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Accounting ratios, stock prices, and COVID-19: a study in IBOV companies

Índices contables, precios de acciones y Covid-19: un Estudio en empresas del IBOV

Índices contábeis, preço das ações e Covid-19: estudo em empresas do IBOV

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Abstract

Purpose: Investigate the association between profitability, operational, and liquidity accounting indicators and the reaction of companies' stock prices after the COVID-19 pandemic.

Methodology: The research is empirical and quantitative, involving 51 companies listed in the IBOV index between 2018 and 2022. Data were collected from the Refinitiv Eikon and Economatica systems. A multilevel regression model was used to analyze the data, and statistical tests were conducted using RStudio, Python, and Excel.

Results: The results suggest that earnings per share and current liquidity can explain the reaction of stock prices of companies listed in the IBOV. However, the COVID-19 variable did not show statistical significance. Additionally, the effect of COVID-19 was not captured by the

year variable. The control variables size and sectors showed significant variability in explaining stock prices.

Study Contributions: The study contributes to the literature on the value relevance of accounting information in the capital market during the pandemic. Furthermore, it promotes the use of multilevel regression to analyze sectors in the stock market, providing important insights for investors and stakeholders on the usefulness of profitability and liquidity information for decision-making.

Keywords: Multilevel Regression; Economic-financial Indicators; Value Relevance of Accounting Information; B3; COVID-19.

Resumen

Objetivo: Investigar la asociación entre los indicadores contables de rentabilidad, operacionales y de liquidez, y la reacción del precio de las acciones de las empresas después del brote de Covid-19.

Metodología: La investigación es empírica y cuantitativa, involucrando a 51 empresas cotizadas en el índice IBOV entre 2018 y 2022. Los datos fueron recolectados en los sistemas Refinitiv Eikon y Economatica. Se utilizó un modelo de regresión multinivel para analizar los datos, y las pruebas estadísticas se realizaron usando RStudio, Python y Excel.

Resultados: Los resultados sugieren que la ganancia por acción y la liquidez corriente pueden explicar la reacción del precio de las acciones de las empresas cotizadas en el IBOV. Sin embargo, la variable Covid-19 no mostró significancia estadística. Además, el efecto del Covid-19 tampoco fue captado por la variable año. Las variables de control tamaño y los sectores presentaron variabilidad significativa en la explicación del precio de las acciones.

Contribuciones del Estudio: El estudio contribuye a la literatura sobre la relevancia de la información contable en el mercado de capitales durante la pandemia. Además, promueve la utilización de la regresión multinivel para analizar sectores en la bolsa de valores, ofreciendo ideas importantes para inversores y partes interesadas sobre la utilidad de la información de rentabilidad y de capacidad de pago para la toma de decisiones.

Palabras Clave: Regresión Multinivel; Indicadores Económico-financieros; Relevancia de la Información Contable; B3; Covid-19.

Resumo

Objetivo: Investigar a associação entre os indicadores contábeis de rentabilidade, operacionais e de liquidez e a reação do preço das ações das empresas após o surto da Covid-19.

Metodologia: A pesquisa é empírica e quantitativa, envolvendo 51 empresas listadas no índice IBOV entre 2018 e 2022. Os dados foram coletados nos sistemas Refinitiv Eikon e Economatica. Utilizou-se um modelo de regressão multinível para analisar os dados, e os testes estatísticos foram realizados usando RStudio, Python e Excel.

Resultados: Os resultados sugerem que o lucro por ação e a liquidez corrente podem explicar a reação do preço das ações das empresas listadas no IBOV. No entanto, a variável Covid-19

não mostrou significância estatística. Ademais, o efeito da Covid-19 também não foi captado pela variável ano. As variáveis de controle tamanho e os setores apresentaram variabilidade significativa na explicação do preço das ações.

Contribuições do Estudo: O estudo contribui para a literatura sobre a relevância das informações contábeis (*value relevance*) no mercado de capitais durante a pandemia. Além disso, promove a utilização da regressão multinível para analisar setores na bolsa de valores, oferecendo achados importantes para investidores e *stakeholders* sobre a utilidade das informações de lucratividade e de capacidade de pagamento para a tomada de decisão.

Palavras-Chave: Regressão Multinível; Indicadores Econômico-financeiros; Relevância da Informação Contábil; B3; Covid-19.

1 Introduction

The COVID-19 pandemic had a profound impact on numerous sectors, including accounting (Rinaldi et al., 2020). This study investigates the influence of accounting indices on companies' stock prices —excluding financial institutions, holding companies, and insurance firms—listed on the IBOV index of Brazil's stock exchange B3 after the COVID-19 pandemic.

