

Relationship between the accounting asset informativeness and Brazilian companies' systematic risk

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Abstract

Objective: This study analyzed a potential relationship between accounting asset informativeness and Brazilian companies' systematic risk. The research hypothesis assumes that factors restricting uncertainty, including better-quality information, decrease investors' risk perception.

Method: Regressions were estimated with panel data, using data concerning 2010 to 2021 from 186 companies. In addition to overall asset informativeness, the analysis included informativeness resulting from the companies' choices (discretionary component) and informativeness inferred from related companies in the same sector (non-discretionary component).

Results: Asset informativeness proved relevant and negatively associated with the Brazilian companies' systematic risk, with its non-discretionary component having a more intense effect on systematic risk than the discretionary component.

Contributions: This study's results are relevant for users of accounting information, those who prepare accounting reports, and regulators as it contributes to the discussion on the quality of accounting information, highlighting its relationship with the systematic risk of companies through a measure focused on assets, and suggesting metrics that can assist in the estimation of the companies' value, besides providing evidence of the economic consequences of accounting choices.

Keywords: Asset informativeness; Economic capital; Quality of accounting information; Systematic risk; Capital cost.

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1. Introduction

Relevant accounting information concerns the ability to support decision-making. Therefore, financial reporting aims to provide users with helpful information about economic phenomena. Thus, quality accounting information is supposed to contribute to estimating a company's intrinsic value and, as a natural consequence, assist in companies' efficient resource allocation (International Accounting Standards Board [IASB], 2018; Chen *et al.*, 2022). Hence, the quality of accounting information can influence the cost of capital by decreasing investors' uncertainty regarding companies' cash flows (Hribar & Jenkins, 2004; Aboody *et al.*, 2005; Lambert *et al.*, 2007; Francis *et al.*, 2008; Dechow *et al.*, 2010).

The seminal works by Ball and Brown (1968) and Beaver (1968) initiated studies that observed investors' reactions to accounting information through variations in stock prices due to aggregate decisions to buy and sell assets. This line of research remains in current days; however, when observing the development of the literature on the effect of the quality of accounting information on the cost of capital, it appears there are opportunities to continue developing in the field, especially considering the effects of information accuracy and the marginal contribution of each proxy quality in this context (Dechow *et al.*, 2010).

When we look at the limitations of research on the quality of accounting information and cost of capital, specifically observing systematic risk, the literature seems even less extensive, despite evidence indicating a negative relationship between the quality of accounting information and systematic risk (Francis *et al.*, 2005; Ma, 2017; Xing & Yan, 2019).

Lambert *et al.* (2007) explain that the cash flows of individual companies are correlated with those of the market. In this context, the quality of accounting information influences investors' assessments of the covariance of the companies' cash flows with the market. Therefore, as defined by the Capital Asset Pricing Model (CAPM), the quality of accounting information influences a company's systematic risk.

The association of information quality with systematic risk is motivated by the fact that diversifying the portfolio does not eliminate systematic risk; hence, it is decisive for investments' minimum return rate. In this case, the expected association between the quality of information and a company's systematic risk is inversely proportional: i.e., more significant risks are associated with lower-quality information.

Accounting information quality depends on a company's financial performance and the accounting system measuring it. The most commonly used measures are related to accounting results, focusing on properties other than profits, which cannot replace each other, such as persistence of results, income smoothing, timely recognition of losses, benchmarking models, investor response coefficient to results, and external indicators of profit distortions; hence, we cannot state which is the best proxy for the quality of information.

However, quality accounting information contained in a profit report must reflect current performance accurately, indicate future performance, and provide a useful summary, enabling one to assess the company's value (Dechow *et al.*, 2010).

Another line of research concerns value relevance models, which seek to measure the ability of financial statements to explain a company's value, analyzing how accounting profits impact returns, with the empirical model developed by Ohlson (1995) being widely used in this type of research (Holthausen & Watts, 2001; Barth *et al.*, 2001).

Research has shown that accounting information, mainly profits, has lost informative relevance though. Barth *et al.* (2023) oppose this notion, arguing that what is actually occurring is a transition from an industrial economy to a new economy based on services and information technology. Thus, it is not that accounting information is losing relevance but that its value may be more related to intangible assets, growth opportunities, and alternative measures of organizational performance.

Nonetheless, it is beneficial to expand and deepen the possibilities in this field of research. In this sense, the asset informativeness measure (AI) proposed by Chen *et al.* (2022) can be applied in the Brazilian market. Asset informativeness measures the ability of accounting to reveal a company's economic capital value. Note that economic capital concerns the capital stock and its productivity, which determine future cash flows and, therefore, the intrinsic value of companies. Economic capital is not directly observable though. Thus, asset informativeness can be calculated by regression of the economic profit as a function of the lagged accounting asset. In this sense, the coefficient of determination of this regression for each company represents how much the accounting capital stock informs about the economic capital.

Nevertheless, even though accounting assets can measure the value of a company's economic capital, this measurement incorporates noise that is due both to the accounting measurement system and to the company's specific accounting choices (Kanodia *et al.*, 2005; Dutta & Nezlabin, 2017).

Thus, unlike the best-known profit measures, asset informativeness focuses more on the balance sheet, involving aspects related to the measurement and recognition of operational assets (Chen *et al.*, 2022).

The accounting literature on earnings management shows that profits are divided into two: cash flow and accruals, which are adjustments that depend on the accrual basis (Healy, 1985; DeAngelo, 1986; Jones, 1991). Dechow *et al.* (1995), based on Jones' (1991) model, show techniques to isolate the discretionary component of accruals, separating it from its innate part. Similarly, the informativeness of accounting assets can be measured by a company's discretion in determining which information to present to its investors. Thus, asset informativeness can be decomposed into a discretionary portion determined by a company's choices and a non-discretionary component related to the company's sector.

