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An analysis of the relationship between intangible assets and risk disclosure among B3's financial companies

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Abstract

Objective: To analyze the relationship between intangible assets and risk disclosure in financial companies listed on B3.

Methods: The sample comprised 78 financial companies traded on B3 between 2015 and 2019. A quantitative approach was adopted along with descriptive statistics, the test of the difference between the means, correlation, and multiple linear regression with panel data for data analysis.

Results: The results showed differences in financial, non-financial, and general risk disclosure means between intangible-intensive and tangible-intensive companies. Additionally, the regression estimates indicated a positive influence of intangible assets on the companies' risk disclosure. The results indicate that intangibility contributes to more transparent information about financial, non-financial, and general risks in financial companies listed on B3, favoring the adoption of strategies aimed at maximizing their economic value.

Contributions: This study's findings expand the discussion on intangible assets and risk reporting. Additionally, managers may see how the representativeness and structure of intangibles can be used to guide practices associated with disclosing risks to external stakeholders and understand how to manage such assets to create and maintain a company's economic value.

Keywords: Intangible Assets. Risk Disclosure. Financial sector.

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1. Introduction

Intangible assets are discussed in the business environment and have stood out in the discussions of the academic community (Albuquerque Filho, Macedo, Moura, Fank & Heberle, 2019; Gharbi, Sahut & Teulon, 2014; Kayo, 2002; Lev, 2001; Perez & Famá, 2006). Such assets are known as knowledge assets (Lev, 2001; Lev 2019; Moura, Dalchiavon, Scheren & Zanin, 2018; Sveiby, 1997), invisible assets (Sveiby, 1997), intellectual capital, or goodwill (Stewart, 1997). Evidence given to these assets is motivated by a combination of phenomena, such as the advancement of information technology and the intensification of business competition (Albuquerque Filho *et al*., 2019).

Intangible assets are unique and have distinctive characteristics, allowing companies to differentiate and obtain a competitive advantage (Santos, 2015). From this perspective, it is conjectured that (i) there is a relationship between intangibles and wealth generation (Moura *et al*., 2018), and (ii) intangible-intensive companies tend to create more value for shareholders than tangible-intensive companies (Perez & Famá, 2006). Intangible-intensive companies predominantly use intangible assets, leading to higher profits and appreciation in the capital market (Stewart, 1997).

That said, intangible assets are essential for entering business and maintaining a company's competitive position (Kayo, 2002; Nagaraja & Vinay, 2016). According to Albuquerque Filho *et al.* (2019) and Moura *et al.* (2018), relevant competitiveness factors, such as investment in human capital and research and development (R&D), are the main drivers of change in business.

Despite the advantages of holding intangible assets, Higgins (2013) considers that intangible-intensive companies demand special attention, as information about these assets involves more complex recognition, measurement, disclosure, and evaluation procedures. Hendriksen and Van Breda (2007) state that one of the main characteristics of intangibles concerns the high degree of uncertainty regarding their benefits. As a result, companies that invest intensively in these assets tend to have a riskier profile (Kayo & Famá, 2004; Santos & Coelho, 2018). It means that although such assets provide owners competitive advantages, increased productivity, and value creation, they also raise doubts regarding the sustainability of results, as they have a high degree of subjectivity involved in their identification and measurement (Albuquerque Filho, Garcia, Vasconcelos, & Lima, 2021).

Thus, investments in intangible assets are also subject to various risks that affect business performance, and the literature presents some results for the relationship between intangible constructs and corporate risks. Jia (2018) examined the relationship between corporate innovation (intangibles) and the risk of stock price fall among American companies. Wu and Lai (2020) assessed the relationship between intangible intensity and the risk of stock price falling among companies listed on US stock exchanges. They reported a positive relationship between intangible resources and risk. On the other hand, Ben-Nasr, Bouslimi, and Zhong (2021) analyzed whether patented innovations reduce the risk of falling stock prices in American companies, and Lev, Radhakrishnan, and Ciftc (2006) examined future benefits, earnings variability, and stock volatility shares of leading R&D companies. They found a negative relationship between such intangibles and risk.

Such divergences in the results corroborate research showing that companies provide investors with greater evaluative possibilities regarding the risk and profitability of their investments when they recognize and disclose intangibles in their financial reports, such as the balance sheet (representativeness) and explanatory notes (structure) (Al-Hadi, Hasan & Habib, 2016; Santos & Coelho, 2018). Therefore, companies reporting strategic investments with a certain degree of complexity and uncertainty support investors in measuring risks and market value (Abdullah, Shukor & Rahmat, 2017). Furthermore, companies that disclose adequate and sufficient information about risks tend to enjoy higher levels of trust (Leite, Nunes, Assis, Adriano & Fonseca, 2016).

As a result, risk disclosure has currently become relevant for the capital market (Dey, Hossain & Rezae, 2018) to decrease information asymmetry, as it involves financial and non-financial information that organizations provide concerning risk analyses in their institutional reports (Miihkinen, 2012).

Difficulties involved in measuring and disclosing intangible assets, as well as the characteristics of the Brazilian stock market listed by Perez and Famá (2006), such as high volatility, liquidity problems, and excessive concentration of ownership, motivate the study of these assets to understand how companies have reported corporate risks. Furthermore, even though plenty of Brazilian studies on intangible assets address different economic sectors, these generally exclude financial companies due to their peculiar characteristics (Moura, Varela & Beuren, 2014).

Intangible assets and risk disclosure are topics widely studied in non-financial companies. Hence, this study's analysis of intangible assets includes these companies' structure and representativeness due to the disclosure of financial, non-financial, and general risks to advance the empirical literature applied to financial companies.

This study analyzes the relationship between intangible assets and risk disclosure in financial companies listed on B3. Therefore, the intangible assets of 78 companies were analyzed using the structural and representative approach. The risk disclosure analysis also included section 4 of the reference form – Risk factors. Descriptive statistics was used to analyze data from 2015 to 2019 (five years), including the test for differences between means, correlation analysis, and multiple linear regression with panel data.

Although the field of intangible assets and risk disclosure are relatively mature, the relevance of this study lies in the gaps that remain when these aspects are studied together, especially when restricted to financial organizations; due to their specific regulations and particularities, they are often excluded (Kayo, 2002). Furthermore, Al-Hadi et al. (2016) highlight that risk disclosure is relevant for companies because this information is the main instrument for containing banking crises. In the meantime, information transparency in the financial system is essential for the economic decision-making process since intermediation in financial institutions requires stakeholders to trust them (Dantas, Rodrigues, Rodrigues & Capelletto, 2010). The transparency of financial companies includes the disclosure of timely information that enables users to assess a business's risk profile, financial conditions, and risk management practices (Torres & Galdi, 2013). Additionally, intangible assets are essential to recover from a fall in market value during crises (Barajas, Shakina & Fernández-Jardón, 2017; Shakina & Barajas, 2015).

This study also expands discussions involving these topics, providing empirical evidence that supports the decision-making of financial managers, investors, and market regulatory bodies. Considering that financial companies tend to take more risks due to the sector's intense competitiveness, this study shows managers the need to be aware of the best market practices and improve processes to promptly and adequately identify corporate risks to minimize losses, confirming that risk management in financial institutions is a current research topic (Alves & Matias, 2014).