Research on value relevance in accounting has gained traction by incorporating empirical models and theories from other scientific areas. Notable examples include Markowitz's portfolio theory (1952) and Sharpe's asset pricing model (1964) from modern finance, as well as Fama's efficient market hypothesis (1970) from economic theory.

Building on these seminal works, accounting has been investigating the impact of accounting information in the real world through robust statistical tools. Empirical studies reveal that this type of information can explain and predict stock price reactions (Ball & Brown, 1968; Beaver, 1968; Bruni & Famá, 1998; Burke & Wieland, 2017; Collins et al., 1997; Galdi & Lopes, 2008; Lopes, 2001; Machado et al., 2015; Ohlson, 1995; Wang et al., 2013).

However, the pandemic may have caused a structural break, as it increased the demand for accountability, challenged organizational performance, required economic recovery efforts, reduced cash flows, and intensified operational risks (Ahrens & Ferry, 2021; Cui et al., 2021; Leoni et al., 2021; Rinaldi et al., 2020).

The global crisis affected daily business operations, traditional accounting practices, and the financial market, requiring companies' timely and significant adaptations (Chi, 2023). Businesses had to adjust their accounting estimates and assessments to reflect the new economic reality and the uncertainties associated with the pandemic. This scenario forced accounting professionals to reconsider how financial information is reported and interpreted, particularly concerning asset valuation and risk management (Rahmani et al., 2023).

Moreover, the pandemic revisited the need for greater transparency in financial information to assist investors in navigating a volatile and uncertain environment (Rahmani et al., 2023). Studies, such as Cui et al. (2021), show that the pandemic accentuated the importance of high-quality and relevant accounting information. Companies were required to provide more detailed and frequent updates on their financial performance and the impacts of the pandemic, as investor trust in accounting information reduced in the wake of COVID-19 (Fabrizi et al., 2023).

The global health crisis led to a shift in investor expectations and performance evaluation metrics, as evidenced by Fabrizi et al. (2023). With increasing uncertainty and changes in market dynamics, investors have adjusted their perception of the relevance of

accounting indices, which could affect the traditional relationship between these indices and stock prices (Rinaldi, 2022).

Thus, COVID-19 may have altered the relevance of accounting information in the perception of investors. Therefore, the following research question arises: **How do accounting indices of profitability, operational efficiency, and liquidity influence the stock prices of IBOV companies after the onset of COVID-19?**

The study investigates the association between profitability, operational, and liquidity accounting indicators and the reaction of companies' stock prices after the COVID-19 pandemic.

This research is justified by the analysis of the COVID-19 pandemic's influence on the relationship between accounting indices and stock prices, which has not yet been widely explored. Despite the extensive literature on value relevance (Ball & Brown, 1968; Beaver, 1968; Ohlson, 1995), most studies consider periods without controlling economic stress variables. Furthermore, the pandemic introduced unexpected phenomena into the economy, and understanding how these extreme events affect the relationship between indices and stock prices can provide new insights into value relevance during economic crises.

The study used multilevel regression to capture random effects among sectors during the study period and examined the effect of COVID-19 through a temporal dummy variable. This research contributes to the literature on the relevance of accounting information (value relevance) in the capital market during the pandemic. Additionally, it promotes multilevel regression to analyze sectors in the stock market, offering important findings for investors and stakeholders regarding profitability and liquidity information for decision-making.

This article is organized into four additional sections: 2) literature review and hypothesis development; 3) methodology employed in the study; 4) presentation of the results; and 5) concluding remarks.

2 Literature Review and Hypothesis Development

2.1 Value Relevance of Accounting Information in the Capital Market

The seminal works of Ball and Brown (1968) and Beaver (1968) demonstrated that the disclosure of accounting results influenced stock prices and trading volumes in the American capital market. Following the publication of these articles, numerous scientific studies emerged to investigate the importance of accounting information for the capital market (Kothari & Wasley, 2019).

The studies by Ball and Brown (1968) and Beaver (1968) inpired accounting research to integrate theories from finance and economics, such as Markowitz's portfolio theory (1952), Sharpe's asset pricing model (1964), and Fama's (1970) efficient market hypothesis. Notably, while many articles have used theories from other scientific areas, the majority of value relevance studies rely on Ohlson's model (1995) (Kothari & Wasley, 2019).

Ohlson (1995) developed a market valuation function that incorporates the book value of equity, future earnings, and expected dividends. Collins et al. (1997) applied Ohlson's model to the American capital market, suggesting that net income and equity jointly increase the relevance of accounting information. However, when analyzed separately, net income remains relevant while equity becomes less significant.

