The behaviour of financial markets during COVID-19

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Abstract

What is the effect of a growth in the number of confirmed COVID-19 cases on the stock returns in a country? To answer that question this research investigates the behaviour of stock markets, in relation with the daily growth in the number of confirmed COVID-19 cases in 55 countries during the pandemic. The model is estimated on a sample of high-frequency daily panel data over the period 1/1/2020 to 23/04/2021. To ensure that the effect of interest is not affected by other factors, I control for a number of variables related to news coverage, government interventions, culture, and a number of key asset pricing factors. The results indicate that, in line with the hypothesis, a growth in the number of confirmed COVID-19 cases has a negative effect on stock returns in a country. The results show that on a day with a growth rate in the number of infections of 22,31% (median growth rate, when the growth rate is above zero) the index return is -0,0057% instead of 0,0179% (mean index return).The robustness analysis shows that this effect holds during periods with a peak in the number of infections, but not during periods with fewer infections. Furthermore, the effect of an increase in the daily growth rate is twice as strong in Europe than in the rest of the world.

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1. Introduction

In the past one and a half years COVID-19 has impacted our lives on nearly all aspects. News coverage was, and still is, filled with the latest updates on the number of confirmed cases, hospitalizations, and deaths. Many governments implemented harsh lockdown measures to reduce the spread of COVID-19, within their countries. These measures were often met with critical reactions from the inhabitants. Some people considered all the measures far too strict, one of their arguments was that the lockdowns would have a very negative effect on the economy. Another group considered the measures not strict enough, fearing that being too lenient would lead to more confirmed cases, which would cause more deaths, while also having a negative impact on the economy in the long run. In order to prevent companies from going bankrupt, governments and central banks initiated support packages, which would be vital in providing liquidity to struggling organisations, allowing them to survive the crisis (Boot et al., 2020). Despite these support packages, the economic worries, about what was originally a health crisis, continued.

A good way to measure the economic impact of these COVID-19 related measures is through the stock-market. Stock prices function as a continuously updated summary of investors' expectations about the future, making them particularly useful during a crisis (Ramelli and Wagner, 2020; Wagner, 2020). Stock market information is available almost immediately and it is available for most countries in the world, allowing for a real-time analysis of the impact of the latest measures and events concerning COVID-19 around the globe. Stock prices are, of course, affected by a wide variety of factors. This paper aims to control for these influences by using a variety of control variables, like the news coverage in a country, and the cultural differences between countries.

Several papers have already been written on the topic of stock prices during the COVID-19 crisis. In this section I will give a brief overview of some of them, later, in the literature review, these papers will be discussed in depth. First of all, the hypothesized effect of COVID-19 cases on stock prices is rooted in behavioural finance literature on the effect of investors' expectations. Gormsen and Koijen (2020) have investigated this relationship and they found that decreased expectations about future economic growth play an important role in the behaviour of stock prices. There is a great variety of factors that affect these expectations, and thus the stock prices. For example, Ashraf (2020), researched the effect of government interventions on stock prices in 77 different countries. He found that the announcement of social distancing measures has a direct negative effect, due to the impact on economic activity, but also an indirect positive effect, through the reduction of COVID-19 cases. Other measures, such as public awareness programs, testing and quarantine policies, and of course governmental support packages were found to have largely positive effects on the market (Ashraf, 2020). Other research investigated the effect of culture on market response, using two dimensions from Hofstede: individualism and uncertainty avoidance. They find that countries with high individualism scores had a 12.71% lower stock market decline than countries with low individualism scores (Fernandez-Perez et al., 2021). Furthermore, they found that countries with high uncertainty avoidance showed 5.40% greater economic decline than countries with low uncertainty avoidance. Finally, they found that a combination of these two factors, so low individualism and high uncertainty avoidance caused significantly higher volatility (Fernandez-Perez et al., 2021). Other contributions to this body of literature were made by Haroon and Rizvi (2020), they found a positive relationship between the amount of panic-laden news coverage and the volatility in equity markets. Njindan Iyke (2020), who found that returns and volatility of the next one to five days, can partially be predicted by the number of COVID-19 infections or deaths. Erdem (2020) found that the negative effect of COVID-19 on the stock market is more pronounced in less free countries. Finally, a paper written by Zaremba et al. (2021) uses a great variety of factors to create a multidimensional data set that includes factors about economics, demographics, healthcare, government interventions and more. They use this framework to determine which factors make a country financially immune to a global pandemic. These papers are mere examples of a quickly expanding body of literature, which will be further discussed later in this paper.

