ACCOUNTING INFORMATIVENESS DURING TIMES OF HEIGHTENED GLOBAL UNCERTAINTY: EVIDENCE FROM THE COVID-19 PANDEMIC.

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ABSTRACT

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Research Question/Issue: This study investigates empirically the extent to which stock prices have incorporated unexpected earnings, namely accounting informativeness, during the Covid-19 timeframe within the early months of 2020. Prior research provides evidence that the relationship between abnormal returns and unexpected earnings is positive and significant and that it significantly increases during periods of heightened fundamental uncertainty. The present study empirically investigates whether this holds true with pandemic-induced market conditions.

Research Findings/Insights: The empirical findings suggest that stock prices incorporate unexpected earnings to a lower extent amid the Covid-19 pandemic. Cross-sectional variation can also be seen in the results documenting some firm-level attributes (geographical dispersion of operations and the degree of institutional ownership) that significantly affect the relationship under study. Furthermore, the findings show that the main effect is indeed driven by Covid-19 exposure and that it loses strength as it moves away from the early months of 2020.

Theoretical/Academic Implications: The present study's results confirm the shared academic belief that the financial impact of the Covid-19 pandemic is unlike anything experienced in the past. Accounting and finance scholars should be aware that the pandemic has resulted in changes in the business world that have been too disruptive to be properly considered in accounting, inhibiting the ability to draw inferences about the underlying fundamentals of firms. The same holds for attributes at the cross-sectional firm level, which have been investigated in this study, negatively affecting accounting informativeness in pandemic-related market circumstances.

Practitioner/Policy Implications: Recent accounting literature has started to investigate the role of accounting information in supporting public policy in the aftermath of a systemic crisis. We argue that a fully understanding of the potential role of accounting information in the aftermath of a crisis such as the Covid-19 pandemic cannot be obtained without first understanding how and whether accounting informativeness modifies during crises such as the Covid-19 pandemic that have a disruptive nature on firms' value drivers.

1. INTRODUCTION

Accounting literature has been discussing about the relevance of the earnings number and financial reports for a long time. After the seminal work of Ball and Brown (1968) showing a significant relation between earnings and stock price, literature has documented that most earnings announcements do not convey new information to the market (Bamber at al., 2000) concluding that the value relevance of accounting information has decreased over time (Lev and Zarowin, 1999). The key explanation put forward by researchers lays on the incapacity of accounting to conform to several changes occurred over years in the business environment, thus producing a disconnection between the economic value generated by companies and the accounting value measured by earnings. For instance, the fact that many firms build their competitive advantage on intangible assets and accounting proves difficulty to properly measure and report such assets has been advocated as one of the main reasons why we observed a decrease in accounting informativeness (Lev, 1997; Amir and Lev,1996). In this regard, more recently, Barth et al. (2022) reveal a more nuanced - but not declining - relation between share price and accounting information in the new economy, therefore re-opening this longstanding debate. Nonetheless, literature agrees that there are settings where earnings are particularly useful and prior research focused on investigating the circumstances under which earnings announcements play a key role in informing investors.

Specifically, literature argues that when uncertainty about the firm's fundamental value increases, earnings information becomes more important to investors, thus increasing their reaction to earnings announcements. In this line, Anthony and Petroni (1997) adapt the seminal work of Holthausen and Verrecchia (1988) to develop a theoretical model that specifically focuses on uncertainty concerning the level of the firm's future cash flows (i.e. fundamental uncertainty) and they isolate this effect from uncertainty due to noise in the earnings signal. Anthony and Petroni (1997) suggest that the association between changes in earnings and price is increasing in firm's fundamental uncertainty because the greater the uncertainty about future cash flows the more investors are motivated to weight more heavily any observed realization of earnings. Thus, under conditions of heighten uncertainty, investors are expected to use earnings numbers as an "anchor" in their valuation process.

Several studies have empirically documented this prediction. Collins and DeAngelo (1990) find that the earnings response coefficients (ERCs) are higher during proxy contests, suggesting a positive relation between fundamental uncertainty induced by proxy contests and accounting informativeness. Barron and Stuerke (1998) use dispersion in analysts' EPS forecasts as a proxy of fundamental uncertainty about firms' expected future economic performance and document a positive association between ex ante dispersion and the magnitude of price reaction to subsequent earnings release. Christensen (2002) investigates exposure to catastrophe-induced uncertainty (hurricanes, fires, flooding, etc.) and show that the magnitude of the uncertainty is positively associated with the magnitude of the ERCs. Finally, Bepari (2013) show that the value relevance of earnings has increased during the Global Financial Crisis (GFC).

These empirical findings are consistent with predictions in Holthausen and Verrecchia (1988) and Anthony and Petroni (1997) and build on the underlying intuition that when investors face more uncertainty, they anchor more closely their valuation to the observable signals such as earnings realizations. An implicit assumption underlying these results is that investors expect that after the period of uncertainty the future value of the company (and thus its ability to produce cash flows) will be back to its fundamental pre-uncertainty value. In other words, it is rational for investors to weight more heavily earnings during periods of uncertainty if and only if they expect that the post-uncertainty value drivers will be in continuity with the value drivers of the pre-uncertainty period.

Indeed, current earnings realizations, being a backward oriented measure of wealth generated, are not able to predict breakthrough changes in the firms' value drivers.

We build on this debate and claim that the Covid-19 pandemic might have changed investors' perception about the utility of anchoring their valuation more closely to earnings realizations during the crisis period. From this perspective, it is a shared belief among academics and practitioners that the impact of Covid-19 is different from that of past financial crises, such as the 2008 Global Financial Crisis (GFC), which originated in the business environment due to unmanaged risks and executive's greed (see also Ding et al., 2021; Zattoni and Pugliese, 2021). In contrast, the Covid-19 crisis began as a public health concern and severely hit firms' economic activities because of the social-restricting countermeasures taken by governments to limit the spread of the disease, altering many firms' value drivers. Importantly, in comparison to previous crises, the Covid-19 pandemic has caused a simultaneous demand and supply shock (del Rio-Chanona et al., 2020) and for many firms it has challenged their existing business models (Ritter and Pedersen, 2020; Breier et al., 2021) making many of them infeasible (Clauss et al. 2022). Thus, while heightened uncertainty caused by natural disasters or financial crises have not directly questioned the firms' value drivers and business models, Covid-19 did. Consequently, in this paper we investigate whether the documented positive association between heighted uncertainty and earning informativeness shown in prior literature can be generalized to a crisis such as the Covid-19 pandemic. Anecdotal evidence suggests that this might not be the case. 851 companies announced their withdrawal of guidance between March 16 and May 31, 2020[1], despite the SEC's call for more disclosure of performance information and future outlooks on April 8, 2020[2]. Top managers of US firms expressed serious concerns about the fundamental uncertainty caused by the

[1] See https://www.irmagazine.com/reporting/how-covid-19-affecting-earnings-guidance-and-dividend-payments

[2] See https://www.sec.gov/news/public-statement/statement-clayton-hinman

Covid-19 pandemic. In the New York Times, Michael Farr, the Chief Executive and President of the investment management firm Farr, Miller & Washington, said, "The lack of guidance is responsible," and it is "very dangerous thinking you know something that you don't." Similarly, Scott Settersten, the CFO of Ulta Beauty Inc., said in an earning call dated March 12, 2020, "The situation is dynamic, and it's very difficult to predict or quantify the impact of any potential disruption to our supply chain, changes in consumer demand or any other actions that may become necessary as events unfold" (Maurer, 2020). In conclusion, during the unfolding of the Covid-19 pandemic it was very difficult to predict how firms would have been affected by the crisis and what would have been the firm's exposure to the emerging risks. In this context, the mapping of earnings in stock price is definitively a more difficult and uncertain task.

To address our research question, we use a comprehensive sample of listed nonfinancial firms in the US for the periods February–May 2019 and February–May 2020 and analyze to which extent accounting informativeness has changed during the Covid-19 crisis compared to the pre-crisis period. In doing so, we build on Imhoff and Lobo (1992) and isolate fundamental uncertainty from uncertainty due to noise in the signal. We document that during Covid-19 crisis, the magnitude of price reaction to subsequent earnings release has significantly decreased, suggesting that investors have perceived accounting numbers less informative during the Covid-19 period compared to the pre-pandemic period. This result contrasts with existing literature that would have suggested an increase in the ERC during the Covid-19 crisis since it was a period characterized by high uncertainty. Our results show that not all type of uncertainty about firm's future cash flow translate into higher accounting informativeness: when investors perceive that firms' value drivers might change because of the crisis, they decrease the weight put on earnings.

Notably, we reveal cross-sectional variations in our results. First, we examine firms' geographical dispersion. Indeed, an implicit assumption in our study is that more or less accounting informativeness is expected depending on the extent to which firms have been more or less exposed to the economic consequences of the pandemic and it is unclear whether a geographical dispersed configuration has made firms more or less exposed to Covid-19's risks. On one side, some empirical evidence suggests that the global uncertainty resulting from the Covid-19 pandemic has affected multinational firms more than domestic ones (e.g. Miroudot, 2020; Yong and Laing, 2021). On the other side, some studies have reported that firms whose operating plants are situated in more countries may be better positioned to face a lockdown of economic activity in a single country (Sharma et al., 2020). We found geographical dispersion to affect accounting informativeness during the period considered; specifically, geographically dispersed firms experienced a stronger decrease in accounting informativeness during the pandemic than their domestic counterparts did. This result is consistent with Ding et al.'s (2021) claims that geographically dispersed firms tend to be more exposed during the Covid-19 pandemic due to their international supply chains and customers. This stronger exposure to the pandemic induced investors to decrease the extent to which accounting information is used to form stock prices and thus infer firms' underlying economics.

Second, we investigate whether a firm's level of institutional ownership plays a role in determining the extent to which investors have incorporated accounting numbers in stock prices during the Covid-19 crisis. Specifically, we show that institutional owners relied to a lower extent on accounting information during the Covid-19 crisis, suggesting that sophisticated investors anticipated more than unsophisticated ones that earnings released during the pandemic might be less useful to predict firms' future cash flows. Interestingly, passive investors appear to anchor more closely their valuation to earnings compared to active investors during the Covid-19 pandemic.

This study makes several contributions to the literature, the first of which is a relevant investigation into the informative role of accounting during periods of heightened uncertainty. While the existing literature suggests that earnings announcements are more likely to provide timely, value-relevant information to investors during periods of heightened uncertainty (Imhoff and Lobo, 1992; Anthony and Petroni, 1997; Christensen, 2002), the current results show that accounting numbers partially lost their information content during the recent Covid-19 crisis. Consequently, the result that when uncertainty hits investors are motivated to weight more heavily any observed realization of earnings cannot be generalized to all type of crises: when the characteristic of the crisis is such that it has the potential of undermining firms' business models, we expect to find a lower reliance on earnings by investors.

Second, this study contributes to the literature by investigating the economic effects of firms' geographic dispersion. In normal situations, geographic dispersion is an element of complexity and uncertainty that affects management decisions (Bushman et al., 2004; Jennings et al., 2015; Shi et al., 2015), makes financial analysts' forecasting tasks more difficult (Climent et al., 1999; Duru and Reeb, 2002; Plumlee, 2003; Platikanova and Mattei, 2014, Fabrizi et al. 2021), and adds bias to investment decisions (Coval and Moscowitz, 1999; Garcia and Norli, 2011; Chi and Shantikumar, 2017). Notably, very recent works in the literature suggest that geographic dispersion played a peculiar role in the pandemic-affected market (Ding et al., 2021; Mascia and Onali, 2021; Yong and Laing, 2021). The present study sheds light on the relationship between this firm attribute and accounting informativeness during the pandemic.

Finally, this study contributes to the literature on ownership structures, particularly focusing on institutional owners. Recent works have investigated the role of different ownership structures during the Covid-19 pandemic (Huo and Qiu, 2020; Amore et al., 2021; Ding et al., 2021). The present study adds to this context by showing that the level of institutional ownership significantly affected the extent to which stock prices were affected by earnings information during Covid-19 pandemic.