An empirical study conducted on the Shanghai Stock Exchange found that return on equity and earnings per share are value relevant, meaning they explain the variation in stock prices (Wang et al., 2013). According to Zhai and Wang (2016), high-quality accounting

information can maximize investor interest. Evidence shows that the disclosure of integrated reporting is related to stock prices (Barth et al., 2017).

Burke and Wieland (2017) highlighted that bank cash flows are "value relevant" to the capital market. In relation to green investment information, studies suggest that investors respond positively to green investments and Environmental, Social, and Governance (ESG) projects (Garavaglia et al., 2023; Martin & Moser, 2016).

Studies conducted in Brazil, in line with international research, suggest that accounting information is relevant to the Brazilian capital market. Brito (1977) found no evidence supporting the weak form of the efficient market hypothesis in Brazil. However, Bruni and Famá (1998) suggested an association between debt variables, equity, and market value. Based on Ohlson's Model, accounting information appears more relevant than distributed dividends (Lopes, 2001).

Galdi and Lopes (2008) investigated the causality between profit and stock prices of companies in Latin America. Although they did not establish a causal relationship, they identified a correlation between these variables. In Brazil, similar to international studies, it was observed that wealth per share is more relevant to investors than earnings per share (Machado et al., 2015). Furthermore, evidence suggests a relationship between ESG indicators and economic-financial indices (Alexandrino, 2020).

These studies, indicate that accounting and green investment information can explain and predict stock prices reactions in both national and international capital markets. However, the effects of COVID-19 may have positively or negatively influenced this relationship (Rinaldi et al., 2020).

2.2 Value Relevance of Accounting Information during the COVID-19 Pandemic

The COVID-19 pandemic resulted in approximately 769 million cases of the disease, leading to around 7 million deaths (World Health Organization, 2023). On May 5, 2023, the World Health Organization (WHO) declared the end of the COVID-19 pandemic (United Nations, 2023). However, according to Rinaldi et al. (2020), the effects of the pandemic on society will be profound and permanent. This outbreak has fostered sophistication and development in accounting research (Rinaldi et al., 2020).

In this context, the COVID-19 pandemic impacted several areas of accounting, including public budget responsibility, educational accounting, the public sector, financial markets, and corporate disclosure (Rinaldi, 2022). In light of Foucault's theory, Ahrens and Ferry (2021) 'showed that accounting and accountability practices supported statistical and economic normalization in the United Kingdom. Thus, accounting served as a disciplinary tool that highlighted existing inequalities and contributed to identity and perpetuate them during the pandemic (Leoni et al., 2021).

Studies revealed that companies with better sustainable performance experienced less negative impact on their market value during the pandemic (Rinaldi, 2022). However, ESG performance did not reduce stock price volatility. Conversely, information about liquidity, leverage, financial performance, and the development of intangible assets proved to be more effective in protecting organizations during crises (Rinaldi, 2022).

Cui et al. (2021) suggest that entities that conservatively disclose financial statements experienced smaller declines in stock prices during the stock market crash triggered by COVID-19. However, the authors highlighted that the benefits of conservatism are minimal when companies have issues related to information asymmetry (Cui et al., 2021).

Suzana et al. (2022) analyzed the economic-financial indices of the aviation sector before and during the pandemic, reporting a strong decline in sector activities. However, unlike other sectors, the livestock segment showed improved returns on assets and equity indices (Souza et al., 2022). Meanwhile, Neves and Carrera Junior (2022) indicated that, on average, B3-listed companies, excluding financial institutions, showed statistically significant negative indices during the pandemic.

The pandemic transformed various aspects of the world, including research in accounting. According to Rinaldi et al. (2020), despite the extensive studies on the field conducted during this period, there are still many gaps. Furthermore, research in the Brazilian capital market that employs robust statistics to address COVID-19-related issues is still in its early stages, revealing a notable lack of studies from this perspective.

2.3 Hypothesis Development

This study investigates the relationship between accounting information from the annual financial statements of B3 listed companies between 2018 and 2022 and their stock prices before and after the onset of COVID-19, as suggested by the literature.

Among all accounting ratios, profitability indicators, particularly earnings per share and return on equity, are the most relevant to investors in the American capital market (Ball & Brown, 1968; Beaver, 1968; Collins et al., 1997; Ohlson, 1995). In the Brazilian stock market, profitability indicators have shown statistical significance in explaining and predicting stock prices (Galdi & Lopes, 2008; Lopes, 2001). In China, evidence suggests that these indicators are value relevant for investors (Wang et al., 2013; Yanto et al., 2021; Rahman & Liu, 2021). However, this reality may have changed due to the pandemic (Rinaldi et al., 2020). Thus, the following hypothesis is proposed:

- **H1**: Profitability ratios positively correlate with the stock prices of companies listed on the IBOV index (B3) after the onset of COVID-19.