Methodologically speaking, this paper will use a simplified version of the approach from Zaremba et al. (2021), who used a three-step approach. They used the first two steps to find an optimal set of variables for the pooled panel data regression. In this paper I only perform the pooled panel data regression. This simplified approach is justified as my goal is to find the effect of a growth in confirmed COVID-19 cases on stock prices, while controlling for an array of other variables, such as government interventions and news coverage, as opposed to Zaremba et al. (2021), whose goal was to find which factors contributed most to the financial immunity of a country during a pandemic. Furthermore, the variables I use are all rooted in the literature, whereas Zaremba et al. (2021) used a much larger body of variables of which many had not been investigated in this context before.

As a result of this approach, I have found that a positive daily growth rate has a negative effect on the stock index return. The effect is statistically significant at the 1% level. It is also economically significant, as a 1% increase in the number of confirmed daily COVID-19 cases lowers the index return with 0,00106%. The average daily index return in this sample is 0,0179%. Therefore, a 16,9% increase in the number of confirmed infections offsets a positive index return entirely. The median increase of infections on days with a positive growth rate is 22,31%. Therefore, during a period with an increasing number of infections, on a median day the index return is -0,0057% instead of 0,0179%.

With this conclusion, this paper makes a variety of contributions to the literature. First, where the aforementioned papers based their findings solely on the first wave of COVID-19, I will cover a much longer period, which includes several peaks and throughs, allowing for a much clearer understanding of the effects in different periods. The results show that a growth in COVID-19 has a statistically and economically significant effect during the waves, when there are a lot of confirmed COVID-19 cases, but this significance is not found during periods with, on average, less confirmed COVID-19 cases. This finding could be useful for investors as it means that they don’t have to pay too much attention to the current COVID-19 situation during periods with few infections, but very much need to do so during periods with many infections. This finding also has bearings on future research on this topic as researchers should consider focusing solely on periods with high infections instead of the entire period. Another contribution of this research is that the effect of the daily growth of confirmed COVID-19 cases on stock market returns is much stronger and more significant in European countries than in non-European countries. This finding could also have ramifications for practitioners and future researchers. Practitioners should expect a stronger stock market reaction to an increase in COVID-19 cases in Europe than in other parts of the world. Future researchers could aim to find the reason behind this finding.

In the remainder of this paper, I will first discuss the literature, which will lead to the research problem and the hypothesis, then the methodology will be discussed, followed by an overview of the collected data, supplemented with several summary statistics. Then I will analyse the data to find the answer to my research question, and finally I will conclude and discuss those results.

2. Literature review

A great amount of research has already been conducted on the economic effects of the COVID-19 crisis. Examples of this are; Haroon and Rizvi (2020), who found a positive correlation between the amount of panic-laden news coverage and the volatility in equity markets, Njindan Iyke (2020), who found that the number of infections or deaths have predictive power for the returns and volatility of the next one to five days, Erdem (2020), who found that the negative effect of COVID-19 on the stock market is more pronounced in less free countries, Ashraf (2020b), who found that higher uncertainty avoidance is connected to a stronger decline in stock returns when the number of cases increases. These papers all provide examples of the effects of different variables on stock market returns.

The first paper to use a multidimensional dataset to evaluate the effect of the COVID-19 crisis on stock markets was written by Zaremba et al. (2021). They use factors from finance, economics, demographics, technological developments, healthcare, governance, culture, and law. Their focus is on finding the factors that make a country more financially immune to the COVID-19 crisis. They find, amongst other things, that countries with more conservative companies are best equipped to deal with the COVID-19 crisis (Zaremba et al., 2021).

In this paper I focus on the direct effect of a growth in COVID-19 infections on the stock market. For this purpose, I will aim to establish a set of variables that can control for the cultural, economic, and governmental differences between countries. The remainder of this literature review is thus focused on establishing this set of variables.

2.1 News Coverage

One of the factors that could have a significant effect on the relationship between the number of COVID-19 cases and the stock market reaction is the way it is discussed in the news. Research on the effect of news coverage on the reactions of markets is based on the assumption that market returns are driven by investor mood. One of the most influential papers on this topic was written by Tetlock (2007), he found that high media pessimism is connected to downward pressure on stock prices. More evidence regarding the link between stock price movement and good or bad news, comes from Suleman (2012). In his research, on the Pakistani stock exchange, he found that good political news has a positive effect on the price of the index, while simultaneously lowering the volatility. Negative political news on the other hand, decreases the price, and increases the volatility, this effect is twice as strong as the effect of positive news.