2. Literature Review

2.1 Intangible Assets

Intangibles have become essential assets in the organizational scenario (Kayo, 2002). Kaplan and Norton (1997) emphasize that companies' value creation migrates from managing tangible assets to strategies based on knowledge management and exploring intangible assets. In this sense, Stewart (1997) explains that large companies do not become powerful only by accumulating more capital than their competitors but also by having intangible assets that are more valuable than tangible assets, which gives them a competitive advantage.

Although some authors attribute the relevance of intangible assets' definitions to their physical inexistence, Hendriksen and Van Breda (2007) note that this is not a base characteristic for differentiating tangible and intangible assets. They also assert that when the definition, recognition, and measurement requirements are met, intangible assets must be recognized in financial statements. Higgins (2013) considers that companies with intangible assets are more complex and require special attention regarding recognition, measurement, and disclosure procedures. For example, internally generated intangibles are not included in accounting reports, even though the market values them, while acquired intangible assets are identified and presented on the companies' balance sheets (Machado, 2023).

In Brazil, the obligation to record these assets in the balance sheet's non-current assets was determined by Law No. 11,638, from December 28, 2007, which amended and revoked provisions of Law No. 6,404, of December 15, 2007. 1976. Later, based on IAS 38 (2004), CPC 04 established criteria for recognizing and measuring these assets (CPC, 2008, 2010). Based on regulations, not all intangible items can be recorded as intangibles, as they must meet their recognition and measurement requirements.

Regarding the structure, several authors propose classifications, independently of normative provisions, for identifying intangible assets (Brooking, 1996; Edvinsson & Malone, 1998; Kaplan & Norton, 1997; Kayo, 2002; Lev, 2001; Stewart, 1997; Sveiby, 1997). Note that there is no consensus on which classification is the most appropriate, as each author relies on relevant characteristics to facilitate understanding regarding the study of assets intangibility. Therefore, due to the diverse approaches used to address this topic, and also for convenience, this study adopts Kayo's (2002) classification. It divides intangible assets according to shared characteristics: human assets, innovation assets, structural assets, and relationships (with strategic audiences). Among several studies that use this classification, Groff, Marschner, and Sané (2013), Kayo and Famá (2004), Lin and Tang (2009), Machado and Famá (2011), Santos (2015), and Santos, Calíope and Silva Filho (2016), stand out.

Similar to the classification of intangible assets, their representativeness has been the focus of some academic investigations (Leite & Pinheiro, 2014; Mantovani & Santos, 2014; Moura, Fank & Varela, 2012; Moura, Theiss & Cunha, 2014). The representativeness (proportion) of intangible assets has been addressed from the perspective of different groups of the equity structure, such as Non-Current Assets and Total Assets (Mantovani & Santos, 2014).

Regarding representativeness, Moura *et al.* (2018) draw attention to increased investments in intangibles, giving these assets greater prominence and representativeness in total assets. In the opinion of Edvinsson and Malone (1998), intangibility is what fills the gap between a company's accounting value and its market value, being composed of knowledge, applied experience, technology, customer relationships, and professional skills, which provides the company with a competitive advantage (Chiarello, Marassi & Klann, 2015).

Albuquerque Filho et al. (2019) show that the degree of intangibility positively impacts return on equity. Therefore, intangible-intensive companies (predominant in intangible assets) are more profitable than tangible-intensive ones. Kayo and Famá (2004) note that a company's size and market value contribute to increasing or decreasing its probability of being intangible-intensive.

Mansfield and Wagner (1975) warn that investments in intangible assets are more likely to fail than investments in tangible assets though; hence, intangible assets investment imposes more significant risks to a business (Ben-Nasr, Bouslimi & Zhong, 2021; Giuliani, 2013; Wu & Lai, 2020); for example, R&D investments raise different types of corporate risks (Gharbi et al., 2014). They note that the possibility of product failure, systematic risk, profit variability, intellectual property risk, and volatile stock returns lead to such risks. Nonetheless, intangible-intensive companies tend to have low debt levels, as they are often forced to finance their intangibles with internal resources (Santos, 2015).

Furthermore, the risks caused by intangible assets may arise from their internal development, i.e., late and unstable development, but also because they have high acquisition and management costs (Perez & Famá, 2006). Moreover, some intangibles, such as property rights, may be stolen, manipulated, or copied (Lev, 2001). Intangibles such as customer base, relationships, logistics, and distribution channels present high risks since they are at the companies' service but do not belong to them (Perez & Famá, 2015).

Therefore, the relevance of the risks related to these assets in the business and academic context is apparent. Hence, disclosing risks related to these assets decreases information asymmetry between managers, investors, and other interested parties (Moura *et al.*, 2018).

2.2 Risk Disclosures

Even though there is no consensus in reports and studies on the term "risk" (Samson, Reneke & Wiecek, 2009), authors addressing organizational matters propose and accept different understandings. Renn (1992) states that "risk" is the probability that an undesirable state of reality may arise due to human action or natural events. The term "risk" used in this paper aligns with that proposed by Linsley and Shrives (2006). Their definition identifies risk as any opportunity or threat, damage, danger, or exposure that may affect a business in the future or has already affected it, explaining the growing interest among stakeholders in information regarding organizations' risk management (Zonatto & Beuren, 2010).

Miihkinen (2012) states that risk disclosure involves all information an organization provides regarding risk analyses presented in its reports. In turn, Kim and Yasuda (2018) understand that risk disclosure must contain information affecting investor decisions, including all factors influencing a company's future performance.

Santos and Coelho (2018) state that reporting risk management maximizes the chances of a business' success as it supports shareholders' investment decisions. On the other hand, disclosure is fundamental for assessing a manager's ability to deal with market volatility and uncertainty and its influence on the company's performance (Dobler, Lajili & Zéghal, 2011).

Specifically in financial companies, Al-Hadi et al. (2016) clarify that market risk disclosure is critical since this information is essential for containing banking crises. According to Zonatto and Beuren (2010), market risk may be represented by interest rates, exchange rates, stock, or commodity prices; therefore, these are losses resulting from fluctuations in economic-financial variables.

This paper admits that risk management involves risk reporting and generates effects such as decreased information asymmetry between managers and investors (Santos & Coelho, 2018) and reduced fundraising costs (Dey et al., 2018).

Information disclosure is voluntary or compulsory; the latter results from regulations determining the minimum requirements for information disclosure regarding risk for example (Elshandidy & Neri, 2015). Despite such devices, some companies avoid disclosing unfavorable information, deliberately omitting it (Polinsky & Shavell, 2012).

For this reason, the Sarbanes-Oxley Act (Sox) was enacted in the United States to ensure information transparency about risks and provide investors greater protection. As a result, the risk management model proposed by the Committee of Sponsoring Organizations of the Treadway Commission (Coso) was adopted. However, emerging countries have less rigid regulations, and companies enjoy a greater concentration of ownership. Hence, voluntary disclosure is even more critical (Lanzana, 2004).

To assess risk disclosure in this study, we adopted the score of financial companies that results from the sum of disclosed risk factors, according to a structured checklist based on Linsley and Shrives (2006), Miihkinen (2012) and Ntim, Lindop, and Thomas (2013) described in the methodology.