Results also have policy implications. Recent accounting literature started to investigate the role of accounting information in supporting public policy in the aftermath of a systemic crisis. In this regard, Buchetti et al. (2021) build on an accounting-based framework and readily available data from financial statements and forecast the impact of the Covid-19 pandemic in terms of losses, equity depletion, and corporate defaults, absent government intervention. We argue that a fully understanding of the potential role of accounting information in the aftermath of a crisis such as the Covid-19 pandemic cannot be obtained without first understanding how and whether accounting informativeness modifies during crises such as the Covid-19 pandemic that have a disruptive nature on firms' value drivers.

The rest of the paper is structured as follows: In Section 2, a review of the relevant literature and the study hypotheses are presented. In Section 3, the sample, multivariate analysis used, and results related to the main analysis are described. Following this, Section 4 discusses additional cross-sectional analyses, and Section 5 discusses the robustness test conducted in the study. Finally, Section 6 concludes the paper.

2. LITERATURE REVIEW AND CONCEPTUAL DEVELOPMENT

This study draws from and contributes to the emerging stream of research evaluating the firm-level economic consequences of the Covid-19 pandemic. According to this stream of literature, the viral pandemic has had disruptive effects on stock markets, following the path of the disease—first China, then Europe, and finally the US (Bretscher et al., 2020; Ramelli and Wagner, 2020)—and involved plummeting stock returns and dramatically increasing volatility (Ding et al., 2021; Mascia and Onali, 2021). No other pandemic-related events in the past have impacted stock markets as strongly as Covid-19 (Baker et al., 2020). Multiple studies have attempted to investigate the underlying characteristics of firms that have potentially mitigated the disruptive economic effects of the pandemic. In this regard, the findings of Onali and Mascia (2021) suggest that corporate geographic diversification mitigates stock market risks in pandemic-related circumstances, but analog evidence has not been found for industry diversification. Although multiple studies have focused on the negative stock market consequences related to the Covid-19 pandemic and associated mitigation factors, none of the existing studies investigated whether the outbreak of the pandemic has altered the extent to which accounting information maps into the stock price formation process. This is particularly surprising since accounting is essential to understand firms' economic fundamentals and make informed investment decisions, especially for regulators and policymakers in designing countermeasures to ensure firms' survival during the pandemic (Buchetti et al., 2021). This study attempts to fill the gap in the literature by empirically investigating the extent to which accounting information influences stock prices in the pandemic-affected market.

The literature investigating the informativeness conveyed by financial statement numbers has roots on the seminal work by Ball and Brown (1968). The authors, through a standard event analysis, document a significant positive relationship between earnings and stock returns around earnings' announcement dates. This result has been interpreted as evidence that accounting is indeed informative because the market participants use the released information to update stock prices, and multiple studies following Ball and Brown (1968) reach similar conclusions (see e.g. Beaver, 1968; Watts, 1978; Hagerman et al., 1984). Despite the positive association between unexpected earnings and stock returns is a well-consolidated phenomenon in the accounting literature, a more recent stream of research documents that this relationship is weakening over time, and earnings' announcements are not as informative and value relevant as before. For instance, Collins et al., (1997) document that the value relevance of earnings has declined over time. Authors motivate this finding with the shift from an industrialized toward a high tech, service-oriented economy, rendering earnings numbers as a less useful tool to assess shareholders' value. Also according to Lev and Zarowin (1999), the shift toward a new economy has been the main responsible of the earnings' informativeness loss documented in their study. In fact, innovative activities, involving massive investments in R&D and intangibles, generate a mismatch between revenues and cost, leading the usefulness of reported earnings to deteriorate. This seems to explain also findings in Amir and Lev (1996), who use as proxy context high-tech independent cellular firms, finding that their financial information does not explain stock prices. In the same line, Bamber et al. (2000) infer the conclusion that most individual earnings are not associated with unusual price reactions, and the positive association documented in previous studies is the result of cognitive biases of individuals combined with biases in the review process. Recently, Barth et al. (2022) re-open this long-standing debate about the extent to which different accounting items inform stock prices. Their results are consistent with earnings to lose value relevance in explaining share prices over the last decades, replaced by accounting items relating to intangible assets, growth opportunities, and alternative performance measures, better representative of the shift toward a new service-based high-tech economy.

Prior literature also suggests that there are contexts in which the accounting information, especially earnings, is particularly useful in informing investors. In greater detail, when uncertainty about the realization of future cash flows increases, such as during natural catastrophes or financial crises, the market seems to anchor more on the released accounting information to infer the underlying firms' fundamentals. Multiple works provide results consistent with an increased informativeness of earnings during proxy contexts characterized by heightened uncertainty, among them Collins and DeAngelo (1990), Barron and Stuerke (1998), Christensen (2002). The latter is particularly interesting because Christensen (2002) documents that two sources of uncertainty affect the market response to earning announcements under such conditions. The first is the noise in the earning signal, which reduces the market response to earnings' announcements (see also Imhoff and Lobo, 1992; Francis et al., 2007). The second is the fundamental uncertainty concerning the realization of future cash flows, which makes current earnings more important to investors and increases the market response to earning announcements (see also Lang, 1991; Collins and DeAngelo, 1992; Anthony and Petroni, 1997; Barron and Stuerke, 1998). The author argues that during proxy contexts characterized by heightened uncertainty both sources increase, involving potential offsetting effects. Nonetheless, his results show that the overall market response to earning announcements increases under these contexts, symptom that the positive effects of fundamental uncertainty on earning informativeness more than compensate the negative effect due to increased noise in the earning signal. In the same line, Imhoff and Lobo (1992) agree that these two sources of uncertainty coexist with a potential opposite effect on earning informativeness and all the variables representing earnings uncertainty are potentially mixtures of fundamental uncertainty and noise. Accordingly, they present a consistent way to isolate the effect of increased noise in earnings from fundamental uncertainty. Provided that in this study we are interested only in fundamental uncertainty, we adopt the methodology developed in Imhoff and Lobo (1992) to partial out the effect of the increased noise in the earning signal. More recently, also the findings by Bonsall IV et al. (2020) suggest an increased accounting informativeness under uncertain market conditions, since they show that the media coverage of earnings announcements increases during periods of higher market uncertainty and that this increased coverage leads to improved trading and price efficiency. In the same vein, Choi (2019) argues that earnings announcements provide valuable information for investors to forecast future cash flows during high market uncertainty periods. Thus, prior literature documents that during heightened fundamental uncertainty contexts - characterized by greater uncertainty about the future - investors anchor more on released accounting information to infer firms' valuation. This is further confirmed by the evidence from the 2008 GFC; indeed, the value relevance of earnings (Belesis et al., 2019) as well as earning response coefficients (ERCs)[3] increased during the GFC compared to ongoing concerns (Bepari et al., 2013).

Given results in prior literature, and provided that the incumbency of the Covid-19 pandemic has increased dramatically the level of uncertainty in the markets, as it is also shown by the world uncertainty index from Ahir et al. (2022) peaking during the outbreak of the pandemic (Figure 1), we should reasonably expect to observe an overall increased informativeness of accounting during the Covid-19 pandemic. Nonetheless, it is important to notice that the implicit assumption underlying prior literature's findings is that investors expect that after the period of heightened uncertainty the future value of the company (and thus its ability to produce cash flows) will be back to its fundamental pre-uncertainty value. Indeed, it is rational for investors to weight more heavily earnings during periods of uncertainty if and only if they expect that the post-uncertainty value drivers will be in continuity with the value drivers of the pre-uncertainty period.

We claim that the Covid-19 pandemic might have changed investors' perception about the utility of anchoring their valuation more closely to earnings realizations because the above discussed implicit assumption is likely not to hold. In fact, while the financial crisis triggered by the Covid-19 pandemic has some features in common with past financial crises, academics and practitioners believe that it is significantly different from the previous ones (see Reinhard, 2020; Ding et al., 2021; Zattoni and Pugliese, 2021) and has had unprecedented effects on economic

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[3] Earning response coefficient regressions (ERC) are the typical proxy used in the relevant literature to measure the informativeness of accounting. They are obtained by regressing Cumulative Abnormal Stock returns on Unexpected Earnings around the quarterly announcement date, and they measure the extent to which stock price react per unit of unexpected earnings (Teoh and Wong, 1993).

activity around the world (Goolsbee and Syverson, 2021). While severe financial imbalances, unmanaged risks, and management greed were the causes of past crises, the 2020 pandemic framework under study was the result of a viral pandemic that abruptly and severely hit global economic activity (Bernanke, 2020); thus, it is different in terms of its cause, scope, and severity (Reinhart, 2020). When a crisis originates on the business side, it is easier to leverage accounting information to make predictions about how events will evolve compared to a situation that originates outside the business environment, such as the Covid-19 pandemic; in the case of the latter, the consequences may be so pervasive that they hamper investors' use of accounting information to make inferences about firms' underlying fundamentals.[4] Importantly, in comparison to previous crises, the Covid-19 pandemic has caused a simultaneous demand and supply shock (del Rio-Chanona et al., 2020; Borino et al., 2021) and for many firms it has challenged their existing business models (Ritter and Pedersen, 2020; Breier et al., 2021) making many of them infeasible (Clauss et al. 2022). Thus, if on one hand, heightened uncertainty caused by natural disasters or financial crises have not directly questioned the firms' value drivers and business models, Covid-19 did.

In sum, past research predicts that the informative role of accounting, in particular earnings, increases during market phases of heightened fundamental uncertainty, with unexpected earnings being considered more in stock prices. However, the findings from past studies may not apply to the new Covid-19 crisis since during the unfolding of the pandemic it was very difficult to predict how firms would have been affected by the crisis and what would have been the firm's exposure to the emerging risks. Under these circumstances, the mapping of earnings in stock price is definitively a more difficult and uncertain task. Given recent call for the use of accounting

[4] See https://www.irmagazine.com/reporting/how-covid-19-affecting-earnings-guidance-and-dividend-payments

information in supporting public policy in the aftermath of a systemic crisis such as Covid-19 (Buchetti et al. 2021), we deem that an understanding of how and whether accounting informativeness modified during Covid-19 pandemic is crucial.

Thus, assuming that arguments can be provided to support an increase or decrease in accounting informativeness following the Covid-19 crisis, the following null hypothesis has been formulated:

***H0**: The outbreak of the Covid-19 crisis has not affected the informativeness of accounting numbers compared to ongoing concerns.*

3. EMPIRICAL ANALYSIS AND RESULTS

3.1. Multivariate Model

In this study, the informativeness of financial statement numbers is investigated by looking at the extent to which stock market prices incorporate unexpected earnings around quarterly announcements. The association between abnormal returns and unexpected earnings is known as the earnings response coefficient (ERC), and multiple past studies have used ERC as a proxy for the informativeness of earnings[5] (Hagerman et al., 1984; Imhoff and Lobo, 1992; Teoh and Wong, 1993; Francis et al., 2007*)*.

Unexpected Earnings

[5] We acknowledge that recently new techniques have been introduced to assess earnings' informativeness, for example Barth et al. [2021] used Classification and Regression Trees (CART), however we decide to stay at ERC for the purposes of this study because, at the actual state of things, the accuracy gain brought by the new nonparametric techniques is more than compensated by the lack of explainability and interpretation of the model results.

Unexpected earnings (UE) refer to the fraction of the total announced earnings per share (EPS) that has not been forecasted by financial analysts, and it is also known under the denomination of an "earnings surprise." Based on existing literature (Imhoff and Lobo, 1992; Teoh and Wong, 1993 and others), the UE proxy is computed using the following equation:

$$UE_{i,t} = \frac{actual(EPS)_{i,t} - mean(EPS)_{i,t}}{prrcq_{\ i,t}}$$

(Equation 1)

In Equation 1, actual EPS is the actual quarterly EPS announced by firm *i* for quarter *t*. The mean EPS is the average of analysts' EPS forecast issues for firm *i* and quarter *t*, and it is used as a proxy for the analysts' consensus forecast. Subtracting the consensus EPS from the actual EPS and scaling the difference by the share price at the end of the relevant quarter (*prccq*) provides the proxy for the unexpected earnings of firm *i* in quarter *t*.