In accordance with these findings, Haroon and Rizvi (2020) found a positive association between media induced panic, on the topic of COVID-19, and stock market volatility. In their research they use the Ravenpack finance for Panic index, which creates a daily index level of hysteria inducing news, general sentiment of the daily news and the quantity of COVID-19 related news relative to other news. They combine this information with national and sectoral stock price indices, to come to their results (Haroon and Rizvi, 2020). Their data covers the period from 1 January 2020 until 30 April 2020 and considers 23 different sectors in the US.

2.2 National culture

Another variable that has been confirmed to play a major role in stock price behaviour is the national culture. Ashraf (2020b) finds that higher uncertainty avoidance is connected to a stronger decline in stock returns. As mentioned in the introduction, Fernandez-Perez et al. (2021), found significant effects of the extent of uncertainty avoidance and individualism on the decline of the stock market. Another research on this topic focuses on the amount of freedom in a country, and has found that when a country is less free, the negative effect on the stock market is more pronounced (Erdem, 2020).

2.2.1 Freedom

As mentioned above, Erdem (2020) found that freer countries faced a lower decrease in returns and a lower increase in volatility per confirmed case and death in a country. This result is particularly striking, since freer countries report higher numbers of cases and deaths, but the effects of an increase are less pronounced. Erdem (2020) provides a number of potential reasons for his results. Firstly, he mentions that the effects could be driven by the stronger, more effective financial systems in freer countries, but this effect is eliminated by the inclusion of time and country fixed effects. Another reason he provides is more convincing, it might be that inhabitants of less free countries suspect that information about the severity of the pandemic is hindered, and therefore the number of cases and deaths might be underreported. A final reason he provides is that the possibility of expropriation is more pronounced in less free countries, and that this possibility has increased during the crisis, leading to more mismanagement in firms, decreasing their value (Erdem, 2020).

In order to come to these results, Erdem (2020) used daily broad stock market indices between 1 January 2020 until 30 April 2020, from 75 different countries, with the corresponding COVID-19 data (cases and deaths per million) and the freedom scores are taken directly from the 2019 freedom index provided by Freedom House.

2.2.2 Uncertainty avoidance

Uncertainty avoidance is one of Hofstede's six dimensions, which have become a widely respected paradigm describing national culture (Hofstede, 2011). Uncertainty avoidance is described by Hofstede (2011) himself, as the societies tolerance for ambiguity. Societies with higher uncertainty avoidance prefer to have clarity and structure and try to avoid novel, unknown, surprising situations, therefore, it is safe to assume that such countries faced higher levels of stress and anxiety, which could lead to stronger negative reactions on the stock market (Hofstede, 2011).

The effect of uncertainty avoidance on stock price levels during the COVID-19 crisis has been researched by Ashraf (2020b) and Fernandez-Perez et al. (2021). They both found that higher levels of uncertainty avoidance were linked to a stronger decline in market returns when the number of cases increase. They argue that this effect is likely to be driven by the fact that people with higher levels of uncertainty avoidance have a higher likelihood to engage in panic selling in the case of an economic downturn, driving prices even further down. Ashraf (2020b) used COVID-19 and stock market data from 43 different countries for the period January 22, 2020, until April 17, 2020. Fernandez-Perez et al. (2021) used a slightly different approach, measuring the stock market reaction in 63 different countries in the three weeks following the first confirmed case in a country.

2.2.3 Individualism

Individualism, with its opposite collectivism, is another one of Hofstede's cultural dimensions. High individualism scores indicate looser ties between individuals, everyone is only supposed to take care of him/herself and his/her close family, while in a collectivist society, people are integrated in strong, close groups (Hofstede, 2011).

The effect of individualism on stock market returns has been investigated by Fernandez-Perez et al. (2021), and they found that higher individualism scores significantly decreased the effect an increase in the number of cases has on the decline in the stock market. They argue that this effect is driven by the fact that individualistic investors only partially adjust to new public information, combined with the fact that individualistic managers are more likely to withhold bad news, this leads to the conclusion that highly individualistic countries are more likely to underreact to news about the COVID-19 pandemic, resulting in a smaller negative impact on the stock price level (Fernandez-Perez et al., 2021).

