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“Using a hammer to kill a fly”: The Impact of COVID-19 on Firm Performance in Europe

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Abstract

This study aims to evaluate whether firm performance is impacted by countries' choice of lockdown policy and the number of reported COVID-19 cases. We design a quantitative study using the instrumental variable (IV) approach to examine the relationship between lockdown measures and number of reported COVID-19 cases and the subsequent impact on firm performance, in a European setting. Our results suggest countries' choice to implement a lockdown policy is significantly associated with the number of reported COVID-19 cases. We find that firm performance is impacted by the number of reported COVID-19 cases in the residing country of the firm under certain conditions, though the results are inconclusive. These findings contribute to recent studies investigating the development of the COVID-19 pandemic and the subsequent impact on firm performance, as well as providing an improved understanding of firm performance in times of pandemics.

Keywords: *COVID-19, firm performance, lockdown, cases, instrumental variable*

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1. Introduction

“We don’t see it as viable to have this kind of drastic closing down, opening and closing. You can’t open and close schools. That is going to be a disaster. And you probably can’t open and close restaurants and stuff like that either too many times. Once or twice, yes, but then people will get very tired and businesses will probably suffer more than if you close them down completely.” - Anders Tegnell

Sweden’s decision to not impose a lockdown policy to combat the COVID-19 pandemic made worldwide news: with Anders Tegnell, Sweden’s state epidemiologist, going as far as dubbing the lockdown policy as a strategy of “using a hammer to kill a fly” (Milne, 2020). Nonetheless, neighbouring countries in the Nordic region, who imposed lockdowns, experienced substantially lower infection and death rates. As Sweden exhibits one of the highest number of COVID-19 cases and deaths per capita across Europe, with no sign of a slowdown, the critique against Sweden and “officials without talent” administrating “the Swedish Covid experiment” (Savage, 2020) has been vocal within the scientific community. The vastly different public health policies and outcomes, coupled with comparable macroeconomic impact across the Nordic region, illustrates the puzzling conundrum governments face when instituting policies to battle ongoing pandemic shocks.

The objective of this thesis is to examine the impact of lockdown measures on reported COVID-19 cases and in turn on firm performance. Earlier literature highlights and provides answers to questions concerning lockdown policies, health and economic outcome and stock performance during the initial stage of the COVID-19 pandemic. However, there is currently little research related to the distinct relationship between COVID-19 cases, lockdown policies and firm performance, perhaps since the pandemic is yet ongoing. Europe provides a compelling setting, as the juxtaposition of countries such as Sweden and other European countries illustrates the challenge policymakers have faced during the pandemic: being in an onerous position of having to manage both the public health need of controlling the spread of COVID-19, while ensuring the followed economic and social costs (Bonaccorsi et al., 2020) are curtailed. Therefore, we seek to answer the following research question:

Is firm performance impacted by countries’ choice of lockdown policy and the subsequent effect on the number of reported COVID-19 cases?

There is limited research within the area of examining the impact between lockdown measures and number of reported COVID-19 cases, as well quantifying the effect on firm performance. Specifically, the relationship between the COVID-19 pandemic and firm performance as a yet occurring event is a highly unexplored topic. Establishing a link between government policy and public health outcomes is the outset of a study made by Born et al. (2020). They attempt to quantify the “lockdown effect” on the number of reported COVID-19 infection cases and deaths in Nordic and other Western European countries, where they find that the number of reported COVID-19 cases and deaths in Sweden would have been reduced by one half and one third, respectively, had they imposed a lockdown.

Further, Zhang et al. (2020) study the role of face masks as a mitigation measure at policymakers' disposal. The study suggests that face masks significantly reduce the number of reported COVID-19 cases after becoming mandatory, providing support to the notion of lockdown measures not being the sole component of a country's COVID-19 mitigation plan.

Other related research concerns linking COVID-19 cases and deaths with stock market performance, where previous research has presented contrasting pre- and post-lockdown period results: with a negative and positive relationship between the daily increase of the number of confirmed COVID-19 cases and stock returns of listed Vietnamese firms, during the pre-lockdown and post-lockdown periods, respectively (Anh & Gan, 2020). However, a similar study in other geographical regions exhibits a negative relationship between lockdown measures and stock market performance (Eleftheriou & Patsoulis, 2020), which Anh and Gan (2020) notes does not isolate the impact of the lockdown on each individual country and further argued the divergence from their study to be two-folded: relating to both the proactiveness of countries in the early stages of the pandemic, and the high degree of investor's confidence and trust of government.

We design a quantitative study based on panel data containing individual firms' financial information, complemented with reported COVID-19 cases, deaths, chosen lockdown measures and additional country-level data. The aim of the panel regression model is to assess the extent to which reported COVID-19 cases impacts firm performance. We use heterogeneity in the lockdown measures, of a set of European countries, as a viable source of exogenous discrepancy in reported COVID-19 cases to overcome endogeneity concerns. This relates to the methodology aimed at delimiting regression coefficient bias, when the regressor of interest is measured with random errors, also called the Instrumental variables (IV) method (Angrist & Pischke, 2009). We argue that lockdown measures serve as a conceivable instrument for reported COVID-19 cases, as it fairly correlates with reported COVID-19 cases and because it is unlikely to be directly correlated with firm performance. By applying the IV method, we can thereby estimate the (indirect) impact of country-level lockdown measures on individual firm performance. We isolate the impact of lockdown measures on reported COVID-19 cases, with the presumption that it does not impact firm performance through any other medium.

Our study makes three main contributions to prior literature. First, our thesis contributes to previous research within the topic of COVID-19 by examining the relationship between lockdown measures and number of reported COVID-19 cases and the subsequent impact on firm performance, in a European setting. We propose lockdown measures acting as a valid instrumental variable for reported COVID-19 cases, while raising the question of the dynamics between chosen lockdown policies and their influence on the spread rate of COVID-19 cases and the potential existence of dynamic endogeneity. Further, we show that the impact on firm performance under certain conditions is heightened in highly affected regions in Europe, supporting findings for firms in other geographies (Hassan et al., 2020; Shen et al., 2020). Second, the cross-sectional structure of our study of the development of COVID-19 pandemic and the subsequent impact on firm performance provides an improved

understanding of firm performance in times of crises or exogenous shocks. Although previous studies have focused on impact on firm performance through the lens of corporate financial decisions (e.g. the banking sector during the global financial crisis), this paper contributes to previous literature within firm performance through a different lens: examining non-corporate decisions (i.e. policies to combat COVID-19) and their influence on firm performance. In contrast, extant research has investigated firm performance (e.g. expected stock returns) and its relationship with firm-level factors such as dividend pay-out and financing policies (Fama & French, 1988; Campbell & Shiller, 1988). Third, our study contributes to the literature within accounting conservatism, as we document that firms appear to report losses more timely than gains under certain conditions, supporting prior literature within the topic of accounting conservatism in general and its impact on firm performance during crises or periods of exogenous shocks (Watts & Zuo, 2012).

Our main results show that there is a positive association between countries' choice to implement a lockdown policy and the number of reported COVID-19 cases, statistically significant at the five percent level. The relationship is *prima facie* counterintuitive, but may potentially be explained by a time lag associated with lockdowns (Born et al., 2020) resulting in the containment of the COVID-19 spread rate to materialize by the time that lockdowns have been relinquished (i.e. by the period end of our study). We further present the reduced-form regression of the dependent variable (*Performance*) on the instrument variable (*Lockdown*) and other covariates in the model (Angrist & Pischke, 2009), where our main finding is that lockdown measures are significantly negatively correlated with firm performance during the currently ongoing COVID-19 pandemic.

The relationship between lockdown measures, COVID-19 cases and firm performance is ambiguous. European firms are shown to decline in performance by just over one percentage point, on average, using the IV estimates of our baseline specification. Moreover, the results show that there is a positive relationship between firm size and performance and a negative relationship between both leverage and tangibility, respectively, and firm performance. Our IV results are slightly larger than those obtained using ordinary least squares (OLS), providing support to the notion of bias concerns in OLS estimates. However, when including regression models with alternative specifications and certain fixed effects, our results lack statistical significance. Therefore, our research question remains partly unanswered, as our results only hold under certain conditions. In addition to our main tests, we also examine the role of accounting conservatism and stock returns during COVID-19, where we find a slightly positive relationship between pre-COVID-19 accounting conservatism and stock returns during the pandemic, though with lack of statistical significance.

The format of the paper is configured as follows. Section 2 introduces related literature and our hypothesis development. Section 3 presents our research design and our data. The main results are presented and discussed in Section 4. Section 5 presents an additional cross-sectional analysis and robustness tests. Section 6 concludes the paper and Section 7-8 provides details on our data and results through tables and materials found in appendices, as well as producing a reference list.

2. Literature review

2.1 Lockdown measures and COVID-19

2.1.1 Recommendations and lockdown measures during the COVID-19 pandemic

Large scale physical distancing measures and movement restrictions, often referred to as “lockdowns”, have historically been implemented due to specific emergent events for limited time periods, often linked to terrorist attacks, as for instance the three-day lockdown of American airspace after the September 11, 2001 attacks. During the current COVID-19 pandemic, a large proportion of the world has in some way imposed different lockdown measures to contain the number of COVID-19 cases (BBC, 2020). Authorities have issued different sets of recommendations and lockdown measures on national, regional or local levels. The distinction between recommendations and lockdowns can be interpreted as recommendations concerning a set of voluntary guidelines, while lockdowns are measures that restrict all non-essential internal movement for the public. Most nations have adopted both strategies, which meant that inhabitants in these countries initially were urged to avoid any large social gatherings or unnecessary social contacts, but as the number of COVID-19 cases continued to increase, different forms of curfews and travel restrictions were implemented. However, countries such as Sweden chose not to implement any lockdown measures and rather relied on non-enforceable social restrictions, despite an upward trajectory of the number of COVID-19 cases. To bear in mind, despite the absence of lockdown measures in Sweden, mobility data showed people travelled less and spent more time at home than before the pandemic (Google, 2020). Hence, despite the absence of a lockdown, one may suggest that people can still adjust their behaviour and voluntarily reduce the number of physical interactions. Accordingly, the different strategies lead to some variation in lockdown stringency among countries, where the computed average stringency of COVID-19 measures in Sweden was significantly lower than other European countries (Born et al., 2020).

During the summer of 2020, the increase in the number of COVID-19 cases and deaths came to a halt in many European countries. However, during the fall of 2020, the number of cases once again started to increase and many countries reintroduced lockdown measures in order to mitigate the upcoming “the second wave” (BBC, 2020). In early December of 2020, at the time of writing, there are no general indications of a potential slowdown in terms of COVID-19 cases in Europe. However, initiations of extensive vaccinations programs are to be expected in many countries by the end of 2020 or by the start of 2021 (Gallagher, 2020).

2.1.2 Lockdown policies and their impact on COVID-19 cases and deaths

In general, previous research has examined the effects of the COVID-19 pandemic and how lockdown measures relate to the containment of COVID-19 cases and deaths. Born et al. (2020) examine the lockdown effect and its effect on limiting the spread of COVID-19 infections, by performing a counterfactual study for Sweden. The study was performed

through a *synthetic control* methodology, established by Abadie and Gardeazabal, 2003; Abadie et al., 2010, to approximate the outcome for Sweden had they conducted a lockdown. The authors suggest that reported COVID-19 cases and deaths in Sweden would have been reduced by one half and one third, respectively, by the end of the hypothetical lockdown period. The study further proposes that there is a time lag associated with the lockdown, where infections started to slow down only after about 3 to 4 weeks. Citizens were advised by the Swedish authorities, to adjust their behaviour in the beginning of the pandemic, as people were told “to avoid unnecessary traveling and social events, to keep distance to others, and to stay at home” if they had any symptoms (Krisinformation, 2020). Hence, the time lag associated with lockdowns can partly be attributed to (voluntary) social restraints, as the effectiveness of lockdown measures is conditioned by citizens adjusting their behavior, as is the case in the absence of a lockdown.

Additional studies further show that lockdown measures significantly decreased the spread rate of COVID-19 cases during the outbreak in Wuhan, China in January to February 2020 (Lau et al., 2020), attributed to the more stringent confinement of people in high risk areas. Similar studies have been conducted in an European setting (Dehning et al., 2020), where the main interventions in Germany to contain the COVID-19 outbreak in March were threefold: i) canceled large public events, ii) closed schools, childcare facilities, and various stores and iii) far-reaching contact ban including the prohibition of even small public gatherings as well as the closing of restaurants and all nonessential stores. The findings of the study indicate that all three measures each had around a 40% negative impact on the spread rate of COVID-19, supporting the findings made by Lau et al. (2020).

However, other restrictive measures than lockdowns are at policymakers’ disposal. According to Zhang et al. (2020) airborne transmission is the dominant route for the spread of COVID-19, and mitigation measures such as social distancing are argued to be insufficient by themselves in protecting the public during the pandemic. By analyzing mitigation measures in Wuhan, Italy and New York City, they reveal that the difference with and without mandated face covering represents the determinant factor in shaping the trajectory of the pandemic. By using the synthetic control method, the findings are confirmed by an additional study (Mitze et al., 2020) that examined the effect of face masks on the spread of COVID-19 in Germany. They find that face masks reduce the cumulative number of registered COVID-19 cases between 2% and 13% over a period of 10 days after they become (hypothetically) compulsory. Further, they conclude that face masks reduce the daily growth rate of reported COVID-19 cases by around 40%.

2.2 COVID-19 and the impact on firm performance

2.2.1 COVID-19 and the impact on firm-level characteristics

Studies on firm performance during COVID-19 and its relationship with firm-level factors has focused on stock returns, where Wójcik and Ioannuo (2020) note that firm size appears to be a significant factor shaping the stock return outcome during the pandemic. The authors

comment that large market capitalisation (*large caps*) companies' stock prices perform considerably better than *small caps*. This is explained as the stock market viewing company size as part of the overall firm risk profile, during prevailing conditions. Other risk factors studied during the pandemic are firm liquidity, as De Vito and Gomez (2020) examine how the COVID-19 pandemic could affect the liquidity risk of listed firms. In the most adverse scenario, they find that the average firm would exhaust its cash holdings in about two years and about a tenth of the firms would become illiquid within six months.