Liquidity information is significant for stakeholders as it protects companies during periods of crisis (Rinaldi, 2022). Wang et al. (2013) demonstrated that payment capacity indicators do not significantly explain or predict stock prices on the Shanghai Stock Exchange. Meanwhile, Rahman and Liu (2021) and Yanto et al. (2021) suggest that a company's ability to meet its obligations to investors, as measured by the current and quick liquidity ratios, can influence stock price variations. This relationship tends to be positive, as liquidity provides additional resources for investments, settling obligations, and avoiding covenant breaches (Rahman & Liu, 2021). Payment capacity is essential, especially in uncertain environments, such as the pandemic, where many companies struggled to meet their financial obligations (Rahmani et al., 2023). Therefore, the second hypothesis is as follows

- **H2**: Liquidity ratios positively correlate with the stock prices of companies listed on the IBOV index (B3) after the onset of COVID-19.

Operational ratios, such as accounts receivable and inventory turnover, are the most used by researchers (Wang et al., 2013; Rahman & Liu, 2021). According to Rahman and Liu (2021) and Wang et al. (2013), there is no statistical evidence that operational indicators are value relevant for the Chinese capital market. Despite this, operational ratios are essential to assess a company's capacity to survive during crises like COVID-19. Previous studies confirm

that these indicators performed negatively during the pandemic (Rahmani et al., 2023). Thus, it is presumed that firms with stronger operational ratios tend to outperform those with weaker ratios (Rahman & Liu, 2021). Accordingly, the final hypothesis is:

- **H3**: Operational ratios are positively associated with the stock prices of companies listed on the IBOV index (B3) after the onset of COVID-19.

3 Materials and Methods

3.1 Sample Description

The study is empirical and quantitative in nature. It investigates whether accounting indices of liquidity, operational performance, and profitability influence the stock prices of companies—excluding financial institutions, holding companies, and insurers—listed on the IBOV index of the Brazilian stock exchange (B3) after the onset of COVID-19. The analysis covers the period from 2018 to 2022, allowing for the capture of the effects of the variables before and after COVID-19.

The sample selection was non-probabilistic, considering the relevance of the Brazilian stock market, data availability, and the importance of the companies indexed in the capital market. The research population consisted of all 89 companies listed on the IBOV index, including Brazil's most significant publicly traded firms. The final sample comprised 51 companies, as 24 were excluded due to incomplete data, and 14 were financial institutions, holding companies, or insurers, which were excluded because of the unique characteristics of their business operations.

3.2 Selection of the Accounting Indices

According to Wang et al. (2013) and Rahman and Liu (2021), investors use accounting indices to inform decision-making in the capital market, including (1) Return on Equity; (2) Earnings per Share; (3) Current Ratio; (4) Quick Ratio; (5) Accounts Receivable Turnover; and (6) Inventory Turnover.

Return on equity and earnings per share are profitability indices. The quick ratio and current ratio assess the organization's ability to meet short-term obligations, while accounts receivable turnover and inventory turnover measure the company's efficiency in managing its assets (Rahman & Liu, 2021; Wang et al., 2013).

3.3 Research Design

The research model contains companies' accounting information and stock prices. The study aimed to investigate the association between profitability, operational, and liquidity accounting indices and the reaction of stock prices of companies following the COVID-19 pandemic.

The study's conceptual dependent and independent variables were, respectively, the company's market value and the accounting information. The dependent variable was operationalized by the stock prices, while the independent variables were represented by the accounting indices.

The control variables included size, leverage, year, and sectors. These controls were used because organizations may be more or less resilient to crises due to their size, capital structure, and segmentation (Neves & Carrera Junior, 2022).

The first research analysis was descriptive, examining the data collected from Refinitiv Eikon, Economatica, and the companies' official websites. The second analysis was the examination of the Multilevel Multiple Regression model. It is expected that the indices will influence stock prices, as reviewed in the literature. Therefore, the regression model follows that proposed by Ohlson (1995) and further developed by Wang et al. (2013) and Rahman and Liu (2021):

$$P_{it} = \beta_0 + \beta_1 EPS_{itj} + \beta_2 ROE_{itj} + \beta_3 ART_{itj} + \beta_4 IT_{itj} + \beta_5 CR_{itj} + \beta_6 QR_{itj} + \beta_7 C19_t + \beta_8 SIZE_{itj} + \beta_9 LEV_{itj} + \sum_{i=2}^{n=4} \gamma_i YEAR_i + \varepsilon_{it} + \mu_{0j} \quad (1)$$

P is the stock price, EPS is earnings per share, ROE is return on equity, ATR is accounts receivable turnover, IT is inventory turnover, CR is current ratio, QR is quick ratio, CV19 is a dummy variable where 1 refers to the years of the pandemic and 0 refers to the years without COVID-19, SIZE is size, LEV is leverage, YEAR is a dummy variable for each year, ε_i refers to variables not included in the regression model, and μ_{0j} are the intercepts for the sectors. The statistical tests were conducted using RStudio, Python, and Excel. Thus, Table 1 provides an overview of the model variables.

