Audit quality and COVID-19 restrictions

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Abstract

Purpose – This study aims to examine declines in audit quality after the COVID-19 travel restrictions/stay-at-home orders were issued in the USA in early 2020.

Design/methodology/approach – Taking advantage of variation in the dates of stay-at-home orders issued by different US states, this study identifies engagements that were significantly affected by the lock down orders.

Findings – The results suggest that engagements affected by the restrictions produced lower audit quality, as measured through restatements and discretionary accruals, relative to those completed before COVID-19 travel restrictions/stay-at-home orders. Further analysis reveals that this decrease in audit quality was attributable to firms with high inventory relative to assets, high R&D expenses relative to assets and non-Big 4 auditors.

Practical implications – This study finds that the restrictions on physical and on-site interaction caused auditors to universally struggle with resource/judgment-intensive accounts such as inventory and R&D expenditures. The results suggest that while Big 4 auditors managed to maintain their status quo level of audit quality following COVID-19 restrictions, non-Big 4 auditors were unable to overcome the challenges of an online work environment and their audit quality declined.

Originality/value – To the best of the authors' knowledge, this paper is the first to empirically examine changes in audit quality as a response to a substantial change in auditors' working environment due to the global health crisis. As work-from-home becomes more prevalent in audit firms, the results suggest that, on average, this move does diminish audit quality.

Keywords Audit quality, COVID-19, Travel restrictions, Stay-at-home orders, Big 4 auditors, Non-Big 4 auditors

Paper type Research paper

1. Introduction

The COVID-19 pandemic imposed significant challenges upon all industries. Public accounting and the auditing of publicly listed companies were no exception. Due to safety and public health concerns, many countries placed restrictions on international and domestic travel. In the USA, many states issued stay-at-home orders to discourage individuals from going out. With these strict travel restrictions in place, it became difficult, if not impossible, for auditors to complete audit engagements by using their customary

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procedures for evidence collection. These procedures usually include activities such as inspecting physical assets or making inquiries, having discussions and meeting with managers, all of which benefit from in-person interactions with clients on their premises. Instead, auditors were tasked with switching to an online work environment, with minimal physical contact between audit team members and clients. As a result, auditors had few opportunities to collect firsthand information and obtain direct audit evidence. Instead, they had to rely on the information that could be provided through contactless delivery by the client or third parties, electronic documentation and online interactions.

Given this drastic change, an important question to investigate is whether the abrupt shift to a remote work environment during the COVID-19 pandemic influenced the quality of the audits conducted under these tumultuous circumstances, and if so, which firms were most affected. Answering these questions may help investors, regulators, as well as broad financial information users to better understand how the quality of financial statement audits was affected by the pandemic restrictions. To the best of our knowledge, while there have been some studies exploring theoretical predictions on the impact of the pandemic on audit quality (Albitar *et al.*, 2021), there has not been any empirical studies to examine the impact. Our study aims to fill the gap.

Fieldwork is a well-established industry practice for auditors. Auditing usually requires a plethora of face-to-face interactions with clients (Malhotra and Morris, 2009). Previous studies have shown positive returns for auditors who are geographically close to their clients (Beck *et al.*, 2019; Choi *et al.*, 2012; Dong *et al.*, 2018). Without physical access to clients and their on-site resources, we expect auditors to be severely disadvantaged. While accounting firms have adopted different strategies to ensure that their auditors can continue to perform high-quality audit services, many of these procedures lack the historical track record of success that on-site fieldwork has. Firms' strategies to replace traditional fieldwork include replacing physical meetings with remote ones, and increasing their frequency of communication with firm managers, audit committees and other engagement teams (PCAOB, 2020b). In place of physical inspection of assets, some firms have adopted virtual inventory observations (PCAOB, 2020b). While these measures may constitute the best option given the circumstances, the lack of in-person interaction limits the effectiveness of information exchange. Additionally, virtual inspections make it difficult for auditors to collect the direct evidence needed for proper verification. Further, auditors were forced to rely more on client provided information, and their audit procedures were more likely to be constrained by the information supplied by clients, rather than the information they could have collected themselves had they been able to work on-site. The lack of access to firsthand audit evidence may contribute to difficulties in risk assessment, and to auditors' ability to challenge managers' decisions surrounding discretionary accounts. As a result, audit quality might be compromised by the COVID-19 restrictions.

At the same time, the challenges of an online working environment may inspire auditors to raise their professional skepticism if they expect investors and regulators to scrutinize audited financial statements produced under challenging and uncertain circumstances. For example, the public company accounting oversight board (PCAOB) published a reminder for audits near completion in April 2020, in which regulators expected auditors to meet their obligations regarding compliance with PCAOB standards for exercising professional skepticism (PCAOB, 2020a). The PCAOB also released a second report that included staff observations after reviewing some interim financial statements and reiterated the importance of compliance with PCAOB standards (PCAOB, 2020b). Investors may also have had increased concerns regarding financial statement quality during this time. Given the volatile equity markets during the pandemic, ensuring high-quality financial statements is

essential for effective decision making. Under the heightened monitoring of investors and regulators, auditors may increase their professional skepticism and standard of due care, which could offset any drop in audit quality discussed previously.

To investigate the impact of the change in working conditions after COVID-19 restrictions on audit quality, we examine the audited financial statements of US firms submitted to the securities and exchange commission (SEC) before and after the introduction of travel restrictions by individual US states in March/April 2020. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic [1]. Many states immediately issued stay-at-home orders; others delayed the announcement of restrictions, and still others issued no restrictions at all. The staggered timing of stay-at-home orders across the United States created a series of exogenous shocks against auditors' ability to perform their work on-site. Given this, we adopt a difference-in-difference approach and link the change in audit quality to the change in auditors' working environment.

We find that after the implementation of stay-at-home orders, audit quality decreased. On average, firms that filed 10-Ks 7 or 14 days after the stay-at-home order was issued were more likely to issue restatements and had higher abnormal accruals. This is possibly due to auditors losing the opportunity to communicate face to face with managers and the possible forgoing of some outstanding fieldwork due to restrictions. To mitigate the concern that firms with decreases in audit quality post COVID-19 restrictions may be those with naturally lower audit quality relative to the population, we create a matched sample using only treated firms that filed 10-Ks for the year 2019 at least seven days after the issuance date of lockdown orders and observations for those same firms from 2018. If those firms produce consistently lower audit quality, then we should expect no significant change in their audit quality year-to-year. Our result indicates that the treated firms experienced significant decreases in audit quality post COVID-19 restrictions. Since the benchmark is the same firms' audit quality from 2018, this provides further supporting evidence to our findings that the sudden shift to a remote working environment decreased audit quality in 2019.

In cross-sectional tests, we find that firms are affected in different ways by stay-at-home orders. First, we find that engagements with higher inventories experienced a significant decrease in audit quality. This is consistent with engagements with a greater number of assets requiring physical inspection being negatively affected by the transition to online work. This is intuitive as physical inspection relies on firsthand audit evidence and may not be effectively replaced by virtual observation.

