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The Impact of Covid-19 on Audit Delay

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Abstract
As the coronavirus spread throughout the world, this also affected the auditing process. Auditors were hindered in performing their work by limitations in workplace access, making it more difficult for auditors to complete the audit on time. This study examines the consequences of workplace restrictions for the length of the audit. I use a sample of companies in a global setting, in countries which implemented workplace restrictions during the pandemic, within a dataset ranging from 2018-2021 and which were in various ways affected by the pandemic. The results of the four linear models show significant enlargement of the length of the audit caused by workplace restrictions imposed to control the spread of Covid-19. Furthermore, I find this relation significantly affected by having a non-clean opinion and belonging to the most affected industry, but not by being audited by last year's auditor.

Key words: Covid-19, audit delay, workplace closures, auditor's report

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1. Introduction

After the World Health Organization published the first Disease Outbreak News relating to Covid-19 on the 5th of January 2020, the media especially focused on economic consequences and consequences for public health, such as facing bankruptcy or earnings management (RTL Z, 2021) which can significantly impair the auditor's ability to detect material misstatements. This could possibly have a large impact on the level of usefulness of annual reports which are the main source of information for the decision making of stakeholders. Consequently, auditors are likely to provide more explanations of how the audited company is affected by Covid-19, which may impact the auditing process leading to a delay of the audit and a later submission of the auditor's report. In this paper I want to expand prior theoretical research on the effects of Covid-19 by empirical research on audit delay, therefore my research question is:
Did Covid-19 influence the Audit Delay of Firms?

To answer the research question four hypotheses are tested. As maintaining timeliness of the audit is likely to harden due to workplace restrictions imposed to control the spread of Covid-19, audit delay could increase when the impact of the workplace closures is bigger. This impact, however, may vary depending on various characteristics of the company that has been audited. This paper provides evidence of the impact of Covid-19 by examining the relation between workplace closures and audit delay, in general, and by considering other factors of audit delay.

Whereas a lot of research has been done about factors that impact audit delay, no empirical research has been conducted about the impact of Covid-19 on delay of the submission of the auditor's report. This paper provides clarity about the effect of a global crisis such as Covid-19 on the length of the audit.

The trustworthiness of financial statements is of great importance, so if this is impaired, due to an external factor, such as Covid-19, this can be considered by taking political decisions in the future during a similar crisis.

I made use of four OLS regressions to test the impact of workplace closure, the extent of workplace closures following the coronavirus pandemic, on the length of the audit. I measure workplace closures using data from "https://ourworldindata.org/covid-school-workplace-closures". This site provides data on whether workplaces remained open, whether there was some advice to work from home, and whether there were partial or full mandatory workplace closures. I assign a value between 0-3 for each day of the audit period (i.e., the period between the end of the fiscal year and the date of audit report issuance) based on the restrictions in place and then calculate the average of daily restrictions during this period. I repeat the OLS regression and test the relation between workplace closures and length of the audit for the most affected industries by Covid-19 (e.g., retail and transportation), auditor tenure and having a non-clean opinion. The results show that workplace restrictions during the audit period indeed have a significant impact on the length of the audit. The relation between the level of workplace closures and the length of the audit is strengthened for observations in the most affected industries and that have a non-clean audit opinion, but not by auditor tenure. The next section discusses the hypotheses and the use of audit delay as a measure of the impact of Covid-19.

2. Theoretical Background & Hypothesis Development

2.1 Theoretical Background

2.1.1 Effect of COVID-19 on the Economy

According to Sharif et al. (2020), Covid-19 is firstly regarded by US investors as an economic crisis, rather than a geopolitical event. The outbreak of Covid-19 has a substantial impact on US geopolitical events and US economic uncertainty. The authors of this paper found that Covid-19 had the strongest effect on the change of oil prices during the pandemic, as compared to other factors influencing the oil price, and thus according to the authors to measure the economic impact of the pandemic also the effect of Covid-19 on the oil prices, as caused by for example travel restrictions, should be considered. Furthermore, in addition to the effect of the rising oil prices on stocks of companies that are sensitive to the oil price, there are other ways Covid-19 will be reflected in stock prices, such as a reduction in economic productivity in the short term. In the long run, Covid-19 is expected to harm the US economy, however, the final effects are influenced by the long-term path of the US economy and how policymakers respond to the pandemic. The authors acknowledge the assessed impact of Covid-19 is short-term and not long-term and thus caution should be taken by interpreting the long-term economic effect.

2.1.2 Impacted Industries

While Covid-19 benefited the medical industry and suppliers of pharmaceutical products (Goodell & Huynh, 2020), many other industries were affected by the pandemic, such as services, utilities, the hotel, motel, and restaurant branches. Shen et al. (2020) examined the most impacted industries by Covid-19 by forecasting the performance of Chinese companies between the years 2012 and 2019, comparing it to the real data on which Covid-19 had a severe impact through the reduction of the scale of investment and total revenue. The authors of this paper found that tourism, catering, and transportation were the most severely affected industries by Covid-19, through a reduction in production and sales in these industries which led to a negative rate of return. Also, retail and TV entertainment have experienced severe consequences due to the pandemic (Shen et al., 2020), which are industries that have a high level of personnel intensity, social interaction, and cross-border trade.

2.1.3 Health Impact of Covid-19 across the Globe

To assess the most affected countries by the Coronavirus Pandemic Singh et al. (2020) identified the top 15 most affected countries by confirmed cases, death cases and recoveries and predicted the impact of Covid-19 between April and July 2020 on the public health of these countries. China, Switzerland, Germany, Iran, and Brazil had a fast recovery ratio, whereas the Netherlands, Russia, Italy, the United States, and the United Kingdom had a low recovery ratio. The mortality rate would be higher in the United States, Spain, and Italy according to their prediction. In all their sample, except China, Switzerland and Germany, confirmed cases, deaths and recoveries were expected to double, meaning that the spread of the virus in the other three countries was stabilized at that time. However, Singh et al. (2020) agree that public awareness and administrative responses will determine the final impact of Covid-19 on public health in a country.

