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ORIGINAL ARTICLE

The impact of live streaming on stock returns in the Brazilian market

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ABSTRACT

The objective of this study was to investigate whether voluntary financial disclosure through live streaming can determine changes in shareholder returns in the Brazilian market. Corporate disclosure through social media is a new phenomenon, driven by the impacts of the coronavirus disease 2019 (COVID-19) pandemic, and its effects are investigated from the perspective that high levels of investor attention are associated with company engagement with audiences. The findings contribute to the literature on investor and firm behavior with respect to disclosure in non-traditional settings. The work is also relevant because it uses web scraping to process unstructured texts. The study provides elements for the development of voluntary disclosure theory, free of intermediaries and closer to retail investors. The traditional event study technique was used, based on live streaming data obtained through web scraping and text mining. The multivariate regression model was used for additional tests. It was found that live streaming have a positive impact on stock prices, although these effects are volatile and tend to return to previous averages within 5 days. Additional analyses also revealed that the greater the number of subscribers to the channel, if the Chief Executive Officer (CEO) participates, if the topic involves the discussion of results, and if the company is not listed in the Bovespa index (Ibovespa), the greater the chances of the content of the live streaming having an abnormal impact.

Keywords: disclosure, social media, live streaming, text mining, event study.

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1. INTRODUCTION

This study aimed to investigate whether voluntary disclosure through live streaming can determine changes in stock returns in the Brazilian market. Although the mere existence of this new tool is not considered sufficient to guarantee an improvement in business conditions (Alexander & Gentry, 2014; Blankespoor et al., 2014, 2019; Drake et al., 2017; Jung et al., 2018), it can be inferred that the quantity and quality of available information tend to reduce information asymmetry.

Information asymmetry is an impediment to market efficiency, as proposed by Fama (1970), who suggests that stock prices reflect all available information. Asymmetry is not limited to inside information, but also includes the difficulty of assessing the value of information. In this scenario, the mandatory or voluntary disclosure of financial and non-financial information, such as through live streaming, becomes an interesting element to maintain investor confidence and correct stock pricing.

This type of voluntary disclosure through live online conferences is a new phenomenon, driven by the social impacts of the coronavirus disease 2019 (COVID-19) pandemic, which has forced companies to change work routines and rethink planning. Preliminary evidence suggests that the health crisis has forced a change in earnings forecasts, suspending the short-term guidance of several companies (Maslar et al., 2021). In general, there is a perception that the COVID-19 crisis has increased the complexity of corporate governance, leading to a growing demand for more accountability to reflect the magnitude of the impact on results (Rinaldi et al., 2020).

In this transformative scenario, there has been an increase in voluntary disclosure by Brazilian listed companies, based on an informal communication tool, through social networks and other alternative digital media, in which members of executive management or the board of directors present information to a specific audience. For example, until 2019, there was no formal registration of live streaming with the regulatory body, the Brazilian Securities and Exchange Commission (CVM), while in 2020, 395 events were registered and in 2021, 743.

The significant increase in this type of disclosure has attracted the attention of the traditional media, which has linked the increase in stock value to the intense live streaming schedule. For example, globo.com (2020, April 29) reported a possible gain of R$ 3.5 billion in market value as a result of the live streaming activities of Via Varejo executives. Consequently, this motivated the regulation of these events, as evidenced by CVM/SEP Circular Letter n. 7/2020 (CVM, 2020), with general guidelines for live streaming presentations with the presence of executives of listed companies, the first CVM normative document on the subject. Subsequently, the guidelines began to appear in the annual circular letters issued by the agency to provide guidance on the procedures for submitting periodic and occasional information.

These virtual events are attended by executives and are most often hosted through third-party channels (not affiliated with the organization) and broadcast live on social media platforms such as Twitter, Instagram, Facebook, and/or YouTube. It should be noted that voluntary disclosure through social media has been examined in several studies (Alexander & Gentry, 2014; Blankespoor et al., 2014, 2019; Drake et al., 2017; Jung et al., 2018).

This raises the question of whether the holding of live streaming leads to different returns than expected, and whether these abnormal returns would be positive. To answer this, the empirical tests included the application of an event study to analyze the effects on the stock prices of companies listed on the B3 S.A. – Brasil, Bolsa, Balcão (B3) that held live streaming in 2020 and 2021. The period chosen is justified by the context of social isolation, which favored online events, and by the need to understand the effects of the regulation of CVM/SEP Circular Letter no. 7/2020 (CVM, 2020). For data processing purposes, the size of the audience of the channel, the subject of the online event (quarterly and/or annual results or general financial results), and the participation of the Chief Executive Officer (CEO) were taken into account.

The data were obtained by searching the CVM website using automated data collection and non-parametric text mining tools. The results of the event study tests revealed that the live streaming had a positive impact on stock prices, confirming the research hypothesis, but that they were volatile and tended to return to their pre-event averages within 5 days. It was also found that the greater the number of subscribers to the channel, the greater the chances that an online event will have a statistically significant impact on the price, and that the chances of this relevance are greater when the CEO is present, when the subject of the live streaming is related to the release of quarterly or annual results, and when the company has

low coverage, represented by whether or not it is part of the Bovespa index (Ibovespa).

The study contributes to the nascent literature on investor behavior in the face of voluntary corporate disclosures in non-traditional communication settings. From a methodological point of view, it also stands out for its use of web scraping and text mining techniques to collect data from the internet and process them into useful and relevant information that can help design new research in accounting and finance. The research is also relevant to understanding the effects of social media on financial disclosure, as well as providing discussions on the limits of voluntary disclosure in a poorly regulated or unregulated environment, assessing the impact of the social network audience on the market. Finally, it sheds light on a new form of voluntary disclosure, free of intermediaries and closer to retail investors, or small individual investors, which can reduce information asymmetries.

Although some companies are still unfamiliar with the use of social media (Cade, 2018), the results of this study help to understand the effects of CEO behavior in a non-regulatory environment that is closer to retail investors. In addition, professionals and market makers, analysis houses, specialized media, and investors can benefit from understanding the impacts of this communication. Finally, the results can encourage investor relations departments and boards of directors of companies with low coverage to develop disclosure strategies aimed at improving the management of the company's reputational capital (Cade, 2018).

In addition to this introductory section, section 2 presents the literature review and the research hypotheses. Section 3 describes the methodological procedures. Section 4 analyzes the results of the empirical tests. Finally, section 5 presents the conclusions, limitations, and recommendations for future research.