2.2.4 Long-Term Orientation

Another cultural dimension of Hofstede that could be of interest is long-term orientation. As far as I know, this variable has not yet been considered in the context of stock prices during the COVID-19 period. Long-term orientation corresponds to the view that most the important events happen in the future, while short-term orientation is related to the view that the most important events have already happened, or are currently happening (Hofstede, 2011). Societies with shorter-term orientation assign higher importance to the profits of the current year, while long-term oriented societies assign higher importance to the profits in later years (Hammerich, 2019). This could lead to the conclusion that, in short-term oriented countries, the COVID-19 pandemic will lead to stronger stock price reactions. On the other hand, short-term orientation is also connected to higher social spending and consumption, which could have a positive effect on stock prices (Hofstede, 2011). Furthermore, excessive short-term thinking has been named as one of the causes for the global financial crisis of 2008 (Brauer, 2013). In this same research, Brauer (2013) investigates the effect of short versus long-term oriented managers on medium-term results, and he finds that short-term oriented behaviour yields suboptimal results as compared to long-term orientation. All in all, I expect that a higher long-term orientation score corresponds with higher daily returns.

2.3 Government interventions

The final topic is government interventions, which has been researched by Ashraf (2020a). In his paper, he found that different types of government interventions have different effects on stock prices. He distinguishes between three main types of government interventions; the first type is social distancing measures, including the closure of schools, workplaces, shops, and more, the second type is containment and health, this includes public awareness campaigns and testing and quarantining policies, and the final type are income support packages, including financial aid to households and organisations. These different types of measures have different direct effect. It has been found that social distancing measures have a negative direct effect, while containment and health and income support packages have positive direct effects (Ashraf, 2020a). However, there are also indirect effects. For example, more stringent social distancing, containment and health measures, and more generous income support packages supposedly lead to a reduction in the infection rate, which should weaken the negative reaction to a growth in confirmed cases on the stock prices.

The data that Ashraf (2020a) used for his research contained daily stock market returns, daily confirmed COVID-19 cases and for the government measures he used the Oxford COVID-19 Government Response Tracker (OxCGRT) (Hale and Webster, 2020). This database contains daily information about the three types of governmental interventions that were discussed earlier. The data was collected for the period January 22, 2020, until April 17, 2020, for 77 different countries.

3. Research problem

That brings us to the research problem. From the literature review I have identified that a lot of research has already been conducted about the effects of different variables on the effect of an increase in confirmed cases of COVID-19 on stock returns. In previous literature, it has been found that more panic-loaded news coverage, lower freedom scores, higher uncertainty avoidance and lower individualism have a negative impact on the decrease in stock market returns when the number of cases increases. Furthermore, it has been found that stricter social distancing measures have a direct negative effect on stock returns, but an indirect positive effect, through a decrease in the number of cases, and finally that stricter health and containment measures and more generous financial support packages have a direct positive effect on stock returns.

The literature has proven that all these variables have a significant effect on the resulting stock market behaviour. However, there has only been one study that has taken a similar approach and combined multiple variables, the paper from Zaremba et al. (2021). Their paper however, only focused on the relatively short period between January 1, 2020, and April 28, 2020. As mentioned in their limitations, this short time period might have been a constraint. My paper considers a much longer time period, which will allow us to find whether the effects over a longer timespan differ significantly from the effects during a shorter period.

This paper's main contribution to the literature is based on the fact that this research covers a much longer period than previous research. This approach allowed me to find that the effect of a growth in confirmed COVID-19 cases is statistically and economically significant in periods with relatively many infections. During periods with little infections, the effect was not significant. This finding has implications for practitioners as well as researchers. For practitioners it means that in the remainder of the COVID-19 crisis, and in future health crises, they do not need to worry as much about the effect of a pandemic on the stock market during periods with little infections, but they very much need to do so during periods with many infections. For researchers on this subject, this finding means that they should consider only or mainly focusing on periods with many infections and they do not need to waste resources on periods with little infections. Furthermore, the robustness analysis showed that the effect is far stronger and more significant in Europe than in the rest of the world. The reason behind this needs to be investigated in future research.

3.1 Hypothesis

This leads us to the hypothesis that will be tested in this paper.