This study aims to fill a gap concerning asset informativeness, a concept seldom explored. Asset informativeness is a measure recently developed and tested in the American market but not in Brazil due to a lack of knowledge about the association of this variable with the cost of capital. Even though the literature advocates a negative association between the quality of accounting information and the cost of capital, the relationship between the informativeness of Brazilian companies' assets and systematic risk remains unknown. Furthermore, there is no evidence concerning the separation of asset informativeness into two components: a non-discretionary, inherent to an industry's behavior, and a discretionary component, which reflects a company's accounting choices. Additionally, there is unprecedented evidence of the relationship between non-discretionary and discretionary asset informativeness and the systematic risk of Brazilian companies.

Therefore, this study analyzes whether investors perceive the quality of accounting information measured according to asset informativeness, priced through systematic risk, a component of the cost of capital. Hence, this study aims to analyze the effect of accounting asset informativeness on systematic risk based on the following research problem: **Is the informativeness of accounting assets relevant to a company's systematic risk?**

Therefore, this study analyzes these issues in depth, with the fundamental hypothesis that there is a negative association between accounting asset informativeness and Brazilian companies' systematic risk.

Therefore, 186 companies from nine different economic sectors, with stocks traded on the Brazilian stock market, and information available for calculating the study variables were addressed. Quarterly data from 2010 to 2021 were used. Regression models suitable for panel data analysis were performed; four systematic risk models were estimated according to asset informativeness and its discretionary and non-discretionary components. The control variables included asset productivity, size, growth, tangibility, operating cycle, and profit volatility.

The results indicate the relevance of the relationship between asset informativeness and Brazilian companies' systematic risk, confirming the expected negative association and corroborating this study's fundamental hypothesis.

This study is expected to contribute to the literature on the relationship between the quality of accounting information and the cost of capital applied to the Brazilian market. Additionally, this study contributes to the literature by exploring the effects of specific company characteristics on systematic risk.

This is a relevant topic to academia, as it contributes to the discussion of the quality of accounting information by highlighting its relationship with the systematic risk of companies through a measure focused on assets. Accounting information is relevant, notably for investors, when analyzing how the quality of information can affect their decisions to the extent that the minimum return required by shareholders is related to company information. For those preparing accounting reports and regulators, this study provides evidence of the economic consequences of accounting choices related to accounting asset measurement, recognition, and disclosure.

2. Theoretical Framework

2.1 The informativeness of accounting assets

A company's capital stock is typically associated with fixed or operating assets, a more comprehensive classification than fixed assets. According to Soliman (2008), these assets are calculated by subtracting available amounts and short-term investments from total assets. In this context, capital stock is related to a company's productive capacity and, consequently, to future cash flows. Capital stock can also influence future investments. For this reason, capital stock is also known as economic capital, though economic capital is not directly observable (Chen *et al.*, 2022; Kanodia *et al.*, 2005).

Tobin (1969) developed the investment theory q (or Tobin's q), which predicts the relationship between the value of firms and their rates of reinvestment or asset replacement. In a simplified manner, the Q theory of investment is specified as follows:

$$\frac{I_t}{K_{t-1}} = \alpha + \beta q_{t-1} + \varepsilon_t, \quad (1)$$

Where: t indicates unit of time; I_t is the capital investment in the following period; K_{t-1} is the capital stock at the beginning of the period; and q is the quotient of the companies' market value (deducted from financial assets and inventories) over existing capital.

According to the q theory of investment, whenever q is greater than 1, indicating that the company's market value is greater than the value of the existing capital stock, the company's value would be oversized and, consequently, there would be incentives for the company to invest in itself.

On the other hand, with its value oversized, the potential return on a company's stocks due to capital investments would be limited. Thus, according to Xing (2008) and Hou *et al.* (2015), a negative relationship exists between investments and the return on a company's stocks. Considering this relationship, Wu *et al.* (2010) state that accepting new capital investments in companies with high minimum attractiveness rates could be justified by adjusting the disclosure of expected profits *vis-à-vis* cash flows, i.e., by recording accruals.

According to Andrei *et al.* (2019), the Q theory of investment has recently begun to show relevant results, not corroborating the vast literature showing poor performance in previous years. The best fit of the q investment model is related to the substantial growth in spending on research and other intangibles in the aggregate economy. The model has obtained better results in the case of research and development-intensive companies, different from those more intensive in fixed capital, for which the model was developed in the past. Therefore, the q investment model has worked well to capture characteristics related to corporate innovations and learning and can be a proxy for investment opportunities in R&D-intensive sectors.

The findings of Andrei *et al.* (2019) are corroborated by Barth *et al.* (2023), who, contradicting previous research that stated that accounting information had lost relevance over time, argue that what has occurred is a change in the economy that transitioned from a strongly industrial characteristic to being more intensive in services and technology. Indeed, Barth *et al.* (2023) argue that there is a greater relevance of items related to intangible assets, growth opportunities, and new alternative measures of organizational performance to explain a company's value. Thus, the relevance of accounting information has evolved, presenting a differentiated, non-decreasing relationship between the stock prices and accounting information that reflects the new economy.

Dutta and Nezlobin (2017) identified that accounting disclosures about future capital stock and future cash flow act as substitutes. The reason is that more accurate disclosures about future cash flows reduce the positive effects of future capital stock disclosures on investment efficiency and, consequently, on investors' well-being.