2. LITERATURE REVIEW AND HYPOTHESES

2.1 Disclosure Theory and Voluntary Disclosure

In reviews of the literature on disclosure, Healy and Palepu (2001) and Verrecchia (2001) described a large number of studies on the importance of disclosure and its impact on improving stock liquidity, reducing the cost of capital, increasing analyst coverage, and shareholder returns. In particular, Healy and Palepu (2001) observed that corporate disclosure is fundamental to the development of an efficient capital market because it reduces information asymmetry and adverse selection. Market efficiency is enhanced when stock prices quickly reflect all available information; thus, by reducing these market failures, corporate disclosure contributes to a more efficient market, in line with Fama's (1970) principles.

Healy and Palepu (2001) showed that firms provide information to information users in three ways: through regulated financial reports, through voluntary disclosure, and through intermediaries such as financial analysts, industry experts, and specialized media. The authors also pointed out that there are specific incentives in each of these formats, to a lesser extent for regulated disclosure and to a greater extent for voluntary disclosure or through intermediaries. These greater incentives can be seen as distortions of purpose, especially when the information disclosed is not verifiable or when there are no specific regulations (Ronen & Yaari, 2002), which can lead to biases in decision-making.

Discussions of disclosure are even more relevant to accounting research when economic shocks occur, such as the COVID-19 pandemic, as shown by Maslar et al. (2021). The authors found that disclosures are more informative during economic shocks and that managers have an informational advantage over external users due to their position in the firm, creating an information asymmetry regarding the management's future. Maslar et al. (2021) concluded that market participants are expected to recognize that the information generated by management has an advantage over the rest because it is more informative.

In this scenario, where voluntary disclosure takes place in an intermediary environment with the participation of a moderator, usually a market analyst – which can increase the credibility of voluntary information, given the synergy provided by the moderator – the information can be perceived as having high value by investors. Furthermore, in a scenario of uncertainty, the disclosure of information through live streaming may have a different characteristic from other types of disclosure and may have the ability to increase the disclosure of a certain economic event in companies with low analyst coverage (understood in this research as those outside the Ibovespa

portfolio), which can be understood as a phenomenon of reducing information asymmetry and reducing the cost of incorporation.

2.2 Disclosure through Social Media

Research on disclosure has begun to investigate more contemporary issues, such as the emergence of social media and its use by some companies as part of the disclosure process, as well as studying the effects of how managers manage the information environment of companies, given the interactive nature of these platforms (Miller & Skiner, 2015). Arruda et al. (2015) showed that Brazilian companies are using social media to communicate with their investors, customers, and other users.

In this context, the most recurring topics in the literature are the analysis of the value of financial information disclosed on social media and its difference from traditional tools (Blankespoor et al. 2014; Cade, 2018; Chen et al., 2014), the incentives and influences of social media in the disclosure process (Jung et al, 2018; Lee et al., 2015), the effects of this disclosure on investor valuation models (Bartov et al., 2018; Cade, 2018), and the impacts on analyst coverage and potential investors (Alexander & Gentry, 2014; Blankespoor et al., 2014; Drake et al., 2017).

Chen et al. (2014) stated that social media enables two-way public interactions, which generate valuable information in financial markets. Immediate and public feedback from users can enable the development of high-value bottom-up investment content. Social media-based communication specialized in financial markets can enable the production of high-value information. Cade (2018) and Miller and Skinner (2015) stated that social media differs from traditional media in that it encourages two-way public interactions, where company managers do not have full control over what is said. Companies that do not participate in social media will be noted for their silence as individuals' reliance on these platforms increases (Cade, 2018).

Regarding the effects of social media disclosure on investor valuation models, Cade (2018) and Bartov et al. (2018) concluded that the amount of interaction promoted by social media users affects investor perceptions. From this, Cade (2018) inferred that market participants with directional incentives (to buy or sell) can have some success in manipulating a company's stock price by posting (positively or negatively) on social media and encouraging interactions between users. Bartov et al. (2018) found that the aggregate opinion of users of a given network helps predict quarterly results and outliers around earnings releases, especially when firms are in a weak information environment (less media coverage). The results of Cade (2018) introduced new determinants to test the value of information produced on social media, such as the number of interactions, likes, comments, shares, and views.

Bushee et al. (2010) found that wider press coverage reduces spreads and increases the impact of earnings announcements, as it tends to reduce information asymmetry among investors by providing information to a wider range of investors. Alexander and Gentry (2014) pointed out that firms' strategic use of social media, combined with traditional disclosure tools, has a strong impact on stock prices. In contrast, Alexander and Gentry (2014) and Blankespoor et al. (2014) argued that there is a tendency for the media to cover high-profile companies due to the demand for this type of information. In addition, Blankespoor et al. (2014) stated that investors have limited resources to process information, which leads them to prioritize companies with greater visibility and coverage. Companies with wide news coverage have little incentive to create disclosure channels, while those with low coverage through traditional channels have a greater incentive to establish communication channels with investors.

With respect to incentives, Jung et al. (2018) pointed out that the effects of voluntary disclosure on social media may vary depending on firm-specific factors, such as the level of sophistication of the investor base – institutional or individuals – and the size of the audience on the social network. Drake et al. (2017) highlighted differences in the incentives, audiences, and experience levels of the channels and individuals publishing corporate news.

From a practical point of view, live streaming is a more direct form of communication with investors and, at first glance, can be considered an anecdote compared to all the mandatory information content available. Verrecchia (2001) discussed disclosure through instruments similar to live streaming (cheap-talk games) and concluded that the model is well suited to the notion that, in practice, companies may talk about anything, but in such a way that the information is always disclosed with some element of imprecision and that, at times, the message may be whatever the announcer sees fit and may not reveal the accuracy and truthfulness of the information.

Finally, another important point is the manner in which the live streams are communicated, whether through audio or video. Elliott et al. (2012) emphasized that online video disclosures have a significant impact and influence investors' perceptions and reactions to management's explanations. Bilinski (2022) showed

that YouTube videos are associated with progressively more positive price reactions to earnings news when a significant portion of the firm's shares are held by retail investors and/or when the firm is more active on YouTube.

In summary, social media has shown potential to change investor decision-making, although it is still unclear whether and how companies should interact with their audiences in this environment. In any case, more companies are experimenting with social media in an effort to develop best practices, given the positive effects documented in the literature, especially for companies with low traditional media coverage. In light of these discussions, it is natural to hypothesize that live streaming by publicly traded companies, especially those with low media coverage, may be associated with positive abnormal returns, given the beneficial effects – proactivity, reduced information asymmetry, number of interactions, etc. Thus, it is expected that companies that hold live streaming will generate higher than expected shareholder returns, which supports the following research hypothesis:

> H_1: lives webcasts by Brazilian listed companies generate positive abnormal returns.