2.1.4 Possible Effects of Restrictions on Productivity

Bloom et al. (2020) examined the general effects of Covid-19 on productivity. For their research, the authors used measures such as labor productivity and total factor productivity. The variance in impact between the two factors is determined by the relation between the impact of Covid-19 on capital and labor hours worked. Bloom et al. (2020) also found that the least productive firms are disproportionally affected by Covid-19 and that low-productive firms are being replaced by high-productive firms. Furthermore, low-productivity industries are harmed, such as entertainment, accommodation, and travel, by the restrictions imposed to control the spread of Covid-19. One of the reasons why productivity is reduced is due to workplace measures put in place. According to Coulson-Thomas (2020), one of the benefits of working from home is that a virtual work environment increases productivity as transportation time decreases. Also, people tend to be feeling more productive at home. However, the lack of communication decreases the ability of leaders to achieve the goals of the team and thus requires new leadership abilities to maintain the same level of productivity.

The effect of Covid-19 on audit delay is expected to be positive, albeit twofold. As workplaces are closed because of Covid-19, more people are working from home. According to Kniffen et al. (2020), half of the companies among a survey of 229 HR departments had more than 80% of their employees working from home during the early stages of the Coronavirus Pandemic. This could have a considerable impact on the productivity of employees. While some professionals need to perform tasks that require little interaction with peers, others face challenges working from home, such as not being able to consult with the team at location. Another disadvantage of working from home is that not everyone has working space available at home or must share this working space with someone else.

According to Albitar et al. (2020), skills of employees, personal qualities, and training, are also affected by Covid-19, which are as characteristics of human capital important determinants of audit quality. All audit companies mentioned in this paper have cancelled training, workshops, and other professional development programs for auditors at all levels because of Covid-19. Another way Covid-19 affects human capital is due to illness and, due to the risk of contamination, quarantine, which causes sick leave, making it harder to ensure a high level of audit quality. The reduction of the level of education and the decrease in auditing personnel can lead to an increase in audit delay in both the short run and in the long run.

Another factor that may harden the work-from-home strategy is that employees tend to find it hard to maintain a separation between work and leisure, which causes the work-life balance to be disrupted. Boca et al. (2020) found in a study conducted in an Italian setting, that especially women face an increase in workload from both their work as well as their household during the pandemic. However, if men work from home their participation in the household is expected to increase. According to the authors of this paper, an increase in male's participation in the household would increase the activity of women in the labor market during the pandemic.

Working from home during the pandemic has increased (Sasaki et al., 2020), either through mandatory work-from-home measures or employees voluntarily working from home to avoid exposure to Covid-19 infection. As explained above, this change in the work environment could have contributed to audit delay. However, at the same time, the study found that implementing workplace measures reduce psychological distress and maintains performance among employees due to the benefits of working from home.

2.1.5 Factors influencing Audit Delay

Naturally, Covid-19 isn't the only factor that causes audit delay. Johnsen (1996) examined the relation between audit delay and audit fees. The results of this paper, using a two-stage least square regression, suggest that audit delay has a positive effect on audit fees, but not vice versa, thus having no explanatory power for audit delay. However, another research in a Nigerian setting by Modugu et al. (2012) found that the logarithm of audit fees and the logarithm of total assets have a significant effect on audit delay. Modugu et al. (2012) explain that this might be because larger companies have larger audit fees and auditing larger companies take longer because of the higher absolute amount of inventory and receivables.

A study conducted by Wan-Hussin et al. (2013) on Malaysian companies confirmed the significance of the logarithm of total assets affecting audit delay. On top of that, the authors of this paper found that also qualified opinion and auditor tenure, the number of years a firm has been audited by the current auditor seem to have a significant effect on audit delay.

Furthermore, the results of their research imply that the more segmentation of products a firm has, the longer it takes to conduct an audit as the complexity of the audit is increased by the degree of diversification (NG & Tai, 1994). Wan-Hussin et al., (2013) also found significance for whether there is a low proportion in audit committee members, whether more than four audit comities are held during the year, the risk of bankruptcy and whether there is a greater variance between audited and non-audited numbers, as these firms are expected to have a poor internal control quality.

In addition, Wan-Hussin et al. (2013) also control for the sector a firm resides in, based on the assumption that some sectors are relatively easy to audit, such as plantation and technology sectors, while other sectors are more difficult to audit, such as construction and consumer products due to the scale of inventory and product lines. The authors found that whether a company belongs to the plantation and technology sector makes a significant contribution to their test and thus has a diminishing effect on audit delay.

Ng & Tai (1994), who researched a setting of principal joint ventures in China found that the size of the incumbent auditor matters for whether there is audit delay or not, as larger auditors have more capacity to conduct an audit. Lai et al. (2020) also examined based on prior research whether the size of the incumbent auditor matters. The authors of this paper, however, found insignificant evidence to confirm this. In addition to this, they found that controlling for a standard audit opinion and the release of net income figures, that companies of a bigger size release their financial statements earlier, therefore shortening the length of the audit period.

Similarly, to Wan-Hussin et al. (2013), Ahmad & Kamarudin (2003) found in their research conducted on companies listed on the Malaysian Stock Exchange that some factors cause companies to face a higher risk of audit delay, such as when they are non-financial, receive a non-clean opinion, have another fiscal year-end than 31 December, are audited by other than the contemporary big-five or when they incurred negative earnings. This study also found that there are substantial differences between countries in the timeliness of their financial reporting. While New Zealand has a mean audit period of around 88 and 96 days long, Malaysian companies are audited in an average of more than 100 days.

Another factor that may influence audit delay is auditor tenure. In the context of the discussion whether auditor tenure should be regulated, Geiger & Raghunandan (2002) researched companies in the period around the implementation of the Sarbanes-Oxley Act of

2002 in the United States, which mandates auditor rotation after 5 years with the same principal engagement partner. In their research, the authors found that auditor tenure is significantly longer for companies that have a reduction in high fraud risk and that the portion of companies that have a larger auditor tenure is smaller in the group of companies with high fraud risk, thus not supporting the suggestions that longer auditor tenure is associated with more high fraud risk and that auditor rotation is beneficial for audit quality.