A company's value is determined by its investment decisions in the current period (I_t) and the capital stock that already existed in the previous period (K_{t-1}), given the productivity of capital and the cost of investments (Hayashi, 1982; Bai *et al.*, 2016). Equation (2) describes this rationale:

$$V_{ijt}(I_{ijt}, K_{ij,t-1}) = (1 + \tilde{g}_{ijt})(K_{ij,t-1} + I_{ijt}) - \left(I_{ijt} + \frac{Y_{ijt}}{2K_{ij,t-1}} I_{ijt}^2 \right), \quad (2)$$

Where: V_{ijt} is the value of the company; $K_{ij,t-1}$ represents the value of the capital stock at the beginning of the period, I_{ijt} is capital investment added to the initial stock; Y_{ijt} represents an implicit cost adjustment to the investment, a component of the total capital adjustment cost; $\frac{Y_{ijt}}{2K_{ij,t-1}} I_{ijt}^2$; \tilde{g}_{ijt} is the given parameter of marginal productivity of the capital stock at t , which has endogenous components (inherent to the company's management) and exogenous components (unrelated to the company's management, but which affects its productivity), and is not completely known; i is the company; j is the sector in which the company operates; t is the current moment.

Therefore, before making additional investments (I), companies observe a set of private information (f) about expected productivity (g). Thus, according to Chen *et al.* (2022), the optimal investment, which maximizes the value of a firm is described by Equation (3):

$$\frac{I_t^*}{K_{t-1}} = \frac{1}{Y} E(\tilde{g}|f). \quad (3)$$

Hence, a company's value is greater when the capital stock (K) is more productive and when information about productivity is less uncertain. Therefore, information about capital is important for investors to form more accurate expectations about a company's value. However, economic capital is related to the capital stock associated with a given marginal rate of capital productivity that is not completely known, differing to some degree from the value of accounting assets.

The challenge is whether (and how) accounting assets could measure economic capital in a way relevant to the decision-making of accounting information users. If there were no inaccuracies in measurement, the capital stock considered in the previous equations could be replaced by the accounting asset and considered useful information for users seeking information about the value of a company's economic capital.

For Dutta and Nezlobin (2017), once a company makes investments to adjust its capital stock over time, the disclosure of accounting information can affect the efficiency of this investment and the investor's well-being. If more accurate, accounting information mitigates current owners' underinvest incentives, reducing uncertainty and better supporting assessments and decision-making. Such an effect depends on how accounting disclosures report on a company's future capital stock (balance sheet) or future operating cash flows (profits).

Accounting measurements of investments contain a certain degree of imprecision, as they depend on many subjective judgments, estimates, and simplistic conventions due to the difficulty of separating investments (tangible and intangible) from operating cash flows. This does not mean that inaccuracies reduce a firm's value, as they can even increase it (Kanodia et al., 2005).

According to Chen *et al.* (2022), there are at least four reasons why accounting assets may contain measurement inaccuracies concerning economic capital: (i) the sale price of an asset captures its exit value and not its value in use; (ii) the value of a company represents the combination of all its assets and not the sum of the values of each specific asset; (iii) comparative advantages and disadvantages (in terms of production) that a company faces related to other companies can affect its value, as well as its accounting ability to measure its actual productive capacity and that of each asset; and (iv) the standardization of international accounting standards may introduce some noise, due to restricted recognition and measurement criteria, in addition to the need for professional judgment in their application.

Since investments may not be fully reported or reported inaccurately, differences between accounting assets and economic capital may be represented by Equation (4) (Kanodia *et al.*, 2005; Chen *et al.*, 2022):

$$A_t = K_t + \varepsilon_t, \quad (4)$$

where: A_t is the accounting asset, which represents the history of investments and their accounting measurements; K_t is the stock of economic capital, including its productivity; and ε_t is the term that captures noise in accounting measurement, including the cumulative effect of errors in accounting measurements conducted over time, relating to investment.

Thus, accounting asset informativeness (IA) is defined as the ability of A_t (deduced from the error ε_t) to explain K_t . In this context, IA can be represented by the uncertainty that remains about the value of economic capital (K_t) after observing the accounting asset (A_t), measured as a proportion of the uncertainty that existed before observing A_t , according to Equation (5):

$$IA_t = \frac{Var(K_t) - Var(K_t|A_t)}{Var(K_t)} \quad (5)$$

Where: $var(K_t)$ is the *ex-ante* uncertainty; $var(K_t|A_t)$: *ex-post* uncertainty, after observing accounting assets.

Equation (5) indicates that IA_t depends on the ratio between accounting noise and *ex-ante* uncertainty, so that asset informativeness is high when accounting assets reduce uncertainty in relation to the value of economic capital.

2.2 Companies' systematic risk

The Capital Asset Pricing Model (CAPM) relates the volatility of a company's stock returns to the fluctuations of a completely diversified theoretical portfolio representing the market. The specific sensitivity of a company's returns to variations in the market risk premium (excess of market return over the return of a risk-free asset) is known as systematic risk and is determined by a company's specific characteristics relating to its business. In the CAPM model, systematic risk is represented by the beta parameter β_{it} (Sharpe, 1964; Lintner, 1965; Mossin, 1966).

There is evidence that the effect of the information available about a given company or the uncertainty investors face is reflected in the market risk premium, regardless of whether the calculation considers the company's leverage. Thus, even with marginal effects that are different in magnitude, estimating the relationship between the quality of accounting information and systematic risk must be similar using leveraged and unleveraged beta (Hugges *et al.*, 2007; Armstrong *et al.*, 2013).

According to Xing and Yan (2019), the effect of the quality of accounting information on the cost of capital could occur in three ways: the quality of accounting information could be an additional systematic risk factor distinct from other already known factors; the quality of accounting information could not be a risk in itself but affect other known factors; or the quality of accounting information could be related to the systematic risk factor.