It is important to remember that the hypothesis may have limitations due to the sample period in which the data were collected (health crisis and economic uncertainty).

3. DATA AND METHODOLOGY

3.1 Data

The data were collected from the Federal Government's Open Data portal, in the sections CVM Open Data Portal, Open Companies – Documents – Periodical and Occasional. The data were extracted in ".csv" format for the years 2017 to 2021 and contain various information, the most relevant of which are: Reference_Date; Subject; Link_Download. The "Subject" information refers to the summary of the material fact, while "Link_Download" provides a link to access an Adobe Acrobat® text file (pdf) containing detailed data on the material fact. A programming language (Python) with algorithms from the request and pdfplumber libraries was used to develop the web scraping.

The pdf is a non-parameterized report sent by the companies to the regulator and was processed as follows: 1) on the table extracted from the CVM's open data, a word filter was applied to the "Subject" column, using the keywords "live streaming," "event," and "online" to identify the events that were the object of the research; and 2) using the Python language, an individual and line-by-line automated reading of each of the pdf files was carried out using the short topic text modeling (STTM) technique, which made it possible to mine topics from the texts using the keywords "circular letter," "7/2020," "live streaming," "result," "quarter," and "performance," as well as wildcard characters. Finally, the two stages were linked.

When the data were tabulated, it was found that not all the pdf files reported the date of the online event or the subject covered. Similarly, the CVM's open data did not correctly report the date of the event. Therefore, the Python:STTM and Python:Pytube programming languages were used to access the link referenced in the pdf file and collect the following information online: (i) location, which identifies where the video is hosted; (ii) title and description of the video, the information tabulated to describe the subject of the event, and the position of the executive who participated; and, (iii) number of subscribers. After processing, we obtained a sample of 181 companies that held 1,138 online events between 2020 and 2021. From 2017 to 2019, only four online events were registered with the CVM, which were excluded from the study because they were outside the economic, financial, political, and health context of the 2020 to 2021 period.

3.2 Definition of the Object of Study

After processing the data, it became clear that there were events in the sample that did not deal with topics related to results, accounting, finance, performance, or others directly or indirectly related to corporate finance. For example, there is a record of live streaming with the CVM of executive directors participating in educational and/or informative events, such as that of Ms. Carolina Trancucci, Customer Director at Gol Linhas Aéreas, who spoke in live streams about "The new consumer: what companies need to know."

It is inferred that these educational and/or informational events do not have the power to change investor behavior, given the lack of association with measures of future corporate performance and/or that promote the reduction of information asymmetry. Therefore, in order to improve the sample for specific subjects, two treatments were carried out: 1) extraction of the channel description

via web scraping for manual textual analysis; and 2) textual analysis of the subjects of the live streaming, as described in the previous section (keywords). The Python:googleapiclient library was used for the extraction.

The combination of these filters (excluding educational/informational live streams) reduced the sample from 1,138 to 362 events held by 92 listed companies that are members of the Broad Brazil Index (IBrA). The result of the sample treatment is summarized in Figure 1, highlighting that 10 companies participated in more than one online event on the same day, such as Movida S.A., which held two live streaming at different institutions on March 9, 2021 and July 29, 2021. In these cases, only one event was considered, since the price variation is obtained from the daily variation and not from intraday variations. In addition, as described in the next section, the event window is defined for a short period [-1,+1] to reduce the occurrence of other underlying events.

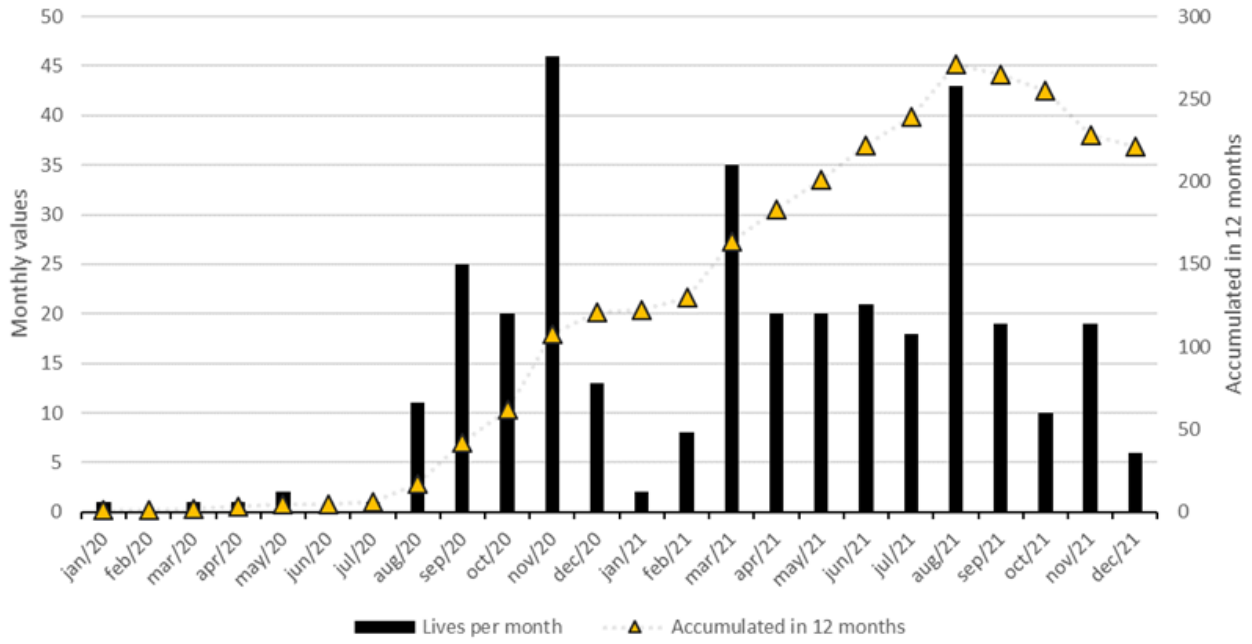

Figure 1 *Live streaming by date of occurrence*

Note: *The primary axis (left side) indicates the monthly number of live streaming, while the secondary axis (right side) shows the accumulated annual values.*

Source: *Open data from the Brazilian Securities and Exchange Commission (CVM) (http://dados.cvm.gov.br/).*

The data show a significant increase starting in August 2020, which coincides with the publication of CVM/SEP Circular Letter no. 7/2020 (CVM, 2020), which required companies to issue a Notice to the Market announcing the date, time, and address of the live streaming, indicating that the regulatory instrument was fundamental in highlighting specific information that had not been widely disclosed. This regulatory effect highlights an important debate about disclosure theory, specifically the role of accounting regulation in promoting full and fair disclosure of information by reporting entities (Lee et al., 2014).