Ashton et al. (1987) found in their study among companies in the USA that for their univariate test seven variables were significantly contributing to audit delay, most notably total revenue and whether a company has a net loss at the end of the year. Furthermore, the authors of this paper used dummy variables to indicate whether the company belonged to a financial or a non-financial industry. The authors of this paper predicated this upon the observation of prior literature that the financial industry has shorter audit delays than the non-financial industry. The authors also managed to collect data about the strength of the company's internal control and found that this was significant in determining the length of the audit. Ashton et al. (1987) created a dummy variable for whether companies have their fiscal year-ends on 31 December or not, which is 1 for companies that do and 0 otherwise and found that companies with a fiscal year-end other than 31 December have a significantly longer audit delay. Another significant variable is whether the company uses less extensive data processing technology.

To document the timeliness of 10-K filings, Brooks et al. (2020) examined the effect of filing date changes on the submission of filing of all firms that are obligated to file with the SEC between 1997 and 2018. The authors found that firms tend to file around the 90-day statutory due date. The authors found in their study that filing date changes influence the number of early filers, but not on the proportion of late filers. This also holds for the percentage of earliest filers, those who filed within 30 days. Another finding is that many big-name companies are filing early, especially after statutory changes. Furthermore, according to the authors calendar fiscal year-end is unlikely to influence the percentage of late filers.

2.2 Hypotheses Formulation

As a result of the increase of social distancing due to Covid-19, the mobility of both audit personnel and personnel of the audited companies is likely decreased. Kniffen et al. (2020) found that half of the surveyed companies had more than 80% of their employees working at home, which puts limits on directly discussing the state of the audit and maintaining a good work-life balance (Boca et al., 2020). This could lead to an increase in time between the date of the start of the audit and the publication date of the annual report. To examine the direction and significance of the effect of workplace restrictions imposed to control the spread of Covid-19 on audit delay, the first hypothesis considers the impact of the level of workplace closures on audit delay:

> *Hypothesis 1: Workplace closures imposed to control the spread of Covid-19 lead to an increase in audit delay.*

I also examine cross-sectional variation in the impact of workplace closures on audit delay. For instance, there also seems to be a difference in the extent to which Covid-19 affected specific industries. Stephany et al. (2020) used a data-mining approach to measure the reported

business risk caused by the pandemic. The authors of this paper found that because of supply-chain and production-related issues, retail and transportation are the largest affected industries by Covid-19. The challenges faced in these industries created by Covid-19 increase the complexity of the audit. The effect of Covid-19 may impact the relation between the most affected industries by Covid-19 and audit delay. This could occur as the most affected industries are more prone to the restrictions imposed on places where consultation between employees or with the client takes place, which results in a higher audit delay. To examine the effect of Covid-19 on the most affected industries, I want to repeat the previous hypothesis while testing the relation between workplace closures and audit delay for companies in industries that were according to prior research most affected by Covid-19:

> *Hypothesis 2: Belonging to the most affected industries strengthens the relation between workplace closures imposed to control the spread of Covid-19 and audit delay.*

Another factor that may impact audit delay is that the audit delay may vary, depending on the length of the period that the client has been audited by the auditor. This is hypothesized on the assumption that auditors get more familiarity with the client over the years which causes the risk and magnitude of the audit delay to decrease, as mentioned by Geiger, & Raghunandan (2002). Workplace closures impact the relation between the auditor tenure and audit delay as auditors have relatively more routine work for companies that are audited by the same auditor for a longer period, which would make it less necessary for these auditors to discuss matters related to the company in the office. To examine the effect of audit opinion on the relation between workplace closures and audit delay, the following hypothesis is examined:

> *Hypothesis 3: Auditor tenure has a diminishing effect on the relation between workplace closures imposed to control the spread of Covid-19 and audit delay.*

Audit delay can be caused by several factors, such as the size of the company and the profit or loss arising from the operations of a company (Suryanto, 2016), such as the losses caused by the global economic crisis in 2008. Furthermore, audit delay seems to be greater for companies that receive a non-clean opinion, which is shown by the later publication date of the auditor's report of these companies (Ashton et al., 1987). According to the authors, this effect may be caused by an increase in the scope of the audit and the extension of the auditor-client communication. The relation between the audit delay and workplace closures may be impacted by the opinion issued. As mentioned earlier the complexity of the audit and the level of communication is increased, which requires more access to office places and a larger effect on audit delay. To examine the effect of audit opinion on the relation between workplace closures and audit delay, the next hypothesis is as follows:

> *Hypothesis 4: Receiving a non-clean opinion strengthens the relation between workplace closures imposed to control the spread of Covid-19 and audit delay.*

3. Research Design

3.1 Construction of the Models

3.1.1 Model 1

After having discussed how social distancing may affect audit quality, I examine the association between workplace closures in countries and audit delay by comparing the average of workplace closures during the length of the audit per country and audit delay. Che-Ahmad et al. (2008) measure audit delay by the number of calendar days from the fiscal year-end date to the date of the issuance of the auditor's report. To answer the first hypothesis an OLS-regression is used, with a dependent variable audit delay, which is the time between the fiscal year-end and the issuance of the auditor's report and independent variable workplace closure, which is measured by the average of the workplace closures during the length of the audit in the country the company resides in. I also make use of control variables, such as a fiscal year-end other than 31 December, type of auditor, whether the company belongs to one of the most affected industries by Covid-19 and whether the company belongs to a financial or a non-financial industry. I include total assets, net income, the book value of the equity and revenue to control for the size of the companies in my dataset and their earnings. These control variables are also included in the regressions of the other hypotheses, and I use data for firms in a global setting.

$$\begin{aligned} Audit\ Delay_{it} = {} & \beta_0 + \beta_1 ClosureImpact + \beta_2 + \log(\text{TotalAssets}) + \log(\text{NetIncome}) \\ & + \log(\text{BookValueEquity}) + \log(\text{Revenue}) + \text{MostAffectedIndustriesSIC} \\ & + \text{FinancialSIC} + \text{FiscalYearIsNot31December} + \text{BigFourAuditor} + \varepsilon_{it} \end{aligned}$$

3.1.2 Model 2

To answer hypothesis 2, I want to examine the moderating effect of companies belonging to the most affected industries on the relation between workplace closure imposed to control the spread of Covid-19 and audit delay. Thus, I make a regression with audit delay as a dependent variable and workplace closures as an independent variable. The effect of belonging to the most affected industries; retail and transportation, are tested on this relation.

$$\begin{aligned} Audit\ Delay_{it} = {} & \alpha + \beta \text{MostAffectedIndustries} SIC + \gamma \text{ClosureImpact} \\ & + \delta(\text{ClosureImpactxMostAffectedIndustriesSIC}) + \log(\text{TotalAssets}) \\ & + \log(\text{NetIncome}) + \log(\text{BookValueEquity}) + \log(\text{Revenue}) \\ & + \text{FinancialSIC} + \text{FiscalYearIsNot31December} + \text{BigFourAuditor} + \varepsilon_{it} \end{aligned}$$

The industries used for this hypothesis and the control variable of the other hypotheses are sorted by SIC code. The most affected industries by Covid-19 have the SIC codes 3999-5000 and 5199-6000, which are predominantly the transportation sector and the retail industry as found to be the most affected industries by Covid-19 by Shen et al. (2020) and Stephany et al. (2020).