This third possibility, less frequently studied, is theoretically supported since it has already been demonstrated that a firm's accounting information can affect investors' views on other economically related companies, on the aggregate economy, and the covariance of the firm's cash flows with the market as a whole (Xing & Yan, 2019; Lambert *et al.*, 2007; Ma, 2017; Patton & Verardo, 2012).

Specific research shows a negative relationship between accounting information quality and systematic risk. Corroborating studies on the *q* theory, it would be possible to argue that high investment rates would be related to greater asset informativeness and, in turn, to lower systematic risk due to lower uncertainty (Chen *et al.*, 2022; Ma, 2017; Xing & Yan, 2013; Francis *et al.*, 2005).

3. Methodological Procedures

3.1 Sample

The sample comprised all companies with stocks traded on B3 and data available for calculating the selected variables, except those belonging to the financial sectors and segments designated as “other,” according to the classification provided by B3. The companies in the financial sector were excluded from the sample due to the specific characteristics of this sector, such as accounting complexity, unique risk and return characteristics, differentiated regulation, specific modeling and evaluation of assets and liabilities, and, most importantly, the greater relevance of available assets and short-term investments, *vis-à-vis* operational assets, in company decisions. Those classified as “others” include companies with different economic activities that violate the criterion of belonging to the same industry. The sample comprised 186 companies belonging to nine sectors: industrial goods, communications, cyclical consumer, non-cyclical consumer, oil, gas and fuels, health, basic materials, telecommunications, and public utilities.

Quarterly accounting data from 2010 to 2021 were extracted from the Economática® platform. These years concern only the period after Brazil converged with international accounting standards. Moving windows of 20 quarters were used to calculate the asset informativeness variable; hence, the estimation period is from 2015 to 2021, and, considering missing data, the sample is composed of 4,654 company-quarter observations.

3.2 Econometric Model

The base model tested is described in Equation (6):

$$\beta_{it+1} = \alpha_{it} + \beta_1 IA_{it} + \lambda_1 Theta_{it} + \lambda_2 TAM_{it} + \lambda_3 B2M_{it} + \lambda_4 TANG_{it} + \lambda_5 CO_{it} + \lambda_6 \sigma RNOA_{it} + \varepsilon_{it} \quad (6)$$

Where: β_{it+1} represents the systematic risk of company i in relation to the market index (Ibovespa), measured according to the traditional CAPM model, with a quarterly moving window of beta calculated using a 60-month series, starting in the 60th month prior to the month of July of year $t+1$, after the base date for calculating asset informativeness in period t ; IA_{it} asset informativeness; $Theta_{it}$: asset productivity, measured by the slope coefficient of the asset informativeness regression (R_{ijt}^2); TAM_{it} is the company's size, calculated by the natural logarithm of Total Assets; $B2M_{it}$ measures the relationship between net equity and market capitalization (book-to-market); $TANG_{it}$ is the asset's tangibility, calculated as a proportion of fixed assets over total assets; CO_{it} is the operating cycle, measured by the natural logarithm of the sum of accounts receivable days and inventory maintenance days; $\sigma RNOA_{it}$ is the volatility of profitability, measured by the standard deviation of the profitability of operating assets.

In this study, the variable of interest IA_{it} is measured in four different ways, as described in Table 1.

3.2.1 Variable of Interest: Asset Informativeness

Accounting profit concerns the comparison of revenues, expenses, and consumed costs, recorded, measured, and evidenced by usually accepted accounting principles. Economic profit is the increase in the present value of net worth and involves subjective aspects (Fuji, 2004).

The empirical model that measures the informativeness of accounting assets is based on the premise that accounting profit can capture economic profit by providing an estimate of the company's value (Black, 1980).

Based on the premise that accounting assets are relevant to informing about a company's economic capital, asset informativeness can be measured by the explanatory power of a profit regression as a function of lagged assets. This is so because if the capital stock determines economic income, the greater the regression's explanatory power, the greater the informativeness of the asset regarding economic capital (Chen *et al.*, 2022):

$$NOPAT_{ijt} = \alpha_{i,0} + \alpha_{i,1}NOA_{ijt-1} + \varepsilon_{ijt} \quad (7)$$

Where: $NOPAT_{ijt}$ is the economic profit of company i in sector j , measured by operating profit after taxes; NOA_{ijt-1} represents the operating assets used in long-term operations of company i in sector j , measured by the initial balance of net operating assets, calculated by the difference between operating assets and operating liabilities. Following Soliman (2008), operating assets are calculated by total assets minus cash and cash equivalents and short-term investments, and operating liabilities are calculated by total assets minus short- and long-term debt and equity.

The coefficient of determination (R^2) of the regression conducted according to Equation (7), for each company i in sector j , which corresponds to the quadratic value of the correlation coefficient between the current economic profit (E_t) and the capital stock of the beginning of the period (A_{t-1}), represents accounting asset informativeness (net operating asset) in relation to economic capital. According to the literature, especially regarding Equation (5), informativeness consists of the part of NOPAT portion explained by NOA estimated by the coefficient of determination in Equation (7).

Four models were considered, each with a measure of asset informativeness as an explanatory variable of interest. The coefficient of determination (R^2) of the regression performed according to Equation (7) is the variable of Model 1 (IA_{ijt}). From this coefficient, the other measures were calculated (Table 1).