According to Imhoff and Lobo (1992) and Christensen (2002), two types of uncertainty can affect the informativeness of earnings during turbulent market phases. The first is the noise in the earnings signal, which reduces the market reaction to earnings reports (see also Francis et al., 2007), and the second is uncertainty about firms' fundamentals. Due to the present study's focus on the second source of uncertainty (i.e. fundamental uncertainty), we isolate the influence of fundamental uncertainty on the informativeness of earnings from the increased noise in the earnings signal. To do so, we follow the approach proposed by Imhoff and Lobo (1992) and we scale the UE measure by the standard deviation given in analysts' forecasts during the quarter $\sigma(Forecast\ EPS)$[6]. Consequently, we compute an adjusted measure of UE, i.e. *UE_adj*, that isolates the component of unexpected earnings due to fundamental uncertainty only:

[6] Another approach to control for the noise in the earning signal is the one proposed by Christensen (2002) and consists in adding a measure of earnings forecasts dispersion as a distinct conditioning factor to the earning response coefficient regression. We investigate this approach as a separate robustness test (robustness 5)

$$UE_{adj\ i,t} = \frac{UE_{i,t}}{\sigma(Forecast\ EPS)_{i,t}}$$

(Equation 2)

Cumulated Abnormal Returns

CAR_{it}, represents the cumulated abnormal returns of firm *i* at the closing of trading day *t*. Cumulated returns can be estimated using a standard Ordinary Least Squares (OLS) market model, as given in Equation 3:

$$R_{it} = \beta_0 + \beta_1 * R_{mt} + u$$

(Equation 3)

Here, R_{it} represents the market returns of stock i at the closing of trading day t, and R_{mt} is the return of the S&P500 index used as proxy for the market return.

For this analysis, the parameters in Equation 3 are estimated from day -11 to day -210, with day 0 (t = 0) being the day of the earnings announcement. The fitted values $\widehat{R_{it}}$ are gathered from Equation 3 and cumulated using a five-days time window around the announcement date to obtain $CAR_{it} = \left(1 + \widehat{R_{-2}}\right) * \left(1 + \widehat{R_{-1}}\right) * \left(1 + \widehat{R_0}\right) * \left(1 + \widehat{R_{+1}}\right) * \left(1 + \widehat{R_{+2}}\right)$.

Multivariate Model

To test our research hypothesis, we investigate the association between UE_adj and *CAR* using an OLS model. In its baseline setup, the model provides a measure of the stock market reaction per unit of *UE_adj*. To compare the pandemic timeframe (February–May 2020) and the ongoing concern (February–May 2019), an augmented version of the model is estimated following the research design of Teoh and Wong (1993):

$$CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj + \alpha_n * \sum controls + u$$

(Equation 4)

Here, CAR_{it} represents the cumulated abnormal returns obtained from Equation 3. UE_adj is the measure of UE corrected for the increased noise in the earnings signal, as given in Equation 2, and α_1 in Equation 4 represents the ERC. The dummy variable *YEAR_2020* takes the value of one if the data is related to the February–May 2020 time window, also known as the Covid-19 first wave (treatment), and the value of zero if it refers to the February–May 2019 time window (control). Figure 2 graphically describes the research design. Notably, the same time period but in the previous year is selected as the baseline for this study in order to avoid seasonality problems. According to Teoh and Wong (1993), ERCs are likely to differ significantly by industry. For this reason, industry fixed effects are also included in a specification of Equation 4, with each industry identified by the first two digits of the corresponding Standard Industry Classification (SIC) code.

<< Insert Figure 2 here >>

As mentioned above, the null hypothesis H0 states that the outbreak of the Covid-19 pandemic has not affected earnings informativeness. Therefore, the interaction between UE_adj and *YEAR_2020* is the main item of interest in this paper, and its coefficient (α_3) provides a formal test for H0. The control variables included in Equation 4 are based on prior literature (e.g., Teoh and Wong, 1993). *Log(TOT_ASSET)* is the natural logarithm for firm *i*'s total assets as a proxy for firm size. *BETA* represents the market model beta resulting from Equation 2, and it is used as a proxy for firm risk in the study analysis. The inverse of the number of analysts (*1/N_ANALYSTS*) is used as a proxy for noise in a pre-disclosure environment and market-to-book (*MTB*) as a proxy for the firm's growth opportunities and earnings persistence[7]. All the variables in the model are winsorized at 1% and 99%.

3.2. Sample Selection

The data used in this analysis are from Compustat, Thomson Reuters EIKON and I/B/E/S. The sample includes all firms incorporated in the United States that have data available to calculate all variables in Equation (4) during the periods February-May 2019 and February-May 2020 (Covid-19 first wave). We also require information concerning parent-subsidiaries relationship to be available for subsequent cross-sectional analyses and we used a Python application to query CorpWatch's API for each company's subsidiary information to obtain data for 2019 and 2020. Our final sample consists of 2,667 quarterly observations[8].

3.3. Descriptive Statistics

Table 1 reports the descriptive statistics for the estimation of Equation 4—that is, the main model. Since the main analysis involved two different time windows, the descriptive statistics for each timeframe are reported separately in Table 1: Panel A is for February–May 2019, and Panel B is for the timeframe February–May 2020. In addition, Panel C presents the descriptive statistics for the whole sample, including a t-test comparing the 2019 and 2020 data (column 7) to assess the differences between the pandemic and normal frameworks.

[7] In this paper we have followed the ERC design by Teoh and Wong (1993), which did not include earning persistence, even if this is likely to affect the ERC. In this study, we adopted the same simplifying assumption, However, Collins and Kothari (1989) suggest that MTB ratio is also affected by persistence. To the extent that this is the case, including this ratio inside the model provides a normalization for persistence as well.

[8] We decided to estimate the main model and the cross-sectional analyses on the same set of firms in order to enhance results' comparability. However, on an un-tabulated analysis, we also estimate the main model Equation 4 on the full set of 6,842 observations. Results are qualitative similar to those reported.

<< Table 1 Here >>

On average, the baseline UE measure (as per Equation 1) is more negative for the year 2020 (-0.004, Panel B, column [2]) than for 2019 (-0.001, Panel A column [2]), implying that earnings targets were missed to a greater extent in 2020 than in 2019. At the same time, the estimated standard deviation in analysts' forecasts $\sigma(Forecast\ EPS)_{i,t}$ is greater for the 2020 timeframe (0.166, Panel B [2]) than for the 2019 timeframe (0.085, Panel A [2]) on average. This confirms that noise in earnings information increases in times of heightened uncertainty, which is in line with Bilinski's (2021) findings. As a result, the final measure of UE corrected by noise in earnings (UE_adj) is greater, on average, for the 2019 period than for the 2020 period. With regard to the sample as a whole (Panel C), significant differences can be seen in the means of UE and *σ(FORECAST EPS)* between 2019 and 2020 (column 7), while no statistical differences can be seen in the UE_adj values between the two timeframes. CAR_{it}, the dependent variable in the main models, is greater for the year 2020 (0.021, Panel B) than 2019 (0.001, Panel A) on average, implying that stock market movements around earning announcements were more nuanced during the pandemic timeframe than in normal times. Furthermore, the control variables of the main models (*log(TOTAL_ASSET); BETA; MTB*) do not exhibit significant differences in their mean values between 2019 and 2020 (Panel C, column [7]). This is as expected, since these accounting variables do not exhibit much yearly variation. The analyst coverage proxy, computed as the inverse of the analysts' followings (*1 / N_ANALYSTS*), is the only control variable that seems to be significantly greater in 2019 than in 2020 (Panel C, column [7]), implying that the number of forecast revisions was significantly greater in 2020 than in 2019; this finding is consistent with the evidence by Bilinski (2021). The pairwise correlations of the relevant variables are given in Table 1, Panel D.

3.4. Multivariate Results

Table 2 reports the results of the main model (Equation 4). Column [1] presents the baseline values for Equation 4, which tests the validity of H0 while column [2] also takes into consideration industry Fixed Effects (FE). Throughout all analyses, standard errors are clustered at the year level[9].

<< Table 2 here >>

The results strongly reject H0. From column [2], the most conservative model including Industry FE, we infer that in 2019, ($YEAR\_2020$ = 0), the ERC (α_1) is positive (+0.070) and significant at 5% (p = 0.011). This suggests that a one-unit increase in the independent variable generates, on average, a 7.00% higher abnormal stock price reaction in 2019, which is consistent with the findings of previous studies (Watts, 1978; Hagerman et al., 1984; Francis et al., 2007). The coefficient of interest α_3 assesses H0; it represents the interaction between the $YEAR\_2020$ dummy and UE_adj or the incremental effects of UE_adj on CAR_{it} for the year 2020. As seen in the table, the coefficient is negative (-0.031) and significant at 10% (p = 0.076). H0 is rejected due to the significance of α_3, while the negative sign indicates that accounting earnings partially lost their informativeness during the Covid-19 pandemic in 2020, as compared to 2019, since the ERC ($\alpha_1 + \alpha_3$ = +3.85%) is almost half the 2019 value (α_1= 7.00%). Column [1], presenting data for Equation 4 without Industry FE, provides analog results. These results suggest that findings in prior literature indicating a stronger reliance on earnings by investors during times of heightened uncertainty cannot be generalized to any types of crises that generate uncertainty. When the

[9] Since for each company we only have two observations (one in the pre-Covid period and one in the post-Covid period) we cannot cluster standard errors at the firm level.

sources of uncertainty are such to threaten firms' business models and competitive advantage – as it was during the Covid-19 pandemic- the opposite effect is documented.

3.5. Covid-19 Exposure

Next, we investigate whether the reduction in earnings informativeness seen in the result of Equation 4 is really driven by exposure to the Covid-19 pandemic. To this end, we first compute a firm-level weighted foreign exposure index ($FOREIGN\_EXPOSURE_{ij}$). For each firm *i*, this index provides the number of operating subsidiaries in country *j* as a percentage of the total subsidiaries, as specified in Equation 5. Thus, for example, if a firm has two operating subsidiaries, one located in the UK and one in China, $FOREIGN\_EXPOSURE_{ij}$ will be 50% for UK and 50% for China.

$$FOREIGN\_EXPOSURE_{ij} = \frac{Number\ Subsidiaries\ Country_j}{Total\ Number\ of\ Subsidiaries}$$

(Equation 5)

Next, we use two firm-level Covid-19 exposure indexes to establish whether results are stronger when firm's exposure to Covid-19 increases. The first index, $MORTALITY_i$, is obtained by considering $FOREIGN\_EXPOSURE_{ij}$ from Equation 5 in relation to the excess Covid-19 mortality rate per country as a percentage of the population measured at the end of the sample period (May 31, 2020), as given in Equation 6. The second index, $POSITIVITY_i$, is obtained by considering $FOREIGN\_EXPOSURE_{ij}$ and the Covid-19 total infection rate per country as a percentage of the population, as in Equation 7. Mortality and infection rate data were retrieved from the covid-owid data repository[10] (Ritchie et al., 2020).

$$MORTALITY_i = \Sigma\ (FOREIGN\_EXPOSURE_{ij} * \frac{COVID19\ MORTALITY\ RATE_j}{POPULATION_j})$$

(Equation 6)

$$POSITIVITY_i = \Sigma\ (FOREIGN\_EXPOSURE_{ij} * \frac{COVID19\ INFECTION\ RATE_j}{POPULATION_j})$$

(Equation 7)

Then, to check whether the reduction in the informativeness of earnings is driven by exposure to the pandemic, we separately run Equation 4 for those firms with a $MORTALITY_i$ index below the sample average ($MORTALITY_i = 0$, Equation 8) and for those above ($MORTALITY_i = 1$, Equation 9). Firms with $MORTALITY_i = 1$ are considered more exposed to Covid-19, those with $MORTALITY_i = 0$ are considered less exposed.

$$CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj + \alpha_n * \sum controls + u \quad if\ MORTALITY_i = 0$$

(Equation 8)

$$CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj + \alpha_n * \sum controls + u \quad if\ MORTALITY_i = 1$$

(Equation 9)

Similarly, ERC was estimated separately for those firms with $POSITIVITY_i$ below the sample average ($POSITIVITY_i = 0$, Equation 10) and for firms with $POSITIVITY_i$ above the sample average ($POSITIVITY_i = 1$, Equation 11).

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[10] Coronavirus Pandemic (COVID-19) - Our World in Data

$$CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj \ + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj \ + \alpha_n * \sum controls + u$$

$$if\, POSITIVITY_i = 0$$

(Equation 10)

$$CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj + \alpha_n * \sum controls + u$$

$$if\, POSITIVITY_i = 1$$

(Equation 11)

The results of these tests are given in Table 3, Panel A.