Taking into account the filter, the data also show that the occurrence of live streaming tends to increase in periods of earnings announcements, but it is not necessarily possible to say that the manager participates in the live streaming because of the financial announcement or that this affects the share price, given the low linear correlation (0.2310) between the number of announcements and the sample events per month.

3.3 Event Study

Campbell et al. (1996) defined an event study as a method capable of measuring the effect of an event on the value of a given firm. It requires a number of steps to be carried out, including: defining the event, specifying the event windows, sample selection criteria, and measuring normal and abnormal returns.

For the event window, a period of 1 day (the day of the event) was defined, given the informal nature of the conversation, in which neither anticipation nor aftereffects are expected (except for after-market live streaming). Furthermore, the average interval between the communication with the regulator and the live event was 1.08 days, which reinforces the view that there is no anticipation of its effects. In addition, the choice of a very short window is justified in order to isolate the live streaming from other underlying events that could affect the study. In order to ensure methodological

rigor, the detailed analysis was carried out on earnings announcement dates in a period from 3 days before to 2 days after the live stream. Only two live streaming took place on the same day as the earnings announcement, both after the market closed. For exploratory purposes, an extended window of 5 days before and after the event was also used to compare the effects with the informality and perenniality of information hypotheses. The estimation window used to determine abnormal returns was 60 days, following Blankespoor et al. (2014), and it is important to clarify the temporal relationship between the estimation window and the event window. The estimation window ends just before the start of the event window (D-1) to avoid any overlap between them, which could bias the results.

According to Campbell et al. (1996), to measure the impact of the event, the expected return was subtracted from the observed return (equation 1). The continuous capitalization method was used to calculate the effective return on assets (equation 2). To measure the expected return, $E(R_{it} | X_t)$, it was calculated according to the market model, where $R_{m,t}$ is the market return given by the Ibovespa (equation 3). Finally, the cumulative abnormal return (CAR) was used as a criterion for aggregating abnormal returns in the event window (equation 4),

$$AR_{it} = R_{it} - E(R_{it} | X_t) \quad (1)$$

$$R_{it} = ln\left(\frac{p_{i,t}}{p_{i,t-1}}\right) = lnp_{i,t} - lnp_{i,t-1} \quad (2)$$

$$E(R_{it} | X_t) = \hat{\alpha}_i + \hat{\beta}_i R_{m,t} + \epsilon_{it} \quad (3)$$

$$CAR_i(t_1, t_2) = \sum_{i-1}^{n} AR_{i,t} \quad (4)$$

where AR_{it} is the abnormal return of asset i on date t, R_{it} is the effective return of asset i on date t, $E(R_{it} | X_t)$ is the expected return of asset i on date t, considering the Ibovespa market portfolio, $ln\ p_{i,t}$ is the logarithm of the price of stock i at t, $ln\ p_{i,t-1}$ is the price of stock i at t-1, $\hat{\alpha}_i$, $\hat{\beta}_i$, and ϵ_{it} are the parameters and the error term of the regression (equation 3) for the estimation windows, and $CAR_I(t_1, t_2)$ is the cumulative abnormal return of asset i between the first (t_1) and last day (t_2) of the event window.

Three approaches were used to statistically test the significance of the results under the null hypothesis that the cumulative abnormal return (CAR) is equal to 0. The first sought to test whether there is a significant difference between the pre- and post-event return in pairs of averages, using Student's parametric t-test. The second used the Wilcoxon sum test, following the guidance of Higgins and Peterson (1998) that, in the case of two independent samples, the Wilcoxon statistic using standardized abnormal returns is the superior test statistic. This second approach followed the advice of Brown and Warner (1985), Corrado (1989, 2011), Cowan (1992), Kolari and Pynnonen (2011), and MacKinlay (1997) that, in the case of event studies using daily returns, the distribution tends to follow a non-normal pattern, which is why nonparametric tests of the rank and sign type tend to be better specified under the null hypothesis and more powerful under the alternative hypothesis than the parametric t-test. For the tests performed, the two samples are considered independent, essentially because the changes in the stock prices on the day before the event are not anticipated, so that the effects of the event are limited to the day it takes place, as already mentioned.

The third statistical approach used the modified t-test (θ) suggested by MacKinlay (1997), considering aggregate abnormal returns. In this test, there can be no overlap in the event windows, so it was necessary to exclude all consecutive live streaming for the same stock, considering an interval of up to 3 days between events. It should be noted that this exclusion may offer a less realistic perspective of the current scenario, since, as has been shown, companies often hold online events in a short period of time, especially during important announcements or moments of market interest; therefore, ignoring them could result in an analysis that is less representative of reality. Nevertheless, this test is presented separately from the others and serves as an additional element of analysis and robustness of the findings.

Finally, for additional analysis purposes, the events for asset i were tested individually, following Brown and Warner (1985) and Campbell et al. (1996), under the null hypothesis that the abnormal return is equal to 0 (*H0:* $E(AR_{,t}) = 0$):

$$t\ test = \frac{AR_{i,t}}{\hat{\sigma}_{(t1,t2)}} \quad (5)$$

where $\hat{\sigma}_{(t1,t2)}$ is the standard deviation of the standard error of regression (1) for asset i in the estimation window.

3.4 Description of the Econometric Model

The final stage of the empirical tests is based on the expectation that the events will have an impact on prices, promoting a statistically significant difference with respect to the market model, not that all events will be significant. Therefore, given the exploratory nature of the work, the aim is to understand which variables related to the event studied are decisive for the statistical relevance found, i.e. which explain the statistically significant abnormal return. For this purpose, model 6 was formulated:

$$SRst_i = \beta_0 + \beta_1 Subsc_i + \beta_2 \bar{R}m_i + \beta_3 CEO_i + \beta_4 Earn_i + \beta_5 Ibov_i + \varepsilon_i \quad (6)$$

where $SRst_i$ is a binary variable indicating whether a statistically relevant abnormal return was found for event *i* at a level of at least 10%, $Subsc_i$ is the number of subscribers to the broadcast channel of event *i*, measured by the logarithm of the number of subscribers, $\bar{R}m$ is the average market return in the 3-day period preceding event *i*, CEO_i is a dummy variable that takes a value of 1 if the speaker at event *i* is the CEO, $Earn_i$ is a dummy variable that takes a value of 1 when event *i* is related to the announcement of earnings, and *Ibov* is a dummy variable that takes a value of 1 if the stock related to event *i* is part of the theoretical Ibovespa portfolio.