Table 1

Asset informativeness measures

Model	Variable of interest Asset informativeness	Calculation	Reference
1	Asset informativeness Global (IA_{ijt})	$IA_{ijt} = R_{ijt}^2 = \frac{Cov^2(NOPAT_t, NOA_{t-1})}{Var(NOPAT_t)Var(NO A_{t-1})}$	Chen <i>et al.</i> (2022)
2	Asset informativeness: Non-discretionary ($IA_{ind,t}$)	$IA_{ind,t} = R_{ind,t}^2 = \frac{e^{\hat{\phi}_{it}}}{1 + e^{\hat{\phi}_{it}}}$, where $\hat{\phi}_{it} = \frac{1}{N_{it}} \sum_{j=1}^{N_{it}} \left(\ln \frac{R_{ijt}^2}{1 - R_{ijt}^2} \right)$ of all companies i in the j sector in quarter t .	Chen <i>et al.</i> (2022)
3	Asset informativeness: Discretionary component - Option 1 ($IA_{firm1,t}$)	$IA_{firm1,t} = R_{firm1,t}^2 = \frac{R_{ijt}^2 - R_{ind,t}^2}{1 - R_{ind,t}^2}$	Chen <i>et al.</i> (2022)
4	Asset informativeness: Discretionary component - Option 2 ($IA_{firm2,t}$)	$IA_{firm2,t} = R_{firm2,t}^2 = \sqrt{(R_{ijt}^2 - R_{ind,t}^2)^2}$	Developed by the authors

Source: developed by the authors.

For Model 1, a moving window was adopted to generate an IA_{ijt} for each additional company-quarter from March 2015 to December 2021, and this series was considered as an independent variable. This measure is called Global IA.

Subsequently, based on the of each company-sector-quarter, the non-discretionary and discretionary components were calculated. Following the specifications highlighted in Table 1, non-discretionary informativeness ($IA_{ind,t}$) represents the average effects of all companies in the industry, being the variable of interest included in Model 2.

The discretionary component of asset informativeness ($IA_{firm1,t}$) is the variable of interest in Model 3. These variables are calculated according to Chen *et al.* (2022).

Additionally, this study presents an alternative measure for the discretionary component of asset informativeness ($IA_{firm2,t}$). The metric suggested by Chen *et al.* (2022) - ($IA_{firm1,t}$), presented a high dispersion in relation to the difference between the Global AI (IA_{ijt}) and its innate part ($IA_{ind,t}$). Thus, the square root of the difference between the Global AI and its non-discretionary part was adopted for the discretionary component, as described in Table 1. This variable of interest was inserted in Model 4.

As Chen *et al.* (2002) did to overcome the problem of small samples in the regressions for each company, only 12 quarters were chosen for using quarterly windows from $t-3$ to t , generating considerably larger samples.

3.2.2 Control variables

Control variables were selected following Chen *et al.* (2022), but focusing on their relationship with systematic risk.

Since greater asset productivity would lead to greater profitability, the relationship with systematic risk is expected to be negative. This premise is based on the literature on asset profitability, understanding that both deal with a correlated phenomenon (Sarmiento-Sabogal & Sadeghi, 2015).

Considering that larger companies would be less risky as they can access better conditions to develop their operations, such as credit and suppliers, a negative relationship between size and systematic risk is expected (Beaver *et al.*, 1970; Castagna & Matolcsy, 1978; Atiase, 1985). Some research, however, indicates a positive relationship due to risks that these companies would face, for example, higher R&D expenses (Koussis & Makrominas, 2015; Wiyono & Mardijuwono, 2020).

Companies with a low book-to-market (B2M) ratio are considered to have more significant growth potential, and companies with high B2M are companies of value, as their net equity is closer to or greater than the market value. The relationship between systematic risk and companies with low B2M is expected to be negative (Koussis & Makrominas, 2015). Note that the negative relationship does not mean lower risk. On the contrary, because these are companies possibly related to technology, Internet, or R&D-intensive activities, they are perceived as more risky. For these companies, the market would fail to understand accounting information adequately, assigning greater risk to spend on R&D or intangible assets, which are not recognized for their ability to generate future gains but for increasing the unpredictability of future cash flows, giving the impression that these expenses would be bad for a company (Mohanram, 2005; Kothari *et al.*, 2002).

On the other hand, a positive relationship with systematic risk is expected for companies with high B2M. These companies are considered more risky because they tend to present financial difficulties as they have less access to disclosure channels and less analyst coverage (Piotroski, 2000).

There are two aspects of tangibility: the level of fixed capital in relation to total assets. The first considers that the variable would have a positive relationship with systematic risk due to the greater exposure that large capital expenditures associated with increased operating leverage would cause (Lev, 1974; Jose & Stevens, 1987). The other view considers that capital-intensive companies with high tangibility are likely to exercise monopoly power, which would reduce their exposure to systematic risks (Subrahmanyam & Thomadakis, 1980; Barton, 1988).

The relationship between the operating cycle and beta is expected to be positive, as the shorter the cycle, the greater the availability of resources and the lower the risk arising from mismatching flows of current assets and current liabilities, which is current liquidity. The current liquidity level negatively relates to systematic risk (Beaver *et al.*, 1970; Castagna & Matolcsy, 1978).

Earnings volatility and systematic risk are expected to be positively related (Beaver *et al.*, 1970; Hong & Sarkar, 2007). This relationship corroborates an understanding that earnings volatility is a measure of uncertainty, negatively associated with earnings predictability, and can be determined both by economic factors represented in the market risk premium and by accounting factors determined by the company itself or by the accounting measurement system (Dichev & Tang, 2009).

Finally, it should be noted that the selection of control variables observes the principle of parsimony to keep the model as small as possible. As will be seen later, these control variables are sufficient to obtain models that do not violate the regression assumptions.

4. Presentation and Discussion of Results

Table 2 presents the descriptive statistics of the variables considered in this study. Note that most series are asymmetric to the left, with a median lower than the mean. The largest amplitude is earnings volatility ($\sigma RNOA$), which has the highest standard deviation. Concerning systematic risk (β_{it}), the mean and median are close to 1, which means the average risk of companies is close to that of the market. Average asset informativeness equal to 0.30 means that for this sample and period, 30% of the profit is explained by the lagged asset.