Table 1

Variables and Controls of the Empirical Model

Variables and Controls	Code	Categories	General Formula	Literature
Earnings per Share	EPS	Profitability	Net income / Number of shares	Ball & Brown (1968), Beaver (1968), Ohlson (1995), Collins et al. (1997), Rahman & Liu (2021), Wang et al. (2013), Yanto et al. (2021)
Return on Equity	ROE	Profitability	Net income / Total equity	Wang et al. (2013), Yanto et al. (2021), Rahman & Liu (2021)
Accounts Receivable Turnover	ART	Operational	Revenue from business activities / Receivables	Rahman & Liu (2021), Wang et al. (2013)
Inventory Turnover	IT	Operational	Cost of revenue / Inventory	Rahman & Liu (2021), Wang et al. (2013)
Current Ratio	CR	Liquidity	Current assets / Current liabilities	Rahman & Liu (2021), Wang et al. (2013), Yanto et al. (2021)
Quick Ratio	QR	Liquidity	(Current assets - Inventory) / Current liabilities	Rahman & Liu (2021), Wang et al. (2013), Yanto et al. (2021)
COVID-19	CV19	COVID-19 Effect	1 for years with COVID-19 and 0 for years without COVID-19	Silva (2022)

Size	SIZE	Control	Natural logarithm of assets	Zhai & Wang (2016), Cui et al. (2021)
Leverage	LEV	Control	Total debt / Total assets	Zhai & Wang (2016), Cui et al. (2021), Neves & Carrera Junior (2022)
Sector	μ_0j	Control	Sector intercept	Zhai & Wang (2016), Cui et al. (2021), Neves & Carrera Junior (2022)
Year	YEAR	Control	1 if the information belongs to the period and 0 for other years	-

Source: *Adapted from Rahman & Liu (2021)*.

3.4 Data Treatment

According to Gujarati and Porter (2011), a sample can be considered reasonably large if it contains 50 or more observations. Thus, the sample with 51 companies adequately represents the research population. The portfolio of companies that make up the IBOV index was collected from the B3 website and was valid from September to December 2022, the last period analyzed.

Stock prices and accounting information were gathered from the Refinitiv Eikon system, Economatica, and the companies' official websites, covering the periods from 2018 to 2022. The data were processed using tests conducted in RStudio and Python. The quick ratio variable was removed from the model to avoid multicollinearity issues, as it was highly correlated with the current ratio.

The data were organized into a balanced panel, and a logarithmic transformation was applied to the dependent variable to find the model that best fit the data. Additionally, annual dummy variables were created to control for the evolution of stock prices and capture the effect of COVID-19. However, the dummy variable for the year 2022 was excluded due to multicollinearity. Random effects were also used for the sectors to obtain more accurate predictions for each sector.

4 Results

4.1 Correlation Analysis

This section identifies the existence of multicollinearity among the variables. High correlation between independent variables can make the OLS estimators less precise and inefficient. Table 2 shows the correlation analysis among the variables included in the study, as follows:

Table 2
Correlation Matrix of Variables

Variables	P	EPS	ROE	IT	ART	CR	CV19	LEV	SIZE
P	1								
EPS	0.3504	1							
ROE	0.0185	0.2371	1						
IT	-0.0205	0.0227	0.0251	1					
ART	-0.0666	0.1778	0.1330	-0.0470	1				

CR	0.0891	0.0543	-0.0291	-0.1424	-0.1323	1			
CV19	0.1093	0.1231	0.0575	-0.0816	0.0126	-0.0162	1		
LEV	0.0613	0.3299	0.0097	0.0373	0.2259	-0.2899	0.1836	1	
SIZE	-0.0533	-0.3577	0.1223	0.0096	0.1719	-0.4137	0.0538	0.0897	1

Note: P = Stock Price; EPS = Earnings per Share; ROE = Return on Equity; IT = Inventory Turnover; ART = Accounts Receivable Turnover; CR = Current Ratio; CV19 = COVID-19; SIZE = Size; LEV = Leverage.
Source: *Research data (2023)*.