2.3 Hypothesis Formulation

Studies analyze the relationship between intangible assets and several variables, such as debt and risk level (Kayo, 2002), corporate governance (Moura et al., 2014), corporate social responsibility, innovation (Santos, Silva, Gallon & De Luca, 2012), and business performance (Nagaraja & Vinay, 2016).

Nagaraja and Vinay (2016) investigated the relationship between the intangible assets, financial performance, and financial policies of Indian companies. They found that intangible assets positively influence a company's financial performance and value. On the other hand, the same was not found for financial policies.

Moura et al. (2014) analyzed the balance sheets, explanatory notes, and management reports of 260 BM&FBovespa companies in 2009. They found that (i) the average disclosure compliance index based on CPC 04 was 75%, and (ii) companies with greater intangibility and better governance practices are those with higher levels of compliance with mandatory disclosure.

Elshandidy and Neri (2015) compared non-financial companies in the United Kingdom (290) and Italy (88). They found that governance practices play a significant role in the high levels of risk disclosure in the annual reports of United Kingdom companies. As for the Italian companies, they found that governance motivated them to provide more information on a mandatory basis.

On the other hand, Dey et al. (2018) consider that, despite regulations, companies consistently and regularly resist disclosing risk information. Their findings result from a study comprising 48 industrial companies in Bangladesh from 2010 to 2015.

Still, in the context of companies from different sectors, regarding the relationship between intangible assets and risk, Giuliani (2013) states that intangible assets impose risks, and companies are restricted by long-term strategic investment. This means that the strategic assets of intangible-intensive companies may succeed (or fail) in times of difficulty when resources are limited (Barajas et al., 2017). Therefore, companies' intangibility has been treated as a construct composed of multiple dimensions with different effects on risk (Brasil, Sampaio & Perin, 2008).

Gharbi et al. (2014) note that the uncertainty of investments in intangible assets, especially related to R&D, is substantially higher than that of tangible assets. According to the authors above, R&D investments involve many types of risk, such as product failure, profit variability, systematic risk, intellectual property, and the volatility of stock returns. Therefore, the level of information asymmetry in intangible-intensive companies is generally high due to the complexity and technicality of innovation (Gharbi et al., 2014).

Therefore, intangible assets suggest more significant uncertainty due to their characteristics; i.e., they raise earning potential but increase business risk. Thus, considering these assets are more "subjective," intangible-intensive companies may present higher risks and higher risk disclosure, a conjecture representing the central relationship investigated here through the companies in the B3 financial sector. As noted by Fernandes (2012), disclosing information regarding the effects of a company's operational activity tends to reduce information asymmetry between managers and stakeholders, which might mitigate corporate risks.

Furthermore, previous studies have seldom addressed intangible assets and risk disclosure in the context of financial companies, especially when these are studied together. In any case, investments in intangibles are known to present specific characteristics –, such as uncertainty, intangibility, and difficult appropriation –, which, combined with market failures like informational asymmetry, moral risk, and indivisibility, make activities that consume these resources more risky, costly, and less accessible (O'Brien, 2003).

Chiarello et al. (2015) assessed the level of information disclosure related to intangible assets in financial companies on the BM&FBovespa from 2010 to 2012. Their results show that the financial sector has low levels of disclosure of intangible assets, with larger companies presenting higher levels of disclosure regarding these assets, because large companies are subject to more regulatory requirements or seek to decrease the cost of capital by attracting investors.

Zonatto, Sousa, and Fernandes (2015) analyzed the level of market risk disclosure of 24 financial institutions on the BM&FBovespa and found no significant differences between banks listed at different levels of governance. The results show that the disclosure practices of financial companies are not standardized, highlighting the possibility of companies selecting information for disclosure, which diverges from other studies' results.

By analyzing the annual reports of financial companies listed on the Shanghai "A" share market from 2013 to 2015, Elshandidy, Neri, and Guo (2018) examined the main factors for the quality of risk disclosure and found that the size of companies is the most significant factor, while a firm's capital and risk structure do not affect the quality of risk disclosure.

Li, Li, Liu, and Zhu (2018) analyzed the trends and evolutionary mechanisms of risk disclosure in the annual reports of financial companies from 2006 to 2016. Their study showed that changes in company characteristics might explain the general trends in risk disclosure attributes.

More recently, Souza, Santos, and Gordiano (2022) investigated the relationship between intangible assets and economic-financial performance in a sample of financial companies in 2018. The findings showed that intangible assets positively influence the economic-financial performance of companies in the financial sector.

Thus, based on the arguments in the literature generally aimed at non-financial companies, the following hypothesis is proposed:

H1: The intangibility of assets influences risk disclosure in financial companies listed on the Brazilian stock exchange

3. Methodological Procedures

The study population comprises 83 companies in the financial sector listed on B3 on December 18, 2020. Note that five companies were excluded for not having their financial statements on the B3 website. Thus, data from 78 companies concerning the five-year period (2015-2019) were used. The financial companies were identified according to the B3 classification, whose grouping criteria include analyzing the services or products that contribute the most to these companies' revenues. Table 1 presents the final sample with 78 companies.

Table 1

Segmentation of companies classified in the B3 financial sector B3

Subsector	Segment	Companies	
		Number	Percentage (%)
Financial intermediaries	Banks	23	29
Receivable securitization	Receivable securitization	16	20
Real State Exploration	Real State Exploration	13	17
Pensions and insurance	Insurance	6	7
Miscellaneous financial services	Resource and investment management	5	6
Diversified holdings	Diversified holdings	3	4
Financial intermediaries	Commercial leasing	3	4
Financial intermediaries	Credit and financing	3	4
Real State Exploration	Real State intermediation	2	3
Pensions and insurance	Insurance brokers	2	3
Miscellaneous financial services	Miscellaneous financial services	2	3

Source: developed by the authors.

Table 1 shows that banks (29%), receivables securitization companies (20%), and real estate exploration companies (17%) represent 66% of the study sample.

The next step consisted of analyzing the intangible assets reported by the companies in the balance sheet and the explanatory notes, addressing the assets' representativeness and structure. The first approach (representativeness) aimed to highlight each firm's share of the intangible assets relative to the total assets and non-current assets, which enabled measuring their equity relevance (Albuquerque Filho *et al.*, 2019; Moura *et al.*, 2014; Nagaraja & Vinay, 2016). The second approach (structural) considered the composition of intangible assets integrating the equity structure, according to the classification of Kayo (2002) and Santos (2015): innovation assets, structural assets, and relationship assets.

A qualitative approach was adopted in the reports' documentary analysis to assess risk disclosure. Two researchers concomitantly applied this technique, which two other authors reviewed later. The document analysis focused on the reports' risk section (Beattie, McInnes & Fearnley, 2004). Similar to what was performed by Almendra, Vasconcelos, Silva, and De Luca (2018), the observations were verified using the reference form, section 4 – Risk Factors. The scale proposed by Van Staden and Hooks (2007) was used to measure the information reported by the companies in the risk section (Table 2).

Table 2
Disclosure level measurement scale

Score	Description
0	There is no comment on the risk factor, or there is information that the company is not subject to this factor.
1	Qualitative information with brief mention. Descriptive details only.
2	Qualitative information with an explanation of the sources of risk. Disclosure of risk policies
3	Quantitative information with brief mention. Only details in monetary terms or actual physical quantities.
4	Quantitative information identifying sources of risk. Evidence of policies, impact, and/or probability of risk.