<< Table 3, Panel A here >>

For the subsample of firms less exposed to Covid-19 in terms of mortality ($MORTALITY_i = 0$, column 1), we can see that the relevant coefficient of the interaction between $YEAR\_2020$ and UE_adj is negative ($\alpha_3 = -0.028$) but with less significance (p = 0.115). In contrast, this coefficient is still negative and significant for the subsample of firms more exposed to Covid-19 mortality ($MORTALITY_i = 1$, column 2). The F-test results given in Table 3, Panel B confirm that the coefficients of the two specifications are statistically different at 10% (p = 0.071). This suggests that the results related to the main model (Equation 4) are driven by exposure to Covid-19, since the relevant coefficient α_3 is significant only when considering the subsample of firms more exposed to Covid-19 in terms of mortality.

<< Table 3, Panel B here >>

To further validate this result, exposure to Covid-19 was tested in terms of infection rather than mortality. For the subsample of firms less exposed to Covid-19 in terms of infection rate ($POSITIVITY_i = 0$, column 3 of Table 3, Panel A), the coefficient of the interaction between $YEAR\_2020$ and UE_adj, which serves as a formal test for H0, loses significance (p = 0.169).

However, this coefficient is negative (-0.057) and significant (p = 0.019) for the subsample of firms more exposed to Covid-19 in terms of infection rate ($POSITIVITY_i = 1$, column 4). An F-test (Table 3, Panel B) shows that the relevant coefficients of the two specifications are statistically different (p = 0.000). This further confirms that the loss of accounting informativeness documented in H0 was driven by greater exposure to the Covid-19 pandemic.

4. CROSS-SECTIONAL ANALYSES: GEOGRAPHICAL DISPERSION AND INSTITUTIONAL OWNERSHIP

The results of the main analysis show that the advent of the Covid-19 pandemic significantly reduced earnings informativeness eventually because the changes introduced in the business world by the pandemic were too disruptive to be properly explained by the accounting. Nonetheless, we expect the pandemic's impact on accounting informativeness to be nonhomogeneous across companies. Indeed, we expect some firm-level characteristics to play a role in determining the extent to which accounting has become more or less informative in the wake of the pandemic. Accordingly, we investigate two specific firm attributes, namely the level of geographic dispersion of firm operations and the level of institutional ownership.

We measure the level of geographic dispersion of the firm operations using the dummy variable $GEO\_DISP\_DUMMY_i$, which takes the value of one if the number of foreign countries in which a firm *i* has operating subsidiaries is greater than the sample average and zero otherwise. To compute this variable, we exploit information on the Exhibit 21 statement, which includes a comprehensive list of all domestic and foreign subsidiaries of a given company. Data related to the parent-subsidiary relationship are extracted using automated parsers from the open-source data provider Corpwatch api (api.corpwatch.org). Corpwatch api extracts this information from the

Exhibit 21 of companies' 10-K filings (similar data collection processes have been performed by Kalodimos, 2017; Fabrizi et al., 2021).

Regarding institutional ownership, previous studies have typically measured institutional ownership holdings as a percentage of the total share outstanding (Utama and Cready, 1997; Jiambalvo et al., 2002; Asquith et al., 2005). Based on this, we set up a dummy variable $INST\_OWN\_DUMMY_i$, which would take the value of one if the firm's level of institutional ownership, interpreted as a percentage of shares outstanding, is above the sample average and zero otherwise.

The descriptive statistics for the geographic dispersion and institutional ownership variables are given in Table 4, Panel A (2019), Panel B (2020), and Panel C (nested). Pairwise correlations are included in Table 4, Panel D.

<< Table 4 here >>

4.1. Geographic Dispersion and Accounting Informativeness Amidst Heightened Global Uncertainty

An implicit assumption in our study is that more or less accounting informativeness is expected depending on the extent to which firms have been more or less exposed to the economic consequences of the pandemic. With this respect, it is unclear whether a geographical dispersed configuration has made firms more or less exposed to Covid-19's risks. In fact, recent studies provide mixed evidence and there are theoretical arguments to support both predictions. An eventual greater exposure to the pandemic would further hamper investors' ability to make inference about the underlying fundamentals leveraging accounting information. On one side, some empirical evidence suggests that the global uncertainty resulting from the Covid-19 pandemic has affected multinational firms more than domestic ones. At normal times, multinational firms face more severe agency problems than domestic firms (Bushman, 2004; Gao et al., 2008), which may have been exacerbated by the pandemic. In addition, international firms rely on global supply chains and just-in-time technologies to minimize costs, whose smooth functionality has been hindered by social restrictions and lockdown measures (Yong and Laing, 2021), increasing the uncertainty about geographical dispersed firms' ability to face the needs peculiar to their multinational configuration. Along the same lines, international firms are more likely than domestic firms to have operations in at least one country hit by the pandemic. While domestic firms are exposed only to domestic market shocks, multinational firms are exposed to both domestic and foreign market shocks, increasing the uncertainty these firms face when a shock simultaneously hits multiple markets, such as during the Covid-19 pandemic (Borino et al., 2021). Moreover, international firms are more likely to experience a reduction in logistics services due to the pandemic, consistent with the documented disruption in transport networks and logistics, which becomes an additional vulnerability to international trade (Miroudot, 2020). In addition, pandemic-induced declines in stock prices have been greater among firms with more exposure to Covid-19 through their international supply chains and customers (Ding et al., 2021). Thus, according to this stream of literature, multinational firms are affected to a greater extent by heightened global uncertainty than domestic firms.

On the other side, some studies have reported that the geographically diversified configuration typical of multinational firms may better position them to face heightened global uncertainty derived from the pandemic than domestic firms. Indeed, firms whose operating plants are situated in more countries may be better positioned to face a lockdown of economic activity in a single country. For example, firms that had established vast supply chain networks across the world to reduce their dependence on China were able to shift their production more effectively from one location to another during the Covid-19 spread, thus facing a slowdown in production instead of a complete shutdown (Sharma et al., 2020). Furthermore, Young and Laing's (2021) findings provide an analog conclusion: with the globalization and internationalization of trade, multinational firms become more resilient to unexpected economic shocks such as the Covid-19 pandemic. Notably, an internationally diversified configuration has been associated with lower stock market risk in the event of a negative exogenous shock such as the pandemic, implying that such firms are less hit by the economic consequences of the pandemic than their counterparts (Mascia and Onali, 2021).

Consequently, whether and in which direction geographic dispersion moderates the main findings documented in Table 2 is an empirical issue that we investigate including a triple-interaction ERC model, as given in Equation 12:

$$CAR_{it} = \beta_0 + \beta_1 * UE\_adj + \beta_2 * YEAR\_2020 + \beta_3 * GEO\_DISP\_DUMMY_i + \beta_4 * UE\_adj * YEAR\_2020 + \beta_5 * UE\_adj * GEO\_DISP\_DUMMY_i + \beta_6 * YEAR\_2020 * GEO\_DISP\_DUMMY_i + \beta_7 * UE\_adj * YEAR\_2020 * GEO\_DISP\_DUMMY_i + \beta_n * \sum controls + u$$

(Equation 12)

The significance of the three-way coefficient β_7 in Equation 12 determines whether a firm's level of geographical dispersion has affected its earnings informativeness in pandemic-related market circumstances, while its sign indicates the direction. The controls were the same as those used for Equation 4.

Results

From Table 4, we infer that on average, the sampled firms have operating subsidiaries (*FOREIGN_SUBS*) in 13 foreign countries, but the median firm has only seven, which means that the distribution of *FOREIGN_SUBS* is positively skewed. Therefore, $GEO\_DISP\_DUMMY_i$ would equal one if *FOREIGN_SUBS > 13* and zero otherwise. *FOREIGN_SUBS* is sticky and, as seen in the table, does not exhibit any significant difference between the years 2019 and 2020.

The results of Equation 12 are given in Table 5. Column [1] provides the baseline specification of the equation, while column [2] also considers the industry fixed effects.

<< Table 5 here >>

Similar to Equation 4, the results of Equation 12 confirm that earnings are informative at normal times since the coefficient β_1 is positive (0.049) and significant (p = 0.045) in the most conservative model. In addition, the double interaction between $YEAR\_2020$ and UE_adj (β_3) is negative, similar to Equation 4, but not statistically significant at the conventional level (p-value = 0.181 in the most conservative model with Industry FE [2]). Furthermore, the results show that geographical dispersion tends to positively affect earnings informativeness in normal circumstances; the coefficient of the interaction between UE_adj and $GEO\_DISP\_DUMMY_i$ (β_5) is positive (0.127) and significant (p = 0.065), implying that a one-unit increase of UE_adj generates, on average, a 12.7% higher abnormal stock price reaction among geographical dispersed firms than their domestic counterparties. Importantly, the coefficient of the three-way interaction between UE_adj, $YEAR\_2020$ and $GEO\_DISP\_DUMMY_i$ (β_7) is negative (-0.083) and statistically significant (p = 0.079), implying that the outbreak of the Covid-19 crisis has further reduced the extent to which unexpected earnings information is accounted for in the stock prices of geographically dispersed firms. In particular, this finding supports Ding et al.'s (2021) view that firms with international supply chains and customers have been more exposed to the pandemic's effects, experiencing also greater declines in stock prices. A stronger exposure to the pandemic for geographical dispersed firms has turned their accounting into a less useful tool to predict the underlying economic fundamentals, inducing investors to decrease their use of accounting information to form stock prices. Consistent with this view, the F-test results reported in Table 5, confirm that the sum of the coefficients $\beta_3 + \beta_7$ is negative and statistically significant (p = 0.028 in the more conservative model).

4.2. Institutional Ownership and Accounting Informativeness Amidst Heightened Global Uncertainty

In addition to geographic dispersion, ownership structure is also expected to affect earnings informativeness amidst the heightened global uncertainty related to the Covid-19 pandemic, particularly institutional ownership. Many studies in the literature have documented the extent to which institutional ownership affects the informativeness of earnings, and they have shown that the percentage of outstanding shares held by institutional owners positively affects the extent to which stock prices incorporate earnings information (Jiambalvo et al., 2002). This finding seems to hold true outside the US as well, as evidenced by Jung and Kwon (2002) for Korea and Luo et al. (2014) for Japan. It is also coherent with the view that institutional investors are sophisticated and are thus better able to map current accounting information to predict future earnings; accordingly, stock prices should reflect more of the available information on future-period earnings as institutional ownership increases.

The main model of the present study (Equation 4) shows that the heightened uncertainty related to the Covid-19 pandemic has significantly reduced the informativeness of earnings compared to normal times. We conjecture that this is due to accounting being perceived as less useful in uncovering firms' underlying economics during these market phases, due to which less consideration is given to earnings in the stock price formation process. In turn, sophisticated investors may be expected to rely even less than unsophisticated investors on signals with limited usefulness. If the accounting information does not reveal the firms' underlying economics, there is no reason for sophisticated investors to base their investment decisions on it. Therefore, it was deemed reasonable to assume that institutional investors would base stock prices on signals to a lower extent when these signals are less informative.

To shed light on this issue, a measure of institutional ownership was defined in this study and introduced into the model as a moderator variable. Next, to formally test the role of institutional ownership as a cross-sectional source of variation in earnings informativeness, we consider the following triple-interaction ERC model (Equation 13):

$$CAR_{it} = \gamma_0 + \gamma_1 * UE\_adj + \gamma_2 * YEAR\_2020 + \gamma_3 * INST\_OWN\_DUMMY_i + \gamma_4 * UE\_adj * YEAR\_2020 + \gamma_5 * UE\_adj * INST\_OWN\_DUMMY_i + \gamma_6 * YEAR\_2020 * INST\_OWN\_DUMMY_i + \gamma_7 * UE\_adj * YEAR\_2020 * INST\_OWN\_DUMMY_i + \gamma_n * \sum controls + u$$

(Equation 13)

The coefficient of the triple-interaction term γ_7 allows for the formal testing of the effect of institutional ownership on earnings informativeness in pandemic-related market circumstances. As previously mentioned, we conjecture that institutional ownership negatively affected the extent to which stock prices incorporated unexpected earnings information during the time of the Covid-19 pandemic. This view would be supported if the triple-interaction term γ_7 was negative and significant.