For the control variable FinancialSIC the SIC codes 6011-6099 are used for depository institutions, the SIC codes 6111-6163 for non-depository institutions and the SIC codes 6211 & 6712 for securities to group the companies in the dataset into companies belonging to financial and non-financial industries.

3.1.3 Model 3

To answer the third hypothesis the effect of auditor tenure on the relation between workplace closures and audit delay is examined. CurrentIsPreviousAuditor is 1 when a company has been audited by the same auditor the previous year, the variable takes a value of 0 when the company hasn't been audited by the same auditor as the previous year. For the dependent variable Audit Delay, the date of the issuance of the auditor's report is used as can be found in Audit Analytics. This can be compared with the end of the fiscal year as Wan-Hussin et al. (2013) have done in their research. Next a regression can be run with workplace closures as an independent variable to examine whether the relation between workplace closures imposed and audit delay is affected by auditor tenure.

$$\begin{aligned} Audit\ Delay_{it} = {} & \alpha + \beta CurrentIsPreviousAuditor + \gamma \text{ClosureImpact} \\ & + \delta(ClosureImpactxCurrentIsPreviousAuditor) \\ & + \log(\text{BookValueEquity}) + \log(\text{Revenue}) + \log(\text{NetIncome}) \\ & + \log(\text{TotalAssets}) + \text{MostAffectedIndustriesSIC} + \text{FinancialSIC} \\ & + \text{FiscalYearIsNot31December} + \text{BigFourAuditor} + \varepsilon_{it} \end{aligned}$$

3.1.4 Model 4

Albitar et al. (2020), found that audit procedures take longer before and during the pandemic, as it gets more difficult for auditors to examine whether a company will receive a non-clean opinion. For hypothesis 4 the impact of a non-clean opinion on the relation between workplace closures due to Covid-19 and audit delay is examined. The dummy variable takes 1 when a company had a non-clear opinion the year of the audit and 0 otherwise.

$$\begin{aligned} Audit\ Delay_{it} = {} & \alpha + \beta NonCleanOpinionIssued + \gamma \text{ClosureImpact} \\ & + \delta(ClosureImpactxNonCleanOpinionIssued) + log(NetIncome) \\ & + log(Revenue) + log(BookValue) + \log(\text{TotalAssets}) \\ & + \text{MostAffectedIndustriesSIC} + \text{FinancialSIC} \\ & + \text{FiscalYearIsNot31December} + \text{BigFourAuditor} + \varepsilon_{it} \end{aligned}$$

3.2 Independent Variables

To answer the hypotheses, I make use of the filing date of the auditor's report in Audit Analytics. The data on workplace closure are retrieved from "ourworldindata.org/coronavirus". These restrictions can take values of 0,1,2 and 3, which stand for no measures, measures recommended, measures required at some levels, and measures required at all levels respectively. For answering hypothesis 2, I test the effect of belonging to the most affected industries by Covid-19 on the relation between the impact of workplace closures imposed to control the spread of Covid-19 and audit delay. The dummy variable used takes 1 if the industry is one of the industries described by the SIC-codes belonging to the most affected industries (e.g., retail and transportation) and 0 otherwise. To answer hypothesis 3, I make use of the variable CurrentIsPreviousAuditor, to determine if a company has been audited by the same auditor in the previous year. A dummy variable is used which takes 1 when the current auditor is equal to the auditor of the previous year and 0 otherwise. For hypothesis 4 I take a similar approach, but with having a non-clean opinion as part of the interaction effect instead, which takes 1 if a company receives a non-clean opinion in the year of the audit and 0 otherwise.

3.3 Control Variables

The following control variables are used: As found by Modugu et al. (2012) and affirmed to be significant by Wan-Hussin et al (2013), I make use of the logarithm of total assets as a control variable. Ashton et al. (1987) found in their research that extraordinary items that increase net income are associated with audit delay. Therefore, I also control for net income and revenue as given on the income statement, which are expected to have a negative effect. I don't control for extraordinary items directly as this would cause a lack of observations for my models. Lai et al. (2020) found that the size of the company audited affects audit delay. Therefore, I created variables that simulate the size of the company in monetary terms, by the value of the total assets and book value of equity, which are both expected to have a negative effect. While the size of the incumbent auditor wasn't found to have significant results according to Lia et al. (2020), NG & Tai. (1994) found it had, so I include this as the control variable BigFourAuditor, which takes 1 if the company is audited by a Big Four accounting firm and 0 otherwise. This is also expected to have a negative effect. I also include a control variable for whether the fiscal year-end is not 31 December, which is according to Ashton et al. (1987) expected to have a positive effect on audit delay, As Ashton et al. (1987) found that financial industries have shorter audit delays than non-financial industries, I also made a control variable FinancialSIC which is expected to have a negative sign.

3.4 Data Sample

3.4.1 Extracting Data

I make use of both firm-level audit data, for the audit delay, and data on workplace closures imposed to control the spread of Covid 19. Hence, why the data that is used for this research is derived from ourworldindata.org and Audit Analytics. In Audit Analytics, I select "Director and Officer Changes" as the database I want to search in, because of its extensivity. I choose the country a company resides in as a query variable to merge the datasets from audit analytics and ourworldindata.org. The datasets can be merged by renaming the values for the country of residence in R under a common name, using the names of the countries as listed on the website ourworldindata.org, and by renaming the date variable. Covid-19 was first reported in Wuhan China, on 31 December 2019. However, to strengthen the validity of the research I chose to use data from 2018 until 2021. In this way, the whole pre-pandemic and pandemic periods are well covered.