Second, we find that engagements with higher R&D expenditures experienced a decrease in audit quality. This suggests that engagements with more discretionary accounts, or accounts requiring inquiry and/or interaction with client management, were negatively affected by the shift to online work. Without flexible and direct access to management and other personnel on-site, auditors may have had insufficient time or opportunity to comprehend, question and challenge their clients on matters requiring judgement. The results suggest that increases in professional skepticism can only aid audit quality to the extent that auditors can make decisions that do not depend on physical inspection or extensive information exchange with clients during face-to-face communication.

Finally, we find that most of the decrease in audit quality is attributable to non-Big 4 firms, while Big 4 firms' audit quality remained statistically unchanged following the announcement of stay-at-home orders. The decrease in audit quality being driven by non-Big 4 auditors suggests that non-Big 4 auditors were not able to adapt to the sudden shift to remote working as swiftly and successfully as Big 4 auditors.

Our paper contributes to the literature by providing evidence on how audit quality responds to changes in working conditions. To the best of our knowledge, our paper is the first to empirically examine changes in audit quality as a response to auditors' experiencing a substantial change in their working environment due to the global health crisis. As work-from-home becomes more prevalent within audit firms, our results suggest that, on average, this move does diminish audit quality. While larger audit firms appear capable of adapting quickly to changes and managing to maintain their audit quality levels, smaller non-Big 4 firms show evidence of some challenges when tasked with shifting their audit process to the remote working environment. Additionally, for clients with accounts requiring physical inspection or complex and discretionary accounts, investors and regulators may need to pay closer attention as audit quality is likely to suffer in those engagements.

The remainder of this paper is organized as follows. Section 2 discusses the literature and presents the hypotheses. Section 3 outlines the data and methodology. Section 4 analyzes the results. Section 5 concludes this study.

2. Literature review and hypothesis development

The traditional auditing method is through fieldwork, which consists predominantly of in-person interactions and on-site evidence collection and analysis. Auditors require physical access to clients' premises and work closely with client personnel. Face-to-face interactions are frequent and necessary for the auditors to collect both quantitative and qualitative evidence. Bennett and Hatfield (2013) surveyed staff-level auditors and found that 86% of staff auditors met with management at least three to five times per week when conducting fieldwork, and 37% of auditors said that they met with management every day. This would suggest that being geographically close and having physical access to clients is critical to the audit process. Extant literature has shown that geographical proximity can aid auditors and their ability to make audit-related decisions by facilitating information exchange between auditors and clients. Choi *et al.* (2012) document that local auditors, defined based on the geographic proximity between auditors and clients, deliver higher audit quality than non-local auditors. Dong *et al.* (2018) examine the relationship between geographic proximity and audit report timeliness and find that audit reports are timelier for auditors that are geographically close to their clients. Francis *et al.* (2021) investigate the distance between audit partners and clients and provide evidence that audit quality is negatively related to the geographic distance between audit partners and the clients they audit. Additionally, they find that the negative association is mitigated when there are direct flights available between partners' locations and their clients' headquarters, which indicates the importance of face-to-face interaction and ease of physical access in the audit process. Beck *et al.* (2019) argue that the decentralization of audit firms increases the proximity between auditors and clients, although it comes at cost of reduced proximity between audit offices. They provide evidence that small offices that are geographically close to clients and large offices within the same firm deliver high audit quality. Overall, industry practice and academic evidence document that in-person contact and communication with clients is important for auditors to perform audits effectively and deliver high audit quality.

Following the travel restrictions that took effect at the beginning of the pandemic, the benefits of geographic proximity were lost as most auditors were forced to switch from face-to-face interactions to strictly virtual communication with their clients. Auditors could not travel to clients' workplaces and lost the opportunity for in-person interactions with their clients. Instead, auditors had to communicate with their clients remotely through email or phone, which could have a significant impact on auditors' decision-making and judgment. Even prior to the pandemic, audit partners, in a survey conducted by Bennett and Hatfield (2013),

voiced concern that more young auditors than ever relied upon computer-medium-communications (CMCs) to connect with clients. Their concern was that the reduction of face-to-face interactions would hamper the auditors' ability to build a relationship with clients and collect evidence from them. Previous literature also provides evidence that using more electronic communications could affect the audit process and thus audit results. For example, Bennett and Hatfield (2018) find that when auditors communicate electronically with client managers, they tend to ask fewer follow-up questions, have a shorter interaction and avoid "back and forth" conversations. They also find that auditors request more documents if they communicate electronically, despite asking fewer questions. This additional documentation could enrich auditors' analyses and improve the review process.

The method of communication can also affect clients' responses to auditors' inquiries. Saiewitz and Kida (2018) find that managers tend to provide information that supports their positions when they receive email inquiries compared to inquiries that come through audio or phone requests. Managers have more time to react to and structure their responses to email inquiries; virtual meetings or phone calls made managers more likely to react spontaneously.

On the other hand, given the unprecedented nature of the pandemic, auditors may have anticipated financial statements released during this time period to be under greater scrutiny. Previous literature has shown that auditors responded to the financial crisis by increasing their effort (Xu *et al.*, 2013;Geiger *et al.*, 2014). Kend and Nguyen (2022) examine auditing procedures undertaken by audit firms in Australia during the initial year of the pandemic and find that some firms adopted audit procedures specially designed to address audit risk associated with the pandemic, which possibly had a positive impact on audit quality. Additionally, investors and regulators may pay close attention to financial statements due to the uncertainty brought on by the pandemic. Higher accountability to investors and regulators can increase auditors' professional skepticism (Boyle and Carpenter, 2015; Kathy Hurtt *et al.*, 2013), which is essential to effective audit under PCAOB standards (PCAOB, 2012). Kim and Trotman (2015) document that auditors increase their level of professional skepticism when they face higher accountability to justify their judgment process. Sayed Hussin *et al.* (2017) find that professional skepticism is positively related to auditors' assessment of the risk of material misstatements. Increased professional skepticism can also motivate auditors to question managements more and conduct additional evidence assessments as well as reviewing processes more rigidly, resulting in higher audit quality (Carpenter and Reimers, 2013).

Given the opposing arguments, *ex ante* it is not clear how audit quality would change after the shift in auditors' working environment due to COVID-19. Therefore, we present our first hypothesis in null form as follows:

H1. Following the implementation of COVID-19 travel restrictions, audit quality remained unchanged.