The variables EPS, ROE, CR, CV19, and LEV have a positive correlation with the dependent variable. In contrast, the variables IT, ART, and SIZE show a negative correlation with stock prices. Additionally, there is no correlation above 90% among the variables EPS, ROE, IT, ART, CR, CV19, LEV, and SIZE. Therefore, there are no indications of collinearity (Gujarati & Porter, 2011).

Table 3 presents the Variance Inflation Factors (VIFs) of the independent variables included in the regression model as follows:

Table 3
Variance Inflation Factor Analysis

Variables	EPS	ROE	IT	ART	CR	CV19	LEV	SIZE
VIF	1.5733	1.1453	1.0374	1.1367	1.3420	1.0613	1.3449	1.5735

Note: VIF = Variance Inflation Factor; EPS = Earnings per Share; ROE = Return on Equity; IT = Inventory Turnover; ART = Accounts Receivable Turnover; CR = Current Ratio; CV19 = COVID-19; SIZE = Size; LEV = Leverage.
Source: *Research data (2023).*

The variance inflation factors of the variables EPS, ROE, IT, ART, CR, CV19, LEV, and SIZE resulted in values below 10. Thus, there are no signs of multicollinearity among the analyzed independent variables (Gujarati & Porter, 2011).

4.2 Descriptive Statistics

Table 4 presents the data descriptive analysis, showing information regarding the means, standard deviations, minimums, and maximums of the dependent and independent variables included in the study.

Table 4
Data Descriptive Analysis

Description	No. of Observations	Mean	Standard Deviation	Minimum	Maximum
P	255	21.7514	15.2897	1.9207	86.9701
EPS	255	1.5722	3.7073	-18.2300	23.0755
ROE	255	0.1656	0.4146	-2.4792	4.2003
IT	255	21.9574	49.3725	0.2883	456.8949
ART	255	7.4874	5.0316	1.4554	34.7070
CR	255	1.7940	1.0220	0.2160	8.0481
LEV	255	24.1338	1.1939	20.7673	27.6184
SIZE	255	0.6383	0.2581	0.1091	2.4618

Note: P = Stock Price; EPS = Earnings per Share; ROE = Return on Equity; IT = Inventory Turnover; ART = Accounts Receivable Turnover; CR = Current Ratio; CV19 = COVID-19; SIZE = Size; LEV = Leverage.
Source: *Research data (2023)*.

The average leverage was approximately 24.13, with a standard deviation of about 4.95% of the mean value. The average size was 0.6383, with a standard deviation close to 40.44% of the mean found. Thus, the leverage and size variables exhibit relatively low dispersion.

The approximate average values for stock price are 21.75, 1.57 for earnings per share, 0.17 for return on equity, 21.96 for inventory turnover, 7.84 for accounts receivable turnover, and 1.79 for current ratio. The standard deviations of these variables were approximately greater than 55% of the mean values. Therefore, these elements exhibit high variability.

4.3 Regression Analysis

This section aims to find the regression model that is most accurately specified to determine whether accounting information explains the stock prices of companies that make up the IBOV index between 2018 and 2022, following the onset of the COVID-19 pandemic. The multilevel model is robust to heteroscedasticity and does not require stringent adherence to assumptions, but it must meet the assumptions of normality and serial autocorrelation. The results of regression model 1 are presented below:

$$log\ (P_{it}) = \beta_0 + \beta_1 EPS_{itj} + \beta_2 ROE_{itj} + \beta_3 ART_{itj} + \beta_4 IT_{itj} + \beta_5 CR_{itj} + \beta_6 CV19_t + \beta_7 SIZE_{itj} + \beta_8 LEV_{itj} + \sum_{i=2}^{n=4} \gamma_i YEAR_i + \varepsilon_{it} + \mu_{0j} \quad (2)$$

Table 5
Model 1 of Multilevel Regression

Model 1 of Multilevel Regression					
Number of Observations:	255	**Log-Likelihood:**			-274.567
Number of Grupos:	11	**Scale:**			0.3927
Minimum Group Size:	5	**Converged:**			Yes
Maximum Group Size:	45	**Average Group Size:**			23.200
Statistical Variables	**Coefficient**	**Standard Error**	**Z**	**P>|z|**	**P>|z| 0.025 0.975**
Intercept	1.147	1.141	1.005	0.315	-1.089 3.383
EPS	0.081	0.014	5.715	0.000***	0.053 0.109
ROE	-0.129	0.107	-1.208	0.227	-0.338 0.080
IT	0.000	0.001	-0.398	0.691	-0.002 0.002
ART	-0.004	0.010	-0.343	0.731	-0.024 0.017
CR	0.155	0.049	3.155	0.002***	0.059 0.252
CV19	0.123	0.129	0.953	0.340	-0.130 0.376
LEV	0.024	0.046	0.521	0.602	-0.067 0.115
SIZE	0.621	0.213	2.916	0.004***	0.203 1.038
Year_2019	0.444	0.126	3.525	0.000***	0.197 0.690
Year_2020	0.382	0.126	3.021	0.003***	0.134 0.629
Year_2021	0.161	0.125	1.282	0.200	-0.085 0.406