The independent variable ClosureImpact is calculated by the sum of the level of workplace closures divided by the length of the audit. The level of workplace closures, which can take values from 0-3, which stand for no measures, measures recommended, measures required at some levels, and measures required at all levels respectively.

The length of the audit, which is necessary to calculate ClosureImpact, can be calculated by subtracting the fiscal year-end date from the filing date of the auditor's report. The fiscal year-end date is extracted by adding the current year as extracted from the filing date to the fiscal year-end variable from Audit Analytics, which consists of month and day and by subtracting this date with a year in the case this is bigger than the filing date of the audit report.

Custom variables in the dataset include the binary variables that are used to test the relation between workplace closures imposed and audit delay for characteristics affecting this relation. To test hypothesis 2 MostAffectedIndustiesSIC is used, which takes a value of 1 when

the company belongs to one of the most affected industries (e.g., retail and transportation) and 0 otherwise. To test hypothesis 3 CurrentAuditorIsPreviousAuditor is used, which takes a value of 1 if the current auditor is last year's auditor and 0 otherwise. To test hypothesis 4 NonCleanOpinionIssued is used, which takes a value of 1 if the company received a non-clean opinion and 0 otherwise.

Other variables in the dataset are the quarterly variables net income and revenue from the income statement and book value of the equity and total assets from the balance sheet and the custom variables FiscalYear31December, BigFourAuditor, FinancialSIC.

3.4.2 Countries of the Sample

As Ahmad & Kamarudin (2003) concluded that the difference in the extent of the audit delay can be partly attributed to the circumstances in each country, the hypotheses of this research are run on a selection of countries with different circumstances. A diversified sample includes countries, under which were the most affected countries, such as the United States and India and faster-recovering countries, such as China and Switzerland (Singh et al., 2020). The most diversified sample is with as many as possible countries included, hence why this approach is used for the research. I chose to include 67 countries for the first three models and 41 countries for the last model, as this was the most extensive dataset possible. The observations per country as used for each model are visible in Table 1.

Table 1

Description of the Firm-Year Observations in the Models

Country	Model 1.	Model 2.	Model 3.	Model 4.
ARGENTINA	404	404	404	89
AUSTRALIA	372	372	372	31
BAHAMAS	15	15	15	*NA*
BELGIUM	108	108	108	62
BERMUDA	671	671	671	51
BRAZIL	1154	1154	1154	689
CANADA	4144	4144	4144	*NA*
CAYMAN ISLANDS	165	165	165	*NA*
CHILE	208	208	208	150
CHINA	2767	2767	2767	112
COLOMBIA	96	96	96	10
CYPRUS	34	34	34	*NA*
CZECH REPUBLIC	35	35	35	19
DENMARK	99	99	99	75
FINLAND	71	71	71	*NA*
FRANCE	260	260	260	*NA*
GEORGIA (ASIA)	11	11	11	*NA*
GERMANY	306	306	306	111
GREECE	116	116	116	*NA*
GUAM	13	13	13	*NA*
HONG KONG	412	412	412	37
INDIA	244	244	244	78
INDONESIA	43	53	53	*NA*
IRELAND	472	472	472	19
ISRAEL	1297	1297	1297	386
ITALY	115	115	115	14
JAPAN	597	597	597	445
JERSEY	46	46	46	*NA*
KOREA (SOUTH)	239	239	239	43
LITHUANIA	2	2	2	*NA*
LUXEMBOURG	222	222	222	39
MACAU	10	10	10	*NA*
MALAYSIA	54	112	112	*NA*
MALTA	19	19	19	*NA*
MARSHALL ISLANDS	6	6	6	*NA*
MEXICO	162	162	162	75
MONACO	34	34	34	*NA*
NETHERLANDS	491	491	491	169
NETHERLANDS ANTILLES	21	21	21	*NA*
NEW ZEALAND	32	32	32	*NA*
NORWAY	67	67	67	61
PANAMA	40	40	40	22
PERU	78	78	78	54
PHILIPPINES	93	93	93	*NA*
PUERTO RICO	71	71	71	*NA*
RUSSIA	59	59	59	59
SINGAPORE	112	112	112	*NA*
SOUTH AFRICA	312	312	312	37
SPAIN	218	218	218	*NA*
SWEDEN	107	107	107	*NA*
SWITZERLAND	356	356	356	130
TAIWAN (CHINA)	147	147	147	64
THAILAND	21	21	21	*NA*
TURKEY	57	57	57	55
UNITED ARAB EMIRATES	30	30	30	*NA*
UNITED KINGDOM	1937	1937	1937	411
UNITED STATES	60654	60654	60658	151
URUGUAY	12	12	12	*NA*
VIRGIN ISLANDS (BRITISH)	52	52	52	30
VIRGIN ISLANDS (US)	18	18	18	*NA*
DOMINICAN REPUBLIC	5	5	5	*NA*
ISLE OF MAN	6	6	6	*NA*
JORDAN	5	5	5	*NA*

Note. The observations in the sample of all 4 models are given. 63 countries are included in the sample. Note that firm-year observations of the first three datasets are equal and the fourth one is different to due merger with another WRDS-dataset to obtain the non-Clean Opinion variable.

3.4.3 Sample Selection

For all regressions, the datasets from Audit Analytics, Compustat and ourworldindata.org/coronavirus are combined in R causing a reduction of observations in the final datasets. In this final dataset first, the number of NA's are removed from the columns that host the variables used in the regressions. The respective regression analyses are run on the resulting datasets. The data selection process is visualized in Table 2. To test the hypotheses, the regressions are run on two samples of different sizes which is due to a lack of matching observations in Compustat for the type of audit opinion issued, used for the last regression analysis.

Table 2

Data Sample Selection

Sample selection	*N*
Firm-year Observations in AuditAnalytics in 2018-2021	*81663*
Less:	
Firms missing Workplace closure data	*(1571)*
Firms missing Total Assets	*(889)*
Firms missing Book Value	*(5748)*
Firms missing Revenue	*(10295)*
Firms missing Net Income	*(9425)*
Firms missing SIC	*(330)*
Final sample	*53154*

Note. Overview of the sample selection. Note that the number of observations in the final sample of model 4 is reduced to 3117 by merging the WRDS-Audit Analytics with a WRDS-Compustat Global datatset.