Table 2

Asset informativeness measures

	β_{it}	IA_{ijt}	$IA_{ind,t}$	$IA_{firm1,t}$	$IA_{firm2,t}$	Θ	TAM	$B2M$	$TANG$	CO	$\sigma RNOA$
Mean	0,848	0,299	0,183	0,139	0,219	0,056	15,038	0,862	0,229	4,803	0,289
Median	0,781	0,225	0,165	0,061	0,157	0,062	15,131	0,585	0,201	4,765	0,057
Maximum	3,392	0,946	0,548	0,940	0,844	0,952	19,149	5,902	0,825	7,896	19,73
Minimum	-1,103	0,000	0,001	-0,887	0,000	-3,873	9,626	0,000	0,000	2,049	0,008
Standard Deviation	0,656	0,269	0,088	0,331	0,184	0,280	1,782	0,959	0,192	0,859	1,213
Asymmetry	0,498	0,653	1,021	0,458	1,111	-3,308	-0,224	2,138	0,723	0,490	8,967
Kurtosis	3,321	2,223	4,092	2,481	3,423	44,549	2,685	8,374	2,832	3,848	104,3

Source: developed by the authors.

Tests were performed before the estimations to verify data robustness. The explanatory variables were tested for their multicollinearity with the others using the variance inflation factor (VIF). According to the VIF test, the variables did not show signs of multicollinearity.

Bartlett, Levene, and Brown-Forsythe tests were performed, which suggested that the hypothesis of homoscedasticity of the residuals should be rejected. Furthermore, the Durbin-Watson and Wooldridge (2010) tests suggest positive autocorrelation of the residuals.

For this reason, all estimations were performed with robust standard errors using the Cross-Section Seemingly Unrelated Regression (SUR) method with Panel-Corrected Standard Errors (PCSE) to avoid heteroscedasticity and serial autocorrelation of residuals. Furthermore, fixed effects were adopted, corroborated by rejecting the redundancy hypothesis of these effects. Furthermore, corroborating Chen *et al.* (2022), regressions with fixed effects generated models with greater explanatory power than those with grouped data. The Hausman test enables a comparison between fixed and random effects; however, the assumptions of the variance calculation of the Hausman test may not be consistent with adopted robust standard errors (Li & Wibbens, 2023). For this reason, random effects estimations were not performed.

The estimates' results are presented in Table 3. As expected, the quality of accounting information measured by global asset informativeness (IA_{ijt}) is statistically significant and has a negative relationship with the systematic risk of companies traded on the Brazilian stock market, corroborating both studies on the quality of accounting information and the q investment theory (Francis *et al.*, 2005; Ma, 2017; Xing & Yan, 2019; Chen *et al.*, 2022). Such a result indicates that investors consider information about assets as qualified to measure economic capital in their assessments of companies.

Non-discretionary asset informativeness (IA_{ind}), an indicator related to factors that are outside management's control that are characteristic of the industry, business model, operating environment, and accounting rules, is relevant and negatively associated with systematic risk, with its effect being more intense than the global measure and discretionary components. These results may be related to the relevant effects of peers on the companies' systematic risk, an externality already documented in the literature (Ma, 2017).

The discretionary component of asset informativeness (IA_{firm1}), as proposed by Chen *et al.* (2022), is also negatively associated with systematic risk. However, its coefficient is only 40% of the coefficient of the measure proposed in this study (IA_{firm2}); such a finding is an additional contribution of this study to the development of related literature.

Table 3

Result of estimations

Base Model								
$\beta_{it+1} = \alpha_{it} + \beta_1 IA_{it} + \lambda_1 Theta_{it} + \lambda_2 TAM_{it} + \lambda_3 B2M_{it} + \lambda_4 TANG_{it} + \lambda_5 CO_{it} + \lambda_6 \sigma RNOA_{it} + \varepsilon_{it}$								
	Model 1		Model 2		Model 3		Model 4	
Const.	-0,452 (0,354)		-0,568 (0,356)		-0,407 (0,363)		-0,399 (0,357)	
$IA_{it}^{(a)}$	-0,093 (0,021)	***	-0,248 (0,123)	**	-0,051 (0,018)	***	-0,129 (0,027)	***
$THETA_{ij}$	-0,032 (0,031)		-0,045 (0,029)		-0,037 (0,031)		-0,035 (0,03)	
TAM_{ij}	0,110 (0,024)	***	0,119 (0,025)	***	0,106 (0,025)	***	0,106 (0,025)	***
$B2M_{ij}$	-0,075 (0,017)	***	-0,074 (0,017)	***	-0,074 (0,018)	***	-0,075 (0,017)	***
$TANG_{ij}$	-0,396 (0,099)	***	-0,404 (0,093)	***	-0,397 (0,099)	***	-0,404 (0,099)	***
OC_{ij}	-0,031 (0,022)		-0,031 (0,022)		-0,030 (0,022)		-0,029 (0,022)	
$RNOA_{ij}$	-0,014 (0,007)	*	-0,013 (0,007)	*	-0,014 (0,007)	*	-0,015 (0,007)	**
$R^2 Aj.$	0,678		0,677		0,678		0,678	
$Est. F$	47,38	***	47,59	***	47,34	***	47,36	***
N° Obs.	4612		4654		4612		4612	

Note: IA_{it} represents the asset informativeness as shown in Table 1 - in Model 1, the global informativeness (discretionary and non-discretionary parts) of assets (IA_{ij}); in Model 2, the informativeness (non-discretionary part) of assets ($IA_{ind,t}$); in Model 3, the informativeness (discretionary part) of a company's assets ($IA_{Firm1,t}$) calculated according to Chen *et al.* (2022); and, in Model 4, informativeness (discretionary part) of a company's assets ($IA_{Firm2,t}$) calculated as proposed by the authors. The values in parentheses are the standard deviations of each estimate, where ***, **, * concerns the significance level of the parameters at 1%, 5%, and 10%, respectively.