Sector_code Var	0.157	0.163			
Intraclass Correlation Coefficient (ICC)		**19.47%**			
Statistical Tests		**Coefficient**		**P-value**	
Shapiro-Wilk		0.994		0.398	
Durbin-Watson		1.812		-	

Note: EPS = Earnings per Share; ROE = Return on Equity; IT = Inventory Turnover; ART = Accounts Receivables Turnover; CR = Current Ratio; CV19 = COVID-19; SIZE = Size; LEV = Leverage; *** p-value < 0.01.
Source: *Research Data (2023).*

Within the scope of multilevel models, the commonly used starting point refers to the null model. According to Hair Jr. and Fávero (2019), this model involves analyzing the dependent variable concerning the random variables, which, in this study's context, are represented by the sectors of the companies. Applying this method, known as the step-up strategy, allowed for identifying an intraclass correlation of 19.47%. In this case, the intraclass correlation measures the proportion of total variation attributed to differences between sectors.

As shown in Table 5, the variables ROE, IT, ART, and LEV were not statistically significant. Thus, these indices were unable to explain the stock prices of companies in the IBOV index during the analyzed periods. The variable CV19 in the study was also not statistically significant. The dummy variables for the periods suggest that the pandemic does not explain the variation in prices when analyzed annually.

Stocks in 2019 had, on average, a logarithmic price of 0.444 units higher than those in 2018, holding all else constant. In 2020 and 2021, the stocks had, on average, logarithmic prices greater than those in 2018, despite the decrease from 2019 to 2020 and from 2020 to 2021, all else held constant. Therefore, it is observed that even with the onset of the pandemic, the stock prices comprising the IBOV increased compared to the initial period analyzed.

For a more precise analysis of the specified model, the variables that did not show statistical significance were excluded, resulting in Equation 3. This manual process of including and excluding variables, guided by an underlying understanding of the phenomenon and statistical significance, aligns with what Hair Jr. and Fávero (2019) define as a "step-up" strategy. Table 6 presents the results of the new model that will be used for a deeper analysis, aiming to clarify the problem more accurately.

$$log\ (P_{it}) = \beta_0 + \beta_1 EPS_{itj} + \beta_2 CR_{itj} + \beta_3 SIZE_{itj} + \sum_{i=2}^{n=4} \gamma_i YEAR_i + \varepsilon_{it} + \mu_{0j} \quad (3)$$

Table 6
Model 2 of Multilevel Regression

Model 2 of Multilevel Regression					
Number of Observations:	255	**Log-Likelihood:**			-262.203
Number of Groups:	11	**Scale:**			0.3912
Minimum Group Size:	5	**Converged:**			Yes
Maximum Group Size:	45	**Average Group Size:**			23.200
Statistical Variables	**Coefficient**	**Standard Error**	**z**	**P>|z|**	**P>|z| [0.025 0.975]**
Intercept	1.772	0.233	7.594	0.000***	1.315 2.230
EPS	0.080	0.013	6.387	0.000***	0.055 0.105
CR	0.146	0.047	3.086	0.002***	0.053 0.239

SIZE	0.589	0.206	2.860	0.004***	0.185 0.993
Year_2019	0.392	0.108	3.641	0.000***	0.181 0.603
Year_2020	0.447	0.108	4.146	0.000***	0.236 0.658
Year_2021	0.219	0.109	2.012	0.044**	0.006 0.432
Sector_code Var	0.153	0.157			

Sector	**Nº**	**u0j**
Cyclical Consumption	0	0.234866
Non-Cyclical Consumption	1	0.139329
Basic Materials	2	0.167068
Non-Basic Materials	3	-0.054618
Diversified	4	-0.642036
Utilities	5	0.164248
Oil	6	-0.020729
Industrial Goods	7	0.198377
Health	8	0.126207
Information Technology	9	-0.537675
Telecommunications	10	0.224962
Intraclass Correlation Coefficient (ICC)		**19.47%**

Statistical Tests	**Coefficient**	**P-value**
Shapiro-Wilk	0.994	0.398
Durbin-Watson	1.812	-

Note: EPS = Earnings per Share; LC = Current Liquidity; TAM = Size; *** p-value < 0.01; ** p-value < 0.05.
Source: *Research Data (2023)*.