3.5 Descriptive Statistics

To illustrate the data used in this research, the descriptive statistics of the variables are shown in Table 3 below. FiscalYearNot31December, BigFourAuditor, MostAffectedIndustriesSIC and FinancialSIC are all binary variables taking values of 0 and 1. ClosureImpact ranges from 0 to 3. The numeric variables NetIncome and BookValueEquity can take negative values, while TotalAssets and Revenue take only positive ones. Finally, Auditdelay ranges from 2 to 365, which denotes the length of the audit.

Table 3

Descriptive Statistics of the Variables used in Model 1

	Mean	Sd	Min	Max	Range	Se
BookValueEquity (x1000)	7.277.680	52.790.440	-20.244.480	3.429.530.000	3.449.774.000	200.206,7
TotalAssets (x1000)	7.249.6120	610.338.300	5579,00	26.967.510.000	26.967.510.000	2.314.695
Revenue (x1000)	3.590.342	14.886.210	0.000	398.676.700	398.676.700	5.657,5
NetIncome (x1000)	499.951,7	2.261.242	-544.260	58.685.000	59.229.260	9.066,7
Auditdelay	235,427	99,751	2	365	363	0,378
ClosureImpact	1,441	0,771	0,000	2,859	2,859	0,003
FiscalYearNot31December	0,205	0,415	0,000	1,000	1,000	0,002
BigFourAuditor	0,669	0,471	0,000	1,000	1,000	0,002
MostAffectedIndustriesSIC	0,166	0,372	0,000	1,000	1,000	0,001
FinancialSIC	0,084	0,277	0,000	1,000	1,000	0,001
CurrentIsPreviousAuditor	1,005	0,071	1,000	2,000	1,000	0,000
NonCleanOpinionIssued	1,307	0,461	1,000	2,000	1,000	0,008

Note. 'BookValueEquity' is the book value of the equity. *'TotalAssets'* is the book value of the total of the assets. *'Revenue'* is the amount of revenue as stated on the income statement. *'NetIncome'* is the NetIncome as stated on the income statement. *'AuditDelay'* is the length of the audit in days. *'ClosureImpact'* is a measure of the impact of workplace closures in a specific country. *'FiscalYearNot31December'* indicates whether the fiscal year end is not December 31. *'BigFourAuditor'* indicates whether the auditor is one of the big four professional services networks. *'MostAffectedIndustriesSIC'* indicates whether the industry into which a company can be classified is one of the most affected industries (e.g., retail and transportation). *'FinancialSIC'* indicates whether the industry into which a company can be classified is financial. *'CurrentIsPreviousAuditor'* indicates whether the current auditor was also the auditor of prior fiscal year. *'NonCleanOpinionIssued*' indicates whether company's auditor issued a non-clean opinion.

4. Empirical Tests and Results

4.1 Regression Models

Table 4

The Effect of Workplace Closures on Audit Delay

	Model 1	**Model 2**	**Model 3**	**Model 4**
(Intercept)	277.36 ***	280.35 ***	276.78 ***	95.59 ***
ClosureImpact	31.23 ***	21.67 ***	49.05 **	-15.97 ***
log(TotalAssets)	-10.07 ***	-9.92 ***	-9.69 ***	-2.21
log(NetIncome)	24.35 ***	24.39 ***	23.86 ***	3.37 ***
log(BookValueEquity)	-4.14 ***	-4.06 ***	-3.81 ***	-11.27 ***
log(Revenue)	-2.42 ***	-2.62 ***	-2.15 ***	0.89
MostAffectedIndustriesSIC	20.83 ***	3.69	20.69 ***	7.37 ***
FinancialSIC	6.44 ***	6.19 ***	6.10 ***	14.70 ***
FiscalYearNot31December	-106.01 ***	-105.78 ***	-106.48 ***	-43.49 ***
BigFourAuditor	-9.26 ***	-9.64 ***	-8.45 ***	27.26 ***
ClosureImpactx MostAffectedIndustriesSIC		11.78 ***		
CurrentIsPreviousAuditor			53.37 ***	
ClosureImpactx CurrentIsPreviousAuditor			-17.25	
NonCleanOpinionIssued				-26.21 ***
ClosureImpactx NonCleanOpinionIssued				61.83 ***
N	53154	53154	53154	3117
R^2	0.37	0.37	0.37	0.50

Note. Coefficients of the four models. All continuous predictors are mean-centered and scaled by 1 standard deviation. *** p < 0.001; ** p < 0.01; * p < 0.05. *'AuditDelay'* is the dependent variable, which indicates the length of the audit in days as measured between the fiscal year-end and filing date. *'ClosureImpact'* is the independent variable and is a measure of the impact of workplace closures in a specific country. *'log(TotalAssets)'* is the log of the book value of the total of the assets. *'log(NetIncome)'* is log of the NetIncome as stated on the income statement. *'log(BookValueEquity)'* is log of the book value of the equity. *'log(Revenue)'* is log of the amount of revenue as stated on the income statement. *'MostAffectedIndustriesSIC'* indicates whether the industry into which a company can be classified is one of the most affected industries (e.g., retail and transportation). *'FinancialSIC'* indicates whether the industry into which a company can be classified is financial. *'FiscalYearNot31December'* indicates whether the fiscal year end is not December 31. *'BigFourAuditor'* indicates whether the auditor is one of the big four professional services networks. *'ClosureImpactxMostAffectedIndustriesSIC' denotes the relationship among 'ClosureImpact' and 'MostAffectedIndustriesSIC'. 'CurrentIsPreviousAuditor'* indicates whether the current auditor was also the auditor of prior fiscal year. *'ClosureImpactxNonCleanOpinionIssued' denotes the relationship among 'ClosureImpact' and 'CurrentIsPreviousAuditor'. 'NonCleanOpinionIssued'* indicates whether company's auditor issued a non-clean opinion. *'NonCleanOpinionIssued' denotes the relationship among 'ClosureImpact' and 'NonCleanOpinionIssued'*.