In general, almost all firms appear to have been affected by the COVID-19 pandemic. This notion is expanded by Hassan et al. (2020), who examine firm-level measures of risk, sentiment and exposure during COVID-19, and conclude that the pandemic affects almost all firms across all industries and geographical regions. In contrast, other large-scale epidemics such as SARS and H1N1 (the Swine Flu pandemic) affected specific regions and sectors directly impacted by the outbreak. Nonetheless, the impact of COVID-19 on firms is not unanimous, as a large degree of heterogeneity between firms prevails, namely in terms of differences between geographical regions and industries and sectors. For instance, the risk associated with COVID-19 has been noted as higher for firms within the educational and healthcare sectors (Hassan et al., 2020), whereas the technology sector appears to have been positively impacted as the trend of digitalization has been accelerated, namely in the IT and software industries (Gu et al., 2020). In contrast, the transportation industry suffered a huge collapse in demand when the world started to close down during the early days of the pandemic and different travel-restrictions were imposed (Hassan et al., 2020), with similar negative effects across the manufacturing industry (Gu et al., 2020).

2.2.2 COVID-19 and the role of demand and supply shocks

Previous studies investigating the impact of large-scale catastrophes or crises, such as for instance the global financial crisis, on company activities and the stock market have focused on endogenous shock factors. In the case of the global financial crisis, the endogenous factor related to the impact of corporate decisions, facilitating the outcome of the banking sector and the global economy in general. However, the COVID-19 pandemic was an unanticipated event and primarily a shock to the real economy, not attributable to endogenous factors such as the banking sector during the global financial crisis. Ramelli and F. Wagner (2020) study market reactions to COVID-19 and how real shocks and financial policies drive firm value, where they find that the effects of the pandemic outbreak are exacerbated by financial channels, linking the results to firms' dependence on global trade and supply chain linkages as well as financial strength. Interestingly, the authors note a gradual shift in how investors assessed the development of COVID-19 cases and the attractiveness for individual companies and stock exposure:

“(...) Initially, as China was effectively shut down, investors shunned U.S. stocks with China exposure and internationally oriented companies; as the virus situation in China improved relative to the situation in Europe and in the United States, investors perceived

those companies more favourably again. As the virus spread in Europe and in the United States, leading to lockdowns in these economies, markets moved feverishly.”

The authors further comment on the pattern of the stock returns as being a result of investors and equity analysts progressively being concerned about increasing levels of corporate debt and the potential survival rate of firms with low cash levels: stressing the importance of prudent cash holdings in times of distress such as the emergence of the pandemic. The findings have macroeconomic implications, as COVID-19 has induced a sharp reduction of fiscal revenues for both national and local governments. Subsequently, this trickles down to the economic conditions of individuals: exacerbated by the imposed mobility restraints (i.e. lockdowns) which disproportionately affects municipalities skewed towards low-income households (Bonaccorsi et al., 2020).

On the topic of shocks, the current pandemic has resulted in a simultaneous shock of both supply and demand, in contrast to previous epidemic outbreaks in which solely demand shocks are more prevalent. In terms of divergence across geographies, COVID-19 exposure appears to be relatively more demand-related in Asia, and to a lesser extent Europe whereas the rest of the world seems to be equally weighted towards supply and demand (Hassan et al., 2020). It is notable that during the second and third quarter of 2020, demand-related issues were increasingly prevalent in firms located in regions in which the outbreak was relatively more controlled: particularly China and other Asian countries. Further differences can also be observed at the industry or sector level, where the technology sector demand exposure is increasingly emphasized, consistent with the view that the pandemic has spurred society to adopt more digital solutions at a higher pace whereas in materials, energy and healthcare sectors, supply shocks are more important (Hassan et al., 2020).

2.2.3 COVID-19 and the impact on corporate performance: previous research

There is currently limited research related to the relationship between lockdown measures and firm performance, especially in a European setting. Previous studies have investigated the relationship between the predictions of disease outbreaks and stock returns, where researchers have found significant increases in predictions of 2003 SARS cases in Hong Kong to be negatively correlated with market return volatility (Alfaro et al., 2020). Specifically, the results indicate a doubling of predicted SARS cases leading to declines of eight to eleven percent in the Hang Seng index in Hong Kong during the SARS outbreak. The findings can be interpreted as stock markets as less reactive to new cases, as they continue to follow previously estimated parameters. Thus, investors appear to track changes in epidemiological predictions and may revise their beliefs about the development of the disease outbreak.

The pandemic and the subsequent lockdown's impact on stock market performance has been studied by Anh and Gan (2020), who examine the impact of COVID-19 on stock returns during the periods before and after the lockdown in Vietnam: an economy that successfully managed the outbreak of the pandemic with the re-emergence of the stock market post-lockdown. The study finds contrasting pre- and post-lockdown period results: with a negative

(positive) relationship between the daily increase of the number of confirmed COVID-19 cases and stock returns of during the pre-lockdown (post-lockdown) period, respectively. The authors note that their findings contradict previous studies that had found a negative correlation between the lockdown and stock returns, when analyzing the impact of 45 major stock indices (Eleftheriou & Patsoulis, 2020). The main conclusion is two-fold: firstly, early mitigation measures and proactive planning and action are prerequisite conditions for countries to protect stock markets from severe declines. Secondly, the positive relationship between lockdown and stock returns in Vietnam stems from both the lockdown, and the ensued control of the disease outbreak, and the investors' confidence and trust in the Vietnamese government's actions relating to the COVID-19 pandemic. The authors therefore suggest that investors' uncertainty has a direct impact on stock returns, regardless of the chosen lockdown policy. Considering this, governments would be wise to proactively temper the outbreak of viruses or crises in general to promote investor confidence and sustainable recovery of the stock market and the overall economy.

The severity of the COVID-19 exposure appears to have strong linkages with firm outcomes. Firms in geographical regions with higher COVID-19 exposure are shown to be increasingly exposed to financing supply chain-related issues (Hassan et al., 2020). Further, the negative impact on firm performance is much more pronounced in highly affected areas, as strict quarantine measures limit both production and consumption, sending negative signals to managers and firm stakeholders (Shen et al., 2020). In addition, the outbreak of the pandemic is shown to have an influence on the subsequently decreasing scale of investments and revenue among listed firms in China.

2.3 Economic outcome: regulatory and policy considerations

Previous studies examining the role of regulatory considerations found a positive influence of the rule of law on economic growth over time (Barro, 1997; Haggard & Tiede, 2011). In addition, studies exploring its role during the financial crisis found a similar impact on firm performance for European firms, namely from the quality of a jurisdiction's legal framework (Van Essen et al., 2013). They further commented that European firms in countries with better creditor right protection performed better during the crisis. However, policy indexes such as "Investor protection" and "Anti-director rights" did not have a positive impact on firm performance during the crisis. Hence, it appears as some policies, but not all, can have an impact on firm performance during a period of crisis. Further, the legal environment may also have an impact on valuation, as there is some evidence of higher firm valuations in countries with stronger legal protection of both creditors and shareholders (La Porta et al., 2002). They argue that laws aimed at protecting outside investors drive investor willingness to finance firms, resulting in more developed financial markets with higher valuations.

Lucas (1976) argues that the setup of econometric models consist of economic decision makers with superior decision rules, where it follows that any policy change will subsequently shift the structure of econometric models. Further, he suggests that econometric practices, such as for instance epidemiologic prediction models, must incorporate expected

citizen response to economic policies for the policies to bear fruit. In the case of COVID-19, these findings may be relayed as such as that times of expected drastic future economic downturns may influence the set of lockdown policies used to combat the outbreak, thereby causing policymakers to adapt and alter the outcome trajectory of the COVID-19 pandemic. The conclusion of the study resonates with the findings of Anh and Gan (2020), as it would suggest that both governmental and corporate entities must incorporate expected reactions from their stakeholders in their decision-making process and forecast, in order to facilitate the desired outcome of said group.

2.4 Hypothesis development

In summary, previous studies provide strong evidence that strict lockdown measures have a negative impact on the number of reported COVID-19 cases by slowing down the spread rate, albeit other available restrictions measures such as face mask arguably have an impact as well (Born et al., 2020; Dehning et al., 2020; Lau et al., 2020). To that end, the critique of the Swedish strategy of not imposing any notable lockdown measures, coupled with a high rate of COVID-19 cases deaths, would appear to be supported by previous research. Further, it is established that the COVID-19 pandemic has had an economic impact on firm performance (Anh & Gan 2020; Ramelli & F. Wagner 2020), especially in highly affected areas (Hassan et al., 2020; Shen et al., 2020). Therefore, we would expect that the number of reported COVID-19 cases impacts firm performance. Based on previously acknowledged research, we formulate a hypothesis to test our research question as following:

Firm performance during the COVID-19 period is impacted by the number of reported COVID-19 cases in the residing country of the firm.

3. Research design and data

3.1 Research design

3.1.1 Regression model approach

We design a quantitative study based on panel data containing individual firms' financial information, complemented with reported COVID-19 cases and deaths, lockdown measures and additional country-level data. The aim of the panel regression is to assess the extent to which reported COVID-19 cases impacts firm performance.

One important assumption when performing OLS regressions is with regard to unbiased estimates: in particular, that regressors are independent from the error term and thus exogenous (Khandker et al., 2010). If this assumption is not satisfied, in situations of endogenous explanatory variables, the resulting regression would produce a bias across the other estimates in the model equation, including the coefficient of the endogenous variable. In our study, the concern is raised by the fact that reported COVID-19 cases are endogenous (i.e. non-random), which may influence the accuracy of an OLS regression model, as the variable is included as an explanatory variable to the dependent variable of firm performance.

To illustrate this, consider the following basic OLS regression formula, Equation (1), excluding firm-level control and fixed effects variables:

$$Y_{iqt} = a + X_{iqt} + \varepsilon_{iqt} \quad (1)$$

where Y is firm performance and the dependent variable, X is reported COVID-19 cases and an explanatory variable, a is the intercept and ε denotes the error term. Using Equation (1), with reported COVID-19 cases being a non-random variable, its correlation with the error term would lead us to either overstate or understate its impact on firm performance and in general give us an imprecise measure due to an omitted variable bias (Khandker et al., 2010).

The IV approach is set out to mitigate the effects of endogeneity concerns. The IV aims to clean up the correlation between X and ε . Specifically, the variation in X that is uncorrelated with ε needs to be extracted. To do so, one needs to find an instrumental variable that satisfies two conditions: non-zero correlation between the IV and the endogenous explanatory variable i.e. $\text{cov}(\text{IV}, X) \neq 0$, and the IV and the error term being uncorrelated. To apply the IV approach, we use heterogeneity in the chosen lockdown policy on a country level, as a tenable source of exogenous discrepancy in reported COVID-19 cases across nations. We believe it to be a plausible instrument for reported COVID-19 cases as it reasonably correlates with reported COVID-19 cases and because it is unlikely to be directly correlated with firm performance. In theory, the IV method would, if valid, suggest that we expect the chosen lockdown policy in the country of the individual firm to affect reported COVID-19 cases, and not affect firm performance through any other channel(s) except for its direct effect on reported COVID-19 cases.

However, a potential limitation of IV estimation is that it only factors firms that are affected by the instrument (i.e. lockdown policy). This concern has been raised in previous research where only a subset of firms has been affected by the IV (Bennedsen et al., 2007). However, we argue that the interpretation only affects our reduced-form regression model [see Section 3.4]: as our IV is a country-level dummy variable and the impact on firm performance is captured for the subset of firms that reside in countries that impose lockdown measures.

A hypothesized second source of endogeneity is dynamic endogeneity: which arises when present values of the independent variables are related to previous values of the dependent variable(s) (Khandker et al., 2010). In our study, this would be applicable in the case of the current choice of lockdown policy is related to preceding numbers of reported COVID-19 cases: being dynamically decided based on the current and expected outbreak trajectory of COVID-19, in turn influencing the outcome of the number of reported COVID-19 cases on and on. This becomes a potential issue in our regression model as the association (i.e. the coefficient sign) between the endogenous variable (number of reported COVID-19 cases) and the instrumental variable (choice of lockdown policy) can not be easily interpreted, as the link between them is reciprocal. See Section 4.2-4.3 for further discussion with regards to our study.

The empirical model following the IV approach is further detailed in Section 3.4.

3.1.2 COVID-19 period

We define the COVID-19 period to be from January 1, 2020 to September 30, 2020. The start date has been defined to accommodate the structure of firm-level quarterly financial data, as well as being based on the reported start day of lockdown in European countries, sourced from Oxford COVID-19 Government Response Tracker, mainly falling during the end of March and thus fitting our defined start date in an appropriate manner. The end date is based on publicly available firm-level quarterly financial data at the point of writing this paper. Thus, we acknowledge the fact that the COVID-19 pandemic is yet ongoing and that the design of this research paper is limited on current (inconclusive) data.

3.2 Sample collection

We have a dataset of 8,627 listed firms in Europe, between 1 January 2010 and 30 September 2020. The data contains quarterly firm-level financial information, share price, GDP-growth and unemployment rate per country, exchange rates, country-level COVID-related data (chosen lockdown policies per quarter and reported number of COVID-19 cases and deaths per quarter), size of population per country and number of hospital beds per 100,000 inhabitants. The data was obtained from five different sources:

1. Annual and quarterly financial information and share price data retrieved from *Compustat Global Daily*. Compustat Global Daily is provided by Wharton Research Data Services. We obtained financial information from 1 January 2010 to 30 September 2020 and share

price data from 1 January 2018 to 30 September 2020. All data were collected in October 2020.