Based on the ICC, approximately 19.47% of the total variability in the logarithm of prices is attributed to differences between sectors. In other words, sectors explain about 19.47% of the price variation, while 80.53% of the variance is attributed to variations within sectors or other sources of variation not explained by the model. Practically speaking, if two assets belong to the same sector, the correlation between their logarithmic prices is expected to be around 19.47% due to the common association with that sector.

The intercept is 1.772, so the expected variation in stock prices when all variables are equal to 0 is $e^{\beta 0}$, or 5.88, while holding all other variables constant. An increase of one unit in EPS is expected to result in an 8% increase in stock prices, keeping everything else constant. An increment of one unit in CR results in an expected variation of about 14.60% in the dependent variable, with other variables held constant. An increase of one unit in SIZE is expected to lead to a variation of 58.90% in Y, holding other variables constant.

Regarding the time periods, in 2019, 2020, and 2021, it was found that stock prices were, respectively, about 48%, 56%, and 24.50% higher compared to 2018, keeping everything else constant. Thus, even with the onset of COVID-19, stock prices increased when analyzed annually.

Random effects allow for adjustments to the intercepts of each sector in relation to the model intercept. The sectors of cyclical consumption, non-cyclical consumption, basic materials, utilities, industrial goods, healthcare, and telecommunications have positive random effects, suggesting that, on average, the logarithm of prices for assets in these segments is higher than the regression intercept. Meanwhile, the sectors of non-basic consumption, diversified, oil, and information technology have negative random effects. Therefore, it is assumed that, on

average, the logarithm of prices for assets in these categories is lower than the regression intercept.

From the results of Model 2, it is noted that the EPS index has a positive influence on stock prices and is significant, corroborating studies by Ball and Brown (1968), Beaver (1968), Collins et al. (1997), Lopes (2001), Galdi and Lopes (2008), Wang et al. (2013), and Rahman and Liu (2021). However, the ROE index was not significant, according to Rahman and Liu (2021), contradicting Wang et al. (2013) and Yanto et al. (2021).

The current liquidity index has a positive relationship with stock prices and is significant, as per the study by Rahman and Liu (2021), which contradicts the research by Wang et al. (2013). The inventory turnover and accounts receivable indices have a positive influence but are not significant, as noted in the study by Wang et al. (2013). The control variable SIZE has a positive and significant association. Thus, hypotheses H1 and H2 are accepted, and hypothesis H3 is rejected.

5 Concluding Remarks

Value relevance studies examine the relevance of accounting information to the stock market (Kothari & Wasley, 2019). This study investigated the association between profitability, operational, and liquidity accounting indices and the reaction of companies' stock prices after the COVID-19 pandemic.

The results suggest that the earnings per share, current ratio, and company size indices have a positive association with stock prices, consistent with the literature (Ball & Brown, 1968; Beaver, 1968; Collins et al., 1997; Galdi & Lopes, 2008; Wang et al., 2013; Rahman & Liu, 2021). However, the variables of inventory turnover, accounts receivable turnover, and return on equity were not statistically significant, in line with the literature (Wang et al., 2013; Rahman & Liu, 2021).

The dummy variable for COVID-19 also showed no statistical significance, indicating that the pandemic did not influence IBOV companies' stock prices when analyzed annually. Furthermore, an annual price evolution investigation revealed that, even with the COVID-19 pandemic, stock prices increased.

Additionally, through multilevel linear regression, it was identified that approximately 19.47% of the variation in the logarithm of stock prices is related to sector differences, suggesting that about 80.53% of the observations' variability occurs within sectors. Practically, most of the variability in the independent variable relates to the individual characteristics of entities within each sector and other factors not included in the study.

From a theoretical perspective, the study enriches the literature by strengthening the framework on the value relevance of accounting information in the stock market, particularly regarding earnings and liquidity, even during the pandemic years. It demonstrates the usefulness of profitability and liquidity information for investors, highlighting that part of the variation in stock prices occurs due to sector differences, which can support stakeholders in making more informed decisions.

This study contributes to the literature on the relevance of accounting information (value relevance) in the capital markets during the pandemic. Moreover, it promotes the use of multilevel regression to analyze sectors in the stock market, offering important findings for investors and stakeholders regarding the utility of profitability and liquidity information for decision-making.

The study's limitations are related to the investigation being conducted solely on the main index of the Brazilian stock market, along with the sample size, which limits

generalizations. Additionally, future research is suggested to include monthly analyses to identify the impacts of COVID-19 on stock prices, to increase the sample size, and to conduct the study using quantile regression across the entire stock market, aiming to analyze the impacts of COVID-19 on smaller and larger companies.

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