Source: developed by the authors according to Van Staden and Hooks (2007).

Therefore, the scale ranges from 0 to 4 points; the higher the score, the higher the level of risk disclosure. Furthermore, the checklist for measuring the level of risk disclosure was based on Linsley and Shrives (2006), Miihkinen (2012), and Ntim et al. (2013), from which two risk categories encompassing corporate risk factors were identified: financial and non-financial. Another five risk subcategories are considered: financial, operational, strategic, damage, and integrity. Therefore, 38 risk factors are listed and distributed across the five subcategories. Hence, the risk disclosure index's total/maximum score is 152 points: 28 points concern financial risk disclosure, and 124 points concern risk disclosure non-financial (Table 3).

Table 3

Categories, subcategories, and risk factors

Category: Financial risk disclosure	
Subcategory	**Risk Factor**
Financial Risk	Interest rate changes Sudden changes in exchange rates Risk of insufficient working capital (liquidity) Risk of not receiving payments (credit/default) Sudden changes in share price Changes in prices and coverage of financial instruments Commodity price volatility Maximum total subcategory score: 28 points
Category: Non-Financial risk disclosure	
Subcategory	**Risk Factor**
Operational risk	Effects of negative marketing (customer boycott) Third-party complaints Sudden unavailability of resources and/or problems in the supply of inputs Risks in the production and product development process Risk of infringement of industrial property rights and/or problems with their protection Risk of failures in information technology and/or cyber risk Risk of dependence and/or unavailability of human resources Risk of social and environmental damage Risk of reduced revenue and/or significant discount due to inventory obsolescence Risk of brand erosion Health and safety risk in the workplace **Maximum total subcategory score: 44 points**
Damage risk	Risk of insufficient insurance coverage Risk of unfavorable court decisions (significant lawsuits) **Maximum total subcategory score: 8 points**
Integrity risk	Internal or external fraudulent actions Negative impact on the company's reputation or image Ethical problems and corruption in business **Maximum total subcategory score: 12 points**
Strategic risk	High level of competitiveness and risk of unfair competition Risk of Industry-Specific Changes Geopolitical instabilities Risk of regulatory changes Risk of political changes, with the possibility of changes in tax legislation Risk of economic changes Changes in the inflation rate Risk of natural disasters affecting the business environment Risk of loss of control over suppliers and/or risk of dependence on suppliers Changing customer preferences Risk of loss of control over customers and/or risk of customer dependency Risks associated with the launch of new products Risks associated with the preparation and implementation of mergers and acquisitions Political Risk on Sovereign Bonds Risks associated with business portfolio diversification **Maximum total subcategory score: 60 points**

Source: developed by the authors according to Linsley and Shrives (2006), Miihkinen (2012), and Ntim et al. (2013).

Based on specialized literature, this study adopted the following control variables: company size (SIZE), considering that large companies are prone to assume higher levels of risk due to capital availability (Rengel, Sousa, Monteiro & Meurer, 2020); debt (DEBT) because it is associated with a company's risk and it transmits information about business risks (Nascimento, Angotti, Macedo & Bortolon, 2018); and return on assets (ROA), which, according to Shahzad, Fareed, Wang and Shah (2020), the higher the company's performance, the greater a company's perceived risk.

Descriptive statistics, the test of differences between means, correlation analysis, and multiple linear regression with panel data were applied. Basic assumptions such as normality of residuals, homoscedasticity, and multicollinearity were met, and linear regression tests were performed.

The test of difference between means was intended to verify potentially significant differences in risk disclosure (financial, non-financial, and general) between intangible-intensive (G1) and tangible-intensive (G2) companies. These groups were created to represent companies: G1, comprising companies whose values were equal to or above the intangible variables median (representativeness), and G2, comprising companies whose values were below the median (Oliveira, Schossler, Campus & Luce, 2014; Perez & Famá, 2006). Note that the classification of companies into these two groups (G1 and G2) was also considered when performing descriptive statistics and regressions involving the representativeness of intangible assets to obtain more robust results. In this sense, a dummy variable (G1 and G2) was included in each model involving the variables of representative intangible assets (INTANG_TA - quotient between intangible assets and total assets; INTANG_NC - quotient between intangible assets and non-current assets; and NI - mean of intangibility proxies relative to their representativeness) (Carlos & Angelo, 2019; Magro, Silva, Padilha, & Klann, 2017) to verify whether the group of intangible-intensive companies influences the disclosure of financial, non-financial, and general risk. The tests were performed using STATA, version 13.

Table 4 summarizes the study variables.

Table 4
Dependent, independent and control variables

	Variable	Description	References
Dependent	Risk Disclosure	FD – financial risk disclosure Intangibility	Chiarello, Marassi and Klann (2015) Elshandidy *et al.* (2018) Zonatto *et al.* (2015)
		NFD – non-financial risk disclosure	
		GD – general risk disclosure	
Independent	Intangibility (Representativeness)	INTANG_TA – quotient between intangible assets and total assets	Albuquerque Filho et al. (2019) Moura *et al.* (2014) Nagaraja and Vinay (2016)
		INTANG_NC – quotient between intangible assets and non-current assets	
		NI – mean of proxies of intangibility relative to its representativeness	
	Intangibility (Structure)	Relationship assets – proportion relative to total intangible assets	Kayo (2002) Santos (2015)
		Innovation assets - proportion relative to total intangible assets	
		Structural assets – proportion relative to total intangible assets.	
Control		SIZE – company's size – Ln of total assets.	Albuquerque Filho et al. (2019) Kayo (2002) Moura *et al.* (2014) Nagaraja and Vinay (2016) Rengel *et al*. (2020) Shahzad *et al.* (2020)
		DEBT – company's debt – quotient between payable liabilities and total assets.	
		ROA – return on assets – quotient between net profit and total assets	
		Dummy (G1, G2) – takes on 1 for intangible-intensive companies regarding representativeness (G1) and 0 for tangible-intensive companies (G2)	Carlos and Angelo (2019) Magro *et al.* (2017)

Source: developed by the authors.

The econometric models in this study are defined as follows:

$$Risk\ Disclosure = \beta_0 + \beta_1 Intangibility_{i,t}\ (representativeness) + \beta_2 SIZE_{i,t} + \beta_3 DEBT_{i,t} + \beta_4 ROA_{i,t} + Dummy\ (G1,G2)\ \varepsilon_{i,t} \quad \textit{Equation 1}$$

$$Risk\ Disclosure = \beta_0 + \beta_1 Intangibility_{i,t}\ (structure) + \beta_2 SIZE_{i,t} + \beta_3 DEBT_{i,t} + \beta_4 ROA_{i,t} + \varepsilon_{i,t} \quad \textit{Equation 2}$$

As the models were tested using the linear regression technique with panel data, the application of fixed effects (F), random (A), or pooled OLS (P) panel models was performed through the application of the Hausman tests, Breush-Pagan and F test for individual effects. According to the test results, the most appropriate type of effect was used in each model.

4. Results

Table 5 presents the descriptive analysis of risk disclosure and the representativeness and structure of companies' intangible assets in the five years (2015-2019).

