adjusted
		B	Beta			
(M6) SR	(Constant)	−44.039		0.353		0.25
	Assets	2.966	0.278	0.063	1.353	
	ROE	−2.006	−0.139	0.324	1.233	
	Debt	21.808	0.319	0.076	1.957	
	Independence of the BD	−0.171	−0.225	0.113	1.225	
	Gender of the BD	−0.064	−0.039	0.774	1.13	
	Audit	10.339	0.27	0.050	1.142	
	Setor_1	−9.969	−0.277	0.092	1.636	
	Setor_2	11.664	0.242	0.109	1.384	
	Setor_3	−5.933	−0.141	0.447	2.167	
(M7) TR	(Constant)	−27.739		0.486		0.33
	Assets	2.316	0.243	0.084	1.353	
	ROE	−1.809	−0.14	0.291	1.233	
	Debt	17.36	0.284	0.093	1.957	
	Independence of the BD	−0.201	−0.295	0.029	1.225	
	Gender of the BD	−0.021	−0.014	0.913	1.13	
	Audit	5.926	0.173	0.177	1.142	
	Setor_1	−5.223	−0.162	0.289	1.636	
	Setor_2	12.499	0.289	0.044	1.384	
	Setor_3	5.708	0.152	0.386	2.167	

Table 13 shows that the first regression model (M1 FR) presented an explanatory capacity of 29% of the level of disclosure of the FR in IRs. It was also found that only the coefficient of the independent variable non-executive members on the BD was a statistically significant predictor, with a negative sign for the coefficient. Thus, this finding indicates an inverse relationship between the percentage of non-executive members on the BD and the level of FR disclosure in RI.

Regarding the second regression model (M2 OR), no significant independent variables were identified for the level of disclosure of the OR in IRs. The model was not statistically significant considering the ANOVA results, presenting an explanatory capacity of only 9% of the total OR disclosure explanation.

As for the third regression model (M3 LMR), it was found that the independent variable sector 2 (energy) was assumed to be a statistically significant predictor. The value of the positive coefficient indicates that entities in this sector potentially disclose more information regarding LMR in IRs. From the analysis performed, it was observed that the third regression model presented an explanatory capacity of 38% of the total disclosures of the LMR. It should be noted that this was the model with the greatest explanatory capacity among those analyzed in this study.

Regarding the fourth regression model (M4 ITR), an explanatory capacity of 23% of the total ITR disclosures was found and the statistically significant independent variables were again observed for the second century, with the same signal, as well as for the size. Thus, an interpretation that is close to the previous one (in the context of the LMR) can be made for the ITR. Concerning the size, the coefficient indicates that larger entities tend to present a higher average level of ITR disclosures in IRs.

For the fifth regression model (M5 IR_) assessed, referring to the risk typology of IR_ in IRs, it was observed that this, like the second model, was not statistically significant according to the results of ANOVA, presenting an explanatory capacity of only 7% of total RI_ disclosures.

In what concerns the sixth regression model (M6 SR), there was an explanatory capacity of 25% of the total SR disclosures and the independent variable auditor was assumed to be a statistically significant predictor, with a coefficient indicating a positive association. In

this sense, the entities whose reports were audited by an external audit tended to have a higher level of SR disclosure in IRs.

Finally, the seventh regression model, with the second highest explanatory capacity (33%), represented the total risks disclosure index in IRs (M7 TR). For this model, the statistically significant predictors were again the sector 2 and non-executive members on the BD. Sector 2 presented the same (positive) sign of association identified in the context of (M3 LMR) and (M4 ITR), while the negative sign for non-executive members on the BD was aligned with the results found for M1 FR.

The findings of this research are discussed in the following section.

3.2. Discussion

Considering the results previously presented, it is possible to verify that size presented itself as an explanatory factor that positively influenced the level of disclosure of the ITR typology. It is verified that the entities listed in B3 of larger size presented, tangentially, a higher level of disclosure of this type of risk. The result obtained for this explanatory factor partially confirms the first hypothesis (**H1**) of the present study, in which the level of disclosure of matters related to risk in IR is positively associated with the size of the entity. This finding is aligned with the empirical studies carried out on the subject (namely, by Linsley and Shrives 2006; Ereira 2007; Vandemaele et al. 2009; Elzahar and Hussainey 2012; Elshandidy et al. 2013, 2021; Kılıç and Kuzey 2018; Serrasqueiro and Mineiro 2018; Iredele 2019; Rizzi et al. 2019). The positive association found in the present study, even if partially, is aligned with the theories of agency and legitimacy, as larger entities present a greater public interest and, as such, present additional disclosure needs (namely, De Lima e Silva et al. 2015; Ereira 2007).