Source: developed by the authors.

The results reveal that a company's idiosyncratic characteristics implicit in the recorded assets - the result of accounting choices and management's daily decisions regarding short-term operations and investment - are helpful as a measure of the quality of accounting information, although with lower sensitivity than non-discretionary effects on systematic risk.

When moving on to the control variables, size appears positively related to systematic risk, corroborating studies reporting that these companies face more risks, especially those related to higher R&D expenses (Koussis & Makrominas, 2015; Wiyono & Mardijuwono, 2020).

The B2M variable showed a negative relationship with systematic risk. This result has two potential interpretations. Companies with high B2M (high value) are considered to have lower systematic risk, possibly due to investors' reassessment of potential past overvaluation. Investors may use relevant historical information to eliminate companies with poor prospects from their portfolios. There are benefits related to a more in-depth analysis of financial statements, especially in the case of small and medium-sized companies, companies with low stock turnover, and companies without analyst monitoring, which may be the case (Piotroski, 2000).

The negative relationship would be analyzed from the perspective of companies with low B2M (growth opportunity) based on the hypothesis that the market would fail to adequately understand accounting information, attributing greater risk due to R&D expenses or intangible assets that are not recognized for their future earning capacity (Mohanram, 2005).

The tangibility variable was negatively and significantly related to systematic risk. Such a result corroborates the understanding of Barth *et al.* (2023) as, with the world's transition to a new economy, measures based on fixed assets may be less relevant concerning measures that consider intangible assets, growth opportunities, and alternative performance measures. Therefore, the risk inherent to fixed costs or the positive effects of a monopolistic position would be negatively associated with systematic risk in the context of the new economy, updating, for the Brazilian case, the findings of past research such as Lev (1974), Jose and Stevens (1987), Subrahmanyam and Thomadakis (1980) and Barton (1988).

The companies' volatility results are negatively associated with systematic risk, diverging from related literature in which this variable represents uncertainty regarding the company's future, possibly a consequence of both economic and accounting situations (Beaver *et al.*, 1970; Hong & Sarkar, 2007; Dichev & Tang, 2009).

The productivity and operating cycle variables were not relevant to systematic risk in the Brazilian context.

5. Complementary Tests

Additional tests were performed to validate the study's results. The control variables from the primary model were kept in all tests described in this section. First, the primary model's dependent variable, leveraged beta, was replaced by unleveraged beta. The negative association of asset informativeness measures with systematic risk was maintained but with less intensity in all its variations.

To deepen the robustness tests, regressions with dummy variables were estimated for 2016 to 2021 to represent macroeconomic events that could affect the explanatory variables and mitigate potential endogeneity problems. For example, 2019 marked the period when the International Financial Reporting Standard 16 – IFRS 16 entered into effect concerning the accounting of leases. This standard no longer allows operating leases to be kept off the balance sheet, which forced accounting for right-of-use assets and lease liabilities, which may have worsened many companies' financial indicators, and 2020 and 2021 marked the COVID-19 pandemic.

The results confirmed the statistical relevance, as all years are significant and positively associated with systematic risk. Furthermore, when years are added to the regression, the non-discretionary informativeness variable loses statistical relevance, indicating some simultaneous macroeconomic effect on this sector indicator in the case of the five-year beta window and asset informativeness variables.

Additionally, tests were performed with 3-year (12 quarters) and 7-year (28 quarters) windows to estimate the beta and asset informativeness, different from the primary model that adopted five years or 20 quarters.

For the three-year windows, the results with the leveraged beta are analogous to those of the primary model, confirming the importance of asset informativeness and its negative relationship with systematic risk. In the case of unleveraged beta, the relevance of non-discretionary informativeness (IA_{ind}) and discretionary informativeness proposed by this study (IA_{firm2}) was observed, with the expected negative sign.

However, when dummies for 2014 to 2021 are added, only IA_{Firm2} is significantly and negatively associated with systematic risk when leveraged, again indicating a potential simultaneous effect of macroeconomic variables on informativeness variables calculated with three-year windows. Such results make sense, considering the macroeconomic environment can affect assets and results. As for the relevance of the years included, except 2014 and 2015, all are positively related to systematic risk.

In the case of seven-year windows, the expected negative relationship with systematic risk remains significant, but only for global (IA_i) and discretionary (IA_{Firm1} ; IA_{Firm2}) informativeness in the case of leveraged beta, and non-discretionary (IA_{ind}), in the case of unleveraged beta.

When 2018 to 2021 are added, they appear positively related to leveraged beta, but only 2019 to 2021 remain relevant when the beta is deleveraged. Including the years in the regression revealed that global and non-discretionary informativeness (IA_i and IA_{ind}) are related to leveraged beta, but only non-discretionary informativeness (IA_{ind}) matters with the unleveraged beta, with a negative association.

Thus, tests with windows larger and smaller than the primary regression indicate that the most appropriate size is the 5-year window (20 quarters) and that with different windows, the non-discretionary informativeness (IA_{ind}), which indicates the sector characteristics overlap with the other measures in terms of relevance, both for leveraged and unleveraged beta, corroborating the existence of externalities of the industry's effect on systematic risk (Ma, 2017).