Table 5
Descriptive analysis of variables

Variable	No. of observations	Minimum	Maximum	Mean	Standard deviation
FD	390	0	26	9,35	6,324
NFD	390	0	53	22,30	13,009
GD	390	0	73	31,65	17,991
INTANG_TA	390	0	0,7967	0,4618	0,1507
INTANG_NC	390	0	0,6102	0,2071	0,7271
NI	390	0	0,3122	0,1279	0,4227
Relationship assets	116	0	0,7257	0,1951	0,4043
Innovation assets	73	138	0,6947	0,2037	0,5566
Structural assets	126	22	0,6810	0,2570	0,5080

Legend: FD – Financial risk disclosure; NFD – Non-financial risk disclosure; GD – general risk disclosure; INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangibility proxies concerning representativeness; Relationship assets – proportion relative to total intangible assets; Innovation assets – proportion relative to total intangible assets: Structural assets – proportion relative to total intangible assets.

Source: developed by the authors.

The companies recorded a general risk disclosure mean of 31.65 points (20.8%). Some companies did not record any risk factor, while others recorded up to 73 points (48.0%) out of a maximum score of 152. Note that there is a discrepancy in general risk disclosure between companies; some companies scored a maximum of 26 points for financial risk disclosure (92.9% of the total), and some scored 73 points for non-financial risk disclosure (58.9%).

This finding corroborates Almendra et al. (2018) and Polinsky and Shavell (2012), who highlighted that, despite regulations, some companies disclose little or insufficient information about risks. According to Beretta and Bozzolan (2004), such lack of information hinders external users' assessment regarding the impacts to which companies are subjected.

Some financial companies do not report values regarding the representativeness of intangible assets. In contrast, the companies with the most significant representation recorded 79.69% of total assets, 61.02% of non-current assets, and 31.22% of proxies representing intangible assets.

As for the structure of intangibles, the most representative group in financial companies involves structural assets, with a mean of 25.70% of total intangible assets, followed by innovation intangibles, with a mean of 20.37%. Other intangible assets, not included in Kayo's (2002) classification, represent 34.42% of the companies' intangible assets.

Table 6 presents the companies' descriptive statistics based on the classification into intangible-intensive (G1) and tangible-intensive (G2), showing the behavior and dispersion of companies regarding different types of risk disclosure.

Table 6

Descriptive analysis of risk disclosure variables, considering the classification of companies in the G1 and G2 based on the variables of representative intangible

Variable	INTANG_TA	No. of observations	Minimum	Maximum	Mean	Standard-deviation
FD	G1	193	0	26	9,45	6,335
	G2	191	0	26	9,341	6,324
NFD	G1	193	0	53	22,70	13,16
	G2	191	0	53	22,29	13,00
GD	G1	193	0	73	32,16	18,07
	G2	191	0	73	31,64	17,99
Variable	**INTANG_NC**	**No. of observations**	**Minimum**	**Maximum**	**Mean**	**Standard-deviation**
FD	G1	193	0	26	9,33	6,334
	G2	191	0	26	9,28	6,324
NFD	G1	193	0	53	22,43	13,06
	G2	191	0	53	21,30	12,95
GD	G1	193	0	73	33,77	18,05
	G2	191	0	73	32,23	17,87
Variable	**NI**	**No. of observations**	**Minimum**	**Maximum**	**Mean**	**Standard-deviation**
FD	G1	193	0	26	9,538	6,382
	G2	191	0	26	9,351	6,324
NFD	G1	193	0	53	22,63	13,23
	G2	191	0	53	21,14	13,00
GD	G1	193	0	73	32,33	18,17
	G2	191	0	73	31,64	17,99

Legend: FD – Financial risk disclosure; NFD – Non-financial risk disclosure; GD – general risk disclosure; INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangibility proxies concerning representativeness; G1 – group of intangible-intensive companies; G2 – group of tangible-intensive companies.

Source: developed by the authors.

Table 6 shows that intangible-intensive companies are more likely to disclose risk information (general, financial, and non-financial) than tangible-intensive companies despite the greater dispersion identified among G1 companies. In any case, note that both groups comprise companies that did not disclose risk factors. Furthermore, the dispersion of the results concerning G1 and G2 companies is greater in non-financial and general risk disclosure.

The companies recorded a general risk disclosure mean of 31.65 points (20.8%). Some companies did not record any risk factor, while others recorded up to 73 points (48.0%) out of a maximum score of 152 points. Note that there is a discrepancy in general risk disclosure between companies, with some presenting a maximum of 26 points for financial risk disclosure (92.9% of the total) and 73 points for non-financial risk disclosure (58.9%).

Thus, it is clear that some Brazilian financial companies avoid disclosing all their risk information, restricting information disclosure required by law. Despite regulations, some companies consistently and regularly do not disclose risk information (Dey et al., 2018). Polinsky and Shavell (2012) mention that a potential explanation arises from companies not disclosing unfavorable information and risk disclosure, as such information can influence investors' decision-making (Kim & Yasuda, 2018).

Table 7 presents the main intangible assets, according to group and respective components.

Table 7

Primary intangible assets reported by companies according to group and respective components

Intangible group	Components	Companies		Mean in the 2015-2019 period (in thousand Reais)
			Percentage (%)	
Innovation assets	Software development	8	10	40,599.70
	Patents	6	8	603.66
Structural assets	Software	33	42	229,320.76
	Right to use landline telephone	3	4	200.82
	Distribution channel	3	4	10,343.78
Relationship assets	Brands	10	13	8,352.20
	Customer portfolio	10	13	58,208.54
	Non-compete agreement	6	8	535.83
	Exclusivity contract	4	5	118.90
	Right to renew contracts	3	4	55.40
	Service contract	2	3	190.72
	Right of exploration	1	1	200,540.68
	Acquisition of financial rights	1	1	91,4332.26
	Association for promoting and offering financial products and services	1	1	33.66

Source: developed by the authors.

Table 7 shows that the financial companies in the sample reported 14 intangible components within the groups of intangible assets according to Kayo's (2002) classification. Furthermore, it is worth noting that no components of human assets were identified, and other intangibles with unrepresentative individual values were identified in only one company and were not reported in Table 6.

In terms of the companies' structure of intangible assets, the components most frequently disclosed are Software (42%), Brands (13%), Customer portfolio (13%), Software development (10%), Patents (8%), and Non-compete Agreement (8%). A comparison of our results with the findings reported by Moura et al. (2014), in which the most recurrent were Software (85%), Concession contracts (36%), and Trademarks (31%), indicates a certain similarity.

Regarding the representativeness of intangible investments however, Software, Exploration rights, Acquisition of financial rights, Customer portfolio, and Software development present the highest mean values in 2015-2019.

Table 8 presents the results of the test differences between the risk disclosure means (financial, non-financial, and general) of intangible-intensive (G1) and tangible-intensive (G2) companies.