As for profitability, the findings do not allow us to confirm the proposed hypothesis (**H2**). Thus, it is not confirmed that the level of disclosure of risk-related matters in IR is associated with the entities' profitability. In the literature, studies have found a positive (Elshandidy et al. 2013, 2021; Iredele 2019), a negative (Vandemaele et al. 2009; Coulmont et al. 2020), and even a non-association (Ereira 2007; Elzahar and Hussainey 2012; Serrasqueiro and Mineiro 2018), as was found in this research. This finding thus contradicts the agency theory and signaling, which highlights that managers of entities with higher levels of profitability tend to signal more information about risk in the reports, to also justify to shareholders their current performance (namely, Elzahar and Hussainey 2012; Ereira 2007).

Concerning the indebtedness, the findings do not allow us to confirm hypothesis (**H3**), in which the level of disclosure of matters related to risk in IRs is positively associated with the indebtedness of the entity. It should also be noted the divergence in the literature on this subject, with studies indicating a positive association (for instance, Elshandidy et al. 2021) or, as also evidenced by this study, others that did not find any associations (Linsley and Shrives 2006; Ereira 2007; Serrasqueiro and Mineiro 2018; Iredele 2019). In this sense, the result obtained contradicts the signaling theory, in which the less indebted entities are encouraged to send signals to the market about their position, causing higher levels of disclosure (De Lima e Silva et al. 2015).

Regarding the independence of the BD, the findings do not confirm hypothesis (**H4**), which proposed that the level of disclosure of risk-related matters in IRs is positively associated with the weight of non-executive directors on the BD. The study found, on the contrary, a negative association, based on the risk typologies, namely FR and TR. It does not corroborate, therefore, the literature that globally points to a positive association (namely, Kılıç and Kuzey 2018; Iredele 2019; Elshandidy et al. 2013, 2021; Songini et al. 2021). It is also not in line with the agency theory, which indicates that lower levels of participation by these members in management activities, and consequently lower monitoring powers, would result in greater incentives for the entity to signal their ability to act through increased dissemination (Barako et al. 2006). However, the findings in this study can be eventually explained by the still reduced weight (less than 50% on average, with an even lower median)

and low variability identified (5% variance) for the number of non-executive directors on the BD of the entities included in the sample of this study.

In what concerns the gender of the BD, the findings do not allow us to confirm hypothesis (**H5**), in which we proposed that the level of disclosure of matters related to risk in IRs is positively associated with gender diversity in the BD. In the literature, studies point to a positive association (namely, Ntim et al. 2013; Allini et al. 2014; Mineiro 2016). The result obtained thus contradicts the theory of the upper echelons, which advocates that certain characteristics of the BD, such as gender, can influence strategic decision making (Mineiro 2016). Here, too, there is little significant participation of women on the BDs, since men represent 87% of the members of the BDs of the entities analyzed in the present study.

Regarding audits, the findings indicate that the proposed hypothesis (**H6**), from which the level of disclosure of matters related to risk in IRs is positively associated with the assurance of reliability by an external audit, is only partially confirmed. This result is based on the identified association between that factor and the level of disclosure of a single type of risk, namely SR. In the literature, studies differ as to the proposed association, finding positive associations (Elshandidy et al. 2021) or, even, nonexistent ones (Serrasqueiro and Mineiro 2018; Kılıç and Kuzey 2018). The findings from this research are partially in accordance with the agency theory, which argues that entities are motivated to hire and audit firms to reduce high agency costs, also increasing the credibility of disclosures (Jensen and Meckling 1976).

Concerning the activity sector, the findings indicate that the proposed hypothesis (**H7**), from which the level of disclosure of risk-related matters in IRs is associated with the entity's activity sector, is partially confirmed. The evidence was obtained in the context of the LMR, IR_, as well as for the TR, aligning, inter alia, with the evidence obtained by Elzahar and Hussainey (2012). Although partially, the results of this study corroborate with signaling theory, in that entities in the same activity sector are more likely to adopt similar levels of disclosure, but which may be different from entities in other sectors (Khlif and Hussainey 2016).