2. GDP-growth, population, hospital beds per 100,000 inhabitants and unemployment data are from *Eurostat*. GDP-growth and unemployment data per quarter is from 1 January 2010 to 30 September 2020, size of population data is by end of 2019 and data for hospital beds per 100,000 inhabitants are by end of 2019. The data were collected in October 2020.
3. The exchange rates are from *Oanda*. We obtained the data from 1 January 2010 to 30 September 2020 using the European Central Bank exchange rates. The data were collected in October 2020.
4. The reported number of COVID-19 cases and deaths data per quarterly are from European Centre for Disease Prevention and Control, *ECDC*. The data were collected in October 2020.
5. Chosen lockdown policies data are from *Oxford COVID-19 Government Response Tracker*. We obtained the data from 1 January 2020 to 30 September 2020 and the data were collected in November 2020.

Table 1. Sample Selection

	Observations
Total number of firm-year-quarter observations from 2010-2020 with Compustat data	364,643
Excluding financial and real estate companies (SIC 4900-4999, 6000-6999)	-101,196
Final sample	263,447
Total sample size (no. of companies)	8,627

Table 2 shows the sample composition of firm and firm-quarter observations by country. To note, the sampled firms with headquarters in the United Kingdom, Sweden, France, Germany and Poland together constitute approximately 60 % of the total sample.

Table 2. Firm sample composition by country

	Firm-quarter observations	% of Firm-quarter observations	Number of Firms	% of Firms
Austria	2,420	0.92	77	0.89
Belgium	3,798	1.44	124	1.44
Bulgaria	2,741	1.04	115	1.33
Switzerland	7,788	2.96	225	2.61
Cyprus	2,532	0.96	75	0.87
Czech Republic	403	0.15	18	0.21
Germany	23,372	8.87	779	9.03
Denmark	4,942	1.88	167	1.94
Spain	5,245	1.99	154	1.79
Estonia	555	0.21	15	0.17
Finland	5,671	2.15	174	2.02
France	25,21	9.57	835	9.68
United Kingdom	52,559	19.95	1,775	20.57
Greece	7,744	2.94	236	2.74
Croatia	3,681	1.40	133	1.54
Hungary	856	0.32	36	0.42
Ireland	2,514	0.95	87	1.01
Iceland	612	0.23	17	0.20
Italy	10,834	4.11	399	4.63
Lithuania	1,069	0.41	35	0.41
Luxembourg	1,321	0.50	49	0.57
Latvia	1,088	0.41	31	0.36
Malta	599	0.23	20	0.23
Netherlands	4,891	1.86	159	1.84
Norway	7,803	2.96	312	3.62
Poland	27,688	10.51	780	9.04
Portugal	1,785	0.68	49	0.57
Romania	4,598	1.75	150	1.74
Russia	7,190	2.73	229	2.65
Serbia	1,102	0.42	66	0.77
Slovakia	389	0.15	14	0.16
Slovenia	1,054	0.40	38	0.44
Sweden	25,520	9.69	865	10.03
Turkey	12,808	4.86	332	3.85
Ukraine	1,065	0.40	57	0.66
Total	263,447	100.00	8,627	100.00

3.3 Control variables

In this sub-section, we present the definition of all variables included in the regression models. A comprehensive description of the items included in all variables is presented in *Appendix A*.

Firm-level controls

$Size_{itc}$: In line with previous research with similar research design and dependent variable(s) (Bennedsen et al. 2007), we use size as a control variable: calculated as the natural

logarithm of the total book value of assets in Euro at quarter end for firm i , in quarter q , in year $t-1$ and country c . We choose to control for firm size as it is suggested to be a significant factor shaping the corporate return outcome during the pandemic (Wójcik & Ioannuo 2020) and as firm size is reported to have a significant impact on firm performance (Peni, 2014).

Liquidity_{iqtc}: Liquidity is calculated as current assets over current liabilities for firm i , in quarter q , in year $t-1$ and country c . Previous studies find that the COVID-19 pandemic could affect the liquidity of listed firms severely (De Vito & Gomez, 2020) and that liquidity management can have an impact on firm performance (Wang, 2002).

Leverage_{iqtc}: Leverage is total debt over total assets for firm i , in quarter q , in year $t-1$ and country c . Rajan and Zingales (1995) find that profitability is negatively correlated with leverage and that leverage serves as a proxy for the financial condition of the firm (Peni, 2014) and, thus, an important component when estimating firm performance.

Tangibility_{iqtc}: Tangibility is non-current assets over total assets for firm i , in quarter q , in year $t-1$ and country c . Prior research predicts that tangibility can have conflicting effects on profitability. Given that tangible assets are easily monitored and provide good collateral, they tend to mitigate agency conflicts. Conversely, firms with high levels of intangible assets tend to have more investment opportunities in the long term and consequently negative association between tangibility and profitability (Dawar, 2014). Further, tangibility is shown to be useful for measuring the weight of company assets that could be used as collaterals in a liquidation scenario, thereby reducing the level of asymmetric information and information opacity (La Rocca & Cambrea, 2019).

Revenue Growth_{iqtc}: Revenue Growth is the quarter on quarter growth of revenue, calculated as revenue for firm i in quarter q , in year $t-1$ and country c , over revenue last quarter for firm i in quarter $q-1$, in year $t-1$ and country c . Revenue growth takes into account the firm's growth opportunities (La Rocca & Cambrea, 2019) and may positively impact firm performance (Peni, 2014).

Country-level controls

Unemployment_{qtc}: Unemployment is the unemployment rate in quarter q , in year $t-1$ and country c . Issah and Antwi (2017) argue that the macroeconomic conditions should be incorporated when predicting firms' performance, hence, we incorporate unemployment rate in the model.

GDP Growth_{qtc}: GDP Growth is the quarterly GDP growth in quarter q , in year $t-1$ and country c . Issah and Antwi (2017) argue that the macroeconomic conditions should be incorporated when predicting firms' performance, hence, we incorporate GDP growth in the model.

Hospital Beds_{qtc}: Hospital Beds is the number of hospital beds per 100,000 inhabitants in quarter q , in year $t-1$ and country c . We hypothesize the number of hospital beds to be associated with COVID-19 outcomes, namely the number of reported COVID-19 deaths.

Dependent Variables

Performance_{iqtc}: is return on assets (ROA), defined as annualized net income before extraordinary items divided by average assets trailing four quarters for firm i , in quarter q in year t and country c .

Stock Return_{iqtc}: is price change of stock, calculated as the stock price for firm i , in quarter q in year t and country c , over stock price for firm i , in quarter $q-1$ in year t and country c .

Other Variables

COVID – 19 Impact_{qtc}: is an indicator variable equal to zero when the number of reported COVID-19 cases fall below the median number per 100,000 inhabitants, and equal to 1 otherwise in quarter q in year t and country c . COVID-19 impact is classified into two groups: *Low* if equal to 0 and *High* if equal to 1. Note that the *COVID-19 Impact* variable is included for Table 3 Panel A and is not included in our main tests.

Cases_{qtc}: is the natural logarithm of the number of reported COVID-19 cases in quarter q , in year t and country c , scaled by size of population per 100,000 inhabitants in country c .

Deaths_{qtc}: is the natural logarithm of the number of reported COVID-19 deaths in quarter q in year t and country c , scaled by size of population per 100,000 inhabitants in country c .

Instrumental Variable

Lockdown_{qtc}: Lockdown is a dummy variable that is equal to one if lockdown measures have been implemented, and equal to zero otherwise, in quarter q , in year t and country c , and zero if otherwise.

3.4 Statistical methods

In Section 4, we present the detailed specification for our panel regression using the chosen lockdown policy as an instrument and additional firm-level and country controls. To implement the IV estimator, we first run the following regression:

$$Cases_{iqtc} = \gamma_1 + \beta_1 Lockdown_{iqtc} + \lambda_1 CONTROLS_{iqtc} + \delta_1 FEs + \varepsilon_{iqtc} \quad (2)$$

where *Cases_{iqtc}* is the natural logarithm of the total reported COVID-19 cases for firm i , in quarter q , in year t and country c , scaled by size of population per 100,000 inhabitants in country c . *Lockdown_{iqtc}* is the instrument variable that is an indicator variable equal to one if lockdown measures have been implemented in quarter q in year t and country c and zero if

not. $CONTROLS_{iqt c}$ include the firm-level and country-level controls presented in Section 3.3. FES include fixed effects controlling for year-quarter, country, firm and firm-year-quarter, included in our alternative specifications. ε is the error term in the regression model for firm i , in quarter q , in year t and country c . Equation (2) represents the first-stage regression. It aims to assess the relationship between the instrumental and instrumented variables, i.e. the first casual effect.

After examining the impact of chosen lockdown policies on reported COVID-19 cases, we turn to analyzing its impact on firm performance. Estimating the reduced-form correlation between the instrument and ROA, our key firm performance dependent variable, is done as followed:

$$Performance_{iqt c} = \gamma_2 + \beta_2 Lockdown_{iqt c} + \lambda_2 CONTROLS_{iqt c} + \delta_2 FES + \varepsilon_{iqt c} \quad (3)$$

where $Performance_{iqt c}$ is return on assets (ROA), the dependent variable defined as annualized net income before extraordinary items divided by total assets, for firm i , in quarter q in year t and country c , scaled by size of population per 100k habitants in country c . $Lockdown_{iqt c}$ is the instrument variable that is equal to one if lockdown measures have been implemented for firm i , in quarter q in year t and country c , and zero if not. $CONTROLS_{iqt c}$ include the firm-level and country-level controls presented in Section 3.3, for firm i , in quarter q , in year t and country c . FES include fixed effects controlling for year-quarter, country, firm and firm-year-quarter, included in our alternative specifications. ε is the error term in the regression model for firm i , in quarter q , in year t and country c . Equation (3) represents the reduced-form regression.

After examining the impact of the lockdown measures on ROA, we turn to the IV-Two-Stage Least Squares (IV-2SLS) regression model to analyze the impact of reported COVID-19 cases on changes in firm performance, performed as followed:

$$Performance_{iqt c} = \gamma_3 + \beta_3 \widehat{Cases}_{iqt c} + \lambda_3 CONTROLS_{iqt c} + \delta_3 FES + \varepsilon_{iqt c} \quad (4)$$

where $Performance_{iqt c}$ is return on assets (ROA), the dependent variable defined as annualized net income before extraordinary items divided by average assets trailing four quarters, for firm i , in quarter q in year t and country c . $\widehat{Cases}_{iqt c}$ are fitted values from the first-stage regression in Equation (2). $CONTROLS_{iqt c}$ include the firm-level and country-level controls presented in Section 3.3, for firm i , in quarter q , in year t and country c . FES include fixed effects controlling for year-quarter, country, firm and firm-year-quarter, included in our alternative specifications. ε is the error term in the regression model for firm i , in quarter q , in year t and country c . Equation (4) represents the second-stage regression. The coefficient (β) is of interest as it captures the direct impact of reported COVID-19 cases on changes in firm performance.

4. Results and analysis

4.1 Descriptive statistics

To analyze the impact of lockdown measures on reported COVID-19 cases, and in turn the impact firm performance, we first present basic descriptive results as a benchmark.

Table 3 Panel A presents summary statistics of the firm-year-quarter-country observations, stated four quarters prior to the COVID-19 period to serve as control variables for the firm observation going into the COVID-19 period. Columns (2) and (3), respectively, display the firms that reside in countries where the number of reported COVID-19 cases fall below the median number in quarter q (*Low*), and firms that reside in countries where reported COVID-19 cases exceed the median number (*High*), respectively. Comparing firm characteristics between the *Low* and *High* groups, we observe firms within the *High* category tended to be larger, with the mean difference (column 4) between the *Low* and *High* group being significant at the one percent level ($p < 0.1\%$). Secondly, firms within the *High* category appear to be located in countries with higher unemployment rates, lower quarterly GDP growth rates and fewer number of hospital beds per 100,000 habitants: all significant at the one percent level. In contrast, firms within the *Low* category exhibit higher asset tangibility and higher leverage, coupled with lower revenue growth and liquidity levels, though, with non-statistical mean differences.

Table 3 Panel B presents summary statistics of the firm-year-quarter-country observations during the COVID-19 period. Columns (2) and (3), respectively, display the firms that reside in countries where lockdown measures have been implemented, in quarter q , and firms that reside in countries where lockdown measures have not been implemented, respectively. A comprehensive list of the lockdown measures per country is presented in Appendix B. When we compare firm characteristics between the two groups, we find that firms that reside in countries where lockdown measures have been implemented exhibit higher asset tangibility and on average are larger in size. In contrast, we find that firms that reside in countries where lockdown measures have not been implemented exhibit higher leverage, revenue growth and liquidity, though, with non-significant statistical mean differences. To note, country-level control variables (i.e. unemployment rate, GDP growth and number of hospital beds per 100,000 habitants) have been excluded from the table, due to an insufficient amount of data available during the COVID-19 period.