Table 8
Teste de média

Variable	INTANG_TA	No. of observations	Student's t test		Levene's test	
			Mean	Sig.	F	Sig.
FD	G1	193	10,85	0,000(*)	1,330	0,249
	G2	191	8,13	0,000		
NFD	G1	193	27,48	0,000	4,005	0,46(**)
	G2	191	17,76	0,000(*)		
GD	G1	193	38,33	0,000(*)	1,274	0,260
		191	25,89	0,000		
Variable	**INTANG_NC**	**No. of observations**	**Student's t test**		**Levene's test**	
			Mean	**Sig.**	**F**	**Sig.**
FD	G1	193	10,37	0,000(*)	0,001	0,917
	G2	191	7,88	0,000		
NFD	G1	193	27,30	0,000	3,217	0,074(***)
	G2	191	17,10	0,000(*)		
GD	G1	193	37,67	0,000(*)	0,858	0,355
		191	24,99	0,000		
Variable	**NI**	**No. of observations**	**Student's t test**		**Levene's test**	
			Mean	Sig.	F	Sig.
FD	G1	193	10,39	0,000(*)	0,162	0,688
	G2	191	8,01	0,000		
NFD	G1	193	27,09	0,000	8,023	0,005(*)
	G2	191	17,62	0,000(*)		
GD	G1	193	37,48	0,000	3,979	0,047(**)
	G1	191	25,63	0,000(*)		

Note: (***) significant at 1%; (**) significant at 5%; (*) significant at 10%.
Legend: FD – Financial risk disclosure; NFD – Non-financial risk disclosure; GD – general risk disclosure; INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangibility proxies concerning representativeness; G1 – group of intangible-intensive companies; G2 – group of tangible-intensive companies.

Source: developed by the authors.

Intangible-intensive and tangible-intensive companies present significant differences between the three risk disclosure proxies. Non-financial risk disclosure is heterogeneous between G1 and G2, while general risk disclosure showed more significant variability when the INTANG_TOTAL variable was used. In general, risk disclosure is more evident in intangible-intensive companies than in tangible-intensive ones. This result is consistent with the findings of Mansfield and Wagner (1975), Gharbi et al. (2014), and Albuquerque Filho *et al.* (2019), who note that intangible-intensive companies are more likely to fail in investments in intangibles, while the market demand more information on the associated risks.

For example, Gharbi et al. (2014) indicate that R&D investments may incur different types of risk, even more so among financial companies, which, in the view of Gomes, Ferreira, De Luca, and Ponte (2013), are prone to more significant risks compared to companies in other sectors. Thus, when financial companies adopt high transparency standards, such as risk disclosure, they provide investors with sufficient conditions to assess their capital sufficiency and performance about risks (Gomes et al., 2013).

Table 9 presents the (in)existing correlations between the independent and control variables and risk disclosure.

Table 9
Pearson's Correlation

Intangible assets	Variable	Risk Disclosure		
		Financial (FD)	Non-financial (NFD)	General (GD)
Representativeness	INTANG_TA	NS	+(**)	+(**)
	INTANG_NC	NS	+(**)	+(**)
	NI	NS	+(**)	+(***)
Structure	Relationship assets	+(*)	+(***)	+(***)
	Innovation assets	+(*)	+(**)	+(**)
	Structural assets	+(*)	NS	NS
Control	SIZE	+(**)	+(**)	+(*)
	DEBT	NS	NS	NS
	ROA	NS	NS	NS

Note: (***) significant at 1%; (**)significant at 5%; (*)significant at 10%; NS – non-significant correlation; + – positive correlation.
Legend: INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangibility proxies concerning representativeness; Relationship assets – proportion relative to total intangible assets; Innovation assets – proportion relative to total intangible assets: Structural assets – proportion relative to total intangible assets; SIZE – company's size; DEBT – company's debt; ROA – return on assets.

Source: developed by the authors.

Intangibility assessed by its representativeness positively correlates with non-financial and general risk disclosure. Additionally, about its structure, intangibility positively correlates with financial risk disclosure. As for relationship and innovation intangibles, these positively correlate with non-financial and general disclosure. Furthermore, size is positively correlated with the three risk disclosure proxies.

Table 10 presents the models' estimations that analyze the influence of the representativeness of intangibles on financial risk disclosure.

Table 10
Intangibility (representativeness) and Financial risk disclosure

Variable	Financial risk disclosure			
	Model I	**Model II**	**Model III**	**Model IV**
INTANG_TA	-0,296	-	-0,959	-
INTANG_NC	-	-0,956	-0,839	-
NI	-	-	-	-1,832
SIZE	0,805(*)	0,737(*)	0,731(*)	0,755(*)
DEBT	0,905	0,335	0,689	0,991
ROA	0,040	1,403(*)	1,234(*)	0,247(*)
Dummy (G1, G2)	0,747	2,232	2,330	2,246
Constant	-0,579	-1,921	-1,837	-1,864
Wald Chi2	19,33	23,74	25,55	-
p-value	0,000	0,000	0,000	-
F	-	-	-	30,05
p-value	-	-	-	0,000
Effect	A	A	A	P
R^2	0,2180	0,2260	0,2250	0,248
Mean VIF	1,20	1,10	1,18	1,16

Note: (*) significant at 10%.
Legend: INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangibility proxies concerning representativeness; SIZE – company's size; DEBT – company's debt; ROA – return on assets; Dummy G1 – intangible-intensive companies; G2 – tangible-intensive companies.

Source: developed by the authors.

The models show that no intangible variables were significant in explaining financial risk disclosure. Additionally, the coefficients of the dummy variable (G1, G2) did not present statistical significance, indicating that intangible-intensive and tangible-intensive companies do not affect financial risk disclosure when considering the representativeness of intangible assets. Therefore, size explains intangibles' disclosure and representativeness, while performance presented a positive coefficient in models I, II, and III.

According to Barcelos, Moreira, and Nossa (2023), the representativeness of intangible assets can be considered a strategic resource in terms of a company's competitiveness and economic value generation. However, it is irrelevant in reducing financial difficulties (financial risk). Furthermore, Shahwan and Habib (2020) note that a company is no less vulnerable when intangibles as a whole (representativeness) or even exclusively the human or intellectual capital is considered.

Table 11 shows the influence of the structure of intangibles on financial risk disclosure.

Table 11
Intangibility (structure) and Financial risk disclosure

Variable	Financial Risk Disclosure			
	Model I	**Model II**	**Model III**	**Model IV**
Relationship assets	0,000	-	-	0,000
Innovation assets	-	0,000(***)	-	0,000(**)
Structural assets	-	-	0,000	-0,000
SIZE	1,202(*)	0,944(**)	0,898(*)	1,132(*)
DEBT	-0,189	-1,569	2,727	9,293
ROA	5,171(*)	3,739	3,386(***)	-1,247
Constant	-6,752	-3,745	-4,594	-12,79(**)
Wald Chi2	49,18	-	22,23	-
p-value	0,000	-	0,000	-
F	-	5,65	-	122,4
p-value	-	0,003	-	0,000
Effect	A	P	A	P
R	0,5900	0,3011	0,3920	0,4178
Mean VIF	1,89	1,22	1,55	1,92

Note: (***) significant at 1%; (**) significant at 5%; (*) significant at 10%
Legend: Relationship assets – proportion relative to total intangible assets; Innovation assets – proportion relative to total intangible assets; Structural assets – proportion relative to total intangible assets; SIZE – company's size; DEBT – company's debt; ROA – Return on assets.

Source: Developed by authors.

Innovation assets have a positive influence (models II and IV), suggesting that innovation assets enable increased financial risk disclosure. It is also noteworthy that size presents a positive influence in all models, while performance (model III) positively affects financial risk disclosure.