The next section provides the conclusions, as well as the limitations and avenues for future investigation, on the theme proposed in this paper.

4. Conclusions

The main objective of this study was to assess the risk disclosures by entities in IRs, identifying the explanatory factors of the level of risk disclosure by different typologies, taking as a sample the entities of the Brazilian stock exchange, which on 31 December 2020, were part of the IBX-100 index.

Considering that objective, seven hypotheses were formulated based on different characteristics of the entities, namely size, profitability, indebtedness, number of non-executive members on the BD, gender of the BD, audit, and activity sector. Linear regression models were used for the analysis of these hypotheses, complemented by descriptive statistical techniques and non-parametric tests of differences, having, as dependent variables, the indices of disclosure of the different risk typologies.

The descriptive analysis found a still low level of disclosures of matters related to risk, and it was observed that the entities disclosed only 26% of the items related to risk in IRs compared with what was expected, considering the proposal of this study. By type, the IR_ was the most disclosed, with 33% of observations in the total of expected items, contrary to the LMR, with only 11% of observations. It was also possible to find a greater number of disclosures of a qualitative nature compared with quantitative ones. It was found that the entities referred 45% of the risks in the IR, reporting their actions for prevention and mitigation of such risks in only 37% of the cases evaluated. On the other hand, the disclosure of actions in the short, medium, and long term was referenced in only 2% of the cases observed. Regarding the disclosure attributes, it was observed that, in the FR typology, entities disclosed more information about market risk compared with interest rate and exchange rate risks. As for the OR, there was a predominance of the

disclosure of the risk of efficiency and performance, compared with the risk of obsolescence of inventories. In the typology of the risk LMR, the disclosure of the risk of leadership and management stood out. By assessing the attributes of disclosure concerning ITR, the equivalent disclosure of integrity and access/availability risks were found. As for IR_, there was a predominance of disclosures of the risk of illegal acts. Finally, in the SR risk typology, there was the disclosure of more information about the environmental risk, given the competitive risks.

As regards the proposed associations, it was found that the size, the audit, the activity sector, and the weight of the non-executive members on the BD partly explain the number of the proposed risk disclosure typologies in RI, namely the FR, the LMR, IR_, and SR. For TR, however, only the last two factors mentioned were potentially significant in explaining the level of disclosure. Thus, it was found that these explanatory factors allow us to partially support the theories of legitimacy, signaling, and agency, except for the weight of non-executive members on the BD, which thus obtained greater support in the present study. These findings are consistent with those found in the literature in this field, such as Elshandidy et al. (2021), regarding size and audit, and Elzahar and Hussainey (2012), concerning the activity sector.

This study has some limitations, namely the still small number of studies in the literature specifically about the disclosure of risk in IRs. A second limitation is that the study was conducted only with entities from Brazil and for only one year, which results in a lack of comparability of the characteristics of the disclosure between periods and entities from different countries.

Thus, to fill this gap, it is suggested that future research continue the proposal of this study, with the inclusion of entities from different countries, namely European countries, and a broader time horizon. As such, other explanatory factors may be proposed, including factors relating to local culture and legal, social, and economic contexts.

Despite its limitations, it is relevant to highlight, however, as a novelty of this study, the detailed analysis of the different typologies and attributes of the risk disclosed in IRs, from an approach not yet found in the literature. Consequently, this paper contributes to the literature on the explanatory factors of risk disclosure by proposing its analysis using different typologies and attributes, with IR as a source of information, content still little explored in studies in this area. The still small number of studies dedicated to the analysis of the disclosure of content elements in IR and, more specifically, on the disclosure of risks (Manes-Rossi et al. 2017), indicates the relevance of this study in the context of the literature on the subject.

An innovative approach was also included in this research, which involved integrating elements related to the classification of risks related to the SD from the inclusion of ESG factors. By developing explanatory factors of risk disclosure and proposing their analysis using different typologies and attributes, it then contributes to the presentation of a new risk analysis model in integrated reports. Therefore, a new risk analysis model is proposed in the IR of this study as a scientific contribution.

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