For clients with a significant amount of tangible assets, auditors need to conduct a physical inspection to verify the existence, valuation and ownership of accounts asserted on the balance sheet. Although auditors can conduct virtual inventory and property, plant, and equipment inspections through online tools, they cannot replicate the thoroughness of in-person physical inspections. Moyes (1997) surveyed auditors and find that methods involving direct evidence collection, such as in-person viewing inventory in public warehouses, are more effective in detecting fraud than indirect evidence collection, such as discussing the inventory cycle with managers. Virtual observation does not give auditors the ability to collect firsthand direct evidence, interact with the underlying assets and

evaluate controls organically after examining the premises. Inquiries based on virtual inspection are therefore less likely to be as well informed. Appelbaum *et al.* (2020) discusses alternative approaches to conducting inventory audits during and after the pandemic using virtual tools, such as streaming video applications, and cautions that detecting details, such as damage to inventory, may be more difficult compared to physical inspection. Durkin *et al.* (2021) show that auditors are more distracted when they use rich communication modes, such as video conferencing, with their clients and that distracted auditors are more likely to evaluate clients' responses as high quality and tend to ask fewer follow-up questions. For those reasons, we expect the audit quality of engagements with assets significantly comprised inventory to decrease more than engagements with low inventory following the shift to the online work environment. Our second hypothesis is stated as follows:

H2. Engagements with inventory representing a significant proportion of assets experienced a greater decrease in audit quality than engagements with lower inventory, following the implementation of COVID-19 travel restrictions.

Accounts involving a significant amount of judgment, such as R&D expenses, require special attention and scrutiny from auditors (Godfrey and Hamilton, 2005). Managers may use their discretion either to misreport or bias R&D expenses to hide their innovation activities from their competitors (Koh and Reeb, 2015). Even if these accounts are represented faithfully, auditors need to verify the valuations and the substance of the expenses classified as R&D through follow-up inquiries and discussions with managers. The inability to perform these in-person tasks can significantly harm audit quality, given that previous literature suggests that auditors are less skeptical if they use CMC with clients and cannot observe the nonverbal cues associated with deception or fraud (Bennett and Hatfield, 2018). In addition, managers can structure their responses and strategize to present information more tactically before replying to emails or returning phone calls. Therefore, we expect firms with significant R&D expenses to experience a larger decrease in audit quality than firms with lower R&D expenses. Our third hypothesis is as follows:

H3. Engagements with a significant proportion of R&D expenses experienced a greater decrease in audit quality than engagements with lower R&D expenses, following the implementation of COVID-19 travel restrictions.

Finally, Big 4 and non-Big 4 firms may differ in their ability to respond quickly and appropriately to the shift towards an online work environment. Previous literature has established that Big4 and non-Big 4 firms have different attributes (Daoust *et al.*, 2020), and Big 4 firms provide higher audit quality on average than non-Big 4 firms (DeFond and Zhang, 2013; Alareeni, 2018). Big 4 firms provide their employees with more resources for training and learning than non-Big 4 firms (Che *et al.*, 2020). Big offices in Big 4 firms also have more in-house consultants and experts, so auditors in these offices have more internal support (Francis and Yu, 2009). Hence, when faced with the challenges of conducting audits in an online working environment, we could expect Big 4 firms to adapt more rapidly to the changes; non-Big 4 firms generally may lack the resources and human capital to react quickly and maintain their audit quality. As a result, the impact of travel restrictions on Big 4 firms should be less negative than on non-Big 4 firms. Our final hypothesis is as follows:

H4. Relative to Big 4 firms, the audit quality of non-Big 4 firms was more negatively affected by the implementation of COVID-19 travel restrictions.

3. Data and methodology

3.1 Model specification and variable construction

Following previous literature (Beck *et al.*, 2019; Choi *et al.*, 2012), we estimate the following model to examine the change in audit quality after the implementation of COVID-19 travel restrictions:

$$AQ_{i,t} = \alpha + \beta_1 POST + \gamma_i' X + \varepsilon_{i,t} \quad (1)$$

Where $AQ_{i,t}$ is firm i's audit quality in year t. We use restatements issued (*RESTATE*) and the absolute value of abnormal accruals (*ABS_ACC*) as the proxies for audit quality (*AQ*). *RESTATE* equals 1 if a firm issued restatement(s) after filing 10-Ks and 0 otherwise. *ABS_ACC* is calculated using the Jones model controlling for firm performance (Francis and Yu, 2009; Jones, 1991; Kothari *et al.*, 2005). *POST* is a dummy variable that equals 1 if the filing date of a firm's 10-K is at least seven days later than the stay-at-home order issuance date in the auditor's state and 0 otherwise. While we cannot directly access the underlying audit timelines, this seven-day lag period should be sufficiently long such that audit work is still likely to be ongoing when restrictions are put in to effect [2]. As a robustness check, we also define *POST* as a dummy variable that equals 1 if the filing date of a firm's 10-K is at least 14 days later than the stay-at-home order issuance date in the auditor's state and 0 otherwise. Any filing more than seven or 14 days after the issuance of stay-at-home orders should correspond with audits that have not yet been completed at the time of the announcement of restrictions. Therefore, these audits are most likely being affected by the switch to an online audit environment.

$\boldsymbol{X}$ is a vector of control variables. Following previous literature (Becker *et al.*, 1998; DeFond and Jiambalvo, 1994), we include client firm size (*Size*) and debt ratio (*Lev*) as control variables. Firms may have different incentives to manipulate accruals when they report profit or loss, so we also include a dummy variable *Loss* as a control variable. Firms that experience sales growth are likely to experience time discrepancies between revenues and expenses as well as large deviations between book values and market valuations, which could lead to significant changes in accruals. Hence, we control for one-year sales growth (*Sgrowth*) and book-to-market ratio (*BTM*) (Menon and Williams, 2004). Several studies show that Big 4 firms can better mitigate earnings management (Krishnan, 2003a, 2003b), so we also include a dummy variable *Big4*. To control for audit effort intensity, we include account receivables plus inventory scaled by total assets (*Arins*) since these two accounts are resource intensive, typically requiring a significant amount of physical and document inspection. To control for the volatility of sales revenue and cash flow, we include cash flow (*CF*), the standard deviation of cash flow (*Std_cf*) and the standard deviation of revenue (*Std_rev*) as control variables. Finally, we include lagged accruals (*Lagacc*) as a control variable. When firms switch to a different auditor, the audit quality may also be affected (Deis and Giroux, 1996). Thus, we also include a dummy variable *Aud_C* to control for the impact of auditors' change on audit quality. Definitions of all variables are listed in Appendix. Year, industry and state fixed effects are also included for all analyses to control for unobserved time, industry or state varying effects. Standard errors are clustered by state.

3.2 Sample selection and data descriptions

To exclude any shock or uncertainty to firm performance brought on by COVID-19, we examine publicly listed companies in the USA for the fiscal year 2019. Firms' performance in 2019 should not be affected by the pandemic given that the first reported case of COVID-19 in the USA was confirmed on January 21, 2020 [3]. However,

firms' audit quality for their 2019 annual reports might be affected by COVID-19 travel restrictions. We also include firm observations from the fiscal year 2018 as the benchmark group. To create consistent timelines for 10-K filings, we restrict the sample to firms with a fiscal year-end of December. As firms are required to file their 10-Ks with the SEC within 90 days after their fiscal year-end, the auditing process may still be ongoing for many firms when the stay-at-home orders were issued. The dates of the stay-at-home orders issued by different US states were manually collected from state government websites. We then identify engagements with filing dates at least seven days later than the stay-at-home order issuance date, as those engagements were significantly affected by the lockdown orders. Because we are investigating the effect of restrictions on auditors, the location associated with each observation is that of the audit office. Fiscal data were retrieved from Compustat. Restatement data, filing dates, as well as auditor office data, were collected from Audit Analytics. Consistent with the literature on abnormal accruals, we drop firms in the financial sector (SIC code 6000–6999) and utilities (SIC code 4900–4999). The final sample consisted of 3,577 observations.