Results

The descriptive statistics for the institutional ownership variables are included in Table 4, Panel A (2019), Panel B (2020), and Panel C (nested). Pairwise correlations are given in Table 4, Panel D. As can be seen, institutional investors own 77.8% of the total shares outstanding (*INST_OWN_PERC*) on average, and the median is slightly higher at 83.2%. *INST_OWN_PERC* is sticky, and there is no significant difference between the two timeframes.

Equation 13 tests whether institutional owners, with their informed trading practices, have affected the extent to which stock prices account for unexpected earnings during the pandemic. The results of Equation 13 are given in columns [1] and [2] of Table 6; column [1] focuses on the baseline specification, while column [2] also includes industry fixed effects.

<< Table 6 here >>

Results indicate that institutional ownership positively affects accounting informativeness in normal market conditions. In fact, as evidenced by the most conservative model in column [2], the coefficient of the interaction between UE_adj and $INST\_OWN\_DUMMY_i$ (γ_5) is positive (0.062) and significant at 5% (p = 0.043). This finding is consistent with those of past studies investigating the role of institutional ownership in relation to accounting informativeness. According to the literature, sophisticated institutional investors, through their informed trading practices and monitoring roles, positively affect the extent to which stock prices account for unexpected earnings in normal circumstances (Bushee, 1998; Jiambalvo et al., 2002; Jung and Kwon, 2002; Luo et al., 2014). Therefore, the positivity and significance of γ_5 is in line with the literature. Additionally, when the more conservative model is taken as a reference, the coefficient of the double interaction between UE_adj and $YEAR\_2020$ is negative (-0.020) and significant at 10% (p = 0.062); this is consistent with the earnings informativeness reduction documented in the main model (Equation 4). Most importantly, the coefficient of the triple interaction between UE_adj, $YEAR\_2020$ and $INST\_OWN\_MEAN_i$ (γ_7) is negative (-0.045) and significant at 10%

(p = 0.072), implying that in pandemic-related market circumstances, the institutional ownership affects negatively earnings informativeness. In fact, the presence of sophisticated investors has resulted in a -4.5% stock price reaction per unit of UE with respect to non-institutional firms, which aligns with our expectation. Indeed, with the reduction in accounting informativeness and increased distortions resulting from changes in the business world during the Covid-19 pandemic, sophisticated institutional owners' consideration of turbulent information for the formation of stock prices also reduces, which is perfectly rational. This result breaks away from the findings reported in the literature, shedding light on the largely unexplored role of investors when market conditions deviate from ongoing concerns.

Finally, given the recent debate on the role of passive versus active ownership on accounting informativeness (Sammon, 2022; DeLisle et al. 2017), we explore whether results documented in Table 6 are affected by the type of institutional investors. To this end, we restrict the sample to observations with $INST\_OWN\_DUMMY_i = 1$ only, and define the variable *PASSIVE* that takes the value of 1 if the majority of institutional investors are passive (as defined in the database Thomson Reuters Ownership), 0 otherwise. Next we interact the dummy *PASSIVE* with the interaction term between *UE_adj* and *YEAR_2020* and test whether the type of institutional investor affects earnings informativeness during the Covid-19 pandemic. Results are reported in Table 7. The positive and statistically significant coefficient on the three-way interaction in the most conservative model [2] suggests that only active institutional investors weighted less earnings during the Covid-19 crisis, while passive investors did not. Indeed, the sum between the coefficient on the interaction term *UE_adj*YEAR_2020* and the three-way interaction is not statistically significant at any conventional level. These results are consistent with the general argument suggesting that passive investors pay less or no attention to the underlying securities and therefore their prices do not reflect all available information (Sammon, 2022): In the Covid-19 setting, we show that while active owners proactively weight earnings less due to the specific circumstances of the crisis, passive owners did not.

<< Table 7 here>>

5. ROBUSTNESS TESTS

5.1. Test 1: Attenuation of Results after the First Covid-wave

The research setting considered for the main analysis in this study is novel in terms of its market characteristics. Therefore, the study results may be limited to the timeframe under consideration, and the trends seen are likely to be attenuated after the end of these market circumstances. To verify the same, we temporally extended the study until May 2021, and we compute the relevant variables for the estimation of the main model in Equation 4 until that time-point. Then, we introduce two new dummy variables: $YEAR\_2020\_LATE,$ which equals one if data refers to the timeframe between June 2020 and December 2020 (immediately following the first wave of Covid-19) and zero otherwise, and $YEAR\_2021$, which equals one if data refers to the timeframe between February 2021 and May 2021 ("2021") and zero otherwise. Then, we compute the interaction of these two dummies with the independent variable UE_adj to obtain an augmented version of the main model (Equation 4), as specified in Equation 14.

$$CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj \ + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020\_LATE + \alpha_4 * YEAR\_2021$$
$$\alpha_5 * UE\_adj \ * YEAR\_2020 + \alpha_6 * UE\_adj \ * YEAR\_2020\_LATE + \alpha_7 * UE\_adj$$
$$* YEAR\_2021 \ + \alpha_n * \sum controls + u$$

(Equation 14)

In the specification of Equation 14, α_5, α_6, and α_7 represent the UE_adj incremental effect on CAR_{it} in the "Covid" (α_5), "post-Covid" (α_6) and "2021" (α_7) timeframes. If an attenuation of the main finding were to occur, then $\alpha_5 < \alpha_6 < \alpha_7$, meaning that the reduction in accounting informativeness documented during the Covid-19 timeframe would reduce in magnitude with time. It is important to notice that – although we extended the analysis until 2021, Covid-19 was certainly not over by 2021 and for some companies it may have taken time for the worst covid-induced harm to hit the net income. Thus, we do not expect results to disappear in the second part of our sample (i.e. late 2020 and 2021) but it is reasonable to expect that – compared to the very first months of the pandemic, uncertainty has slightly deceased over time and we expect to observe an attenuation of the documented results. The results of this analysis are given in Table 8.

<< Table 8 here >>

As can be seen, the baseline ERC (α_1) is significantly positive and in the same order of magnitude as in Equation 4 (0.074, p = 0.00). As expected, the baseline stock price reaction to unexpected earnings is positive. The coefficient of the interaction between UE_adj and $YEAR\_2020$ is significantly negative in Equation 14, and it is in the same order of magnitude as in Equation 4 (-0.032, p = 0.019), which is in line with the reduction in accounting informativeness documented in the main analysis (Equation 4). The coefficients of interest for the potential eventual reversal are α_6 (-0.028, p = 0.05) and α_7 (-0.023, p = 0.00). While they are both significantly negative, their magnitudes are such that the condition $\alpha_5 < \alpha_6 < \alpha_7$ is satisfied. This condition is consistent with the main effect of losing strength over time, so with the existence of an attenuation effect. To further validate this result, we conduct the Wald test to check whether the sign of the difference ($\alpha_5 - \alpha_6$) is statistically negative, such that $\alpha_5 < \alpha_6$. As seen in Table 8, the resulting p-value of this test is 0.009, implying that the difference is negative and statistically significant at 1%. The Wald test was run again for the condition ($\alpha_6 - \alpha_7$) < 0, that is $\alpha_6 < \alpha_7$. The resulting p-value is 0.004 (Table 8), which implies that the difference is negative and statistically significant at 1%. These results confirm that the condition $\alpha_5 < \alpha_6 < \alpha_7$ is statistically significant.

5.2. Test 2: Controlling for Alternative Specifications of the Independent Variable UE

In this test, we check whether the documented reduction in earnings informativeness in the main model is robust to alternative specifications of the independent variable UE. First, we specify a baseline UE without controlling for noise in the earnings signal (thus removing the scaling by analysts' forecasts standard deviation), as per the following equation:

$$UE' = \frac{actual(VALUE) - mean(VALUE)}{prrcq} \qquad \text{(Equation 15)}$$

Then, we run the main model (Equation 4) with this UE' specification. The results are given in column [1] of Table 9. The interaction between $YEAR\_2020$ and UE' is still negative (-0.522) and significant at 5% (p = 0.035), indicating that the results of the main model are robust with this UE' specification.

We also try to scale the UE variable based on the natural logarithm of the total asset instead of the share price *prccq*, as given in Equation 16.

$$UE'' = \frac{\left(\frac{actual(VALUE) - mean(VALUE)}{\log(TOTAL\_ASSET)}\right)}{\sigma(Forecast\ EPS)_{i,t}} \qquad \text{(Equation 16)}$$

Results using UE'' are displayed in column [2] of Table 9. The interaction between $YEAR\_2020$ and UE'' is negative (-0.012) and significant at 10% (p = 0.076); thus, the reduction in earnings informativeness during the pandemic timeframe is verified with this UE'' specification.

Notably, in pandemic-related market circumstances, analysts' earnings forecasts may undergo faster changes than in normal circumstances. To account for this, we compute UE using the last available forecast ($last(VALUE)$) instead of the mean consensus:

$$UE''' = \frac{\left(\frac{actual(VALUE) - last(VALUE)}{prrcq}\right)}{\sigma(Forecast\ EPS)_{i,t}} \qquad \text{(Equation 17)}$$

Results can be seen in column [3] of Table 9. The interaction between $YEAR\_2020$ and UE''' remains negative (-0.025) and significant at 10% (p = 0.077).

<< Table 9 here >>

5.3. Test 3: Controlling for Analysts' Ex-ante Forecast Dispersion

In the main analyses, to isolate uncertainty related to firms' fundamental from uncertainty related to increased noise in the earning signal we followed the approach proposed by Imhoff and Lobo (1992), who showed that this control can be performed effectively by scaling the UE measure by the standard deviations in the analysts' forecasts.

Another possible approach to isolate fundamental uncertainty involves adding analysts' forecast dispersion as a separate conditioning factor in the earning response coefficient regression (Christensen, 2002). In this robustness check we implement this second approach suggested by Christensen (2002) and we compute the analysts' forecast dispersion as the ratio between the standard deviation of analysts' forecasts ($\sigma(Forecast\ EPS)_{i,t}$) and the share price recorded at the end of the quarter ($prccq$) (Fabrizi et al., 2021):

$$DISPERSION_i = \frac{\sigma(Forecast\ EPS)_{i,t}}{prccq_i} \qquad \text{(Equation 18)}$$

Then, we rerun the main model (Equation 4) using an unscaled UE proxy, as given in Equation 1 (without scaling by analysts' forecasts standard deviation), and we add DISPERSION to the regression, as given in Equation 19.

$$CAR_{it} = \alpha_0 + \alpha_1 * UE + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE + \alpha_4 * DISPERSION + \alpha_5 * DISPERSION * YEAR\_2020 + \alpha_n * \sum controls + u$$

(Equation 19)

The results of this robustness test are presented in Table 10.

<< Table 10 here >>

It can be observed that, even in this specification, the baseline ERC (α_1) is significantly positive (0.815, p = 0.03), which means that the stock price response is of the same sign as the released accounting information in normal circumstances. Notably, $DISPERSION_i$ is positively associated with abnormal stock returns around the earnings announcement date, since α_4 is positive (+0.659) and significant at 5% (p = 0.038). The sign of this relationship is consistent with the findings reported in past studies, thus documenting a positive association between forecast dispersion and the magnitude of price reactions around the time of subsequent earnings information releases (Barron and Stuerke, 1998; Abarbanell and Lehavy, 2003). In this equation, the coefficient of interest is the double-interaction α_3. This is negative (-0.570) and significant at 10% (p = 0.055), implying that the pandemic has significantly reduced market responses to earnings announcements, which is consistent with the evidence obtained from the main analysis. Therefore, it can be concluded that the main result is robust to this specification.