Table 3. Firm Characteristics

Panel A: By COVID-19 impact				
Variable	Covid-19 Impact			Difference
	All	Low	High	
	(1)	(2)	(3)	(4)
Size	4.8378 (0.0219) [13,899]	4.3550 (0.0339) [5,438]	5.1480 (0.0281) [8,461]	-0.7930*** (0.0444)
Liquidity	8.2706 (1.6784) [13,877]	7.8262 (2.3609) [5,430]	8.5563 (2.3021) [8,447]	-0.7301 (3.4391)
Leverage	0.2956 (0.0508) [13,482]	0.3044 (0.0685) [5,242]	0.2900 (0.0709) [8,240]	0.0144 (0.1043)
Tangibility	0.5289 (0.0021) [13,890]	0.5328 (0.0033) [5,434]	0.5264 (0.0026) [8,456]	0.0064 (0.0042)
Revenue Growth	0.3154 (0.0703) [13,183]	0.2995 (0.1344) [5,154]	0.3256 (0.0768) [8,029]	-0.0260 (0.1441)
Unemployment	0.0617 (0.0003) [16,714]	0.0604 (0.0005) [6,549]	0.06251 (0.0003) [10,165]	-0.0021*** (0.0006)
GDP Growth	0.0046 (0.0001) [16,714]	0.0061 (0.0001) [6,549]	0.0036 (0.0001) [10,165]	0.0025*** (0.0001)
Hospital Beds	414.7364 (1.3426) [17,120]	435.9528 (2.2474) [6,727]	401.0038 (1.6520) [10,393]	34.9490*** (2.7360)

The table presents firm characteristics four quarters before the COVID-19 impact. COVID-19 impact is classified into two groups: *low*, when the number of reported COVID-19 cases in the country fall below the median number per 100,000 inhabitants is lower than the median of the quarterly change in reported cases of Covid-19 per 100,000 inhabitants, and *high* otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Liquidity* is lagged current assets over lagged current liabilities. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. *Revenue Growth* is the lagged quarter on quarter growth of revenue. Standard errors are in parentheses and the numbers of observations are in square brackets. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 3. Firm Characteristics (Continued)

Panel B: By lockdown policy		Lockdown		
Variable	All	Yes	No	Difference
	(1)	(2)	(3)	(4)
Size	4.9019 (0.0276) [9,210]	5.0882 (0.0300) [7,524]	4.0705 (0.0657) [1,686]	-1.0177*** (0.0274)
Liquidity	4.0386 (0.4222) [9,577]	4.2759 (0.5309) [7,596]	3.1286 (0.1493) [1,981]	-1.1472 (1.0424)
Leverage	0.2598 (0.0219) [7,710]	0.2737 (0.0260) [6,473]	0.1874 (0.0051) [1,237]	-0.0862 (0.0596)
Tangibility	0.5314 (0.0025) [9,222]	0.5358 (0.0027) [7,531]	0.5118 (0.0060) [1,691]	-0.0239*** (0.0065)
Revenue Growth	0.3364 (0.2477) [8,797]	0.3539 (0.3024) [7,193]	0.2580 (0.0768) [1,604]	-0.0960 (0.6415)

The table presents firm characteristics during the COVID-19 period. In column (2), firm-level variables are presented in country c where lockdown measures have been implemented in quarter q in year t. In column (3), firm-level variables are presented in country c where lockdown measures have not been implemented in quarter q in year t. *Size* is the natural logarithm of the total book value of assets in Euro. *Liquidity* is current assets over current liabilities. *Tangibility* is non-current assets over total assets. *Revenue Growth* is the quarter on quarter growth of revenue. *Hospital beds*, *Unemployment* and *GDP Growth* have been excluded from the table due to insufficient amount of available data. Standard errors are in parentheses and the numbers of observations are in square brackets. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

4.2 Main results

As the paper aims to evaluate whether firm performance is impacted by lockdown measures and in turn the number of reported COVID-19 cases, the next sub-section focuses on presenting the estimates of this relationship, using an IV approach.

Table 4 presents the first-stage relationship between the lockdown measures and reported COVID-19 cases. In column (2) we present our baseline specification, whereas column (3)-(6) serves as alternative specifications, augmented to be more restrictive: including year-quarter, country, firm and firm-year-quarter dummy variables respectively as additional controls. Expectedly, the lockdown measure is shown to be associated with reported COVID-19 cases, statistically significant at the 1 percent level. Interestingly, the *Lockdown* coefficients show positive signs in the range of approximately 3.96–4.35, excluding the results from regressions with year-quarter and firm-year-quarter fixed effects which show negative relationships of approximately -0.50 and -0.47 respectively: all statistically significant at the 1 percent level. Ignoring the time effect, the results would suggest that

countries that have imposed a lockdown, in year t and quarter q , exhibit higher rates of reported COVID-19 cases.

The interpretation of these findings is dual: firstly, our result may indicate the existence of a lag effect: between the implementation of lockdown measures and the subsequent effect on reported COVID-19 cases. We contemplate that the positive association is an indication that countries with higher rates of COVID-19 cases, in quarter q , appear to be increasingly inclined to impose lockdowns, as policymakers iteratively implement policies based on the changing outlook and trajectory of reported COVID-19 cases. This touches upon the raised concern with regards to dynamic endogeneity [see Section 3.1.1]: as present decisions of countries' chosen lockdown policies conceivably relate to previous periods' number of reported cases. However, we can not reliably dismiss the potential occurrence of dynamic endogeneity in the case of our study. Nonetheless, we can not assess whether there is a causal impact of the previous number of reported COVID-19 cases on current choices of lockdown measures, as it falls outside of the parameters of our study.

Secondly, we would argue that the positive relationship may indicate that countries that have imposed lockdowns and higher rates of COVID-19 cases, in quarter q , tend to succeed at suppressing the number of COVID-19 cases by quarter $q+n$. We make this claim by the fact that the observed decrease in number of reported COVID-19 cases coincides with the fact that countries started to relinquish lockdown measures by the end of the COVID-19 period in our study. Thus, the positive coefficient could be construed as the number of reported COVID-19 cases being affected by lockdown measures (i.e. declining) by the time that lockdowns have been relinquished, due to time lag associated with the lockdown, with theoretical support from previous studies (Born et al., 2020). This notion is further supported by our alternative specification, when controlling for year-quarter (i.e. the time effect) and firm-year-quarter, where the *Lockdown* coefficient is negative and statistically significant. This indicates that countries imposing lockdown appear to decrease the spread rate of COVID-19 cases, which has some theoretical support, as policymakers' need to integrate expected citizen response to policies into their econometric models (Lucas, 1976), here interpreted as the chosen policy around implementation of lockdown measure at any point of time being interactively decided, suggesting the existence of dynamic endogeneity.

Lastly, the F-statistic ranging from 544.21 to 15,641, for the baseline specification as well as the varying inclusions of fixed effects, suggests that the lockdown measure is highly unlikely to be a weak instrument. Consequently, the following IV estimates are improbable to show bias towards OLS regression estimates (Staiger & Stock, 1997).

In terms of the relationship between the country-level controls and *Cases* as a dependent variable, we show that the number of hospital beds and *Cases* have a negative relationship, albeit very small, statistically significant at the 1 percent level. Conceivably, one would hypothesize the relationship to be stronger when analyzing the impact on *Deaths* as an explanatory variable, further assessed in Section 5.2.1. GDP growth and *Cases* also show a negative relationship, indicating that countries with lower GDP growth heading into the pandemic experience higher rates of reported COVID-19 cases. In contrast, the

unemployment rate and *Cases* also show a negative relationship which indicate that countries with lower unemployment rates experienced higher spread rates of COVID-19.

In sum, the first stage regression results indicate that lockdown measures have a strong impact on the number of reported COVID-19 cases. Moreover, the inclusion of country-level characteristics not depressing the robustness of its estimated coefficient may point to the effect of lockdown measures on the number of reported COVID-19 cases as potentially unaffected by country characteristics.

Having explored the impact of lockdown measures on the number of reported COVID-19 cases, we examine its relationship with firm performance. We perform the analysis through investigating the reduced-form correlation between the instrument (*Lockdown*) and ROA (*Performance*), our dependent variable as a measure of firm performance.

The reduced-form regression results are presented in Table 5. In column (2) we present our baseline specification, whereas columns (3)-(6) serve as alternative specifications, augmented to be more restrictive: including year-quarter, country, firm and firm-year-quarter dummy variables respectively as additional controls. We find a strong negative correlation between lockdown measures and firm performance, in column (2), statistically significant at the 5 percent level. The estimated coefficient indicates that firms residing in countries that impose lockdown measures on average underperform by approximately 3.9 percentage points. For reference, we show varying results in terms of estimated coefficients and significance levels using alternative specifications based on additional controls. The reduced-form results provide evidence that lockdown is associated with economically and statistically significant declines in firm performance. Yet, when including time fixed effects, the results point to a contradictory relationship: suggesting a positive relationship between lockdown and firm performance by approximately 0.5 percentage points, though not statistically significant.

In conclusion, the reduced-form suggests that lockdowns deteriorate firm performance, arguably in absence of endogeneity. However, when assessing our augmented model specifications and when controlling for time fixed effects in particular, the result is reversed: indicating a positive association between lockdown measures and firm performance, though not statistically significant. The pattern of the relationship when including the time effect echoes the findings in Table 4, in terms of displaying opposite coefficient signs for the lockdown variable. However, we caution against translating the results into implying a positive relationship between the number of reported COVID-19 cases, as it is to be separately assessed in the second-stage regressions.

Table 4. Lockdown and Cases

First stage	Dependent Variable: Cases					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	4.3521*** (0.0110)	4.2996*** (0.0129)	-0.4732*** (0.0238)	4.1153*** (0.0146)	3.9600*** (0.0158)	-0.5032*** (0.0243)
Size		0.0004 (0.0012)	-0.0032*** (0.0002)	-0.0084*** (0.0013)	0.2908*** (0.0088)	0.0142*** (0.0016)
Revenue Growth		-0.0001** (0.0000)	0.0000 (0.0000)	0.0000*** (0.0000)	0.0000* (0.0000)	0.0000 (0.0000)
Liquidity		-0.0001** (0.0000)	0.0000*** (0.0000)	(0.0000) 0.0001	0.0000** (0.0000)	0.0000 (0.0000)
Leverage		-0.0002** (0.0000)	0.0000*** (0.0000)	-0.0000** (0.0000)	-0.0001*** (0.0000)	0.0000** (0.0000)
Tangibility		0.0010 (0.0006)	-0.0001 (0.0001)	0.0001 (0.0008)	-0.0003 (0.0010)	0.0001** (0.0000)
Hospital Beds		-0.0003** (0.0000)	-0.0003*** (0.0000)	-0.0009*** (0.0004)	-0.0008*** (0.0003)	-0.0002*** (0.0003)
GDP Growth		-9.3486** (0.2867)	-0.9563*** (0.0689)	-10.5726*** (0.3231)	-10.1933*** (0.3230)	-0.7971*** (0.0719)
Unemployment		-3.3760** (0.0612)	-0.1945*** (0.0160)	-15.0134*** (0.2161)	-13.4695*** (0.2276)	-0.0896* (0.0539)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	261,535	185,611	185,611	185,611	185,611	185,611
F-statistic	160,000	14,615	544.21	15,641	13,091	83.51

The dependent variable *Cases* is the quarterly change in reported cases of Covid-19 per 100,000 inhabitants per country. *Lockdown* is a dummy variable equal to 1 if the firm resides in a country during the quarter that is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 5. Lockdown and Firm Performance

Reduced-Form	Dependent Variable: Performance					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	-0.0162 (0.0186)	-0.0391** (0.0184)	0.0053 (0.0237)	-0.0395** (0.0188)	-0.0281 (0.0196)	-0.0526** (0.0219)
Size		0.0310** (0.0022)	0.0308*** (0.0022)	0.0329*** (0.0029)	-0.0414 (0.0636)	-0.0449 (0.0681)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0118** (0.0057)	-0.0118** (0.0057)
Tangibility		-0.0026*** (0.0009)	-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0011* (0.0007)	-0.0012* (0.0007)
Hospital Beds		0.0001*** (0.0000)	0.0001*** (0.0000)	0.0002*** (0.0000)	0.0001 (0.0000)	0.0001 (0.0000)
GDP Growth		1.2979*** (0.2007)	1.2879*** (0.2179)	0.4534* (0.2480)	0.3635 (0.2479)	0.1389 (0.2560)
Unemployment		0.3045*** (0.0559)	0.2753*** (0.0499)	0.6224*** (0.1483)	0.4558 (0.2783)	0.6723*** (0.1617)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	194,041	167,282	167,282	167,282	167,282	194,041

The dependent variable *Performance* is return on assets. *Lockdown* is a dummy variable equal to 1 if the firm resides in a country during the quarter that is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

In Table 6 we examine the impact of the number of reported COVID-19 cases on firm performance using alternative regression models: utilizing both OLS and IV estimates, in Panel A and Panel B respectively. This is to examine the magnitude of the differences between the two methods, to assess the IV method and its strength to reliably estimate the impact of the endogenous variable (*Cases*) on *Performance* through the instrument variable (*Lockdown*). To facilitate the comparative analysis, we therefore present OLS estimates of the effect of *Cases* to *Performance*.

To reiterate, we use ROA as defined as a measure of firm performance (*Performance*). In column (2) we present our baseline specification, whereas columns (3)-(6) serve as alternative specifications, augmented to be more restrictive: including year-quarter, country, firm and firm-year-quarter dummy variables respectively as additional controls. In Panel A, we find a strong negative correlation between reported COVID-19 cases and firm performance, when applying our baseline specification presented in column (2), statistically significant at the 1 percent level. The estimated coefficient indicates that the average sample firm underperforms by approximately 1.0 percentage points during the COVID-19 period,

when applying our baseline specification. Additionally, we find increases in performance for larger firms and, in contrast, decreases in performance for firms with higher leverage and asset tangibility: all statistically significant at the 1 percent level. Notably, levels of revenue growth and liquidity do not seem to affect changes in performance. For reference, we show varying results in terms of estimated coefficients and significance levels using restrictive alternative specifications in columns (3)-(6) based on additional controls. In column (3), when including time fixed effects, the results point to an economically larger negative relationship between the number of reported COVID-19 cases and firm performance: estimating the performance for the average sample firm to decrease by approximately 3.2 percentage points during the COVID-19 period, statistically significant at the 1 percent level.