Table 1 presents the descriptive statistics for the sample. Panel A displays statistics for the full sample, whereas Panel B compares observations pre and post travel restrictions. During our sample period, on average, 3.6% of firms issued restatements [4]. The mean and median of absolute values of abnormal accruals are 0.347 and 0.099. For the fiscal year 2019, around 11% of firms filed their 10-Ks at least seven days after their auditors' state lockdown/stay-at-home order issuance dates [5]. Around 6.2% of firms filed their 10-Ks at least 14 days after their auditors' state lockdown/stay-at-home order issuance dates. The average leverage ratio of sample firms is 26.1%. Almost half of the sample firms experienced income loss during our sample period, while around 27.8% of firms experienced positive sales growth. The average cash flow of sample firms is negative, while the median cash flow is positive. The standard deviation of cash flow is 0.214, while the standard deviation of sales growth is smaller at 0.191. The average BTM is 0.327. Sample firms also have average accounts receivable plus inventory as 20.6% of total assets. Around 62.5% of firms are audited by Big 4 firms. All continuous variables are winsorized at the 1st and 99th percentile.

When examining the differences in the descriptive statistics partitioned by the treatment, we do notice some stark differences between the treated ($POST = 1$) and the untreated ($POST = 0$) groups. Both audit quality proxies report significantly higher results for the treated group, suggesting that we are likely to find a negative association between the treatment and audit quality. Treated observations are also significantly smaller in size, more likely to have generated a net loss, have lesser cash flows, smaller BTM ratios, greater receivables and inventory relative to assets, are less likely to have used a Big 4 auditor and are more likely to have undergone an auditor change. Generally, these treated groups with later 10-K filing dates are smaller, less established companies. This is consistent with prior literature on expected audit lag (Durand, 2019). It is important to note that their leverage ratios and sales growth are comparable to their larger counterparts, so their financial health is not necessarily of great concern for audit purposes. Therefore, it falls to the empirical analysis to determine whether the documented differences in independent variables between the treated and untreated groups can explain the difference in audit quality, or if the reductions observed in audit quality for the treated group are the result of the COVID-19-related restrictions.

Panel A: Full sample descriptive statistics

Variable	N	Mean	SD	P25	Median	P75
RESTATE	3,577	0.036	0.186	0	0	0
ABS_ACC	3,292	0.158	0.189	0.036	0.087	0.208
POST	3,577	0.055	0.227	0	0	0
Size	3,577	6.072	2.659	4.388	6.371	7.896
Lev	3,577	0.261	0.268	0.036	0.207	0.389
Loss	3,577	0.506	0.500	0	1	1
Sgrowth	3,577	0.278	0.804	−0.046	0.068	0.222
CF	3,577	−0.135	0.709	−0.103	0.053	0.111
Std_cf	3,577	0.214	0.782	0.024	0.049	0.127
Std_rev	3,577	0.191	0.276	0.049	0.101	0.204
Lagacc	3,577	−0.295	1.498	−0.144	−0.068	−0.023
BTM	3,577	0.327	1.331	0.115	0.334	0.702
Arins	3,577	0.206	0.178	0.064	0.167	0.297
Big 4	3,577	0.625	0.484	0	1	1
Aud_C	3,577	0.086	0.280	0	0	0

Panel B: Descriptive statistics partitioned based on treatment

	POST = 1	*POST* = 0	
Variable	Mean	Mean	Difference
RESTATE	0.097	0.032	0.065***
ABS_ACC	0.267	0.153	0.114***
Size	2.843	6.258	−3.414***
Lev	0.241	0.262	−0.021
Loss	0.836	0.487	0.349***
Sgrowth	0.362	0.273	0.089
CF	−0.633	−0.107	−0.526***
Std_cf	0.660	0.188	0.472***
Std_rev	0.373	0.181	0.192***
Lagacc	−0.863	−0.262	−0.601***
BTM	−0.377	0.368	−0.744***
Arins	0.244	0.204	0.040***
Big 4	0.123	0.654	−0.531***
Aud_C	0.215	0.078	0.137***

Table 1.
Descriptive statistic

Table 2 presents Pearson's correlation metrics of all variables used in our tests. Both *RESTATE* and *ABS_ACC* are positively correlated to *POST*, and the correlation is significant at the 1% level. It suggests that COVID-19 restrictions are associated with decreased audit quality. Client size is negatively related to *RESTATE* and *ABS_ACC*, which is consistent with big firms having higher audit quality. *Sgrowth* is positively related to *ABS_ACC*, which is not surprising since firms with positive sales growth may also experience large changes in accruals. The standard deviation of cash flow (*Std_cf*) and sales revenue (*Std_rev*) are both positively related to *ABS_ACC*. Firms with higher accruals in a prior year are less likely to have restatements, as evidenced by the negative and significant correlation between *RESTATE* and *Lagacc*. *BTM* is negatively related to *ABS_ACC*, which suggests that high growth firms tend to have high abnormal accruals. *Big4* is negatively correlated with both *RESTATE* and *ABS_ACC*, which is consistent with previous findings that Big 4 firms on average deliver higher quality audits. *Aud_C* is positively related to *RESTATE* and *ABS_ACC*, suggesting firms that switched to new auditors are more likely to have restatements and higher abnormal accruals.

Table 2.
Pearson's correlation table

VARIABLES	*RESTATE*	*ABS_ACC*	*POST*	*Size*	*Lev*	*Loss*	*Sgrowth*	*CF*	*Std_cf*	*Std_rev*	*Lagacc*	*BTM*	*Arins*	*Big 4*	*Aud_C*
RESTATE	1.000														
ABS_ACC	0.005	1.000													
POST	0.081***	0.173***	1.000												
Size	−0.028	−0.329***	−0.291***	1.000											
Lev	0.008	0.004	−0.016	0.210***	1.000										
Loss	0.025	0.124***	0.159***	−0.483***	−0.022	1.000									
Sgrowth	−0.000	0.088***	0.019	−0.104***	−0.019	0.111***	1.000								
CF	−0.012	−0.321***	−0.171***	0.519***	−0.026	−0.323***	−0.099***	1.000							
Std_cf	−0.009	0.338***	0.129***	−0.372***	−0.049**	0.188***	0.158***	−0.512***	1.000						
Std_rev	0.016	0.271***	0.161***	−0.403***	0.009	0.148***	0.019	−0.256***	0.354***	1.000					
Lagacc	−0.035*	−0.305***	−0.083***	0.305***	0.057***	−0.143***	−0.132***	0.438***	−0.641***	−0.313***	1.000				
BTM	−0.022	−0.188***	−0.126***	0.197***	−0.254***	−0.112***	−0.019	0.228***	−0.159***	−0.160***	0.161***	1.000			
Arins	0.002	−0.031	0.054**	−0.121***	−0.092***	−0.108***	−0.111***	0.023	−0.028	0.165***	0.031	−0.015	1.000		
Big 4	−0.058***	−0.207***	−0.248***	0.649***	0.163***	−0.253***	−0.012	0.251***	−0.187***	−0.266***	0.164***	0.054**	−0.132***	1.000	
Aud_C	0.044**	0.079***	0.110***	−0.216***	−0.064***	0.104***	0.014	−0.089***	0.069***	0.102***	−0.06***	−0.07***	0.045**	−0.22***	1.000