With respect to the *Subsc* variable, a positive relationship is expected with the statistical relevance of the event, under the assumption that this can be an indicator of audience. From the perspective of Drake et al. (2017), there must be an audience for information to have an impact on the price, and the larger the intermediary's audience, the more likely it is that the event will have an impact on the stock price, which can also be seen as an incentive for management to disseminate certain information. Furthermore, considering that the number of subscribers on YouTube is an important indicator of a channel's ability to attract engaged and recurring audiences (Hou, 2019), as well as being an objective component of organic content distribution through its dissemination algorithm (Hou, 2019), it is expected that the larger the number of subscribers to the intermediary's channel, the greater the likelihood that the event will be disseminated to a wide audience of specialized content consumers, increasing the likelihood that the event will have an impact on the market.

The variable $\bar{R}m$ is used with the expectation of a positive relationship with the dependent variable, given that the behavior of the market in movements of euphoria or despair during the event window may influence the behavior of investors in a particular stock. This expectation is based on studies that have shown that different market conditions (bullish/bearish) can induce different investor reactions to identical events (Docking & Koch, 2005), and that the timing of information disclosure can be an important tool for clarifying uncertainties created by market sentiment (Bird et al., 2014).

In terms of speakers, the participation of the CEO in the live streaming is expected to generate higher abnormal returns compared to the participation of any other member of the management team, giving more veracity and reliability to the information generated and thus providing more credibility to investors (Jiraporn et al., 2014; Jung et al., 2018; Maslar et al., 2021), resulting in a positive relationship with the dependent variable.

We filtered only those live streaming that dealt with financial information, performance, future prospects, etc. Live streams that deal specifically with quarterly and annual financial results are expected to have a greater impact on abnormal returns than others, given that they may reduce the cost of incorporating information (Blankespoor et al., 2019). To identify whether the video was about earnings or not, a textual filter was applied to the "video title" and "Subject" fields with the word "earnings." If there was no text, the filter was applied to the document sent to the CVM. This information is controlled for with the *Earn* variable, and a positive relationship with the dependent variable is expected.

For the dichotomous variable *Ibov*, the objective is to identify the effect of the index on the companies, that is, to test whether companies listed on the Ibovespa, due to their greater visibility and analyst coverage (Nardy et al., 2015), have an impact on the level of statistical significance of the abnormal return in the event window. A negative relationship is expected between these variables, indicating that the company being listed on the Ibovespa is less likely to have an impact on the price resulting from a live streaming due to greater media and analyst coverage, as shown by Bartov et al. (2018), Blankespoor et al. (2014), and Cade (2008).

4. ANALYSIS AND DISCUSSION OF THE RESULTS

4.1 Market Reaction to Live Streaming

The research hypothesis focuses on the possibility that live streaming can generate relevant information that changes investors' valuation models and generates abnormal returns. The empirical tests were based on the abnormal returns observed for the event window, taking into account the days before and after the event [-1,+1] to assess whether the abnormal return from the event changes significantly compared to the previous day. In addition, a 5-day window [-5,+5] was tested to visualize the effects of the event over a longer period of time, also comparing equivalent time dimensions in the pre- and post-event periods. The results are summarized in Table 1.

Table 1
Descriptive statistics and CAR comparison test for the pre- and post-event periods

Panel A – Statistical tests for the entire sample				
	Window [-1,+1]		**Window [-5,+5]**	
	Pre	**Post**	**Pre**	**Post**
Mean	-0.06%	0.14%	0.09%	0.18%
Median	-0.07%	0.01%	-0.06%	0.42%
Standard deviation	2.74%	3.56%	5.98%	7.02%
Minimum	-10.64%	-12.25%	-24.85%	-28.87%
Maximum	11.37%	31.99%	19.31%	27.67%
Sum	-21.22%	51.71%	31.04%	64.40%
(t) statistic	0.8535		0.1907	
p-value (t)	0.3939		0.8488	
Wilcoxon test (z)	25.396		0.4020	
p-value (z)	0.0055***		0.3435	
Nr. observations	362	362	362	362
Panel B – Statistical tests for the reduced sample (excluding overlapping events)				
	Window [-1,+1]		**Window [-5,+5]**	
	Pre	**Post**	**Pre**	**Post**
Mean	0.15%	0.30%	0.19%	0.61%
Median	0.06%	0.03%	0.10%	0.45%
Standard deviation	2.61%	3.47%	5.83%	6.69%
Minimum	-9.65%	-12.25%	-24.85%	-22.29%
Maximum	11.37%	31.99%	19.31%	27.67%
Sum	48.84%	95.76%	60.01%	195.97%
(θ) statistic	20.446		16.204	
p-value (t)	0.0417**		0.1061	
No. observations	319	319	319	319

Note: *Under the assumption of normality, the (t) statistic refers to the Student's t-test for two pairs of means. The (θ) statistic follows the modified t-test according to Mackinley (1997). The Wilcoxon test (z) is the non-parametric test. Cumulative abnormal return (CAR) significance level at 1% (***), 5% (**), and 10% (*).*
Source: *Prepared by the authors.*

For the shorter window [-1,+1], the statistics show that the CARs are generally higher after the event. The trend measures show that the abnormal returns, ignoring the behavioral pattern relative to the market, were negative on the day before the event and became positive on the day of the event. The Student's *t*-test showed that the pre- and post-event samples were not statistically different, while the non-parametric Wilcoxon test revealed significance at the 1% level. In line with Brown and Warner (1985), Corrado (1989, 2011), Cowan (1992), Higgins and Peterson (1998), Kolari and Pynnonen (2011), and MacKinlay (1997), we conclude that the non-parametric Wilcoxon test should be used because in studies of events with daily returns, the distribution tends to be non-normal, compromising the use of parametric tests. Mackinlay's modified *t*-test (1997) is presented in Panel B and indicates statistical significance at the 5% level for the reduced sample (excluding overlapping events), thus confirming the results of the Wilcoxon test, despite the limitations highlighted in Section 3.3. It thus serves as an additional element of analysis and robustness of the findings.

In the extended window [-5,+5], the results show no significant difference in either the parametric or the non-parametric test. Combining the results of the two windows indicates that there are positive effects of live streaming on abnormal returns, but that these are limited to the very short term. These findings are compatible with the perspective presented by Verrecchia (2001) that live streaming adapt to the model of cheap-talk games, i.e. the information provided is disclosed with an element of imprecision and it depends on the action of the audience (recipient) to find it convenient or not, addressing a momentary doubt and reducing the costs

of incorporating certain accounting information. In a longer term scenario, information disclosed live loses its resolving and informative power and is received or interpreted in a more fragile way.