4.1.1 Regression Model Hypothesis 1

An overview of the coefficients of the four models is given in Table 4. As the results in Table 4 show, the first hypothesis holds. A higher average of workplace restriction imposed during the audit period led to an increase in the length of the audit. This is in line with previous literature that states that workplace restriction may create difficulty for employees to maintain the same productivity as before the pandemic (Kniffen et al., 2020). As ClosureImpact, the average of workplace closures during the audit period, increases it seems that AuditDelay increases as well.

4.1.2 Regression Model Hypothesis 2

The second hypothesis should be rejected. If a company belongs to the most affected industries: retail, and transportation, this has a significant negative effect on the relation between workplace closures imposed due to the pandemic and audit delay, as visible in the interaction effect ClosureImpactxMostAffectedIndustriesSIC in Table 4. In the case a company belongs to one of the most affected industries by Covid-19 (e.g., retail and transportation), audit delay is also affected. The variable MostAffectedIndustriesSIC also has a positive sign but is not significant for this model.

4.1.3 Regression Model Hypothesis 3

As the results show having the same auditor as last year increases the audit delay by a 0.001 significance level. However, the interaction effect between auditor tenure and the average of workplace closures imposed during the audit period is not significant. Therefore, the hypothesis can't be approved or rejected.

4.1.4 Regression Model Hypothesis 4

While having a non-clean opinion is significant with a negative effect, the interaction effect between having a non-clean opinion and the average workplace closures during the audit period is significant with a positive effect. Therefore hypothesis 4 should be accepted. Having a non-clean opinion has a significant positive effect on the relation between workplace closures imposed to control the spread of Covid-19 and audit delay.

4.2 Significant Control Variables

Both model 1, the simplest linear regression model, model 2, the model testing for the most affected industries, and model 4, the model testing for companies with a non-clean opinion, show a positive sign for workplace closures, which means that audit delay is increased as the average of workplace restrictions imposed due to the pandemic increases within the period of the audit. Model 3 also has a positive sign, but with a lower significance level.

As predicted in prior research significant larger companies tend to have a shorter audit delay. Model 1 had a significant result by a 0.001 percent significance level for log(Revenue), also echoed by model 2 and model 3, which all have a negative sign, meaning that a larger revenue shortens audit delay. The significant results for log(Revenue) mean that total revenue has a diminishing effect on the length of the audit. Log(NetIncome) is significant by a 0.001 significance level for all models. For model 1, 2 and 3 log(TotalAssets) is significant with a negative sign. This also holds for log(BookValueEquity), which is significant negative for all

four models. As predicted, size appears to have a negative effect on audit delay. FiscalYearNot31December is significant negative, unlike what Ashton et al. (1987) found, for model 1, model 2 and model 3 and for model 4. MostAffectedIndustriesSIC is significant positive for model 1, 3 and 4, but insignificant for the second model. FinancialSIC is significant with a positive sign for all models. This contrasts with the findings of Ashton et al. (1987).

5. Conclusion and Discussion

The research question of this paper is: "Did Covid-19 influence the audit delay of firms?" For testing this research question four hypotheses were developed, of which one tested the impact of workplace closures on Audit Delay, and the other three models also included an interaction effect to test the impact of variables that might affect the relation between workplace restrictions and audit delay.

Model 1 shows a positive sign by a 0.001% percent significance level for the workplace closure impact. This implies that the level of workplace restrictions causes the number of days spent on the audit to increase. The effect of workplace closures on audit length for the other models is also positive with the same significance level, except for model 4 which is significant but negative. This means hypothesis 1 should be accepted.

The impact of workplace closures seems to be significant by a 0.001% significance level for each model. Hereby, it is proven that the average of workplace closures during the audit, which can range from zero to three, has a significant effect on the length of the audit.

The second hypothesis showed that belonging to the most affected industries by Covid-19 (e.g., retail and transportation) has a significant enlarging effect on audit delay for model 1, model 3 and model 4, but insignificant for model 2. However, the interaction effect of model 2 implies with 0.001% significance that belonging to an industry categorized as retail and transportation increases the effect of workplace restrictions, hypothetically due to additional care of the auditor necessary for auditing these industries. This means that hypothesis 2 should be accepted.

Having the same auditor as last year is proven to have a significant positive effect on the length of the audit. However, the interaction effect between workplace closure impact and auditor tenure is not significant, which means it cannot be proven that auditor tenure has a significant effect on the relation between the average of workplace closure measures during the length of the audit and audit delay. Hypotheses 3 can't be proven.

The fourth model has a significant negative effect for having a non-clean opinion and a significant positive effect of having a non-clean opinion on the relation between workplace restrictions and the length of the audit. This implies that having a non-clean opinion seems to shorten audit delay, which is in line with Ashton et al. (1989), but the opposite of what Che-Ahmad et al. (2008) found. On top of that having a non-clean opinion seems to increase the length of the audit. This might be caused by additional care from the auditor for auditing companies that are receiving a non-clean opinion. The results imply hypothesis 4 should be accepted

In short, the average of workplace restrictions during the audit term has an increasing effect on the length of the audit, causing audit delay. In contrast to my expectations, while auditor tenure has a significant positive effect on the relation between the workplace closure impact and audit delay, belonging to one of the most affected industries decreases audit delay, which may indicate that companies in these industries are on average easier to audit in a normal situation. Furthermore, having a non-clean opinion increases the strength of the relation between workplace closures and audit delay. My study indicates that there, indeed, appears to be an effect of workplace restrictions imposed to control the spread of Covid-19 on audit delay.

A limitation of my research is that for model 4, in contrast to the other three models there is a low number of observations, which may affect the outcomes of this model. Regarding the sign of coefficient for having a non-clean opinion in model 4, there seem to be conflicting views in prior literature, which also raises uncertainty regarding the outcome of my model. Another limitation is that workplace closures, for example, due to a pandemic, are just a recent thing. Consequently, this affects collecting data. The small timeframe makes it difficult to collect large observational data. Hypothetically, this problem could be solved if new workplace closure data became available due to, for example, a new pandemic. Another limitation is that the control variable FinancialSIC, which takes a value of 1 for companies that belong to the financial industry has a significant positive effect on audit delay, in contrary to what Ashton et al. (1987) found. This might have been caused by the age of this paper, where the duration to audit a company in the financial industry could have changed since then.