Notes: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

4. Results

4.1 Main results

We evaluate *H1* by estimating Model (1), and the results are presented in Table 3. Column (1) uses *RESTATE* as the dependent variable; Column (2) uses *ABS_ACC* as the dependent variable. The coefficient of our main interest is β_1, which is positive and statistically significant at the 5% level in both columns. This suggests that, on average, audit quality decreased following the implementation of COVID-19 travel restrictions. Because the sample is limited to fiscal years 2018 and 2019, where firm performance was unaffected by COVID-19, the change in audit quality post COVID-19 travel restrictions is unlikely to be attributable to the economic uncertainty brought by the pandemic. It appears that auditors were unable to adapt quickly to the remote working environment after lockdown orders and deliver higher audit quality post stay-at-home orders. The results suggest that auditors were negatively affected by the restrictions imposed on them from not being able to audit clients' assets on-site and having restricted access to client personnel. In untabulated results, we define *POST* as a dummy variable that equals 1 if the filing date of a firm's 10-K is at least 14 days later than the stay-at-home order issuance date in the auditor's state and 0 otherwise. We find the results are consistent with Table 3. The coefficient on *POST* is also positive and statistically significant at the 5% level.

The coefficients on control variables are largely consistent with previous literature. The coefficient on client size (*Size*) is insignificant in Column (1), but negative and significant in Column (2), which suggests that larger firms on average have higher audit quality. Firms with a higher leverage ratio have lower audit quality, as evidenced by the positive and significant coefficient on *Lev* in Column (2). The coefficient on *Loss* is insignificant in

Dependent variable	*RESTATE* (1)	*ABS_ACC* (2)
POST	0.067*** (2.783)	0.040*** (4.144)
Size	0.004 (1.560)	−0.014*** (−7.610)
Lev	0.006 (0.405)	0.021* (1.817)
Loss	0.007 (1.107)	−0.006 (−0.670)
Sgrowth	0.002 (0.581)	0.013*** (2.849)
CF	−0.001 (−0.200)	−0.030*** (−3.527)
Std_cf	−0.015*** (−7.040)	0.017 (1.366)
Std_rev	0.004 (0.280)	0.048*** (3.472)
Lagacc	−0.008** (−2.511)	0.014*** (4.331)
BTM	−0.001 (−0.170)	−0.004 (−1.579)
Arins	0.015 (0.632)	−0.026 (−1.214)
Big4	−0.021** (−2.640)	−0.015* (−1.683)
Aud_C	0.020 (1.180)	0.011 (1.388)
Year, Industry and State FE	Yes	Yes
Observations	3,577	3,290
R-squared	0.041	0.286

Notes: This table reports regression results using Model (1) as follows:

$$AQ_{i,t} = \alpha + \beta_1 POST + \gamma_i' X + \varepsilon_{i,t}$$

Column (1) uses *RESTATE* as the dependent variable, whereas Column (2) uses *ABS_ACC* as the dependent variable. X is a vector of control variables. See Appendix for variable definitions. Standard errors are clustered by state. t-stats are in parentheses. ***, **, *represent significance levels at 1, 5 and 10%, respectively

Table 3. Audit quality after the implementation of COVID-19 travel restrictions

Columns (1) and (2). The coefficient on *CF* is negative and significant in Column (2), which suggests that cash flow is negatively related to absolute abnormal accruals. The coefficient on the standard deviation of cash flow is negative and significant in Column (1), indicating that firms with a high standard deviation of cash flow have lower restatements. Firms that experienced more volatile changes in sales tend to have higher absolute abnormal accruals, as evidenced by the positive coefficient on *Std_rev* in Column (2). Firms with higher accruals in year *t-1* are less likely to have restatements, as evidenced by the negative and significant coefficient on *Lagacc* in Column (1). The coefficient on *BTM* is negative but insignificant in both Columns (1) and (2). Firms audited by Big 4 firms tend to have fewer restatements and lower abnormal accruals, as evidenced by the negative and significant coefficient on *Big4* in Columns (1) and (2).

One potential concern for our findings is that firms with decreases in audit quality post COVID-19 restrictions may be those with naturally lower audit quality relative to the population. To mitigate this concern, we create a matched sample using only treated firms that filed 10-Ks for 2019 at least seven days after the issuance date of lockdown orders and observations for those same firms from 2018. If those firms produce consistently lower audit quality, then we should expect no significant change in their audit quality year-to-year. This analysis helps to mitigate concerns over general differences between the treated and untreated groups. We re-estimate Model (1) with this matched sample and present the results in Table 4. The coefficient on *POST* using this matched sample is positive and statistically significant at the 5% level across both columns. Consistent with our results

Dependent variable	*RESTATE* (1)	*ABS_ACC* (2)
POST	0.070** (2.551)	0.039** (2.306)
Size	0.009 (0.681)	−0.013 (−1.527)
Lev	−0.009 (−0.165)	−0.030 (−0.628)
Loss	0.058 (1.051)	0.053 (1.170)
Sgrowth	−0.008 (−0.528)	0.017 (1.565)
CF	0.006 (0.427)	−0.029* (−1.966)
Std_cf	−0.022*** (−3.362)	0.018*** (3.448)
Std_rev	−0.028 (−0.582)	0.074** (2.259)
Lagacc	−0.019*** (−3.782)	0.020*** (4.997)
BTM	0.003 (0.346)	−0.020*** (−5.164)
Arins	0.009 (0.128)	−0.076 (−1.409)
Big4	−0.065 (−1.063)	−0.005 (−0.0867)
Aud_C	0.089** (2.212)	0.038 (1.505)
Industry and State FE	Yes	Yes
Observations	354	286
R-squared	0.165	0.407

Notes: This table reports regression results using model (1) in a subset of sample firms that filed 10-Ks at least seven days later than the issuance date of state lockdown orders as well as their 2018 observations as follows:

$$AQ_{i,t} = \alpha + \beta_1 POST + \gamma_i' X + \varepsilon_{i,t}$$

Column (1) uses *RESTATE* as the dependent variable while column (2) uses *ABS_ACC* as the dependent variable. $\boldsymbol{X}$ is a vector of control variables. See Appendix for variable definitions. Standard errors are clustered by state. t-stats are in parentheses. ***, **, *represent significance levels at 1, 5 and 10%, respectively

Table 4.
Audit quality after the implementation of COVID-19 travel restrictions (matched sample)

from Table 3, the result suggests that the treated firms experienced significant decreases in audit quality post COVID-19 restrictions. Since the benchmark is the same firms' audit quality from 2018, it is unlikely that the decline in audit quality observed in 2019 is due to any inherent predisposition for low audit quality. This provides further supporting evidence to our findings that the sudden shift to a remote working environment decreased audit quality in 2019.