In Panel B, we present the estimated coefficients using the IV method. In column (2) we present our results using our baseline specification, with high comparability to the equivalent OLS estimates, in terms of both coefficient values and signs and statistical significance. In short, the IV-2SLS baseline specification implies that the ROA for the average sample firm is negatively impacted by approximately 1.1 percentage points. Additionally, we observe similar patterns with regards to coefficient values and statistical significance levels for firm-level controls, coupled with slightly smaller coefficient values for country-level controls when comparing the IV-2SLS method to the OLS regression shown in Panel A. Combining the findings from the baseline specifications of both regression models, one may infer that the OLS method understates the impact of COVID-19 on firm performance.

The alternative specifications in columns (3)-(6) act as augmentations to our baseline specification: where the firm-year-quarter fixed effect serves as the most restrictive specification. In column (3) we present our findings when controlling for the time effect (year-quarter) and the results suggest a negative correlation between *Cases* and *Performance*, although not statistically significant. This also holds true for the OLS regression, as we show in Panel A, where the effect is more pronounced in comparison to the IV approach. Combining the findings from both regression models, one may infer that the OLS method overstates the impact of COVID-19 cases on firm performance, when controlling for the time-effect. In column (4) we present our findings when controlling for the country fixed effect, which further confirms the result in our baseline specification, with smaller estimates of the impact on firm performance (0.84 and 1.02 percentage points for the OLS and IV-2SLS regressions, respectively), statistically significant at the five percent level. Further, the results affirm the proposition of the OLS estimation understating the COVID-19 impact on firm performance. In column (5), the displayed interrelationship between the OLS and IV-2SLS method is maintained, although the results are not statistically significant. However, in column (6), where we present our findings controlling at the firm-year-quarter level, using the most restrictive specification, the IV-2SLS results show a positive impact of the number of reported COVID-19 cases on firm performance, significant at the 5 percent level. In contrast, the OLS estimate in Panel A points to a negative impact on firm performance, though not statistically significant.

In summary, the baseline OLS and IV regressions suggest that the number of reported COVID-19 cases has decreased the ROA of the average sample firm by approximately 0.98 and 1.12 percentage points in terms of ROA, respectively. Although the magnitude of the differences between the alternative specifications may seem miniscule, the attributed coefficient values when using the IV approach are higher. Thus, the OLS appears to inaccurately capture the true differential in firm performance during the COVID-19 period.

Table 6. Firm Performance and Cases: OLS and Instrumental Variables

Panel A: OLS	Dependent Variable: Performance					
	(1)	(2)	(3)	(4)	(5)	(6)
Cases	-0.0077** (0.0045)	-0.0098*** (0.0035)	-0.0317*** (0.0113)	-0.0084** (0.0036)	-0.0045 (0.0043)	-0.0184 (0.0114)
Size		0.0311*** (0.0022)	0.0311*** (0.0022)	0.0331*** (0.0029)	-0.0408 (0.0645)	-0.0439 (0.0688)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0118** (0.0058)	-0.0118** (0.0057)
Tangibility		-0.0026*** (0.0009)	-0.0027*** (0.0008)	-0.0027*** (0.0009)	-0.0011* (0.0007)	-0.0012* (0.0007)
Hospital Beds		0.0001*** (0.0000)	0.0001*** (0.0000)	0.0004*** (0.0000)	0.0002*** (0.0000)	0.0002*** (0.0000)
GDP Growth		1.2249*** (0.1973)	1.2124*** (0.2159)	0.4003 (0.2454)	0.3358 (0.2546)	0.0859 (0.2548)
Unemployment		0.2982*** (0.0564)	0.2704*** (0.0500)	0.6463*** (0.1530)	0.4913* (0.2802)	0.7320*** (0.1697)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	193,102	166,394	166,394	166,394	166,394	166,394

Table 6. Firm Performance and Cases: OLS and Instrumental Variables (Continued)

		Dependent Variable: Performance				
Panel B: IV-2SLS	(1)	(2)	(3)	(4)	(5)	(6)
Cases	-0.0048 (0.0045)	-0.0112*** (0.0046)	-0.0122 (0.0556)	-0.0102** (0.0046)	-0.0069 (0.0048)	0.1211** (0.0506)
Size		0.0311*** (0.0022)	0.0310*** (0.0022)	0.0331*** (0.0029)	-0.0402 (0.0644)	-0.0459 (0.0690)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0118** (0.0057)	-0.0118** (0.0057)
Tangibility		-0.0026*** (0.0009)	-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0011* (0.0007)	-0.0011* (0.0007)
Hospital Beds		0.0001*** (0.0000)	0.0001*** (0.0000)	0.0004*** (0.0000)	0.0002*** (0.0000)	0.0002*** (0.0000)
GDP Growth		1.2201*** (0.1979)	1.2371*** (0.2229)	0.3950 (0.2449)	0.3289 (0.2541)	0.1895 (0.2663)
Unemployment		0.2949*** (0.0558)	0.2737*** (0.0512)	0.6274*** (0.1522)	0.4685* (0.2834)	0.5963*** (0.1734)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	193,102	166,394	166,394	166,394	166,394	166,394
IV						
Lockdown	Yes	Yes	Yes	Yes	Yes	Yes

In Panel A, the estimated coefficients are from ordinary least square (OLS) regressions. In Panel B estimated coefficients are from IV-2SLS regressions. The dependent variable *Performance* is return on assets. *Cases* is the quarterly change in reported cases of Covid-19 per 100,000 inhabitants per country. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. The instrumental variable is *Lockdown* (1=lockdown measures, 0=no lockdown measures). Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

4.3 Concluding analysis

The aim of this thesis has been to examine the impact of COVID-19 on firm performance. The research question has been analysed by estimating the impact of lockdown measures on the number of reported COVID-19 cases and in turn the impact on firm performance.

First, the *first stage* regression shows a positive correlation between choice of lockdown policies and the number of reported COVID-19 cases for the sample. At a glance, the first stage test results do not confirm the findings of previous studies (Born et al., 2020; Dehning et al., 2020). We interpret the contrasting result as countries with higher rates of reported COVID-19 cases as increasingly inclined to subsequently impose lockdown measures. We note this as a probable cause, by acknowledging the fact that the decrease in number of

reported COVID-19 cases coincides with the time that countries started to lessen lockdown measures (i.e. by the end of the COVID-19 period in our study). Thus, our research design of modelling lockdown measures on a quarter-by-quarter basis appears to delimit the sequential development of both lockdown measures and the number of reported COVID-19 cases, in our attempt to fit the reporting format of firm-level data. An additional interpretation of our findings is the potential occurrence of a time lag of lockdowns (Born et al., 2020), potentially leading to the containment of the COVID-19 spread rate materializing by the time that lockdowns have been relinquished. The aspect of timing is reviewed in Section 4.2, where our results seem to indicate the existence of dynamic endogeneity, as controlling for the time-effect shows a negative relationship between lockdown measures and the number of reported COVID-19 cases. Synthesizing these findings with our baseline specification results for the first stage regression, we propose that current decisions of countries' chosen lockdown policies appear to be conditioned by previous periods' number of reported COVID-19 cases, the notion being supported by previous studies on the link between policies and econometric models (Lucas, 1976).

Nonetheless, we do find support for the relevance condition from our IV method, as the lockdown variable is seen as a feasible instrumental variable for the number of reported COVID-19 cases, with strong validity and therefore with minimal risk of 2SLS estimator bias (Angrist & Pischke, 2009). However, we can not conclusively establish the continuous effect of lockdown measures on reported COVID-19 cases, based on two factors. Firstly, the impact on reported COVID-19 cases is estimated to have alternating coefficient signs when examining the various specifications, rendering the relationship ambiguous. Secondly, we can not assess the existence of dynamic endogeneity, through examining the potential occurrence of a causal impact of the previous numbers of reported COVID-19 cases on current lockdown policies. This insinuates that the relationship between lockdown measures and number of reported COVID-19 cases is rather intricate and remains partly unanswered by our study.

Second, the reduced-form and second-stage regressions aim to quantify the economic size of the impact on firm performance: by examining the indirect impact of lockdown measures on ROA and inserting the fitted values from the *first stage* regression of reported COVID-19 cases, respectively. Combining the findings from the two steps, the baseline IV-2SLS results suggest that firms residing in countries that impose lockdown measures experience a larger magnitude of reported COVID-19 cases and in turn experience a decrease in performance, the latter portion of the results confirming findings of previous studies (Anh & Gan, 2020). By observing both the results from the OLS and IV-2SLS regression, the impact of the number of COVID-19 cases on firm performance is negative in both models, across all model specifications except for the firm-year-quarter effect in Table 6 Panel A. The results reinforce the findings in prior literature that show that the negative impact of COVID-19 on firm performance is much more pronounced in highly affected regions (Hassan et al., 2020; Shen et al., 2020). We further show the discrepancies across firms being significant, as firm size has a positive association with profitability in line with Wójcik and Ioannuo (2020) findings of positive stock return outcome and firm size. The results also suggest negative relationships

between leverage as well as tangibility and performance, confirming findings in prior research (Rajan & Zingales, 1995; Dawar, 2014).

Moreover, when examining the alternative model specifications, we show that the combination of both the IV and OLS results provide compelling insights. As shown in Table 6 Panel A-B, the inclusion of the time-effect computes a negative correlation between *Cases* and *Performance*: shown to be overstated by the OLS regression in relation to the IV-2SLS. In comparison, the baseline specification coefficient estimate being larger in the IV approach than the one estimated using OLS. This supports the usefulness of our IV-2SLS regression models to detect and determine reliable differentials in firm performance, ensuring that the actual differential in firm performance is not understated by using an OLS regression, and avoiding inaccurate coefficient values being attributed to explanatory variables or the intercept.

Our findings are not unanimous, as we exhibit opposite coefficient signs for the estimated impact on firm performance when applying the reduced-form and second-stage regressions respectively, controlling for year-quarter fixed effects, as well as seeing opposite coefficient signs when applying the first-stage and second-stage regressions, controlling for firm-year-quarter fixed effects (versus our baseline specification). The inconclusive results when introducing certain fixed effects may hint at the possibility of COVID-19 infection dynamics being rather unstable, capturing unobserved heterogeneity that is irrespective of chosen public health policy (i.e. lockdown measures) (Born et al., 2020). In sum, we find support for our hypothesis under certain conditions but the conclusion of lockdown measures' impact on the number of reported COVID-19 cases, and in turn on firm performance is ambiguous when introducing certain fixed effects. Therefore, we can not reject the null hypothesis as our findings are not conformingly consistent with the stated hypothesis:

Firm performance during the COVID-19 period is impacted by the number of reported COVID-19 cases in the residing country of the firm.

5. Cross-sectional analysis

5.1 Accounting conservatism

5.1.1 Accounting conservatism and firm value: previous research

In this section, we provide additional insights to the cross-sectional study of COVID-19 cases and firm performance in Europe, by examining firm-specific accounting conservatism and its relationship with stock returns, to contribute to previous literature within the topic of firm performance during crises or periods of exogenous shocks and the role of accounting conservatism in particular.

The topic of accounting conservatism is well-established within the area of corporate financial reporting (Basu, 1997). However, as it pertains to accounting conservatism and its impact on firm value and thereby stock returns, the topic is still disputed. On one hand, previous research has shown accounting conservatism to enhance firm value, through constricting agency problems and managerial opportunism (LaFond & Watts, 2008). On the other hand, the proponent view of accounting conservatism has also been opposed as potentially decreasing the quality or sustainability of earnings by distortion of investments and resource allocation (Penman and Zhang, 2002).

Previous research within the topic of accounting conservatism has primarily focused on its role in the debt market. For example, Ahmed et al. (2002) find that borrowers with increasing levels of accounting conservatism enjoy better credit ratings and lower cost of debt, with cost of debt documented as being affected by conservative accounting (Zhang, 2008), as lenders offer lower interest rates to more conservative borrowers. However, there is little direct evidence on if, and to what extent, the benefits of conservatism in the debt market translate into increased firm values: in particular during times of exogenous shocks and crises. Watts and Zuo (2012) examine the impact of accounting conservatism on firm value during the global financial crisis of 2008, where they find a positive relationship between conservativeness and stock returns during the period of the financial crisis. Further, they find that conservatism and firm value is more pronounced for firms with weaker corporate governance or higher information asymmetry. Kim et al. (2013) examines the role of accounting conservatism in the equity market and finds a significant relationship between firms with (more) conservative financial reporting and (less) negative stock market reaction upon announced secondary equity offerings. Overall, the results support the notion of accounting conservatism contributing to firms' governance measures through mitigation of agency and information risks and problems, thereby maximizing shareholder value. Gaio and Raposo (2011) examines the relationship between firm valuation and earnings quality, based on several earnings attributes including conservatism. The findings are argued to suggest a significant positive relationship between earnings quality stock market valuation, reversely implying investors requiring a discount for the decreased information risk versus firms with lower-quality earnings. This relation is particularly strong for firms with greater investment opportunities and in low investor protection countries. In summary, we would expect firms

with higher degrees of accounting conservatism prior to the COVID-19 period experience less negative stock returns during the COVID-19 period.