> H1: An increase in the number of confirmed COVID-19 cases has a statistically and economically significant, negative effect on stock price returns, when controlling for government interventions, news coverage, culture and key asset pricing factors.

4. Methodology

To test the impact of the growth rate in COVID-19 cases on daily stock returns, I will perform a pooled panel data regression. This pooled panel data regression is used to control for other variables that could influence the effect of COVID-19 infections on stock returns. The control variables used in this have been derived from the literature. These control variables are based on cultural differences, differences in the way COVID-19 is reported in the news, differences in governmental interventions, and four key asset pricing factors. These key asset pricing factors have been identified by Fama and French (2012) and Carhart (1997). They are: $\beta_{i,t}$ the country level beta of country i in period t, P/E_t the P/E ratio of country t, $MOM_{i,t}$ the momentum factor of country i at time t and finally $MV_{i,t}$ the market value of country i at time t. The necessary information for these key asset pricing factors will be derived from Refinitiv Datastream, and all data will be daily data.

4.1 Pooled panel data regression

This pooled panel data regression is designed to find the effect of the growth rate of confirmed COVID-19 cases on stock price returns, while controlling for government interventions, culture, news coverage and the key asset pricing factors. The formula is as follows:

$$\begin{aligned} R_{i,t} = {} & \gamma_0 + \gamma_1 \times GCC_{i,t} + \gamma_2 \times News\ Coverage_{i,t} \\ & + \gamma_3 \times Government\ Interventions_{i,t} + \gamma_4 \times Culture_i \times GCC_{i,t} \\ & + \gamma_5 \times Key\ Asset\ Pricing\ Factors_{i,t} + u_{i,t} \end{aligned}$$

In this formula $R_{i,t}$ refers to the stock returns in country i at time t, where t is measured in days. $GCC_{i,t}$ is the growth in the number of confirmed COVID-19 cases. News coverage are the variables related to the news, and the corresponding sentiment. Those are: the media coverage index, the media hype index, the panic index, and the sentiment index. Government interventions refers to the variables that concern the measures imposed by the government. Those are: the economic support index, the stringency index, and the containment & health index. The cultural variables are static representations of the culture of a country and are therefore multiplied with the growth in COVID-19 cases to create an interaction effect. These variables are: long-term orientation, uncertainty avoidance, individualism, and freedom. The key asset pricing factors are: beta, momentum, the P/E ratio, and the market value. Finally, $u_{i,t}$ is the random disturbance term. This term can be split up in two parts $u_{i,t} = v_i + \epsilon_{i,t}$. The first part, v_i refers to the unobservable, country-specific heterogeneity, and the second part $\epsilon_{i,t}$ refers to the idiosyncratic error.

The variable of interest is γ_1, this variable measures the size of the effect of the daily growth in confirmed COVID-19 cases. The other variables, γ_{2-5} are paired with the control variables. The inclusion of these variables ensures that the effect of interest, the daily growth in COVID-19 cases, is isolated, and is not affected by unrelated factors.

To perform this regression, I will use a random effects model. There are multiple reasons for choosing the random effects model over a fixed effects model. First, in a fixed effects model, the variables are constant across different countries, while the random effects model allows them to be different (Kreft and De Leeuw, 1998). Furthermore, the sample does not exhaust the population, it only considers a small part (Gelman, 2005). Another reason to elect a random effects model over a fixed effects model is the presence of time-invariant variables that would correlate with the country-specific fixed effects (Zaremba et al., 2021).

5. Data

In order to investigate which factors affect the daily stock market returns, I need to collect data for all the variables that have been introduced in the literature review. In this section, I will outline the sources of the data, and I will provide a brief description of the variable in question.

5.1 Index returns

I use the index value provided by Datastream Global Equity Indices. This database uses a representative sample of stocks covering at least 75-80% of total market capitalisation. Providing accurate and reliable daily returns for 55 different countries, a listwise overview of the included countries is available in appendix 1. For all these countries, the database includes daily information about all 343 trading days between 1/1/2020 and 23/04/2021. The growth rate is calculated by taking the difference between the natural logarithms of day t and day t-1. Multiplying this outcome by 100 gives the percentile growth rate in discrete time. The formula used to calculate the daily index return is as follows:

$$IndexReturn = \ln\left(IndexReturn_{i,t}\right) - \ln\,(IndexReturn_{i,t-1}) \times 100$$