4.2 COVID-19 restrictions and the auditing of resource/judgment intensive accounts

To test *H2*, we separate firms based on their inventory levels and run Model (1) separately. Firms are classified as having high (low) inventory if their inventory as a percentage of total assets is above (below) the median value [6]. Columns (1) and (3) of Table 5 report regression results using high inventory firms, whereas Columns (2) and (4) report regression results using low inventory firms. The coefficient on *POST* is positive and significant at the 5% level in Columns (1) and (3), which suggests that firms with high ratios of inventory to assets experienced a significant decrease in audit quality post COVID-19 restrictions. The coefficient on *POST* is positive and marginally significant at the 10% level in Columns (2) and (4). While low inventory firms also experience a decrease in audit quality, the decrease is marginally significant. The finding is consistent with auditors were negatively affected by being unable to conduct physical inspection in firms with high inventories. The result supports *H2* and suggests that auditors' assessment of physical inventories is obstructed when their travel and ability to inspect assets on-site is restricted.

Columns (5)–(8) of Table 5 present the results from tests of *H3*. We separate firms based on their R&D expenses and run Model (1) separately. Firms are classified as having high (low) R&D expenses if their R&D as a percentage of total assets is above (below) the median value. Columns (5) and (7) of Table 5 report regression results using high R&D firms, whereas Columns (6) and (8) report regression results using low R&D firms. In Columns (5) and (7), the coefficient on *POST* is positive and significant at the 5% level, suggesting that firms with high R&D experienced a decrease in audit quality after COVID-19 restriction took effect. The results are much weaker in low R&D firms. The coefficient on *POST* is positive but insignificant in Column (6), and positive but marginally significant in Column (8). Overall, these results suggest that audit quality decreased significantly post COVID-19 restrictions for firms with higher R&D expenditures. This finding is consistent with *H3*. Audit quality is harmed when clients have a higher composition of discretionary accounts that require judgment and auditors have reduced access to client personnel. Without the organic in-person setting for inquiry, the depth of the discussions is reduced and knowledge transfers are not as effective, limiting auditors' ability to correctly value and interpret underlying accounts/transactions.

4.3 COVID-19 restrictions and the Big 4/non-Big 4 auditors

Our final hypothesis to test is *H4* which examines whether Big 4 were affected differently from non-Big 4 firms by the abrupt transition to a remote working environment. We separate firms based on whether they are audited by Big 4 auditors and run Model (1) separately. Table 6 reports the results. Columns (1) and (3) report regression results using firms audited by Big 4 firms. Columns (2) and (4) report regression results using firms audited by non-Big 4 firms.

The coefficient on *POST* is positive but insignificant in both Columns (1) and (3), indicating on the one hand that audit quality in firms audited by Big 4 is not significantly affected by COVID-19 restrictions. On the other hand, the non-Big 4 firms are significantly affected by the COVID-19 restrictions. The coefficient on *POST* is positive and significant at

Table 5.
Cross-sectional tests: Changes in audit quality for resource/judgement intensive engagements

Dependent variable	*RESTATE* (1)	(2)	*ABS_ACC* (3)	(4)	*RESTATE* (5)	(6)	*ABS_ACC* (7)	(8)
POST	0.078** (2.521)	0.061* (1.971)	0.033** (2.235)	0.040* (1.733)	0.073** (2.497)	0.058 (1.135)	0.027*** (2.851)	0.052* (1.937)
Size	0.002 (0.657)	0.006** (2.121)	−0.009*** (−4.739)	−0.021*** (−5.954)	0.004 (1.270)	0.009* (1.705)	−0.015*** (−5.125)	−0.012*** (−4.285)
Lev	0.032 (1.061)	−0.012 (−0.596)	0.004 (0.287)	0.037* (2.013)	0.007 (0.461)	−0.003 (−0.115)	0.033** (2.164)	0.011 (0.455)
Loss	0.015 (1.653)	−0.001 (−0.078)	−0.004 (−0.530)	−0.013 (−0.951)	0.008 (0.977)	0.014 (1.330)	−0.008 (−0.708)	−0.002 (−0.222)
Sgrowth	−0.000 (−0.0123)	0.003 (0.813)	0.002 (0.254)	0.016*** (3.208)	0.000 (0.127)	0.007 (0.373)	0.015*** (3.337)	0.002 (0.127)
CF	0.016** (2.515)	−0.009 (−1.284)	−0.073*** (−6.578)	−0.004 (−0.333)	0.001 (0.150)	−0.013 (−0.598)	−0.024*** (−3.233)	−0.079*** (−3.145)
Std_cf	−0.008* (−1.781)	−0.018*** (−3.967)	0.007 (0.526)	0.021 (1.145)	−0.01*** (−3.108)	−0.035*** (−4.720)	0.009 (0.787)	0.104*** (6.070)
Std_rev	0.016 (0.859)	0.002 (0.0948)	0.091*** (6.768)	−0.027 (−1.029)	−0.003 (−0.246)	0.043 (1.581)	0.049** (2.110)	0.028 (0.974)
Lagacc	0.002 (0.633)	−0.012** (−2.441)	0.017* (1.874)	0.011*** (2.844)	−0.005 (−1.461)	−0.028*** (−6.708)	0.012*** (2.796)	0.050*** (4.279)
BTM	−0.006 (−1.409)	0.002 (0.407)	−0.005 (−1.230)	−0.006** (−2.055)	−0.001 (−0.214)	0.001 (0.377)	−0.008** (−2.081)	0.003 (0.746)
Arins	0.048 (1.376)	−0.035 (−0.946)	−0.012 (−0.424)	−0.011 (−0.164)	−0.019 (−0.755)	0.130*** (3.227)	−0.029 (−1.218)	−0.024 (−0.769)
Big4	−0.009 (−0.810)	−0.036*** (−3.469)	−0.016 (−1.551)	−0.008 (−0.547)	−0.019*** (−2.774)	−0.038 (−1.521)	−0.016 (−1.317)	−0.008 (−0.554)
Aud_C	0.026 (1.146)	0.017 (0.726)	0.007 (0.583)	0.015 (0.885)	0.032 (1.562)	−0.005 (−0.214)	0.012 (0.995)	0.012 (0.650)
Year, Industry and State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,787	1,788	1,721	1,566	2,417	1,155	2,187	1,098
R-squared	0.056	0.058	0.315	0.279	0.059	0.080	0.269	0.389