5.1.2 Accounting conservatism – statistical method

We apply the Basu (1997) regression model to measure accounting conservatism, as it has previously been applied in numerous research papers within the topic of accounting conservatism (LaFond & Watts 2008; LaFond & Roychowdhury 2008; Francis & Martin 2010; Watts & Zuo, 2012). The baseline specification is stated as:

$$E = \beta_1 + \beta_2 D + \beta_3 R + \beta_4 D \times R + \varepsilon \quad (5)$$

To test the hypothesis of a positive relationship between stock returns during the COVID-19 pandemic and accounting conservatism prior to the outbreak, we expand the baseline Basu (1997) model, shown in Equation (5), in Equation (6) by including the COVID-19 period stock returns (Model (2)) along with supplementary firm-level controls (Model (3)) in the following regression model:

$$\begin{aligned} NI = & \beta_1 + \beta_2 D + \beta_3 R + \beta_4 D \times R \\ & + \beta_5 COVIDRet + \beta_6 COVIDRet \times D + \beta_7 COVIDRet \times R + \beta_8 COVIDRet \times D \times R \\ & + \beta_9 Leverage + \beta_{10} Leverage \times D + \beta_{11} Leverage \times R + \beta_{12} Leverage \times D \times R \\ & + \beta_{13} Size + \beta_{14} Size \times D + \beta_{15} Size \times R + \beta_{16} Size \times D \times R \\ & + \beta_{17} MTB + \beta_{18} MTB \times D + \beta_{19} MTB \times R + \beta_{20} MTB \times D \times R + \varepsilon \end{aligned} \quad (6)$$

where firm and time subscripts are omitted, and firm characteristics (E , D , R , $Leverage$, $Size$ and MTB) are uniformly measured at the fiscal year end that precedes the COVID-19 period. We examine the effect of accounting conservatism on stock returns through running a one-year cross-sectional regression, using firm data immediately before the exogenous shock, across the future COVID-19 period stock returns ($COVIDRet$). The holding period for the $COVIDRet$ variable is consistent with our previously stated period for the main tests [see Section 3.1.2], i.e. from January 1, 2020 to September 30, 2020. E is net income before extraordinary items, scaled by prior year market value of equity, in the fiscal year prior to the COVID-19 period. R is 12-month compounded returns at the fiscal year end prior to the stated COVID-19 period. D is a dummy variable equal to 1 if R is negative (i.e. less than 0) and 0 otherwise. Accounting conservatism preceding the COVID-19 period is estimated through the Basu coefficient, specifically: ($\beta_4 + \beta_8 COVIDRet + \beta_{12} Leverage + \beta_{16} Size + \beta_{20} MTB$). Basu (1997) applies returns (R) as an approximation of economic news, where he finds a systematic difference: as earnings are significantly more affected by negative returns (news) than for positive returns (news). The essential coefficient of interest is β_8 , which captures the impact of preceding accounting conservatism on stock returns during the COVID-19 period. Thus, a positive coefficient is confirmatory to the hypothesized positive relationship between COVID-19 period stock returns and preceding accounting conservatism.

In accordance with previous studies within the field (LaFond & Roychowdhury 2008; Francis & Martin 2010; Watts & Zuo, 2012), we choose to control for firm size, leverage, and market-to-book. We set firm size (*Size*) as the natural logarithm of total assets in the fiscal year prior to the COVID-19 period. Leverage (*Leverage*) is equal to book value of debt scaled by book value of total assets in the fiscal year prior to the COVID-19 period. MTB (*MTB*) is the firm's market value of equity divided by the book value of equity in the fiscal year prior to the COVID-19 period. We expect β_{12} to have a positive sign due to the 'debt contracting demand' for conservatism stemming from leverage (Watts & Zuo, 2012). We expect β_{16} to have a negative sign, as larger firms tend to suffer less from information asymmetry (Watts & Zuo, 2012) and thus be negatively associated with COVID-19 returns. Lastly, we expect β_{20} to have a negative sign, as firms' market-to-book ratio (*MTB*) incorporate their preceding growth opportunities and asymmetric timing, assumingly diminishing the asymmetry of the timing of future earnings.

5.1.3 Accounting conservatism - empirical findings

There is a large variation in the characteristics of our sample firms. We observe 5,678 unique firms and observations in our regression, with 3,554 remaining in Model (3) when including the additional firm controls. The COVID-19 period return (*COVIDRet*) has a mean of 292% and a median of 16%. The mean of pre-COVID-19 earnings scaled by market value of equity (*E*) is -0.10 with a median value of 0. The mean and median returns (*R*) of firms during the fiscal year prior to the pandemic outbreak are 55% and 0%, respectively. The mean value of the negative return dummy (*D*) of 0.42 suggests that around 42% of sampled firms experience negative stock returns during the fiscal year prior to the COVID-19 period. The average sample firm has a leverage ratio (*Leverage*) of 0.26, a total market value of equity of €1,626 million and a market-to-book-ratio (*MTB*) of 3.80.

Table 7 reports the results of our tests, based on both the baseline Basu regression model in Equation 1 (Model (1)), and the estimation of Model (2)-(3), with a one-year structure of earnings and returns before the COVID-19 period. We begin with presenting Model (1), where the incremental coefficient on negative returns, $D \times R$, is 1.208 and statistically significant at the 5% level (p -value = 2.6%), indicating that the average sample firm reports losses more timely than gains. In addition, the key variable coefficient of interest, the COVID-19 period return interaction with pre-COVID-19 period negative returns ($COVIDRet \times D \times R$), is 0.0045, indicating support for our hypothesis of a positive relationship between COVID-19 period stock returns and preceding accounting conservatism in Model (2), though not statistically significant with a p -value of 10.6%.

Accounting for firm-level controls, the coefficient on the interaction of negative returns with leverage ($Leverage \times D \times R$) and firm size ($Size \times D \times R$) are positive, but not statistically significant (coef. = 0.8446, p -value = 59.8% and coef. = 0.8474, p -value = 13.1%, respectively). The coefficient on the interaction of negative returns with market-to book ($MTB \times D \times R$) is negative (coef. = -0.0063), though with a p -value of 39.7%. Overall, the

results confirm previous research, except for the positive relationship between firm size and preceding accounting conservatism, though with no statistical significance.

Table 7. Regression Analysis of the Association between COVID-19 Period Returns and Accounting Conservatism

Variable	Pred. Sign	Model (1)		Model (2)		Model (3)	
		Coef.	<i>p</i> -value	Coef.	<i>p</i> -value	Coef.	<i>p</i> -value
<i>Intercept</i>		-0.0198	0.000	-0.0191	0.001	-0.0209	0.151
<i>D</i>		0.0992	0.294	0.0984	0.303	-0.1555	0.325
<i>R</i>		-0.0004	0.067	-0.0003	0.447	-0.0022	0.401
<i>DxR</i>	+	1.2008	0.026	1.2108	0.027	-1.2232	0.282
<i>COVIDRet</i>				-0.0012	0.539	-0.0004	0.832
<i>COVIDRetxD</i>				0.0049	0.107	0.0211	0.158
<i>COVIDRetxR</i>				-0.0045	0.491	-0.0027	0.105
<i>COVIDRetxDxR</i>	+			0.0045	0.106	0.0263	0.122
<i>Leverage</i>						-0.0005	0.624
<i>LeveragexD</i>						0.0299	0.688
<i>LeveragexR</i>						-0.0058	0.251
<i>LeveragexDxR</i>	+					0.8446	0.598
<i>Size</i>						-0.0016	0.517
<i>SizexD</i>						0.0959	0.161
<i>SizexR</i>						0.0028	0.007
<i>SizexDxR</i>	-					0.8674	0.131
<i>MTB</i>						0.0006	0.006
<i>MTBxD</i>						-0.0017	0.542
<i>MTBxR</i>						-0.0002	0.001
<i>MTBxDxR</i>	-					-0.0063	0.397
Observations		5,678		5,678		3,554	
Adjusted R ²		0.86%		0.88%		2.99%	

Table 7 applies one-year earnings and returns data prior to the COVID-19 period to test the association between the COVID-19 period return and a firm's accounting conservatism. Accounting conservatism is measured with the incremental coefficient on negative stock returns. Robust standard errors are clustered at firm-level in parentheses to derive the reported *p*-values.

Overall, our results do not confirm the hypothesis of conservative firms experiencing less negative stock returns during the COVID-19 pandemic. Consistent with previous studies, our sample firms are shown to report losses timelier than gains. Further, the positive coefficient on the interaction of negative returns with firm size differs from our expected outcome: not confirming the belief of decreased information asymmetry across larger firms. However, the positive coefficient on the interaction of the COVID-19 period return and pre-COVID-19 period negative returns suggest that firms with increasing rates of conservatism experience less negative stock returns during the COVID-19 period, in line with our hypothesis but lacking statistical significance. In sum, the results in Table 7, and primarily the coefficient of interest: β_8 , lack the significance required to support our hypothesis. Therefore, the null hypothesis can not be rejected. To note, the lack of significant results may stem from our research design and availability of data: as *R* denotes the compounded return during the COVID-19 period, which our study is limited by. Thus, we propose a revisit to this topic once the COVID-19 period can be properly defined to capture the effect of preceding accounting conservatism on stock returns during the pandemic.

5.2 Robustness tests

5.2.1 Alternative instrumented variable: replacing *Cases* with *Deaths*

In our main tests we used the endogenous variable *Cases*, instrumented by *Lockdown*. However, as there might be a significant gap between reported COVID-19 cases and actual COVID-19 cases in practice, we present an additional test where we replace reported COVID-19 cases with reported COVID-19 deaths, potentially serving as a more accurate data variable. The results from the IV regression model(s) as well as the OLS, performed in line with the methodology of the results presented in Section 4, for the test variable *Deaths* are presented in Table 8-10. In a similar fashion as we define *Cases* in the presented results, *Deaths* is defined as the natural logarithm of the number of reported COVID-19 deaths per 100,000 inhabitants.

In summary, the OLS and IV regressions suggest that firms in countries who choose to implement lockdown measures trail the firms in countries without lockdown measures by approximately 2.0 and 3.1 percentage points in terms of performance excluding fixed effects, respectively. As briefly mentioned in Section 3.4, we theorize that the number of hospital beds influence COVID-19 outcomes, namely through the number of reported COVID-19 deaths. However, we find no material differences between the coefficient values when alternating the dependent variable from *Cases* to *Deaths*.

Overall, we find rather similar patterns in terms of regression results across the IV specifications and in comparison to the OLS, as seen when applying *Cases*. We observe the augmented regression models when applying *Deaths* not impacting *p*-values in our models in comparison to our main tests. Further, we find a larger gap between our baseline specification using the IV versus the OLS, which provides further support to the notion of the OLS estimation significantly understating the impact of COVID-19 and thus on firm performance. The results further confirm the strength of the chosen IV method and the robustness of coefficient values in our main tests. However, we note that the observed coefficient signs for the estimated impact on firm performance when applying the *reduced-form* and *second-stage* regressions respectively shown in Table 6 Panel A-B, controlling for year-quarter fixed effects, is reversed when replacing *Cases* with *Deaths*. Specifically, column (3) indicates a positive association for both the *reduced-form* and *second-stage* regressions. Overall, as the differences from shifting the instrumented variable from *Cases* to *Deaths* do not materially change our results and discussions in Section 4, we do not revise our main conclusions.

Table 8. Lockdown and Deaths

First stage	Dependent Variable: Deaths					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	1.6707*** (0.0180)	1.7244*** (0.0208)	-0.6602*** (0.0269)	1.7057*** (0.0204)	1.6904*** (0.0206)	-0.7063*** (0.0273)
Size		0.0036*** (0.0002)	-0.0004 (0.0003)	0.0000* (0.0000)	0.0472*** (0.0032)	0.0128*** (0.0023)
Revenue Growth		0.0000 (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0001*** (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0001)	0.0000** (0.0000)
Leverage		0.0001*** (0.0000)	0.0000 (0.0000)	-0.0001*** (0.0000)	-0.0001*** (0.0000)	0.0000** (0.0000)
Tangibility		0.0001 (0.0000)	-0.0002 (0.0002)	0.0001 (0.0000)	-0.0003 (0.0000)	-0.0001* (0.0000)
Hospital Beds		0.0001*** (0.0000)	0.0000*** (0.0000)	-0.0002*** (0.0000)	-0.0002*** (0.0000)	-0.0001*** (0.0000)
GDP Growth		2.4506*** (0.1188)	-1.2875*** (0.0960)	-3.2941*** (0.1349)	-3.1543*** (0.1330)	-1.4679*** (0.1060)
Unemployment		0.2512*** (0.0213)	0.1217*** (0.0181)	-1.8289*** (0.0572)	-1.4419*** (0.0627)	-0.2605*** (0.0665)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	160,000	185,598	185,598	185,598	185,598	185,598
F-statistic	8,583	1,004	153.71	1,363	1,029	130.45

The dependent variable *Deaths* is the quarterly change in reported deaths related to Covid-19 per 100,000 inhabitants per country. *Lockdown* is a dummy variable equal to 1 if the firm resides in a country during the quarter that is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 9. Lockdown and Firm Performance

Reduced Form	Dependent Variable: Performance					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	-0.0162 (0.0186)	-0.0391** (0.0184)	0.0053 (0.0237)	-0.0395** (0.0188)	-0.0281 (0.0196)	-0.0526** (0.0219)
Size		0.0310** (0.0022)	0.0308*** (0.0022)	0.0329*** (0.0029)	-0.0414 (0.0636)	-0.0449 (0.0681)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0118** (0.0057)	-0.0118** (0.0057)
Tangibility		-0.0026*** (0.0009)	-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0011* (0.0007)	-0.0012* (0.0007)
Hospital Beds		0.0001*** (0.0000)	0.0001*** (0.0000)	0.0002*** (0.0000)	0.0001 (0.0000)	0.0001 (0.0000)
GDP Growth		1.2979*** (0.2007)	1.2879*** (0.2179)	0.4534* (0.2480)	0.3635 (0.2479)	0.1389 (0.2560)
Unemployment		0.3045*** (0.0559)	0.2753*** (0.0499)	0.6224*** (0.1483)	0.4558 (0.2783)	0.6723*** (0.1617)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	194,041	167,282	167,282	167,282	167,282	167,282

The dependent variable *Performance* is return on assets. *Lockdown* is a dummy variable equal to 1 if the firm resides in a country during the quarter that is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 10. Firm Performance and Deaths: OLS and Instrumental Variables