On the other hand, the different results across windows can be interpreted in another way, according to the psychological perspective described by Antweiler and Frank (2006). These authors report that, contrary to the conventional view of efficient markets, when new information is available, there is a now-or-never effect on the part of the investor, followed by a gradual reversal, where the reversal generally exceeds the magnitude of the initial increase. In this study, the post-event median of the extended window is negative, the average return is lower, and there was no statistical difference before and after the event. Finally, Antweiler and Frank (2006) described that this behavior is a typical pattern in the main American stock exchanges between 1973 and 2001, where the process is completed after 2 or 3 weeks. In the case of this research, the return seems to have occurred within 5 days of the event.

Thus, taking into account the nonparametric tests and the very short-term window, the results confirm hypothesis H_1 that, in the Brazilian market, live streaming have a positive impact on the return of companies' stocks, but they tend to return to the pre-event averages, in line with the findings of Antweiler and Frank (2006). From the limited persepctive of social networks, the results are in line with the findings of Yu et al. (2013), who showed short-term impacts on the stock performance (return and risk) of companies in the American market, and Zhang et al. (2016), who identified significant positive abnormal returns and excessive trading volume on the date of the event in the Chinese market, with a return to the previous averages over a period of 50 working days. Considering the effects of YouTube videos on the Brazilian market, Mendes and Lucena (2020) found statistical relevance and positive impacts in the short-term window [-4,+4], but no relevance for the 1-day window [-1,+1]. Finally, the results of this study differ from those of Blankespoor et al. (2014), who found no statistical relevance in the windows established for abnormal returns in the U.S. market.

4.2 Additional Analysis: Market Reaction to Individual Live Streaming

Once the research hypothesis was confirmed, an additional test was carried out to evaluate each event individually, considering only the estimation window for stock *i*. Based on the results of the statistical test proposed by Brown and Warner (1985) and Campbell et al. (1996) for the [-1,+1] window, the distribution of events by significance level is summarized in Table 2.

Table 2
Distribution of events by significance level of abnormal returns

Significance level (%)	No. events	% Part.	Sign of abnormal returns	
			Positive	Negative
1.00	13	3.6	7	6
5.00	13	3.6	6	7
10.00	22	6.1	12	10
Non-significant	314	86.7		
Total	362	100.0	25	23

Source: *Prepared by the authors.*

The results show that although the hypothesis that the events produce positive abnormal returns is confirmed for the sample as a whole, when the data for each event are examined in isolation, differences between the abnormal returns are found in 13.3% of the events and there is no preponderance of the signs found.

To try to identify any characteristics that might help explain the statistical relevance of the event's abnormal return, we first compared the descriptive statistics of the characteristics of the two blocks of data – events with and without statistical significance at the level of at least 10% – as shown in Table 3.

Table 3
Descriptive statistics of events with and without statistical significance

	Events with statistical significance			Events with no statistical significance		
Panel A – Continuous variables						
	Subsc	*Rm*	*AR*	*Subsc*	*Rm*	*AR*
Mean	10.7897	0.26%	1.38%	9.3847	0.07%	-0.05%
Median	10.9894	0.21%	2.94%	11.3145	0.04%	-0.01%
Standard deviation	2.8260	1.08%	7.99%	4.3147	0.68%	2.17%
Maximum	14.1520	4.09%	31.99%	13.5670	1.67%	6.22%
Minimum	0.0000	-2.19%	-12.25%	0.0000	-2.19%	-9.04%
Count	48	48	48	314	314	314
Panel B – Categorical variables						
	Earn	*Ibov*	*CEO*	*Earn*	*Ibov*	*CEO*
Value 0	23	38	28	213	207	241
Value 1	25	10	20	101	107	73
% Value 1	52.08	20.83	41.67	32.17	34.08	23.25

Note: *Subsc is the number of subscribers to the broadcast channel of the event, $R\bar{m}$ is the average market return in the 3 days preceding the event, AR is the abnormal return from the event, CEO indicates if the speaker at the event is the CEO, Earn indicates if the event is related to an earnings announcement, Ibov indicates if the stock related to the event is part of the theoretical Ibovespa portfolio, and Online indicates if a video is available or not.*
Source: *Prepared by the authors.*

Panel A of Table 3 shows that the average abnormal returns and the median of the events with statistical relevance are positive, while the opposite effect is observed for the events without statistical relevance, showing once again that the impact of the live streaming was predominantly positive on the stock's performance in the short term. The average return and the market median (*Rm*) are positive in both scenarios, but in the case of the scenarios without statistical relevance, the values have different signs to the *AR* variable. The difference between the *Subsc* variable for events with statistical relevance and those without is significant, indicating that the variable may play an important role. The events with relevance occurred on channels with an average of 194,844 subscribers and those without relevance with an average of 141,167 subscribers.

One point that aroused curiosity was the highest recorded abnormal return of 31.99%. It was observed that the cause was not essentially the live streaming, but the combination of the release of quarterly results (the day before) with an online event held on the InfoMoney YouTube channel, which has more than 449,000 subscribers, on May 7, 2020.

The candlestick chart in Figure 2 represents the total intraday transactions on the day of the event, and each candlestick represents a 30-minute trading interval. It can be seen that there was a sharp rise in the price at the start of the trading session, followed by a sideways movement until 2pm. After that time, there was a jump of almost 20% in the value of the stock, from R$ 3.30 to R$ 3.96. Thus, although it is not possible to draw conclusions about causality, there are strong indications that the event held on the social network may have influenced the explanation of the results, reducing the costs of obtaining detailed information and facilitating the process of incorporation of the information by the audience, which shows consistency with the findings of the literature (Blankespoor et al., 2014; Cade, 2018; Chen et al., 2014; Drake et al., 2017; Miller & Skinner, 2015).