Notes: This table reports regression results using Model (1) as follows using firms split by their inventory and R&D expenses:

$$AQ_{i,t} = \alpha + \beta_1 POST + \gamma_i' X + \varepsilon_{i,t}$$

Columns (1), (2), (5) and (6) use *RESTATE* as the dependent variable, whereas Columns (3), (4), (7) and (8) use *ABS_ACC* as the dependent variable. High (low) inventory firms are classified as firms that have inventory scaled by total assets above (below) the median inventory scaled by total assets. High (low) R&D firms are defined as firms that have R&D expenses scaled by total assets above (below) the median R&D expenses scaled by total assets. Columns (1) and (3) report regression results in firms with high inventory, whereas Columns (2) and (4) report regression results in firms with low inventory. Columns (5) and (7) report regression results in firms with high R&D, whereas Columns (6) and (8) report regression results in firms with low R&D. $\boldsymbol{X}$ is a vector of control variables. See Appendix for variable definitions. Standard errors are clustered by state. t-stats are in parentheses. ***, **, * represent significance levels at 1, 5 and 10%, respectively

Dependent variable	*RESTATE* (1)	*RESTATE* (2)	*ABS_ACC* (3)	*ABS_ACC* (4)
POST	0.059 (1.062)	0.065** (2.278)	0.056 (0.777)	0.033** (2.340)
Size	0.004 (1.436)	0.004 (1.069)	−0.029*** (−3.432)	−0.022*** (−4.110)
Lev	−0.013 (−0.710)	0.023 (1.230)	0.141** (2.386)	0.018 (0.731)
Loss	0.011 (1.086)	0.005 (0.521)	−0.062* (−1.847)	0.009 (0.594)
Sgrowth	0.004 (0.937)	−0.002 (−0.415)	0.027*** (3.116)	0.016 (1.467)
CF	−0.006 (−0.392)	−0.000 (−0.025)	−0.015 (−0.208)	−0.032*** (−3.524)
Std_cf	−0.008 (−1.152)	−0.015*** (−5.225)	0.018 (0.504)	0.016 (0.937)
Std_rev	0.029 (0.965)	−0.005 (−0.274)	0.202 (1.643)	0.044 (1.677)
Lagacc	0.000 (0.0567)	−0.009*** (−2.790)	−0.006 (−0.238)	0.018*** (4.274)
BTM	−0.004 (−0.785)	0.003 (0.669)	0.013 (1.191)	−0.007 (−1.429)
Arins	0.048 (1.051)	0.005 (0.236)	−0.082 (−1.110)	−0.065** (−2.389)
Aud_C	0.002 (0.068)	0.035 (1.442)	−0.022 (−0.509)	0.005 (0.403)
Year, Industry and State FE	Yes	Yes	Yes	Yes
Observations	2,237	1,338	2,212	1,149
R-squared	0.054	0.060	0.238	0.266

Notes: This table reports regression results using model (1) as follows for firms split by whether they are audited by Big4 firms:

$$AQ_{i,t} = \alpha + \beta_1 POST + \gamma_i' X + \varepsilon_{i,t}$$

Columns (1) and (2) use *RESTATE* as the dependent variable, whereas Columns (3) and (4) use *ABS_ACC* as the dependent variable. Column (1) and (3) report regression results for firms audited by Big 4 firms, whereas Columns (2) and (4) report regression results using firms audited by non-Big 4 firms. $\boldsymbol{X}$ is a vector of control variables. See Appendix for variable definitions. Standard errors are clustered by state. *t*-stats are in parentheses. ***, **, *represent significance levels at 1, 5 and 10%, respectively

Table 6. Audit quality changes for Big 4 versus non-Big 4 engagements

the 5% level in both Columns (2) and (4). Overall, Big 4 firms adapted effectively to the remote working environment and maintained their audit quality after the COVID-19 restrictions took effect, whereas non-Big 4 firms were unable to do so. Non-Big 4 firms thus show a significant post-COVID decrease in audit quality. This finding is consistent with *H4* and speaks to the advantages that Big 4 auditors with greater resources available to them have during times of abrupt change.

4.4 Auditor versus client state-based restrictions

For our analyses, lockdown dates are determined based on the issuance date of stay-at-home orders for the state in which the auditor associated with the engagement is located. This choice was made because we should expect audit quality to be affected by restrictions imposed on auditors rather than those imposed on clients. However, this may not be the case. If our findings are driven by restrictions imposed on clients rather than those imposed on auditors, our results may be more emblematic of earnings management or other omitted variables.

To test this alternative, we divide our treated observations (*POST* = 1) into three groups. The first group *POST_Before* is equal to 1 if the auditor's state issued stay-at-home orders before the client's state, 0 otherwise. A total of 28.5% of treated observations fall into this group. The second group *POST_Same* is equal to 1 if the auditor's state and the client's state issued stay-at-home orders on the same date and 0 otherwise. 53.4% of treated

observations fall into this group. Finally, our third group *POST_After* is equal to 1 if the auditor's state issued stay-at-home orders after their client's state, 0 otherwise. 18.1% of treated observations fall into this final group. If our results are driven by restrictions imposed on auditors, we should expect positive and significant coefficients for *POST_Before* and *POST_Same*. This would be consistent with our conclusion that the changes observed are driven by auditors being forced to adapt to a new working environment. On the other hand, if *POST_After* produces a significant result and the other variables of interest do not, this would suggest that the results are more likely driven by client restrictions rather than auditor restrictions. Results from re-running Model (1) with the treatment observations split into the three groups described above are presented in Table 7.

Column (1) of Table 7 reports the regression results using *RESTATE* as the dependent variable, whereas Column (2) reports the regression results using *ABS_ACC* as the dependent variable. Examining the coefficients for the variables of interest, we find a positive and significant result for *POST_Before* in both Columns (1) and (2), a positive and significant result for *POST_Same* in Column (1) and a positive result for *POST_Same* in Column (2) and an insignificant result for *POST_After*. Together, these three results are consistent with the observed changes in audit quality stemming from lockdown restrictions imposed on auditors, rather than those imposed on clients. The two situations in which the

Dependent variable	*RESTATE* (1)	*ABS_ACC* (2)
POST_Before	0.087* (1.880)	0.103*** (2.833)
POST_Same	0.079** (2.039)	0.024 (1.624)
POST_After	−0.006 (−0.310)	−0.007 (−0.221)
Size	0.004 (1.560)	−0.014*** (−7.731)
Lev	0.006 (0.474)	0.022* (1.949)
Loss	0.007 (1.115)	−0.006 (−0.657)
Sgrowth	0.002 (0.644)	0.013*** (2.760)
CF	−0.002 (−0.299)	−0.029*** (−3.290)
Std_cf	−0.015*** (−5.809)	0.017 (1.407)
Std_rev	0.006 (0.380)	0.049*** (3.403)
Lagacc	−0.008** (−2.464)	0.014*** (4.369)
BTM	−0.000 (−0.124)	−0.004 (−1.522)
Arins	0.017 (0.698)	−0.027 (−1.248)
Big4	−0.021** (−2.554)	−0.014 (−1.666)
Aud_C	0.019 (1.131)	0.011 (1.364)
Year, Industry and State FE	Yes	Yes
Observations	3,577	3,290
R-squared	0.042	0.288