5.2 Coronavirus cases

The information about the number of confirmed COVID-19 cases is extracted from the Ravenpack Finance for Panic index. This index provides the total number of confirmed cases, as well as the deaths and recoveries. In line with Zaremba et al. (2021), I have used this information to compute the growth rate in the total number of cases. The growth rate in confirmed daily cases is computed in the same way as the growth rate of the index return, by taking the difference between the natural logarithms of day t and day t-1, Multiplied by 100. The formula for this calculation is as follows:

$$DailyGrowth = \ln\left(DailyCases_{i,t}\right) - \ln\,(DailyCases_{i,t-1}) \times 100$$

5.3 News coverage

The first control variable that was discussed in the literature review was the news coverage. Data about news coverage is extracted from the Ravenpack Finance for Panic index. This database provides a variety of different variables concerning the amount of news coverage concerning the Coronavirus, the panic-ladenness of this news coverage, and the general sentiment of the coverage. The media coverage index is the percentage of all news sources that cover the Coronavirus, a value of 60 means that at that moment 60% of all sampled news sources cover Corona related stories. The panic index works the same way but shows the percentage of news that mentions both the Coronavirus and a reference to panic of hysteria. The sentiment index provides a score between -100 and 100, which corresponds to the general sentiment of entities mentioned in the news, alongside the Coronavirus. A score of -100 is the most negative, 0 is neutral and 100 is the most positive. Finally, there is the media hype index, which is similar to the media coverage index. The difference is that the media coverage index concerns the percentage of news sources covering the Coronavirus, while the media hype index concerns the percentage of news covering the Coronavirus.

5.4 National culture

As discussed in the literature review, the national culture is measured with four different variables, these are freedom, uncertainty avoidance, individualism, and long-term orientation. The first one, freedom, is measured with the global freedom scores from Freedomhouse (2021). These freedom scores are a weighted average between political rights and civil liberties, which, in turn consist of a variety of scores on topics such as the electoral process, the functioning of the government, freedom of expression and belief, personal autonomy and individual rights (Freedomhouse, 2021). This leads to a score on a scale between 0 and 100, where 0 to 35 correspond to not free, 35 to 70 correspond to partly free and 70 or higher is considered free.

The other cultural variables, individualism, uncertainty avoidance and long-term orientation, are part of the famous Hofstede cultural variables. Hofstede (2011) explains that he has positioned all countries relative to all other countries by giving them a score on each dimension on a scale of 0 to 100. For individualism this means that a high score corresponds to high levels of individualism, while a low score corresponds with high levels of collectivism. For uncertainty avoidance a high score corresponds to strong uncertainty avoidance, while a low score corresponds to weak uncertainty avoidance. And for long-term orientation this means that a high score corresponds with strong long-term orientation, while a low score corresponds with strong short-term orientation (Hofstede, 2011).

5.5 Government interventions

The final set of control variables that will be used in this research belong to the government interventions. The information for these variables has been extracted from the Oxford COVID-19 Government Response Tracker (OxCGRT) (Hale and Webster, 2020). Variables that are part of this set include the overall government support index, containing information about the government response on all indicators in the database, a containment and health index, which contains information about lockdown restrictions, with testing and tracing policies, as well as short-term investments in healthcare and vaccines, an economic support index, which corresponds with measures such as income support and debt relief, and a stringency index, which records the strictness of behaviour restricting policies. These variables are the result of a combination of underlying variables. Examples of this are, amongst others, school closing, workplace closing, and the cancelation of public events as underlying variables for the containment variable (Hale and Webster, 2020). These underlying variables are then used to determine a score on a scale from 0 to 100, where 0 corresponds with no support or measures, and 100 corresponds with full support or measures.

5.6 Control variables

As mentioned before, this research uses four key asset pricing factors, country level beta, momentum, the P/E ratio, and the market value. In this section I will outline how these variables were determined. First, the country level beta, for this variable, I used the returns for the 12 months prior to time t. It was calculated by taking the covariance between the daily returns of the country and the world portfolio and dividing this by the variance in the world portfolio's returns. The formula for this is as follows:

$$\beta_{i,t} = \frac{Cov\left(Returns_{i,t-365:t};\ Returns_{w,t-365:t}\right)}{Var\left(Returns_{w,t-365:t}\right)}$$

Where $Returns_{i,t}$ corresponds to the returns of country i and $returns_w$ corresponds to the returns of the world portfolio. The momentum factor at time t was determined by taking the average returns from the 12 months prior to time t. Finally, the P/E ratio and the Market value were extracted from the Thomson Reuters Eikon Datastream database.