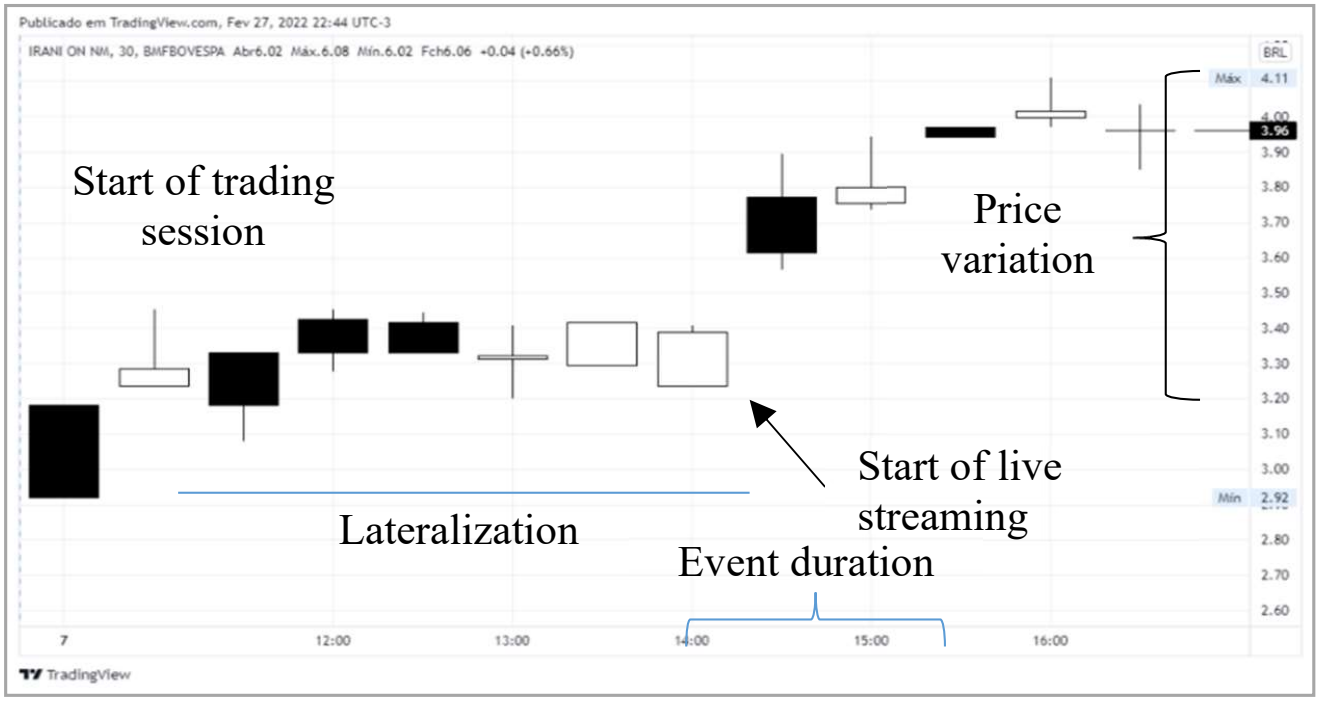

Figure 2 *30 minute intraday candlestick chart for May 7, 2020 for Celulose Irani S.A. (RANI3).*

Note: *The chart groups the price volume into rectangles. Filled rectangles represent falling prices and empty rectangles represent rising prices. The intraday chart was taken from the website of the B3 S.A. – Brasil, Bolsa, Balcão (B3) (https://www.b3.com.br/pt_br/market-data-e-indices/servicos-de-dados/market-data/cotacoes/).*

Source: *Tradeview.*

Panel B of Table 3 shows the categorical data for the variables *Earn*, *Ibov*, and *CEO*. In the first group, with statistical significance, the information shows that 52% of the events are related to earnings releases, that the majority of the live streaming were held by companies outside the Ibovespa (80%), and that 41% had the participation of the CEO. Compared to the second group, the relative participation of events with statistical significance has proportionally fewer events held by companies that are part of the Ibovespa and more events related to earnings releases and with the participation of the CEO.

These data indicate that the content of the live stream (*Earn*), low analyst coverage (*Ibov*), and CEO participation are relevant items and contribute to the event's stastistical relevance and, therefore, to the generation of abnormal returns. The evidence regarding low coverage and CEO participation is consistent with the findings of Jung et al. (2018) and Maslar et al. (2021), while in terms of the content of the live event, it was already expected that the subject related to quarterly or annual results would be relevant in affecting the price, as these are items that have been historically discussed in the positive accounting theory literature (Ball & Brown, 1968; Brown & Warner, 1985). Therefore, events concerning various subjects were not expected to affect the price, although due to the nature of cheap talk, it may happen that the speaker makes a sensitive speech that has the ability to change investor behavior.

4.3 Determinants of the Relevance of Lives Webcasts

The results of the estimation tests for model 6 are presented in Table 4 and identify the determinants of the statistical relevance of abnormal returns for individual events using the *SRst* variable.

Table 4
Results of the estimation to identify the determinants of live stream relevance

Model tested:
$$SRst_i = \beta_0 + \beta_1 Subsc_i + \beta_2 \bar{R}m_i + \beta_3 CEO_i + \beta_4 Earn_i + \beta_5 Ibov_i + \varepsilon_i$$

Regressors	Coef.	Standard error	*t*-ratio	*p-value*	Signif.
Subsc	0.0097	0.0026	3.7130	0.0002	***
Rm	3.6550	2.3351	1.5650	0.1184	
CEO	0.1073	0.0400	2.6850	0.0076	***
Earn	0.0770	0.0385	2.0010	0.0461	**
Ibov	-0.0811	0.0364	-2.2250	0.0267	**
Mean of the dependent variable		0.1326	St. deviation of the dependent variable		0.3396
Sum of squares of residuals		39.0798	Standard error of regression		0.3309
Non-centered R-squared		0.1858	Centered R-squared		0.0614
F(4, 304)		16.2975	*p-value* (F)		0.0000
Log-likelihood		–110.7427	Akaike criterion		213.4855
Schwarz criterion		250.9437	Hannan-Quinn criterion		239.2208

Note: *SRst indicates whether an abnormal return with statistical significance was found for event i at a level of at least 10%, Subsc is the number of subscribers to the broadcast channel of the event, $\bar{R}m$ is the average market return in the 3 days preceding the event, CEO indicates whether the speaker at the event is the CEO, Earn indicates whether the event is related to the release of earnings, Ibov indicates whether the stock related to the event is part of the theoretical Ibovespa portfolio. White's test for heteroskedasticity (0.01527), normality of the residuals (> 0.01), and RESET test (0.032) were carried out and no statistical problems were detected. Significance level at 1% (***), 5% (**), and 10% (*).*
Source: *Prepared by the authors.*

The results presented follow the interpretations of the previous section and show that, based on the variability of the variables *Subsc*, *Rm*, *CEO*, *Earn*, and *Ibov*, it was possible to explain 18.58% of the variation in the relevance of the events (R-squared) with significance at the 1% level. In addition, the explanatory variables, with the exception of *Rm*, showed the expected signs, with statistical significance at a level of at least 5%.