Future research could elaborate on the discussion in which way audit delay is affected by the issuance of a non-clean opinion or not. Furthermore, similar research on the impact of Covid-19, through workplace measures on audit delay could be conducted, by also considering the post-Covid-19 future which I due to the time of the writing couldn't incorporate in my research.

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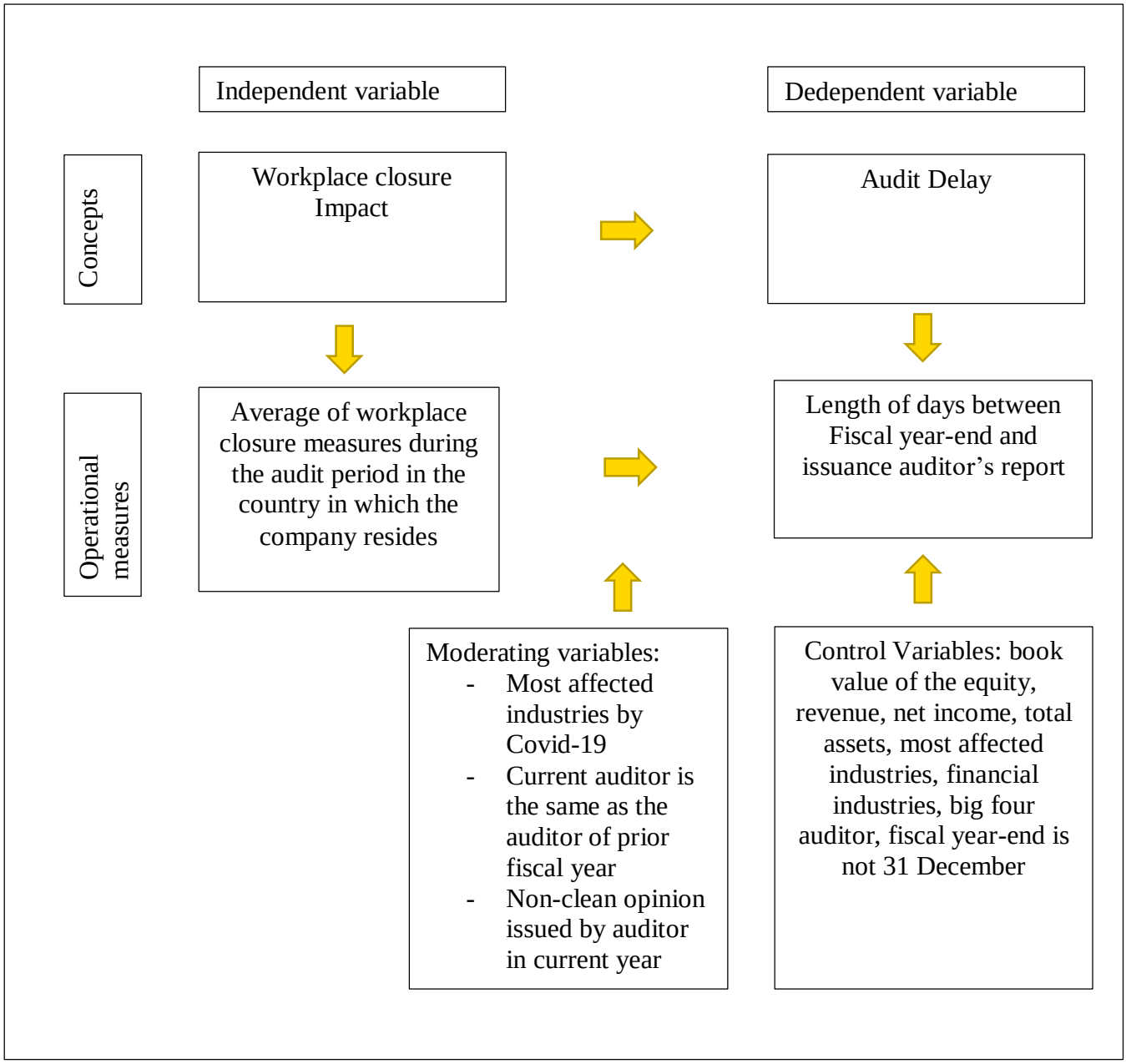
7. Appendix

Appendix A. Description of the Variables and Predicted Sign

Variable	Definition	Predicted Sign
Audit Delay	Length of the audit in days as measured between the fiscal year-end and filing date	
ClosureImpact	Sum of the level of workplace closures, ranging from 0-3 (no measures, measures recommended, measures required at some levels, and measures required at all levels) and extracted from ourworldindata.org/coronavirus, divided by the length of the audit in days	+
BookValueEquity	Quarterly book value of equity as on the balance sheet	-
Revenue	Quarterly revenue as on the income statement	-
NetIncome	Quarterly net income as on the income statement	-
TotalAssets	Quarterly total assets as on the balance sheet	-
MostAffectedIndustriesSIC	Binary variable whether company belongs to one of the most affected industries (e.g., retail: 3999-5000 and transportation: 5199-6000)	+
FinancialSIC	Binary variable taking 1 if the company belongs to financial industry and 0 otherwise (e.g., depository institutions: 6011-6099, non-depository institutions: 6111-6163, securities: 6211 & 6712)	-
BigFourAuditor	Binary variable taking 1 if the auditor is a Big Four auditor and 0 otherwise	-
FiscalYearNot31December	Binary variable taking 1 if the fiscal year-end is 31 December and 0 otherwise	+
CurrentIsPreviousAuditor	Binary variable that takes 1 for a company which current auditor is equal to its last year's auditor and 0 otherwise	-
NonCleanOpinionIssued	Binary variable that takes 1 for a company when the company's auditor issued a non-clean opinion and 0 otherwise	+

Note. Variables are extracted from WRDS-Audit Analytics, except for ClosureImpact which is calculated with data from ourworldindata.org/coronavirus and NoncleanOpinionIssued which is extracted from WRDS-Compustat Global

Appendix B. Libby Boxes



Note. The boxes at the top are concepts formulated based on the theory with the aim of answering the research question. The boxes on the bottom aim to operationalize the concepts to answer the hypotheses. Mediating variables are used to test their impact on the relation between the independent and dependent variable. Control variables are held constant to more accurately determine the relation between the dependent and independent variable