6. CONCLUSIONS

This study investigated whether the uncertainty related to the outbreak of the Covid-19 pandemic has affected accounting informativeness, that is, the extent to which stock prices are informed by unexpected earnings. While past research predicts that the informativeness of earnings increases during times of heightened global uncertainty because the market reacts to the increased uncertainty by anchoring more on earning numbers, the present study provides evidence of a significant reduction in the informativeness of accounting numbers during the Covid-19 "first-wave" (initial months of 2020) compared to the same period of the previous year, considering a comprehensive sample of listed nonfinancial firms in the US. Consequently, the result that when uncertainty hits investors are motivated to weight more heavily any observed realization of earnings cannot be generalized to all type of crises: when the characteristic of the crisis is such that it has the potential of undermining firms' business models, we document a lower reliance on earnings by investors. This supports the view shared by many academics and practitioners that the circumstances of the recent Covid-19 pandemic, altering existing firms' business models and value drivers, have been completely different from past events, to the extent that even accounting has partially lost its adequacy in reflecting firms' underlying economic fundamentals. Furthermore, this main effect seems to be driven by exposure to the pandemic; indeed, the reduction in informativeness loses significance when only those firms minimally exposed to Covid-19 in terms of mortality or infection rate are considered. Additionally, the study shows that informativeness reduction loses strength with further distance from the early stages of 2020, and it is therefore likely to expire as the market approaches normal conditions.

Moreover, a set of cross-sectional tests was performed, focusing on firm-level attributes that are likely to affect earnings informativeness in pandemic-related market circumstances. First, the firms' level of geographic dispersion was documented based on the parent-subsidiary relationship data in the Exhibit 21 statement, and this variable was found to negatively affect the informativeness of earnings in these market circumstances, supporting the emerging view that geographically dispersed firms were more exposed to the negative consequences of the pandemic through their international supply chains and customers, inducing investors to rely less on their accounting numbers to infer the underlying economic fundamentals and thus to form stock prices. Second, the study results show that the level of institutional ownership of a firm, measured as the shares owned by institutional investors over total shares outstanding, also negatively affects the extent to which stock prices account for unexpected earnings in pandemic-related market circumstances. When accounting becomes less informative about the underlying economics, sophisticated investors do not incorporate the information into their trading decisions, further weakening the abnormal returns/unexpected earnings relationship. Notably, we also show that while active institutional owners proactively weighted earnings less due to the specific circumstances of the crisis, passive owners did not.

The present study's results have implications at multiple levels. First, accounting scholars should be aware that the well-consolidated findings in the literature about accounting informativeness during times of heightened uncertainty may not extend to the context of the Covid-19 pandemic, which seems to be a novel phenomenon and should be further addressed by future research. Second, the results suggest that firms' management should be aware that the accounting information released during uncertain market phases may not be adequate for outside capital providers, shareholders, and other stakeholders to infer the firms underlying economics. Finally, when designing accounting-based relief mechanisms to ensure the survival of corporations and limit the economic effects of the viral pandemic, regulators and policymakers should be aware that accounting may partially lose its informative role under these exceptional market circumstances; thus, attention should be given to preventing the increased likelihood of information distortions.

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LIST OF TABLES

Table 1: Descriptive statistics of the main model's variables

	[1]	[2]	[3]	[4]	[5]	[6]	[7] Mean Difference
	N	Mean	Std. Dev	p25	Median	p75	2019 vs. 2020
Panel A: Descriptive statistics for the fiscal year 2019							
CAR	1285	0.001	0.090	-0.045	0.001	0.044	
UE	1285	-0.001	0.014	-0.001	0.001	0.027	
σ(FORECAST EPS)	1285	0.085	0.405	0.020	0.039	0.083	
UE_adj	1285	0.011	0.239	-0.008	0.013	0.060	
Log(TOTAL ASSET)	1285	7.969	1.850	6.724	7.883	9.165	
BETA	1285	1.066	0.413	0.798	1.036	1.327	
1/N_ANALYSTS	1285	0.186	0.221	0.056	0.111	0.200	
MTB	1285	3.908	10.192	1.339	2.489	4.711	
Panel B: Descriptive statistics for the fiscal year 2020							
CAR	1382	0.021	0.107	-0.044	0.011	0.071	
UE	1382	-0.004	0.031	-0.003	0.000	0.003	
σ(FORECAST EPS)	1382	0.166	0.329	0.037	0.077	0.158	
UE_adj	1382	0.001	0.383	-0.029	0.006	0.050	
Log(TOTAL ASSET)	1382	8.013	1.890	6.814	7.943	9.236	
BETA	1382	1.092	0.320	0.894	1.088	1.273	
1/N_ANALYSTS	1382	0.158	0.207	0.043	0.083	0.167	
MTB	1382	4.134	11.045	1.395	2.637	5.247	
Panel C: Descriptive statistics for the fiscal years 2019 and 2020							
CAR	2667	0.011	0.099	-0.044	0.006	0.057	-.020*** (0.000)
UE	2667	-0.002	0.025	-0.002	0.001	0.003	.003*** (0.000)
σ(FORECAST EPS)	2667	0.126	0.371	0.026	0.056	0.120	-.081*** (0.000)
UE_adj	2667	0.006	0.321	-0.019	0.009	0.056	.010 (0.405)
Log(TOTAL ASSET)	2667	7.991	1.870	6.782	7.911	9.209	-.043 (0.534)
BETA	2667	1.079	0.369	0.850	1.068	1.292	-.026* (0.056)
1/N_ANALYSTS	2667	0.172	0.214	0.049	0.091	0.200	.028*** (0.000)
MTB	2667	4.025	10.638	1.376	2.566	4.974	-.226 (0.571)
N	2667						

Table 1 reports the descriptive statistics for the main variables used in the analysis. **Panel A** provides data for the year 2019, **Panel B** for the year 2020, and **Panel C** for 2019 and 2020. ***CAR*** represents the abnormal stock returns cumulated by firm *i* over a two-day time window around the quarterly earnings announcement date. ***UE*** represents the unexpected earnings of firm *i*, which is computed as the difference between the recorded earnings and the mean consensus forecast scaled by the latter. This was used as a proxy for the earnings surprise of firm i. ***σ(FORECAST EPS)*** is the standard

deviation of the analysts' forecasts. ***UE_adj*** is the measure of unexpected earnings in the present study, which is corrected for noise in analysts' forecasts. ***Log(TOTAL ASSET)*** is the natural logarithm of the firm's total assets **(AT)**, and it is used as a proxy to control for firm size. ***BETA*** is the beta coefficient resulting from the estimation of the market model, applying Equation 2, and it is used in the earning response coefficient regression to control for the firm's level of systemic risk. ***1/N_ANALYSTS*** is the inverse of the number of analysts constituting the consensus for firm i, and it is used as a proxy for the noise in the pre-disclosure environment in the ERC regression. ***MTB*** is the market-to-book ratio, which is computed as the book value of equity divided by the market value of equity.

Table 1, Panel D: Pairwise correlations of the main model's variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) *CAR*	1.000							
(2) *UE_adj*	0.071***	1.000						
	(0.000)							
(3) *σ(FORECAST EPS)*	0.022	-0.145***	1.000					
	(0.242)	(0.000)						
(4) *UE*	0.144***	0.708***	-0.023	1.000				
	(0.000)	(0.000)	(0.226)					
(5) *Log(TOTAL ASSET)*	-0.059***	-0.039**	0.118***	-0.040**	1.000			
	(0.002)	(0.034)	(0.000)	(0.037)				
(6) *BETA*	0.020	-0.057**	0.067***	-0.025	-0.004	1.000		
	(0.283)	(0.002)	(0.000)	(0.193)	(0.845)			
(7) *1/N_ANALYSTS*	-0.013	-0.049***	-0.092***	-0.045**	-0.461***	-0.196***	1.000	
	(0.481)	(0.009)	(0.000)	(0.018)	(0.000)	(0.000)		
(8) *MTB*	0.009	0.023	-0.008	0.007	-0.063***	0.049***	-0.044**	1.000
	(0.615)	(0.220)	(0.666)	(0.724)	(0.001)	(0.009)	(0.019)	

Table 1, Panel D provides the pairwise correlations of the variables in the main model (earning response coefficient regressions). Two tailed P-values are given in brackets.

*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Table 2: Results of the main model (Equation 4)

	[1] CAR *Estimated coefficients (p-value, two-tailed)*	[2] CAR *Estimated coefficients (p-value, two-tailed)*
(α_1)*UE_adj*	0.071**	0.070**
	(0.028)	(0.011)
(α_2) *YEAR_2020*	0.023**	0.023***
	(0.024)	(0.008)
(α_3) *UE_adj* YEAR_2020*	-0.031*	-0.031*
	(0.067)	(0.076)
(α_4) *Log(TOTAL ASSET)*	-0.004	-0.005
	(0.245)	(0.193)
(α_5) *MTB*	-0.001	0.006
	(0.866)	(0.189)
(α_6) *BETA*	0.002	0.000
	(0.903)	(0.971)
(α_7)*1 / n_ANALYSTS*	-0.007	-0.004
	(0.893)	(0.909)
(α_0) *INTERCEPT*	0.035	0.046
	(0.131)	(0.635)
Robust SE	**Yes**	**Yes**
Industry FE	**No**	**Yes**
R-squared	**4.64%**	**7.69%**
Observations	**2667**	**2667**

Table 2 presents the results of the main model Equation 4, where:

$$[1]\ CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj + \alpha_n * \sum controls + u$$

$$[2]\ CAR_{it} = \alpha_0 + \alpha_1 * UE\_adj + \alpha_2 * YEAR\_2020 + \alpha_3 * YEAR\_2020 * UE\_adj + \alpha_n * \sum controls + Industry\ FE + u$$

Equation 4 is an augmented ERC regression based on Teoh and Wong's (1993) analysis. The coefficient of interest is the interaction between UE and the dummy YEAR_2020 (UE_adj * YEAR_2020), since this measures the incremental effect of unexpected earnings (UE_adj) on cumulated abnormal returns (*CAR*) in 2020 (treatment year) versus 2019 (control year), thus providing a formal test for H0.

*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Table 3, Panel A: Data partition – Controlling for firm-level Covid-19 exposure

	[1] *CAR* *Estimated coefficients (p-value, two-tailed)* *Mortality = 0*	*[2]* *CAR* *Estimated coefficients (p-value, two-tailed)* *Mortality = 1*	*[3]* *CAR* *Estimated coefficients (p-value, two-tailed)* *Positivity = 0*	*[4]* *CAR* *Estimated coefficients (p-value, two-tailed)* *Positivity = 1*
UE_adj	0.063**	0.082**	0.055**	0.096***
	(0.047)	(0.011)	(0.037)	(0.010)
YEAR_2020	0.025*	0.019**	0.022*	0.021**
	(0.065)	(0.029)	(0.097)	(0.037)
UE_adj * *YEAR_2020*	-0.028	-0.035**	-0.009	-0.057**
	(0.115)	(0.022)	(0.169)	(0.019)
Log(TOTAL ASSET)	-0.005	-0.005	-0.005	-0.005
	(0.175)	(0.323)	(0.147)	(0.331)
MTB	-0.011	0.014	-0.005	0.004
	(0.332)	(0.337)	(0.749)	(0.614)
BETA	0.017	-0.016	0.018	-0.012
	(0.515)	(0.089)	(0.577)	(0.100)
1 / n_ANALYSTS	0.009	-0.039	0.038	-0.065
	(0.862)	(0.572)	(0.429)	(0.443)
INTERCEPT	0.025*	0.058	0.024	0.054
	(0.016)	(0.275)	(0.200)	(0.342)
Robust SE	**Yes**	**Yes**	**Yes**	**Yes**
R-squared	**5.26%**	**5.12%**	**5.33%**	**5.70%**
Observations	**1306**	**1354**	**1269**	**1391**

Table 3, Panel A provides the results of the data partition referring to the main model (Equation 4), controlling for the firm-level exposure to Covid-19. Column [1] presents the results of Equation 4, estimated using a subsample of firms such that *MORTALITY = 0.* Column [2] provides the estimates for Equation 4, considering a subsample of firms such that *MORTALITY = 1.* Column [3] provides the estimates of Equation 4 based on a subsample of firms such that *POSITIVITY = 0,* while column [4] is for a subsample with *POSITIVITY = 1.* The coefficient of interest is still the interaction UE_adj * *YEAR_2020,* and a comparison of this coefficient between [1] and [2] and between [3] and [4] reveals whether the main model's results are driven by Covid-19 mortality in the first case and by the Covid-19 infection rate in the second case.