Panel A: OLS	Dependent Variable: Performance					
	(1)	(2)	(3)	(4)	(5)	(6)
Deaths	-0.0216*** (0.0083)	-0.0203** (0.0083)	-0.0306*** (0.0098)	-0.0158* (0.0085)	-0.0094 (0.0087)	-0.0157 (0.0096)
Size		0.0310*** (0.0022)	0.0311*** (0.0022)	0.0331*** (0.0029)	-0.0410 (0.0643)	-0.0438 (0.0688)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0153*** (0.0056)	-0.0118** (0.0057)	-0.0118** (0.0057)
Tangibility		-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0011* (0.0007)	-0.0012* (0.0007)
Hospital Beds		0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0000*** (0.0000)
GDP Growth		1.2098*** (0.1971)	1.1838*** (0.2149)	0.3887 (0.2461)	0.3279 (0.2557)	0.0786 (0.2559)
Unemployment		0.3053*** (0.0566)	0.2731*** (0.0501)	0.6783*** (0.1538)	0.5048* (0.2894)	0.7270*** (0.1685)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	193,102	166,394	166,394	166,394	166,394	166,394

Table 10. Firm Performance and Deaths: OLS and Instrumental Variables (Continued)

		Dependent Variable: Performance				
Panel B: IV-2SLS	(1)	(2)	(3)	(4)	(5)	(6)
Deaths	-0.0131 (0.0122)	-0.0306** (0.0125)	0.0081 (0.0370)	-0.0278** (0.0126)	-0.0190 (0.0131)	0.0791** (0.0329)
Size		0.0311*** (0.0022)	0.0311*** (0.0022)	0.0331*** (0.0029)	-0.0400 (0.0645)	-0.0461 (0.0690)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		-0.0153*** (0.00055)	-0.0153*** (0.0055)	-0.0153*** (0.0055)	-0.0118** (0.0057)	-0.0118** (0.0057)
Tangibility		-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0027*** (0.0009)	-0.0011* (0.0007)	-0.0012* (0.0007)
Hospital Beds		0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)
GDP Growth		1.1852*** (0.1969)	1.1512*** (0.2306)	0.3609 (0.2436)	0.3064 (0.2601)	0.2047 (0.2690)
Unemployment		0.2968*** (0.05586)	0.2926*** (0.0500)	0.6340*** (0.1520)	0.4751* (0.2848)	0.6492*** (0.1692)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	193,102	166,394	166,394	166,394	166,394	166,394
IV						
Lockdown	Yes	Yes	Yes	Yes	Yes	Yes

In Panel A, the estimated coefficients are from least square regressions. In Panel B estimated coefficients are from IV-2SLS regressions. The dependent variable *Performance* is return on assets. *Deaths* is the quarterly change in reported deaths related to Covid-19 per 100,000 inhabitants per country. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. The instrumental variable is *Lockdown* (1=lockdown measures, 0=no lockdown measures). Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

5.2.2 Results when only including the Nordic firm sample

As briefly mentioned in Section 1, the clear divergence in public health policies and outcomes, paired with comparable macroeconomic impact across the Nordic region poses as a compelling setting at the outset of our study.

The results from the OLS and IV regression model(s), performed in line with the methodology of the results presented in Section 4, for the Nordic (Sweden, Norway, Denmark, Finland) sample firms are presented in *Appendix C-F*. Overall, the presented results for our main test (i.e. the total sample) is not verified when focusing on the sampled Nordic firms. On one hand, the *first stage* regression is confirmed as the association between lockdown measures and the number of reported COVID-19 cases for our Nordic sample display the same coefficient signs as shown in the main tests (across specifications), with statistical significance. On the other hand, we find no statistical significance across the

alternative specifications across the *reduced-form* and *second-stage* IV regressions, as well as the OLS. The stark contrast in reported COVID-19 cases in Sweden versus the other Nordic countries, especially with Sweden's higher infection and death rates coupled with no lockdown measures being implemented, would suggest the sub-sample to be displayed in more contrast. Nonetheless, we find no support for lockdown measures impacting firm performance, through its impact on the number of reported COVID-19 cases, for the sampled Nordic firms during the COVID-19 period. Potentially, the differences from excluding all non-Nordic firms ultimately delimits our sample and the nuances in firms' exposure to lockdown measures, and therefore, we do not revise our main conclusions.

5.2.3 Alternative dependent variable: replacing *Performance* with stock returns

In our main tests, we have used *Performance* as the dependent variable representing firm performance. However, as this accounting figure is subject to various accounting standards across firm industries (and perhaps some countries), we have chosen to test the regression model by applying stock returns as an alternative firm performance measure to assess the comparability of our findings, examining market values in addition to book values. The reduced-form, the IV-2SLS and OLS estimates are shown below, whereas the first-stage regression is identical to the one presented in the main tests in Table 4.

For our IV-2SLS regression, we find no significant coefficient values for the IV, however, indicating an economically large positive impact of reported COVID-19 cases on stock returns around 6.9 percentage points for our baseline specification. This result does not support the findings on our main test, though column (3) in Table 12 Panel B indicates a statistical significant negative impact on firm performance (stock returns) when controlling for the time-effect at the 5 percent level. In terms of the differences in the baseline results, we provide two possible explanations. Firstly, the research design of our study entailed the stock returns to be computed quarterly, which may curtail the true differences in stock performance as it makes the firm sample more susceptible to day-specific share prices (i.e. share prices on the first and the last day of each corresponding quarter). Secondly, as current stock market prices can be partially explained by expected future prices (Fama & French, 1988), whereas ROA corresponds to historical operating performance, the time aspect of the alternative dependent variable is fundamentally different and thus, the stock return variable can be interpreted as linked to other parameters.

In sum, we acknowledge that other factors, the instrumental variable notwithstanding, do affect stock performance, also during the COVID-19 period. We can not confirm the findings made in a similar fashion as proposed in previous studies (Anh & Gan, 2020; Wójcik & Ioannuo, 2020). Yet, we do not believe this fact diminishes the findings in our main study.

Table 11. Lockdown and Stock Return

Reduced Form	Dependent Variable: Stock Return					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	0.2824 (0.2571)	0.2058 (0.2580)	0.6108** (0.2845)	0.1594 (0.2520)	0.2370 (0.2585)	0.4843 (0.3085)
Size		-0.1154*** (0.0320)	-0.1166*** (0.0325)	-0.1357*** (0.0420)	-1.0198* (0.6131)	-1.1355 (0.6940)
Revenue Growth		-0.0004** (0.0004)	-0.0004** (0.0002)	-0.0004** (0.0002)	-0.0003 (0.0003)	-0.0004 (0.0003)
Liquidity		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		0.0447 (0.0417)	0.0456 (0.0422)	0.0441 (0.0417)	0.0616 (0.0514)	0.0618 (0.0515)
Tangibility		0.3781* (0.2166)	0.3641 (0.2228)	0.4789** (0.2239)	-0.3034 (0.8337)	-0.4899 (0.9523)
Hospital Beds		-0.0007 (0.0005)	-0.0008 (0.0005)	-0.0007 (0.0005)	-0.0008 (0.0005)	-0.0007 (0.0004)
GDP Growth		-1.5897 (8.8552)	4.4417 (9.5653)	6.9316 (9.3432)	6.0771 (8.8992)	17.7239 (12.2929)
Unemployment		-1.2885 (1.2869)	-1.1188 (1.3110)	-7.1499 (5.2711)	-11.411 (8.1547)	-0.0285 (4.3419)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	64,310	50,931	50,931	50,931	50,931	50,931

The dependent variable *Share Return* is share price over share price last quarter. *Lockdown* is a dummy variable equal to 1 if the residing country during the quarter is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 12. Stock Return and Cases: OLS and Instrumental Variables

Panel A: OLS	Dependent Variable: Stock Return					
	(1)	(2)	(3)	(4)	(5)	(6)
Cases	0.0484 (0.0377)	0.0501 (0.0467)	0.2080 (0.2372)	0.0476 (0.0449)	0.0832 (0.0626)	0.1746 (0.2151)
Size		-0.1157*** (0.0334)	-0.1147*** (0.0340)	-0.1359*** (0.0430)	-1.1477 (0.7143)	-1.1578 (0.7116)
Revenue Growth		-0.0004** (0.0002)	-0.0004** (0.0002)	-0.0004** (0.0002)	-0.0004 (0.0003)	-0.0004 (0.0003)
Liquidity		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		0.0446 (0.0415)	0.0455 (0.0419)	0.0440 (0.0416)	0.0601 (0.0511)	0.0614 (0.0513)
Tangibility		0.3694 (0.2286)	0.3742* (0.2272)	0.4726** (0.2311)	-0.5759 (0.9906)	-0.5116 (0.9735)
Hospital Beds		-0.0007 (0.0005)	-0.0007 (0.0005)	-0.0007 (0.0005)	-0.0007 (0.0005)	-0.0009 (0.0006)
GDP Growth		2.4778 (9.5079)	6.6067 (9.5019)	10.3860 (11.1172)	11.4441 (10.8974)	19.8967 (12.8289)
Unemployment		-0.9605 (1.3966)	-0.7944 (1.4641)	-3.2024 (2.7057)	-5.1240 (4.4388)	-0.3585 (4.7407)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	64,310	50,014	50,014	50,014	50,014	50,014

Table 12. Stock Return and Cases: OLS and Instrumental Variables (Continued)

		Dependent Variable: Share Return				
Panel B: IV-2SLS	(1)	(2)	(3)	(4)	(5)	(6)
Cases	0.0953 (0.0861)	0.0691 (0.0844)	-1.3612** (0.6899)	0.0529 (0.0876)	0.0850 (0.0953)	-0.9313 (0.6335)
Size		-0.1162*** (0.0326)	-0.0985*** (0.0329)	-0.1360*** (0.0423)	-1.1509* (0.6771)	-1.1159 (0.7076)
Revenue Growth		-0.0004** (0.0002)	-0.0004** (0.0002)	-0.0004** (0.0002)	-0.0004 (0.0003)	-0.0004 (0.0003)
Liquidity		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Leverage		0.0446 (0.0415)	0.0456 (0.0418)	0.0440 (0.0416)	0.0600 (0.0512)	0.0617 (0.0513)
Tangibility		0.3617 (0.2387)	0.3003 (0.2399)	0.4705* (0.2457)	-0.5831 (0.9029)	-0.4551 (0.9724)
Hospital Beds		-0.0006 (0.0005)	-0.0009 (0.0006)	-0.0008 (0.0005)	-0.0008 (0.0005)	-0.0009 (0.0005)
GDP Growth		3.5135 (13.369)	-1.7831 (7.2906)	10.6682 (14.4413)	11.5321 (13.6191)	14.3980 (11.8816)
Unemployment		-0.8757 (1.1382)	-2.2073 (1.7453)	-2.6534 (8.5846)	-4.9551 (9.4693)	-0.4340 (4.7846)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	64,310	50,014	50,014	50,014	50,014	50,014
IV						
Lockdown	Yes	Yes	Yes	Yes	Yes	Yes

In Panel A, the estimated coefficients are from least square regressions. In Panel B estimated coefficients are from IV-2SLS regressions. The dependent variable *Share Return* is share price over share price last quarter. *Cases* is the quarterly change in reported cases of Covid-19 per 100,000 inhabitants per country. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. The instrumental variable is *Lockdown* (1=lockdown measures, 0=no lockdown measures). Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

5.2.4 Multicollinearity

Multicollinearity concerns the presence of correlation between independent variables in a multiple regression model. Multicollinearity can invalidate results from statistical tests as the independent contribution of each variable cannot be distinguished (Farrar & Glauber, 1967). Therefore, we conduct a Variance Inflation Factors test (VIF) to test for multicollinearity in the regression, where the results can be seen in *Appendix G*. A VIF below 10 is generally not seen as problematic (Wooldridge, 2012) and as all independent variables in our results have a VIF below 1.04, we can conclude that the regressions in this paper are not affected by multicollinearity.

6. Concluding remarks, limitations and implications for future research

In this thesis, we aim to evaluate the potential impact of lockdown measures and the number of reported COVID-19 cases on firm performance. We use a dataset of 8,627 listed European firms with quarterly financial data, including country-level controls. To examine the synchronous relationship between chosen lockdown policies and reported COVID-19 cases and in turn firm performance, we utilize the IV method to assess the plausibility of lockdown measures as an instrumental variable for reported COVID-19 cases, and in turn investigate its impact on firm performance. We find that lockdown measures tend to be positively associated with the number of reported COVID-19 cases in the sample, and that the lockdown variable is a feasible instrumental variable with strong validity. Following, European firms are shown to decline in performance by just over one percentage point, on average, using the IV estimates of our baseline specification. Further, our results support the conclusion that the impact on firm performance is amplified in highly affected regions (Hassan et al., 2020; Shen et al., 2020) and add to the literature of firm performance during crises or periods of exogenous shocks. Further, we display the influence of firm-level factors confirming the findings in prior research (Wójcik & Ioannuo, 2020; Rajan & Zingales, 1995). However, when introducing certain fixed effects in our regressions, we find differing results and as such, we hesitate to translate our baseline results into a conclusive support of our hypothesis of firm performance being impacted by the number of reported COVID-19 cases. Thus, our research question remains partly unanswered. In addition to our main results, we contribute to previous literature within the topic of accounting conservatism and its impact on firm performance during crises or periods of exogenous shocks. We find a slightly positive relationship between pre-COVID-19 accounting conservatism and stock returns during the pandemic, though with lack of statistical significance potentially derived from our research design and (lack of) availability of data.

We recognize that our findings are limited by numerous factors. As the COVID-19 pandemic is yet ongoing, the start and end of the period for research purposes can not yet be accurately defined. Thus, the limited amount of available data may distort the true influence on firm performance throughout the pandemic. For instance, we hypothesize this factor impacting the outcome of our regression results in the instance of our additional test of preceding accounting conservatism and stock returns during the COVID-19 period. Therefore, we hesitate to fully compare our findings with previous studies of crises and periods of exogenous shocks. Further, as our results are based on a sample of listed firms from Europe, we are cautioned to compare our results with findings in studies with U.S. data, due to accounting standard differences affecting our dependent variable (i.e. return on assets). With regards to the multiple regression analyses for both our main tests and robustness tests, we note that we cannot preclude the likelihood of excluded independent variables explaining parts of the differences in firm performance. However, the aim of this thesis is to present linkages between country-level policies, public health outcomes and outcomes within the

firm sample, rather than providing a model predicting firm performance during COVID-19, that fully explains the variance in outcome.