Furthermore, the interference of the macroeconomic environment becomes evident when observing the results after the inclusion of annual dummies. However, the negative association does not change, and the statistical significance of asset informativeness can sometimes alternate in relation to the study's four measures, but it still reveals its importance.

Additionally, tests were conducted to verify potentially differentiated behaviors by the economic sector, using a five-year window for beta, asset informativeness, and ERC.

For the industrial goods sector, a higher IA_{ind} is associated with greater systematic risk (leveraged or otherwise). IA_{Firm1} maintains the expected negative direction of its relationship with risk, but only when leveraged.

In the public utilities sector, while IA_{ind} presents a negative sign in the relationship with systematic risk, IA_{Firm1} and IA_{Firm2} present a positive sign, possibly revealing the investors' poor assessment of the discretionary choices of companies in this sector.

In the healthcare sector, all asset informativeness measures are associated with greater risk (except IA_{ind} for unleveraged beta), not corroborating previous literature. Conversely, in the cyclical consumer sector, all measures of asset informativeness corroborate the expected negative sign concerning systematic risk, leveraged or otherwise (except IA_{Firm1} , for the unleveraged beta).

The non-cyclical consumer, regardless of whether the beta is leveraged, is one sector in which asset informativeness does not matter for systematic risk. In turn, the basic materials and oil, gas, and fuel sectors converged with a negative and significant relationship between IA and IA_{Firm} with beta. In the case of basic materials though, higher IA_{ind} is associated with higher systematic risk.

The asset informativeness of companies in the communications sector corroborates the literature, showing a negative relationship with leveraged systematic risk, but only when measured by global IA or IA_{ind} . When beta is deleveraged, only IA_{Firm} has a significant and positive relationship.

Additionally, although this study's objective is to propose using asset informativeness as a measure of information quality, it was compared with earnings informativeness, known as Earnings Response Coefficient (ERC), measured according to Dechow *et al.* (2010). This variable was not relevant in any of the initial regressions, with neither leveraged nor unleveraged beta.

However, tests by sector highlighted the statistical significance of the ERC variable for the public utilities and communications sectors, in which the relationship is negative, with the beta leveraged or otherwise. The relationship is positive for the basic materials and non-cyclical consumer sectors and only occurs when beta is leveraged.

Dechow *et al.* (2010), despite presenting several measures of earnings quality, including the ERC, state that these indicators measure different earnings properties. Corroborating this notion, the results indicate that the ERC is not comparable to asset informativeness.

Therefore, it appears that when the relationship between asset informativeness or profit by sectors is observed in greater detail, the relationships vary depending on the measure used and whether financial leverage affects the beta.

6. Conclusions

This study analyzed the effect of accounting asset informativeness on systematic risk. Asset informativeness is a measure of the quality of accounting information, which concerns the ability of accounting operational assets to inform the value of a company's economic capital.

Using four models estimated by ordinary least squares, with cross-sectional panel data and data from 2010 to 2021 of Brazilian companies traded on B3, it was analyzed how asset informativeness influences systematic risk. In addition, the influences of each component of the asset informativeness, company-specific (discretionary) and sector-typical (non-discretionary), on the company's systematic risk were analyzed. An alternative measure was proposed in this study for the discretionary component in addition to the measure provided in the literature. The models also considered control variables: asset productivity, size, growth, tangibility, operating cycle, and profitability volatility.

The results reveal that asset informativeness is relevant and negatively associated with the systematic risk of Brazilian companies in any of the four measures used in this study. Therefore, it is a useful alternative measure for users who wish to estimate companies' intrinsic value.

When the non-discretionary component is observed separately, its intensity is close to one standard deviation higher than the effects of global and discretionary informativeness. This result indicates a potential effect of externalities from the industry's effect on systematic risk, as Ma (2017) suggested.

The discretionary component measured according to Chen *et al.* (2022) is relevant. Its intensity is only 40% of the factorial load of the measure proposed by the authors though, which is a contribution of this study to the development of related literature. Such findings show that the specific characteristics of companies related to their accounting choices and their daily management decisions regarding operations and investments are relevant but with less intensity on the effects of the industry.

The growth opportunity, tangibility, and profit volatility control variables showed a negative relationship with systematic risk, while the size variable showed a positive association. The productivity and operating cycle variables were not statistically significant.

The following complementary tests were performed: regressions using unleveraged beta to measure systematic risk; comparisons of IA variables with the earnings response coefficient (ERC); inclusion of dummy variables representing years and macroeconomic effects in the models; larger and smaller windows were used for estimating the beta and asset informativeness; and tests of IA interactions according to economic sectors.

The tests generally corroborate the results that asset informativeness is negatively associated with systematic risk. The inclusion of years revealed potential endogeneity in the informativeness measures, and the separation by sectors indicated differentiated behavior, both in terms of statistical significance and the direction of the relationship, depending on the case. Furthermore, only by deepening the analysis was it possible to identify the relevance of the ERC variable, representing the informativeness of profits.

This study's main limitation is related to the quantity of data due to the size of the Brazilian stock market and the relatively short period after Brazil converged with international accounting standards.

This study contributes to the literature on the quality of accounting information, primarily based on accounting results, and the literature on determinants of the cost of capital. This topic is relevant for users of accounting information, notably investors, as it suggests a source of relevant information for estimates of a company's value and consequent capital allocation. It is also relevant for those preparing accounting reports and regulators, as it provides evidence of the economic consequences of accounting choices related to the measurement, recognition, and disclosure of accounting assets.

An opportunity for future research would be verifying whether asset informativeness changes according to accounting standards issued by regulators, identifying whether the determinants of asset informativeness are the same for other quality measures of accounting information, and demonstrating potential determinants of variations between sectors and even countries.

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