*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Table 3, Panel B – F-test for UE_adj * *YEAR_2020*

UE_adj * *YEAR_2020*	UE_adj * *YEAR_2020*
[1] = [2] Prob > chi2 = 0.071	[3] = [4] Prob > chi2 = 0.000

Table 3, Panel B presents the results of comparing the UE_adj * *YEAR_2020* interaction coefficient between specifications [1] and [2] and between [3] and [4].

Table 4: Descriptive statistics of the additional analyses' variables

	[1] N	[2] Mean	[3] Std. Dev	[4] p25	[5] Median	[6] p75	[7] Mean Difference (p-value, two-tailed) 2019 vs. 2020
Panel A: Descriptive statistics for the fiscal year 2019							
FOREIGN_SUBS	1285	13	16	2	7	19	
INST_OWN_PERC	1285	0.780	0.206	0.695	0.835	0.910	
GEO_DISP_DUMMY	1285	0.332	0.471	0	0	1	
INST_OWN_DUMMY	1285	0.607	0.489	0	1	1	
Panel B: Descriptive statistics for the fiscal year 2020							
FOREIGN_SUBS	1382	13	15	2	7	19	
INST_OWN_PERC	1382	0.775	0.211	0.688	0.830	0.909	
GEO_DISP_DUMMY	1382	0.328	0.470	0	0	1	
INST_OWN_DUMMY	1382	0.598	0.490	0	1	1	
Panel C: Descriptive statistics for the fiscal years 2019 and 2020							
FOREIGN_SUBS	2667	13	15	2	7	19	0.130 (0.826)
INST_OWN_PERC	2667	0.777	0.208	0.692	0.832	0.910	0.005 (0.529)
GEO_DISP_DUMMY	2667	0.330	0.470	0	0	1	0.004 (0.817)
INST_OWN_DUMMY	2667	0.602	0.489	0	1	1	0.008 (0.651)
N	2667						

Table 4: *FOREIGN_SUBS* represents the total number of foreign subsidiaries based on the Exhibit 21 statement. ***INST_OWN_PERC*** is the amount of shares owned by institutional investors over the total shares outstanding. ***GEO_DISP_DUMMY*** is a dummy equal to one if firm *i* has a greater number of operating subsidiaries in other countries than the sample average (COUNTRIES_FOREIGN >13) and zero otherwise. ***INST_OWN_DUMMY*** is a dummy equal to one if a firm's INST_OWN_PERC is above the sample average and 0 otherwise. All variables are winsorized at 1% and 99%.

*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Table 4, Panel D: Pairwise correlations of the variables in the cross-sectional analyses

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
***(1)** CAR*	1.000											
***(2)** UE_adj*	0.071***	1.000										
	(0.000)											
***(3)** σ(FORECAST EPS)*	0.022	-0.145***	1.000									
	(0.242)	(0.000)										
***(4)** UE*	0.144***	0.708***	-0.023	1.000								
	(0.000)	(0.000)	(0.226)									
***(5)** Log(TOTAL ASSET)*	-0.059***	-0.039**	0.118***	-0.040**	1.000							
	(0.002)	(0.034)	(0.000)	(0.037)								
***(6)** BETA*	0.020	-0.057***	0.067***	-0.025	-0.004	1.000						
	(0.283)	(0.002)	(0.000)	(0.193)	(0.845)							
***(7)** 1/N_ANALYSTS*	-0.013	-0.049*	-0.092***	-0.045**	-0.461***	-0.196***	1.000					
	(0.481)	(0.009)	(0.000)	(0.018)	(0.000)	(0.000)						
***(8)** MTB*	0.009	0.023	-0.008	0.007	-0.063***	0.049***	-0.044**	1.000				
	(0.615)	(0.220)	(0.666)	(0.724)	(0.001)	(0.009)	(0.019)					
***(9)** FOREIGN_SUBS*	-0.066***	0.023	-0.028	0.014	0.342***	-0.013	-0.193***	0.001	1.000			
	(0.000)	(0.214)	(0.138)	(0.472)	(0.000)	(0.476)	(0.000)	(0.962)				
***(10)** INST_OWN_PERC*	-0.007	0.039**	0.059***	0.043**	0.175***	0.156***	-0.330***	-0.005	0.104***	1.000		
	(0.691)	(0.038)	(0.002)	(0.025)	(0.000)	(0.000)	(0.000)	(0.779)	(0.000)			
***(11)** GEO_DISP_DUMMY*	-0.069***	0.023	-0.031	0.020	0.282***	0.014	-0.187***	-0.024	0.783***	0.131***	1.000	
	(0.000)	(0.223)	(0.103)	(0.305)	(0.000)	(0.462)	(0.000)	(0.199)	(0.000)	(0.000)		
***(12)** INST_OWN_DUMMY*	-0.005	0.063***	0.014	0.060***	0.070***	0.104***	-0.220***	-0.025	0.079***	0.761***	0.120***	1.000
	(0.777)	(0.001)	(0.446)	(0.002)	(0.000)	(0.000)	(0.000)	(0.180)	(0.000)	(0.000)	(0.000)	

Table 4, Panel D presents the pairwise correlations of the variables in the cross-sectional analyses (earning response coefficient regressions). P-values are given in brackets.

*** Statistically significant at 1% level.

** Statistically significant at 5% level.

* Statistically significant at 10% level.

Table 5: Additional test (1), geographical dispersion as a cross-sectional source of variation in the ERC (Equation 12)

	[1] *CAR* *Estimated coefficients (p-value, two-tailed)*	*[2]* *CAR* *Estimated coefficients (p-value, two-tailed)*
(β_1) *UE_adj*	0.052**	0.049**
	(0.045)	(0.045)
(β_2) *YEAR_2020*	0.024**	0.024***
	(0.021)	(0.008)
(β_3) *UE_adj * YEAR_2020*	-0.021	-0.019
	(0.106)	(0.181)
(β_4) *GEO_DISP_DUMMY*	-0.014***	-0.013**
	(0.004)	(0.020)
(β_5) *UE_adj * GEO_DISP_DUMMY*	0.117**	0.127*
	(0.016)	(0.065)
(β_6) *YEAR_2020 * GEO_DISP_DUMMY*	0.000	0.001
	(0.570)	(0.194)
(β_7) *UE_adj* YEAR_2020 * GEO_DISP_DUMMY*	-0.068**	-0.083*
	(0.016)	(0.079)
(β_8) *Log(TOTAL ASSET)*	-0.004	-0.004
	(0.274)	(0.201)
(β_9) *MTB*	-0.002	0.003
	(0.746)	(0.336)
(β_{10}) *BETA*	0.002	0.000
	(0.901)	(0.988)
(β_{11}) *1 / n_ANALYSTS*	-0.014	-0.008
	(0.797)	(0.820)
(β_0) *INTERCEPT*	0.035	0.039
	(0.135)	(0.691)
F-test *($\beta_3 + \beta_7$) = 0*	-0.089	-0.102
	(0.013)	(0.028)
Robust SE	**Yes**	**Yes**
Industry FE	**No**	**Yes**
R-squared	**5.80%**	**8.77%**
Observations	**2667**	**2667**

Table 5 presents the results of the first additional test (Equation 12), where:

$$[1]\ CAR_{it} = \beta_0 + \beta_1 * UE\_adj + \beta_2 * YEAR\_2020 + \beta_3 * GEO\_DISP\_DUMMY_i + \beta_4 * UE\_adj * YEAR\_2020 + \beta_5 * UE\_adj * GEO\_DISP\_DUMMY_i + \beta_6 * YEAR\_2020 * GEO\_DISP\_DUMMY_i + \beta_7 * UE\_adj * YEAR\_2020 * GEO\_DISP\_DUMMY_i + \beta_n * \sum controls + u$$

$$[2]\ CAR_{it} = \beta_0 + \beta_1 * UE\_adj + \beta_2 * YEAR\_2020 + \beta_3 * GEO\_DISP\_DUMMY_i + \beta_4 * UE\_adj * YEAR\_2020 + \beta_5 * UE\_adj * GEO\_DISP\_DUMMY_i + \beta_6 * YEAR\_2020 * GEO\_DISP\_DUMMY_i + \beta_7 * UE\_adj * YEAR\_2020 * GEO\_DISP\_DUMMY_i + \beta_n * \sum controls + Industry\ FE + u$$

Equation 5 involves a triple-interaction ERC, with the coefficient of interest being $UE\_adj * YEAR\_2020 * GEO\_DISP\_DUMMY_i$, which measures the incremental effect of geographical

dispersion on UE in pandemic related market circumstances.
*** Significant at 1% level;
** Significant at 5% level;
* Significant at 10% level.

Table 6: Additional test (2), institutional ownership as a cross-sectional source of variation in the ERC (Equation 13)

	[1] *CAR* *Estimated coefficients (p-value, two-tailed)*	*[2]* *CAR* *Estimated coefficients (p-value, two-tailed)*
(γ_1) *UE_adj*	0.055**	0.053***
	(0.032)	(0.004)
(γ_2) *YEAR_2020*	0.019**	0.019**
	(0.047)	(0.011)
(γ_3) *UE_adj * YEAR_2020*	-0.021	-0.020*
	(0.100)	(0.062)
(γ_4) *INST_OWN_DUMMY*	-0.009	-0.007
	(0.189)	(0.192)
(γ_5) *UE_adj * INST_OWN_DUMMY*	0.057*	0.062**
	(0.015)	(0.043)
(γ_6) *YEAR_2020 * INST_OWN_DUMMY*	0.008	0.007***
	(0.069)	(0.005)
(γ_7) *UE_adj * YEAR_2020 * INST_OWN_DUMMY*	-0.040**	-0.045*
	(0.035)	(0.072)
(γ_8) *Log(TOTAL ASSET)*	-0.005	-0.005
	(0.237)	(0.186)
(γ_9) *MTB*	-0.002	0.005
	(0.737)	(0.154)
(γ_{10}) *BETA*	0.003	0.001
	(0.873)	(0.928)
(γ_{11}) *1 / n_ANALYSTS*	-0.011	-0.007
	(0.827)	(0.815)
(γ_0) *INTERCEPT*	0.040	0.047
	(0.131)	(0.621)
F-test $(\gamma_3 + \gamma_7) = 0$	-0.061	-0.065
	(0.012)	(0.069)
Robust SE	**Yes**	**Yes**
Industry FE	**No**	**Yes**
R-squared	**4.94%**	**8.00%**
Observations	**2667**	**2667**

Table 6 presents the results of the second additional test (Equation 13), where Columns [1] and [2] are as follows:

$$[1]\ CAR_{it} = \gamma_0 + \gamma_1 * UE\_adj + \gamma_2 * YEAR\_2020 + \gamma_3 * INST\_OWN\_DUMMY_i + \gamma_4 * UE\_adj * YEAR\_2020 + \gamma_5 * UE\_adj * INST\_OWN\_DUMMY_i + \gamma_6 * YEAR\_2020 * INST\_OWN\_DUMMY_i + \gamma_7 * UE\_adj * YEAR\_2020 * INST\_OWN\_DUMMY_i + \gamma_n * \sum controls + u$$

$$[2]\ CAR_{it} = \gamma_0 + \gamma_1 * UE\_adj + \gamma_2 * YEAR\_2020 + \gamma_3 * INST\_OWN\_DUMMY_i + \gamma_4 * UE\_adj * YEAR\_2020 + \gamma_5 * UE\_adj * INST\_OWN\_DUMMY_i + \gamma_6 * YEAR\_2020 * INST\_OWN\_DUMMY_i + \gamma_7 * UE\_adj * YEAR\_2020 * INST\_OWN\_DUMMY_i + \gamma_n * \sum controls + Industry\ FE + u$$

Equation 6 is a triple-interaction ERC in which the coefficient of interest is the interaction $UE\_adj * YEAR\_2020 * INST\_OWN\_DUMMY$, measuring the incremental effect of institutional ownership on CAR during the Covid-19 pandemic.

***Significant at 1% level;

** Significant at 5% level;

* Significant at 10% level.