These results corroborate Gharbi et al. (2014) who indicate that innovation intangibles bring many risks to companies, caused by technological and market uncertainty and appropriation problems. Therefore, investors tend to demand more information regarding the risks inherent to investments in innovation assets. Gomes et al. (2013) consider this requirement even more evident in financial companies, as it is a sector more prone to risks, to the extent that it is expected to progressively replace investments in tangible by intangible assets. As Stewart (1997, p. 27) noted, it is "characteristic of knowledge companies to eliminate fixed assets from their balance sheets."

Table 12 shows the influence of the representativeness of intangibles on non-financial risk disclosure.

Table 12
Intangible (representativeness) and Non-Financial risk Disclosure

Variable	Non-Financial risk disclosure			
	Model I	Model II	Model III	Model IV
INTANG_TA	8,157(***)	-	1,314	-
INTANG_NC	-	1,799(*)	0,647	-
NI	-	-	-	2,976(**)
SIZE	1,521(*)	1,274(*)	1,269(*)	1,292(*)
DEBT	1,580	-1,215	2,111	-2,438
ROA	-0,469	-0,858	0,719	0,134(*)
Dummy (G1, G2)	1,131(**)	1,701(**)	1,700	2,421(**)
Constant	0,716	0,593	1,668	1,354
Wald Chi2	22,48	-	22,64	-
p-value	0,000	-	0,000	-
F	-	8,83	-	11,37
p-value	-	0,000	-	0,000
Effect	A	P	A	P
R^2	0,288	0,233	0,284	0,278
Mean VIF	1,19	1,18	1,20	1,16

Note: (***) significant at 1%; (**)significant at 5%; (*)significant at 10%.
Legend: INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangibility proxies concerning representativeness; SIZE – company's size; DEBT – company's debt; ROA – return on assets; Dummy G1 – intangible-intensive companies; G2 – tangible-intensive companies.

Source: developed by the authors.

The intangibility variables presented a positive coefficient in Model I (INTANG_TA), model II (INTANG_NC), and model IV (NI). Thus, the representativeness of intangibles in the equity structure contributes to increasing non-financial risk disclosure. Furthermore, representativeness in intangible-intensive companies (Dummy G1, G2) tends to present higher non-financial risk disclosure (models I, II, and IV) than in tangible-intensive companies. Additionally, size obtained a positive coefficient in all models, and performance presented a positive coefficient in Model IV.

Therefore, it is clear that a greater representativeness of intangibles requires companies to disclose their non-financial risk to investors, i.e., companies must signal to the market that they will not misuse their intangibles in the future (Moura *et al.*, 2014), considering that the management of risks inherent to their assets is crucial when exposed to various types of risks, such as strategic and operational risks (Costa, Leal & Ponte, 2017).

Furthermore, as investors' decisions are affected by disclosed risk information, they tend to assess the expected return on these intangibles and the associated risks (Moura *et al.*, 2014). Hence, based on this return-risk relationship, as intangible assets are resources that generate greater performance and create economic value (Barcelos et al., 2023; Lev & Zarowin, 1999; Nagaraja & Vinay, 2016), they are also associated with high risks (Higgins, 2013). Additionally, despite the risks associated with intangibles, intangible-intensive companies obtain better economic results, strengthening the theoretical assumption that competitive advantages and abnormal returns are related to intangible and intellectual resources (Perez & Famá, 2004).

Table 13 shows the influence of the structure of intangibles on non-financial risk disclosure.

Table 13
Intangibility (structure) and Non-Financial Risk Disclosure

Variable	*Non-Financial Risk Disclosure*			
	Model I	**Model II**	**Model III**	**Model IV**
Relationship assets	0,000(**)	-	-	0,000
Innovation assets	-	0,000	-	0,000(**)
Structural assets	-	-	0,000	-0,000
SIZE	1,020(*)	9,699(**)	1,898(*)	1,634(*)
DEBT	-4,031	-11,20	-0,118	-10,59
ROA	-1,835	4,314	-0,574	5,302
Constant	16,10(**)	-12,83(**)	-0,710	-0,791
Wald Chi2	-	-	9,79	
p-value	-	-	0,044	
F	14,13	2,84	-	1,99
p-value	0,000	0,034	-	0,100
Effect	P	F	A	P
R	0,1667	0,4705	0,1169	0,3150
Mean VIF	1,66	1,22	1,75	1,75

Note: (***) significant at 1%; (**) significant at 5%.
Legend: Relationship assets – proportion relative to total intangible assets; Innovation assets – proportion relative to total intangible assets: Structural assets – proportion relative to total intangible assets; SIZE – company's size; DEBT – company's debt; ROA – return on assets.

Source: developed by the authors.

The relationship assets positively influence non-financial risk disclosure (Model III), as well as innovation assets, when in the presence of other classes of intangibles. Furthermore, size presented a positive coefficient for non-financial risk disclosure.

Regarding intangibility and its effects on non-financial risk disclosure, the structure of intangibles was found to increase non-financial risk disclosure. In other words, the disclosure of operational, damage, integrity, and strategic risks (subcategories of non-financial risk) tends to increase due to the companies' intangible structure. Additionally, the reporting of non-financial risk information is even more accentuated among financial companies in the presence of relationship and innovation assets.

According to Melo and Leitão (2018), the disclosure of operational risks is necessary to mitigate the risks of financial companies, as they need to be disclosed to the market to decrease uncertainty associated with financial institutions. In the same sense, Lev and Zarowin (1999) showed that intangibles, such as R&D, technology, and brands, are considered the most critical drivers of a business because they lead to changes in products, operations, economic conditions, and the companies' economic value. Therefore, disclosing information (including risk information) is essential for business continuity (Nagaraja & Vinay, 2016).

In addition, it is worth noting that a Brand brings several other benefits besides improved performance and competitiveness, such as higher loyalty levels, less vulnerability to competitor marketing actions and marketing crises, higher profit margins, price increases, potential licensing opportunities, and brand extension (Kayo, Kimura, Martin & Nakamura, 2006), highlighting the importance of disclosing risks inherent to this intangible. R&D, on the other hand, is relevant not only for a company's survival but also for its valuation (Albuquerque Filho et al., 2021), which corroborates Freeman and Soete's (2008, p. 457) statement, "not innovating is equivalent to dying." [Free translation]

Table 14 shows the influence of intangible representativeness on general risk disclosure.

Table 14

Intangibility (representativeness) and general risk disclosure

Variable	General risk disclosure			
	Model I	Model II	Model III	Model IV
INTANG_TA	9,882(***)	-	28,60(**)	-
INTANG_NC	-	2,157(**)	3,192(***)	-
NI	-	-	-	1,348(**)
SIZE	2,33(*)	2,011(*)	1,999(*)	1,470(*)
DEBT	-2,485	-1,850	-2,845	1,429
ROA	-1,390	-1,487	-5,336	-0,164
Dummy (G1. G2)	1,877(**)	1,833(**)	1,849(**)	1,218(**)
Constant	-1,866	-1,328	1,170	1,519
Wald Chi2	-	-	242,65	21,88
p-value	-	-	0,000	0,000
F	17,88	8,44	-	-
p-value	0,000	0,000	-	-
Effect	P	P	A	A
R^2	0,229	0,292	0,289	0,283
Mean VIF	1,16	1,20	1,30	1,38

Note: (***) significant at 1%; (**) significant at 5%; (*) significant at 10%.
Legend: INTANG_TA – quotient between intangible assets and total assets; INTANG_NC – quotient between intangible assets and non-current assets; NI – mean of intangible proxies relative its representativeness; SIZE – company's size: DEBT – company's debt; ROA – return on assets; Dummy G1 – intangible-intensive companies; G2 – tangible-intensive companies.