Notes: This table reports regression results using modified model (1) by adding three dummy variables: *POST_Before, POST_Same* and *POST_After*:

$$AQ_{i,t} = \alpha + \beta_1 POST\_Before + \beta_2 POST\_Same + \beta_3 POST\_After + \gamma_i' X + \varepsilon_{i,t}$$

POST_Before equals 1 if the auditor's state issued a stay-at-home order earlier than the client's state, 0 otherwise; *POST_Same* equals 1 if the auditor's state issued a stay-at-home order on the same date as did the client's state, 1 otherwise; *POST_After* equals 1 if the auditor's state issued a stay-at-home order later than the client's state, 0 otherwise. *X* is a vector of control variables. See Appendix for variable definitions. Standard errors are clustered by state. *t*-stats are in parentheses. ***, **, * represent significance levels at 1%, 5% and 10%, respectively

Table 7. Audit quality after COVID-19 restrictions issued by auditor states versus client states

auditors are directly affected by the restrictions (*POST_Before* and *POST_Same*) yield a significant result, whereas the scenario in which clients are restricted before auditors (*POST_After*) yields a null result. The change is only observed when auditors have had restrictions imposed on them. This provides additional evidence consistent with the conclusions drawn from our main results.

5. Conclusion

This study examines changes in audit quality after the implementation of COVID-19 travel restrictions/stay-at-home orders issued across the USA in early 2020. Our results suggest that engagements affected by the restrictions produced lower audit quality, as measured through restatements and discretionary accruals, relative to those completed prior to the implementation of restrictions. Further testing reveals that this decrease in audit quality was largely attributable to firms with high inventory relative to assets, high R&D expenditures relative to assets and engagements involving non-Big 4 auditors. Our results suggest that the restrictions on physical and on-site interaction caused auditors to universally struggle with resource/judgment intensive accounts such as inventory and R&D expenditures. While Big 4 auditors managed to maintain their status quo level of audit quality following COVID-19 restrictions, non-Big 4 auditors were unable to overcome the challenges of an online work environment and their audit quality decreased as a result.

The pandemic required auditors to adjust quickly to a radically altered workplace. Although eventually the pandemic may end, the likelihood that auditors continue using remote work environments into the future is high (Drew, 2020; McCabe, 2020). Based on the results of post-restriction audits, it appears that auditors have had difficulty maintaining audit quality after being forced to work remotely. Audit firms will therefore need to continue to develop effective ways to improve their audit process and overcome the limitations of the virtual work environment for the post COVID-19 future.

Our findings are subject to some limitations. First, due to our sample period, we are only able to assess the audit quality of financial statements issued at the beginning of the pandemic. As time progresses and audit firms become more adept at helping auditors succeed when working remotely, they may adopt new processes, provide staff more or better tailored support to their situations and improve their information systems to overcome the difficulties brought on by remote work. This acclamation to the new working environment may improve audit quality. Simultaneously, it is also possible that professional skepticism when working remotely could wane over time if auditors feel demoralized or detached due to the lack of in-person interaction. Audit quality may not remain static, and it is not possible to say definitively how audit quality trends will evolve over time. Future research will be needed to assess the long-term effects of these changes. Second, our study does not address other aspects of audit quality, such as the accuracy of going concern opinions or the accuracy of estimates. Given the great uncertainty brought on by the pandemic, firms faced serious challenges in determining their future viability and likewise auditors were tasked with the unenviable job of deciding when going concern opinions were warranted and how the value of uncertain estimates should be treated. While our data and methodology limit our ability to address these issues at this time, future research could investigate how well auditors handled operational and financial uncertainty during the pandemic.

Notes

1. https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-COVID-19—11-march-2020

2. Designating a shorter lag period will increase the number of treated observations but is likely to capture many engagements that are already in the final review/quality assurance review stage or just awaiting a meeting of the board of directors to sign off on the audit when restrictions come into effect. The longer lag period of 7 or 14 days increases the likelihood that field work is still being performed when restrictions are put into effect.
3. https://www.cbsnews.com/news/coronavirus-centers-for-disease-control-first-case-united-states/
4. Due to time constraints, we only collected restatement data up to June 30, 2021. We acknowledge that some firms may issue restatements for fiscal year 2018 or 2019 financial statements in the second half of 2021 or 2022. However, having small restatement data may bias against, if any, our findings.
5. This corresponds with 5.5% of the full sample as no audits of the 2018 fiscal were affected by COVID-19 restrictions.
6. While a continuous interaction term would also be logical alternative test methodology, the literature on how auditors measure risk suggests that auditors use a categorical approach with qualitative sorting(AICPA, 2002; Fukukawa and Mock, 2011; Phillips, 1999). It appears that in practice auditors tend to label clients' risk assessment as high or low rather than on a continuous scale. For that reason, we choose to partition the samples for all cross-sectional tests based on the median rather than using a continuous interaction term.

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Appendix

Table A1. Definition of variables

Variables	Definition
ABS_ACC	Absolute abnormal accruals, calculated by estimating the model below by industry and year $TA_{i,t} = \alpha + \beta_1 \Delta REV_{i,t} + \beta_2 PPE_{i,t} + \beta_3 ROA_{i,t-1} + \epsilon_{i,t}$ Where $TA_{i,t}$ is total accruals of firm *i* in year *t*. $\Delta REV_{i,t}$ is firm *i*'s change in sales revenue from year *t-1* to year *t*. $PPE_{i,t}$ is firm *i*'s PPE in year *t* while $NI_{i,t}$ is firm *i*'s net income in year *t*. All variables are scaled by total assets at the beginning of year *t*.
RESTATE	Dummy variable that equals 1 if a firm issues restatement(s) for 2018 or 2019 financial statements, 0 otherwise.
POST	Dummy variable that equals one if a firm filed 10-k with SEC at least seven days later than the issuance date of stay-at-home order in its auditor's state
ΔREV	Change in sales revenue divided by total assets at the beginning of year *t*
PPE	Gross amount of property, plant and equipment divided by total assets at the beginning of year *t*
ROA	Income before extraordinary items divided by total assets at the beginning of year *t*
Size	Log of total assets
Lev	Long term debt divided by total assets
Loss	Dummy variable that equals 1 if a firm has negative net income, 0 otherwise
Sgrowth	Change in sales revenue from year *t-1* to year *t* divided by sales revenue in year *t-1*
CF	Operating cash flow divided by total assets
Std_cf	Standard deviation of cash flow for the period year *t-4* through year *t-1*
Std_rev	Standard deviation of sales revenue for the period year *t-4* through year *t-1*
Lagacc	Total accruals in year *t-1*
BTM	Book-to-Market ratio, calculated using book value of equity divided by the market value of equity
Arins	Account receivable plus inventory divided by total assets
Big4	Dummy variable that equals 1 if a client firm is audited by Big 4, 0 otherwise
Aud_C	Dummy variable that equals 1 if a client firm switched to a new auditor, 0 otherwise

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