Table 7: Passive ownership analysis results

	[1] *CAR* *Estimated Coefficients (p-value, two-tailed)*	*[2]* *CAR* *Estimated Coefficients (p-value, two-tailed)*
(δ_1) UE_adj	0.120**	0.121*
	(0.026)	(0.061)
(δ_2) YEAR_2020	0.023**	0.023***
	(0.033)	(0.010)
*(δ_3) UE_adj * YEAR_2020*	-0.066**	-0.076*
	(0.041)	(0.096)
(δ_4) PASSIVE	-0.021**	-0.020**
	(0.042)	(0.029)
*(δ_5) PASSIVE * YEAR_2020*	0.019***	0.020**
	(0.005)	(0.028)
*(δ_6) UE_adj * PASSIVE*	-0.026	-0.033
	(0.179)	(0.139)
*(δ_7) UE_adj * PASSIVE * YEAR_2020*	0.049	0.049**
	(0.131)	(0.050)
(δ_8) Log(TOTAL_ASSET)	-0.004	-0.005
	(0.468)	(0.406)
(δ_9) MTB	-0.000	-0.000
	(0.559)	(0.762)
(δ_{10}) BETA	0.006	0.002
	(0.775)	(0.930)
(δ_{11}) 1/n_ANALYSTS	-0.026	-0.014
	(0.787)	(0.787)
(δ_0) INTERCEPT	0.032	0.044
	(0.399)	(0.713)
F-test *($\delta_3 + \delta_7$)*	8.31	11.79
	0.213	0.180
Robust SE	**Yes**	**Yes**
Industry FE	**No**	**Yes**
R-squared	**5.93%**	**9.76%**
Observations	**1644**	**1644**

Table 7 presents the results of the analysis concerning passive and active institutional ownership, where Columns [1] and [2] are as follows:

[1] $CAR_{it} = \gamma_0 + \gamma_1 * UE\_adj + \gamma_2 * YEAR\_2020 + PASSIVE_i + \gamma_4 * UE\_adj * YEAR\_2020 + \gamma_5 * UE\_adj * PASSIVE_i + \gamma_6 * YEAR\_2020 * PASSIVE_i + \gamma_7 * UE\_adj * YEAR\_2020 * PASSIVE_i + \gamma_n * \sum controls + u$

[2] $CAR_{it} = \gamma_0 + \gamma_1 * UE\_adj + \gamma_2 * YEAR\_2020 + \gamma_3 * PASSIVE_i + \gamma_4 * UE\_adj * YEAR\_2020 + \gamma_5 * UE\_adj * PASSIVE_i + \gamma_6 * YEAR\_2020 * PASSIVE_i + \gamma_7 * UE\_adj * YEAR\_2020 * PASSIVE_i + \gamma_n * \sum controls + Industry\ FE + u$

[1] and [2] are triple-interaction ERCs in which the coefficient of interest is the interaction $UE\_adj * YEAR\_2020 * PASSIVE_i$, measuring the incremental effect of Passive Ownership on CAR during the Covid-19 pandemic.

*** Statistically significant at 1% level.

** Statistically significant at 5% level.

* Statistically significant at 10% level.

Table 8: Robustness Test 1 – Attenuation effect (Equation 14)

	CAR Estimated coefficients (p-value, two tailed)
UE_adj	0.074^{***}
	(0.002)
YEAR_2020	0.014^{***}
	(0.008)
YEAR_2020_POST	0.000
	(0.808)
YEAR_2021	-0.019^{**}
	(0.012)
UE_adj * *YEAR_2020*	-0.032^{**}
	(0.019)
UE_adj * *YEAR_2020_POST*	-0.028^{**}
	(0.050)
UE_adj * *YEAR_2021*	-0.023^{***}
	(0.004)
Log(TOTAL ASSET)	-0.001
	(0.689)
MTB	-0.013
	(0.196)
BETA	0.007
	(0.198)
1 / N_ANALYSTS	-0.038
	(0.073)
INTERCEPT	0.012
	(0.427)
Wald tests	
$\alpha_5 < \alpha_6$	5.569
	(0.009)
$\alpha_6 < \alpha_7$	6.920
	(0.004)
Robust SE	**Yes**
R-squared	**3.41%**
Observations	**8393**

Table 8 presents the results of the first robustness test (Equation 14), checking whether the reduction in earnings informativeness documented continues after the time window considered in the main analysis. To estimate this model, the sample period is extended to May 2021, and two new dummies are introduced: ***YEAR_2020_POST*** equals one if the data refers to the time window between June and December 2020, just after the main model's reference period, and zero otherwise. ***YEAR_2021*** equals one if the data refers to the time window between February and May 2021 and zero otherwise. The coefficients of interest are the interactions ***UE_adj * YEAR_2020_POST*** *(α_6)* and ***UE_adj * YEAR_2021*** *(α_7)*. If greater in magnitude than UE_adj * YEAR_2020 *(α_5)*,

these are consistent with the main model's effect of losing strength over time.
*** Significant at 1% level;
** Significant at 5% level;
* Significant at 10% level.

Table 9: Robustness test 2 – Alternative specifications of UE

	[1] *CAR* *Estimated coefficients (p-value, two tailed)*	*[2]* *CAR* *Estimated coefficients (p-value, two tailed)*	*[3]* *CAR* *Estimated coefficients (p-value, two tailed)*
UE’	0.643**		
	(0.027)		
UE’’		0.045*	
		(0.019)	
UE’’’			0.055*
			(0.031)
YEAR_2020	0.021**	0.027*	0.023*
	(0.020)	(0.023)	(0.025)
*UE’ * YEAR_2020*	-0.522**		
	(0.035)		
*UE’’ * YEAR_2020*		-0.012	
		(0.076)	
*UE’’’ * YEAR_2020*			-0.025
			(0.077)
Log(TOTAL ASSET)	-0.004	-0.004	-0.004
	(0.154)	(0.248)	(0.254)
MTB	0.000	-0.004	-0.000
	(0.984)	(0.646)	(0.857)
BETA	0.003	0.001	0.0024
	(0.890)	(0.959)	(0.891)
1/n_ANALYSTS	-0.016	-0.007	-0.014
	(0.567)	(0.876)	(0.819)
INTERCEPT	0.037	0.029	0.034
	(0.069)	(0.114)	(0.134)
Robust SE	**Yes**	**Yes**	**Yes**
Observations	**2819**	**2671**	**2918**

Table 9 presents the results of the second robustness test, which investigates whether the reduction in the informativeness of earnings documented in the main model is robust with different specifications of the main independent variable UE. In column [1], UE is specified without the scaling of the standard deviation of the analysts’ forecasts. In column [2], UE is scaled by the logarithm of the total assets in place of the share price (prccq). Column [3] presents the last available EPS forecast in place of the mean consensus EPS.

*** Statistically significant at 1% level.
** Statistically significant at 5% level.
* Statistically significant at 10% level.

Table 10: Robustness Test 3 – Controlling for analysts' forecast dispersion (Equation 19)

	[1] *CAR* *Estimated Coefficients (p-value, two-tailed)*
UE	0.815**
	(0.030)
YEAR_2020	0.016**
	(0.037)
*UE * YEAR_2020*	-0.570*
	(0.055)
DISPERSION	0.659**
	(0.038)
*DISPERSION * YEAR_2020*	0.148
	(0.125)
Log(TOTAL ASSET)	-0.005
	(0.225)
MTB	0.009
	(0.404)
BETA	-0.002
	(0.821)
1/n_ANALYSTS	-0.022
	(0.729)
INTERCEPT	0.043
	(0.179)
Robust SE	**Yes**
R-squared	**3.09%**
Observations	**2695**

Table 10 displays the results of the third robustness test (Equation 19), investigating whether the reduction in earnings informativeness documented in the main model is robust with the inclusion of analysts' forecast dispersion as a separate conditioning factor in the earnings response coefficient regression.

*** Statistically significant at 1% level.

** Statistically significant at 5% level.

* Statistically significant at 10% level.

LIST OF FIGURES

Figure 1: World Uncertainty Index graphical representation

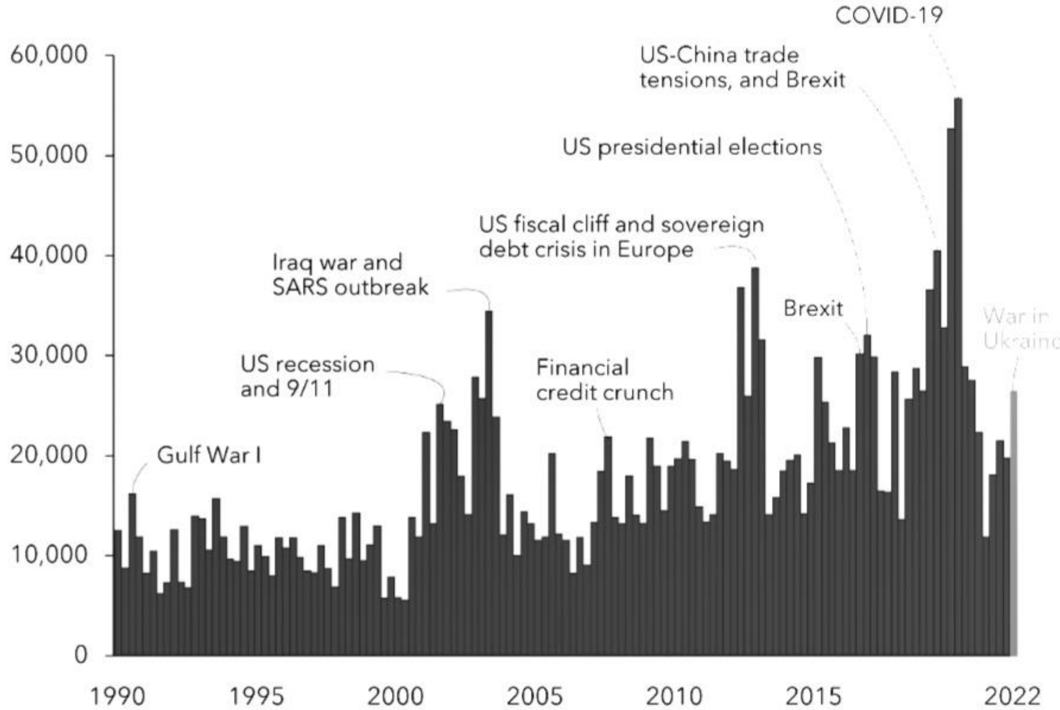

Figure 1: "World Uncertainty Index" graphical representation. The chart has been computed by determining the use percentage of the word "uncertain" (or its variant) in the Economist Intelligence Unit country reports. The index has been rescaled by multiplying it by 1,000,000. A higher number indicates higher uncertainty, and vice versa. (source: Ahir et al., 2022).

Figure 2: Research setting timeframe configuration

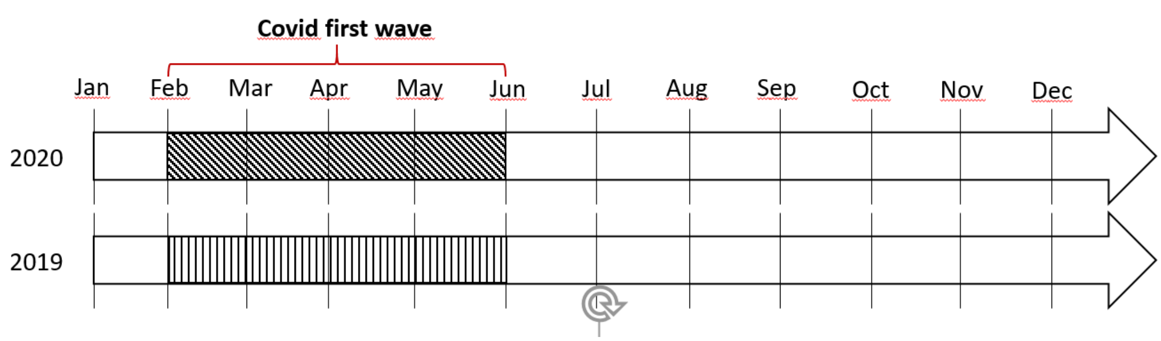

Figure 2 plots the time setting of the earning response coefficient regressions. The treatment time period corresponds to the timeframe of the COVID-19 first wave, specifically from February 2020 to June 2020 (YEAR_2020 = 1). The baseline is for the same timeframe but in the previous year, specifically from February 2019 to June 2019. The latter is a good baseline because it is not characterized by any particular market turbulence. Thus, it is a good proxy for ongoing concerns when assessing the informativeness of accounting numbers in normal circumstances.