Source: developed by the authors.

The variables representing intangibles presented positive coefficients in all models. The greater the representativeness of intangibles in a company's equity structure, the greater the general risk disclosure. Furthermore, intangible representativeness in intangible-intensive companies (all models) affects general risk disclosure; also, size positively affects a company's overall risk disclosure.

Perhaps, as companies use their intangibles for better performance (return), these assets will naturally impose more risks to a business. According to Kayo et al. (2006), these risks should not be avoided but adequately managed to create and maintain a company's economic value (Myšková & Hájek, 2020). In the meantime, intangible representativeness in intangible-intensive companies is higher than in other companies, requiring the transparent disclosure of risk information (Cavalcanti, Amaral, Correia & Roma, 2020).

Table 15 presents the influence of the structure of intangibles on general risk disclosure.

Table 15
Intangibility (structure) and general risk disclosure

Variable	General risk disclosure			
	Model I	Model II	Model III	Model IV
Relationship assets	0,000(***)	-	-	0,000
Innovation assets	-	0,000(**)	-	-0,000
Structural assets	-	-	0,000	-0,000
SIZE	2,138(*)	15,14(*)	2,657(*)	2,932(***)
DEBT	-5,192	-16,80	2,309	13,27
ROA	-3,928	-16,60	-2,660	-8,747
Constant	11,41	-20,31(*)	-3,855	-13,47
Wald Chi2	-	-	13,38	10,40
p-value	-	-	0,009	0,100
F	19,55	3,52	-	-
p-value	0,000	0,010	-	-
Effect	P	F	A	A
R	0,3236	0,1890	0,2167	0,2494
Mean VIF	1,56	1,29	1,18	1,68

Note: (***) significant at 1%; (**) significant at 5%; (*) significant at 10%.
Legend: Relationship assets – proportion relative to total intangible assets; Innovation assets – proportion relative to total intangible assets: Structural assets – proportion relative to total intangible assets; SIZE – company's size; DEBT – company's debt; ROA – return on assets.

Source: developed by the authors.

Relationship (Model I) and Innovation assets (Model II) positively affect general risk disclosure. Thus, the higher the investments in relationship and innovation intangibles, the greater a company's general risk disclosure; size also showed a positive influence on all models.

Analytically, financial companies with more intangibles have greater risk disclosure, indicating that this study's hypothesis cannot be rejected. As for investments in intangibles, related risks significantly restrict them, i.e., risk is an essential vector in intangible-intensive companies' decisions. Hence, the internal development of such resources is slow and risky, and their costs and management effort are very high (Perez & Famá, 2006). Higher risk disclosure standards have been found among financial companies, which are prone to taking on more significant risks due to their competitiveness in the sector. Such disclosure standards provide external stakeholders with conditions to evaluate a company's risks (Gomes et al., 2013).

Furthermore, the size variable was statistically significant in all models, indicating that the size of a financial company affects its risk disclosure. This result corroborates the literature, which generally shows that large companies assume more significant risks due to their capital availability (Rengel *et al.*, 2020), requiring high-quality risk disclosure (Elshandidy *et al.*, 2018).

5. Conclusion

This study aimed to analyze the relationship between assets intangibility and risk disclosure in financial companies listed on B3.

The risk disclosure proxies (financial, non-financial, and general) in the descriptive analysis indicate that the disclosure of information concerning corporate risks differs among companies in the financial sector. Some companies did not disclose any or little information in some of the years under study, although risk disclosure became more prominent in the five years (2015-2019). The analysis of the structure of intangibles revealed that Software, Brands, Customer portfolio, Software development, Patents, and Non-compete agreement are the components most frequently disclosed in the explanatory notes, while Software, Right of exploitation, Acquisition of financial rights, Customer portfolio, and Software development are those with the highest average investment values in financial companies.

Additionally, the descriptive analysis of risk disclosure in the groups G1 and G2, based on representative intangible variables, indicated that intangible-intensive companies (G1) are likely to present greater risk disclosure (financial, non-financial, and general) despite the high dispersion identified in the non-financial and general risk disclosure of the two groups of companies. Note that there is a slightly lower dispersion in the disclosure of tangible-intensive companies (G2) compared to intangible-intensive companies (G1).

The results of the mean difference tests indicate significant differences in the risk disclosure (financial, non-financial, and general) of intangible-intensive companies compared to tangible-intensive ones. These findings confirm that financial companies with a higher level of intangibility tend to disclose more information about their corporate risks, as intangibles are more prone to uncertainty than other assets. This encourages investors and others interested in financial information to demand that companies take a stand regarding the risks posed by their assets. Therefore, the results might encourage organizations to expand risk reporting, which is essential in the external stakeholders' decision-making.

The analysis of the influence of intangibility on risk disclosure indicated that the representativeness of intangibles impacts non-financial and general risk disclosure. In contrast, in terms of structure, intangible innovation assets affect financial, non-financial, and general risk disclosure, while structural assets impact non-financial and general risk disclosure. Thus, the finding that companies with a greater representation of intangibles in the equity structure and with a more significant record of innovation and relationship intangibles are more susceptible to disclosing information about risks can reveal important insights and contribute to strategies aimed at maximizing their economic value.

Furthermore, similar to previous studies, a company's size is a factor that contributes to the disclosure of corporate risks.

The results of the regressions for the dummy variable, which represents the division of companies into representativeness according to intangible-intensive (G1) and tangible-intensive (G2), showed i) non-significant influence on financial risk disclosure and ii) positive and significant influence on non-financial risk disclosure and general risk disclosure. Therefore, the greater a company's representativeness of intangible assets (intangible-intensive), the greater the disclosure of non-financial and general risk.

Therefore, intangible-intensive companies more frequently disclose risks than tangible-intensive ones, resulting from more significant uncertainty and volatility linked to intangibles, which require companies to be more transparent with investors. Thus, when investors assess a company's intangibles, they relate expected returns (greater competitiveness, economic value creation, and high financial performance) to the business risk and require companies to be more transparent regarding risk disclosure.

This study contributes to the literature on intangibility and risk disclosure, as its interrelationships are investigated here; no Brazilian studies were identified in the field. The findings of this study reinforce the notion that, although intangibles enable improved performance and market value, they are likely to generate significant risks to the same extent; therefore, companies must provide the market with risk information.

This study expands the debate about these constructs in financial firms, as these companies are generally excluded from studies due to their peculiar characteristics. This study was motivated by the fact that financial companies take more significant risks due to the sector's competitiveness, and managers must be attentive to the best market practices to disclose risks and minimize losses promptly and correctly.

This study's primary limitation concerns a difficulty in using a metric to capture the risk disclosure of financial companies, as there is no consensus in the literature. Future studies are suggested to investigate other models discussed in the literature to identify the level of risk disclosure, and analyze other determinants that may influence the companies' risk disclosure in emerging and developed capital markets.

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