In light of our findings, we propose that researchers should aim to investigate lockdown measures and their shaping of the trajectory of the pandemic, to further track how firm performance relates to changes in outcomes and future predictions of COVID-19 cases, similarly to studies made analyzing previous pandemics (Alfaro et al., 2020). Second, further research is required to explore other potential exogenous determinants of reported COVID-19 cases, i.e. alternative valid instrumental variables, and in turn investigate their impact on firm performance. For instance, previous studies find that face masks significantly reduce the number of COVID-19 cases (Zhang et al., 2020). Consequently, we argue that lockdown measures as a parameter merely serve as an alternative instrumental variable and that future research may want to revisit this research topic and apply alternative research designs, with the choice of the instrumental variable in mind and examining the impact on firm performance when using other measures of mitigation measures, such as the country-level use of face masks.

Further, we observe a continuous increase of the number of COVID-19 cases and deaths in Europe after the period of study in our thesis. With the combination of the current spread of COVID-19 showing no sign of slowdown and the emergence of a COVID-19 vaccine, we propose future research to revisit our (past) findings and evaluate whether conclusions can be supported with a full dataset, once the full COVID-19 period can be appropriately defined. Taking our findings into consideration, whether a time lag associated with the lockdown exists (and in which conditions) or other factors may explain the positive association is yet to be established. This fact resonates with our suggestion of a potential presence of dynamic endogeneity, where we lack the ability to test for the possible causal impact of the historical number of reported COVID-19 cases on current lockdown policies. We propose future researchers to attempt to answer this question by using a combination of more extensive data and alternative research designs. This also holds for our limited insight to the topic of firm-level accounting conservatism and its relationship with stock returns, to further contribute to prior research within the topic of accounting conservatism in general and further to studies focusing on firm performance during crises or periods of exogenous shocks and the role of accounting conservatism.

The academic insights will certainly have practical implications, as both policymakers and companies must incorporate the expected reception of their stakeholders in their decision-making process to accurately forecast and facilitate the desired outcome (Lucas, 1976). As we have seen with the current development of the pandemic, the need of utilizing real-time data to understand the relationship between policies, public health, and economic outcomes, over time, is critical. Therefore, the implementation of effective policies and epidemiologic strategies is crucial to address the challenges that both nations and firms continue to face in a pandemic outbreak.

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8. Appendices

Appendix A

Variable definitions and database sources

Variable	Definition	Database Source
Cases _q	The natural logarithm of the number of reported COVID-19 cases scaled by population per 100,000 inhabitants at quarter end	ECDC
Covid Impact _q	A dummy variable equal to zero when the number of reported COVID-19 cases in a country is lower than the median number of reported COVID-19 cases in quarter <i>q</i> per 100,000 inhabitants, and equal to 1 otherwise at quarter end	ECDC
Deaths _q	The natural logarithm of the total reported COVID-19 related deaths scaled by population per 100,000 inhabitants at quarter end	ECDC
GDP Growth _q	The GDP growth at quarter end	Eurostat
Hospital Beds _q	The number of hospital beds per 100,000 inhabitants at quarter end	Eurostat
Leverage _q	The debt-to-asset ratio calculated as total debt over total assets at quarter end	Compustat Global Daily
Liquidity _q	Current assets over current liabilities at quarter end	Compustat Global Daily
Lockdown _q	Lockdown is a dummy variable that is equal to one if lockdown measures have been implemented and equal to zero otherwise at quarter end	Oxford COVID-19 Government Response Tracker
Performance _q	Return on assets, defined as annualized net income before extraordinary items over average assets trailing four quarters at quarter end	Compustat Global Daily
Revenue Growth _q	Revenue quarter on quarter growth calculated as revenue over revenue last quarter at quarter end	Compustat Global Daily
Stock return _q	Return on stock price calculated as the share price over share price last quarter at quarter end	Compustat Global Daily
Size _q	The natural logarithm of the total book value of assets in Euro at quarter end	Compustat Global Daily
Tangibility _q	Non-current assets over total assets at quarter end	Compustat Global Daily
Unemployment _q	The unemployment rate at quarter end	Eurostat

Appendix B

Lockdown measures per country

Country	Lockdown		
	2020Q1	2020Q2	2020Q3
Austria	x	x	-
Belgium	x	x	-
Bulgaria	x	x	-
Croatia	x	x	-
Cyprus	x	x	-
Czech Republic	x	x	-
Denmark	x	x	-
Estonia	x	x	-
Finland	x	x	-
France	x	x	-
Germany	x	x	-
Greece	x	x	-
Hungary	-	-	-
Iceland	-	-	-
Ireland	x	x	-
Italy	x	x	-
Latvia	-	-	-
Lithuania	x	x	-
Luxembourg	x	x	-
Malta	x	x	-
Netherlands	x	x	-
Norway	x	x	-
Poland	x	x	-
Portugal	x	x	-
Romania	x	x	-
Russia	x	x	-
Serbia	x	x	-
Slovakia	-	-	-
Slovenia	x	x	-
Spain	x	x	-
Sweden	-	-	-
Switzerland	x	x	-
Turkey	x	x	-
Ukraine	x	x	-
United Kingdom	x	x	-

The table displays the chosen lockdown policy among countries in Europe during the first three quarters of 2020, i.e. the period of our study. “x” denotes that the country is imposing lockdown measures during the quarter, whereas “-” denotes that the country is not imposing lockdown measures during the quarter.

Source: Oxford COVID-19 Government Response Tracker

Appendix C. Lockdown and Cases: Nordic Sample

First stage	Dependent Variable: Cases					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	3.8712*** (0.0221)	3.8919*** (0.0272)	-0.7831*** (0.0276)	3.5121*** (0.0331)	3.4247*** (0.0373)	-0.7527*** (0.0292)
Size		-0.0040 (0.0036)	-0.0005 (0.0003)	0.0042 (0.0035)	0.3483*** (0.0201)	0.0071*** (0.0023)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		-0.0006** (0.0002)	-0.0001*** (0.0000)	-0.0007** (0.0003)	-0.0006** (0.0003)	-0.0001*** (0.0000)
Leverage		0.0123*** (0.0021)	-0.0012*** (0.0003)	0.0130*** (0.0014)	0.0240*** (0.0035)	-0.0012*** (0.0002)
Tangibility		0.0922*** (0.0341)	-0.0007 (0.0037)	0.1591*** (0.0332)	0.6676*** (0.0846)	-0.0173** (0.0080)
Hospital Beds		0.0001*** (0.0001)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)
GDP Growth		-27.5614*** (0.8737)	-1.9658*** (0.1303)	-23.7942*** (0.7941)	-23.1472*** (0.7859)	-1.9642*** (0.1361)
Unemployment		-11.8632*** (0.3572)	-0.67013*** (0.0632)	-53.4348*** (1.1062)	-39.7432*** (1.2607)	1.2357*** (0.2560)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	32,526	28,485	28,485	28,485	28,485	28,485
F-statistic	1.21	229.03	212.67	151.18	1.11	255.00

The dependent variable *Cases* is the quarterly change in reported cases of Covid-19 per 100,000 inhabitants per country. *Lockdown* is a dummy variable equal to 1 if the residing country during the quarter is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100,000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Appendix D. Lockdown and Firm Performance: Nordic Sample

Reduced Form	Dependent Variable: Performance					
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	0.0200 (0.0181)	-0.0150 (0.0168)	-0.0200 (0.0463)	-0.0168 (0.0206)	0.0636 (0.0457)	-0.0588 (0.0389)
Size		0.0468*** (0.0069)	0.0467*** (0.0068)	0.0456*** (0.0071)	-0.3193 (0.2069)	-0.3592 (0.2310)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		-0.0006 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0002)	-0.0002 (0.0002)
Leverage		-0.0008 (0.0042)	-0.0004 (0.0044)	-0.0009 (0.0043)	-0.0018 (0.0063)	-0.0036 (0.0073)
Tangibility		-0.2141* (0.1126)	-0.2117* (0.1095)	-0.2148* (0.1122)	-0.6725 (0.4800)	-0.6849 (0.4864)
Hospital Beds		0.0011 (0.0001)	0.0012 (0.0001)	0.0012 (0.0001)	0.0010 (0.0000)	0.0010 (0.0000)
GDP Growth		1.7122 (1.5085)	4.5287 (3.7025)	1.7176 (1.5224)	2.4475 (1.8193)	4.6933 (3.6232)
Unemployment		4.7616** (2.0406)	4.7955** (2.2734)	5.5351*** (1.9817)	-2.8705 (2.3137)	6.1298 (3.8363)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	32,526	28,485	28,485	28,485	28,485	28,485

The dependent variable *Performance* is return on assets. *Lockdown* is a dummy variable equal to 1 if the residing country during the quarter is imposing lockdown measures and equals 0 if otherwise. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100 000 habitants in the residing country in 2019. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Appendix E. Firm Performance and Cases in the Nordic: OLS and Instrumental Variables

Panel A: OLS	Dependent Variable: Performance					
	(1)	(2)	(3)	(4)	(5)	(6)
Cases	-0.0123*** (0.0035)	-0.0002 (0.0031)	0.0233 (0.0418)	0.0019 (0.0033)	0.0239 (0.0150)	0.0136 (0.0247)
Size		0.0468*** (0.0069)	0.0467*** -0.0068	0.0456*** -0.0071	-0.3244 (0.2101)	-0.3586 (0.2299)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		-0.0002 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0002)	-0.0002 (0.0002)
Leverage		-0.0008 (0.0043)	-0.0005 (0.0044)	-0.0008 (0.0043)	-0.0023 (0.0066)	-0.0035 (0.0073)
Tangibility		-0.2142* (0.1128)	-0.2117* (0.1095)	-0.2152* (0.1126)	-0.6824 (0.4857)	-0.6856 (0.4866)
Hospital Beds		0.0014 (0.0002)	0.0010 (0.0002)	0.0009 (0.0001)	0.0013 (0.0002)	0.0018 (0.0003)
GDP Growth		1.7102 (1.5434)	4.5556 (3.7308)	1.7371 (1.5515)	2.7999 (2.0126)	4.6293 (3.6232)
Unemployment		4.7790** (2.0789)	4.8075** (2.2968)	5.6962*** (2.1622)	-2.2867 (1.9911)	6.2794 (3.6232)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	32,526	28,485	28,485	28,485	28,485	28,485

Appendix F. Firm Performance and Cases in the Nordic: OLS and Instrumental Variables (Continued)

		Dependent Variable: Performance				
Panel B: IV-2SLS	(1)	(2)	(3)	(4)	(5)	(6)
Cases	0.0049 (0.0045)	-0.0036 (0.0040)	0.0246 (0.0573)	-0.0042 (0.0052)	0.0159 (0.0114)	0.0731 (0.0487)
Size		0.0468*** (0.0068)	0.0467*** (0.0068)	0.0456*** (0.0070)	-0.3227 (0.2092)	-0.3593 (0.2302)
Revenue Growth		0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Liquidity		-0.0002 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0001)	-0.0002 (0.0002)	-0.0002 (0.0002)
Leverage		-0.0009 (0.0042)	-0.0005 (0.0044)	-0.0009 (0.0043)	-0.0022 (0.0065)	-0.0035 (0.0073)
Tangibility		-0.2140* (0.1126)	-0.2117* (0.1096)	-0.2145* (0.1120)	-0.6780 (0.4835)	-0.6847 (0.4862)
Hospital Beds		0.0011 (0.0007)	0.0012 (0.0008)	0.0010 (0.0000)	0.0015 (0.0000)	0.0017 (0.0001)
GDP Growth		1.6520 (1.4653)	4.5591 (3.7672)	1.6510 (1.4681)	2.6901 (1.9588)	4.7845 (3.6789)
Unemployment		4.7417** (2.0249)	4.8077** (2.2992)	5.4195*** (1.8965)	-2.5885 (2.1559)	6.0940 (3.8184)
Fixed effects						
Year-Quarter	No	No	Yes	No	No	Yes
Country	No	No	No	Yes	No	No
Firm	No	No	No	No	Yes	Yes
Observations	32,526	28,485	28,485	28,485	28,485	32,526
IV						
Lockdown	Yes	Yes	Yes	Yes	Yes	Yes

In Panel A, the estimated coefficients are from least square regressions. In Panel B estimated coefficients are from IV-2SLS regressions. The dependent variable *Performance* is return on assets. *Cases* is the quarterly change in reported cases of Covid-19 per 100 000 inhabitants per country. *Size* is the lagged natural logarithm of the total book value of assets in Euro. *Revenue Growth* is the lagged revenue quarter on quarter growth. *Liquidity* is lagged current assets over lagged current liabilities. *Leverage* is lagged total debt over lagged total assets. *Tangibility* is lagged non-current assets over lagged total assets. *Hospital beds* is the number of hospital beds per 100 000 habitants in the residing country in 2018. *Unemployment* is the lagged unemployment rate in the residing country. *GDP Growth* is the lagged quarterly GDP growth in the residing country. The instrumental variable is *Lockdown* (1=lockdown measures, 0=no lockdown measures). Robust standard errors clustered at firm-level in parentheses. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Appendix G. Multicollinearity: VIF-test

Variable	VIF	1/VIF
Unemployment	1.03	0.9686
GDP growth	1.03	0.9726
Cases	1.01	0.9870
Size	1.01	0.9931
Hospital Beds	1.00	0.9969
Tangibility	1.00	0.9991
Leverage	1.00	0.9994
Liquidity	1.00	0.9999
Revenue growth	1.00	0.9999
Mean VIF	1.01	