The *Subsc* variable showed a positive relationship with the statistical significance of the events, indicating that the number of subscribers to a channel (potential audience) is a likely determinant for a live streaming to affect the stock price at a statistically relevant level. Thus, the greater the number of subscribers to a channel, the greater the chance that the manager's speech will reach investors and have the power to significantly change the price. These findings contribute to the thesis of Jung et al. (2018) that the role of the audience is essential for the dissemination of voluntary information on social media. In this sense, managers should participate more strategically in live streams on channels with large audiences in order to highlight more relevant information for investors.

The short-term market trend regressor (*Rm*) was not significant. The findings therefore do not confirm the expectation that an event announced during a short-term bullish (bearish) trend can have a potentiating effect, so that the event has a profound impact on the price, as found by Docking and Koch (2005) and Bird et al. (2014). The interpretation given to this potentiating phenomenon is described in the literature as mental conflict resolution, i.e., during a trend period, investors experience a state of uncertainty in which they have difficulty interpreting the implications of the earnings announcement for the value of the firm, and when new clarifying information is available, the conflict is resolved by prolonging or not prolonging the trend (drift).

Next, the CEO variable was found to have a positive relationship with the dependent variable, demonstrating that the CEO's participation in the online event is an important determinant for the event to have a statistically significant impact on the price. A possible interpretation of this phenomenon is that the CEO transmits signals to investors about some financial information, which reduces the information cost and helps decision making in a resolutive way. Bilinski (2022) also showed that mentioning the CEO or Chief Financial Officer (CFO) in a tweet seems to improve investors' perceptions of earnings news, thereby increasing the credibility of the information shared. These findings corroborate Jiraporn et al.'s (2014) evidence that information provided directly to the public by a CEO is important and has relevant effects on important firm outcomes, even replacing information provided by analysts. Morevoer, the results are consistent with Maslar et al.'s (2021) thesis that in

times of crisis, such as COVID-19, the role of managers in disclosing information tends to give investors additional confidence due to their information advantage over outsiders.

Regarding the *Earn* variable, a positive relationship was found with the relevance of abnormal returns. The evidence confirms the extensive literature on the impact of earnings on stock prices (Ball & Brown, 1968; Brown & Warner, 1985), i.e. the results of the estimation show that when the declared subject of the live streaming is the communication of earnings, this is a determining factor for the event to have a statistical impact on stock prices.

Finally, the *Ibov* regressor provides an important finding for the literature, showing that online events with the participation of companies not belonging to the main reference portfolio of the Brazilian capital market, the Ibovespa, are more likely to provide statistically relevant abnormal returns than events with the participation of companies belonging to the index. Under the idea of efficient markets, the disclosure literature assumes that information, once disclosed, will be readily available to all investors, but this premise is not necessarily true and prevalent in all markets, especially in Brazil, according to the evidence pointed out by Amorim and Camargos (2021) and Camargos and Barbosa (2010), and until recently, companies with low media and analyst coverage were unable to reach investors without going through intermediaries. Thus, the evidence suggests that live streaming can be a particularly interesting platform for companies with low coverage to disclose earnings, which reinforces the findings of the literature on social networks and their effects on shareholder coverage (Alexander & Gentry, 2014; Blankespoor et al., 2014; Bushee et al., 2010; Miller & Skinner, 2015).

Finally, additional tests were carried out to examine the behavior of live streaming under different circumstances: 1) segmenting companies that reported favorable and unfavorable results; 2) fixed effects by quarter to measure the impact of investor expectations; and 3) using other control variables such as free float, shares outstanding, capitalization, and total assets. These tests do not change the results.

5. CONCLUSIONS

The objective of the research was to determine whether the occurrence of live streaming can cause changes in stock returns in the Brazilian market. Using data from the live streaming held between 2020 and 2021, the empirical tests showed that their content has a positive impact on stock prices, confirming the research hypothesis, but that these effects are short-term, tending to return to the pre-event averages within 5 days. However, it is important to note that the hypothesis was confirmed by the Wilcoxon rank sum test for the full sample and by the modified Mackinlay (1997) *t*-test when the sample was reduced to non-consecutive live streams only. The *t*-test statistics did not confirm this hypothesis, suggesting that the results should be interpreted with caution and that more research is needed to assess the relationship between live streaming and stock prices. In addition, it is important to note that the analysis was based on data from live streaming between 2020 and 2021, which may limit the generalizability of the results to other time periods or contexts.

In addition, when testing the determinants of the individual events that resulted in an impact on prices, promoting a statistically significant difference with respect to the market model, it was found that the number of subscribers to the channel, the presence of the CEO at the event, the subject of the lives webcast being performance, and whether the stock is not part of the Ibovespa portfolio are relevant variables in explaining the statistical relevance of abnormal returns.

The findings of the research are relevant and contribute to the development of the literature on disclosure on social media, especially in the Brazilian market, where there is still little academic production on the topic. Regarding the limitations of the study, it can be highlighted that the data were collected in a health crisis scenario, with high price fluctuations, and may not reflect future behavior. In addition, the inference that the *Ibov* variable can reflect the level of corporate coverage may be fragile, and likewise, the data on the number of subscribers may not actually reflect the number of individual investors or market participants. Furthermore, the profile of Brazilian investors and the characteristics of the Brazilian capital market prevent generalization beyond the scope of the sample, as these factors were not controlled for in this study. Finally, the content of the video may differ from its title and the subject reported by the person who posted it, which may lead to inaccurate categorization of a given event.

This last limitation warrants highlighting: it is understood that it is not the live streaming themselves that generate the abnormal returns, but rather the content of the information released during the event, i.e., in the

context of signaling theory, what effect does the content of the live streaming have on the investor? Is there a surprise effect, an error in the analysts' forecasts, or a specific explanation that leads investors to remove their doubts and reinforce their decisions? Or is it possible that the companies used this tool to mitigate the negative results of the period? The proposed event study does not manage to capture these nuances of the content, and therefore it is suggested that future research could work with analytical ways to synthesize the textual content and relate it to the impacts obtained by the econometrics, such as tone analysis, content analysis or, more contemporary, natural language processing through sentiment analysis.

Another limitation of the study is the events underlying the online event. Although the research shortened the window of events and analyzed each of the occurrences individually, it cannot be determined that the event is the determining cause of the observed abnormal return, but there are strong indications that the live streaming had relevant effects on the daily abnormal return, especially in the shorter sample of the additional section.

Notwithstanding these limitations, the evidence identified is relevant to the development of the voluntary disclosure literature, particularly to further investigate the effects on firms with low shareholder coverage, given the positive effects on price found in this paper.

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