6. Summary statistics

In this chapter, I will analyse and present the summary statistics from my dataset. The purpose of this is to gain a better understanding about the data I collected. To that end, I will show and discuss several graphs and tables about the variables of interest and the control variables. The first graph that I will use for this purpose is a plot of the index returns over time per country. This will be followed by a table with the summary statistics about all relevant variables in the sample. After that I will use scatterplots to visualize the relationship between index returns and the daily growth of confirmed COVID-19 cases. A secondary purpose of this chapter is the detection of potential outliers that could negatively affect the results of the analysis.

6.1 Index returns

The first graph that was used to summarize the data shows the index returns over time for every country. One of the countries has a distinctly different pattern than the rest, this is Indonesia. It seems that the index returns for Indonesia are rather odd. Closer inspection shows that the index returns of Indonesia are based on very odd index values of only \$0,04 to \$0,06, with no additional numbers after the decimal point. This means that returns are either 0%, upwards of 20% or below -16,66%. As shown in table 1, this has a significant negative effect on the index return variable, removing Indonesia from the sample has a positive impact on the standard deviation, as well as heightening the minimum and lowering the maximum value. Therefore, I have decided to drop Indonesia from the sample.

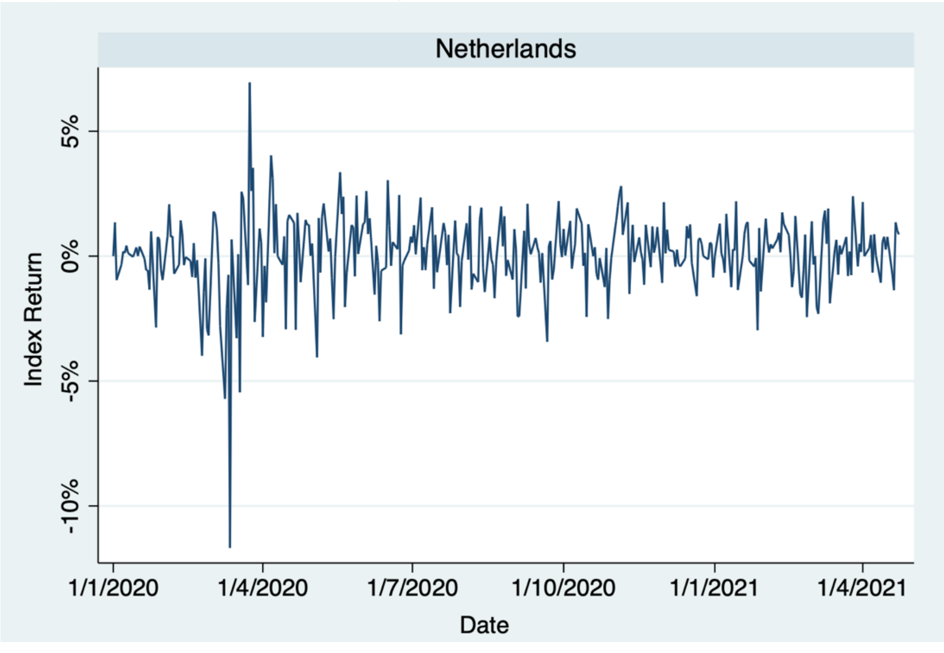
Table 1: Summary statistics of the index returns variable with and without Indonesia in the sample

Variable	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**
Index Return (incl. Indonesia)	19.188	0,036	1,94	-25	33
Index Return (excl. Indonesia)	18.845	0,033	1,71	-17,46	14,40

Graph 1 shows the index returns over time for the Netherlands. This graph shows several deep throughs just before the first of April, during this period the AEX dropped 36%. After this initial crash, the market normalized again, and, over time, the index recovered and one year later, on April 1st, 2021, the AEX even broke its 21-year-old all-time high. The American stock market, as shown in graph 2, shows a similar pattern, albeit with even deeper throughs. The S&P500, for example, dropped from 3386 points on February 19th to 2237 points just a little over one month later, on March 23rd. After hitting rock bottom, the stock market, aided by the support measures announced by the Fed, started rising again, breaking all-time highs in the process.

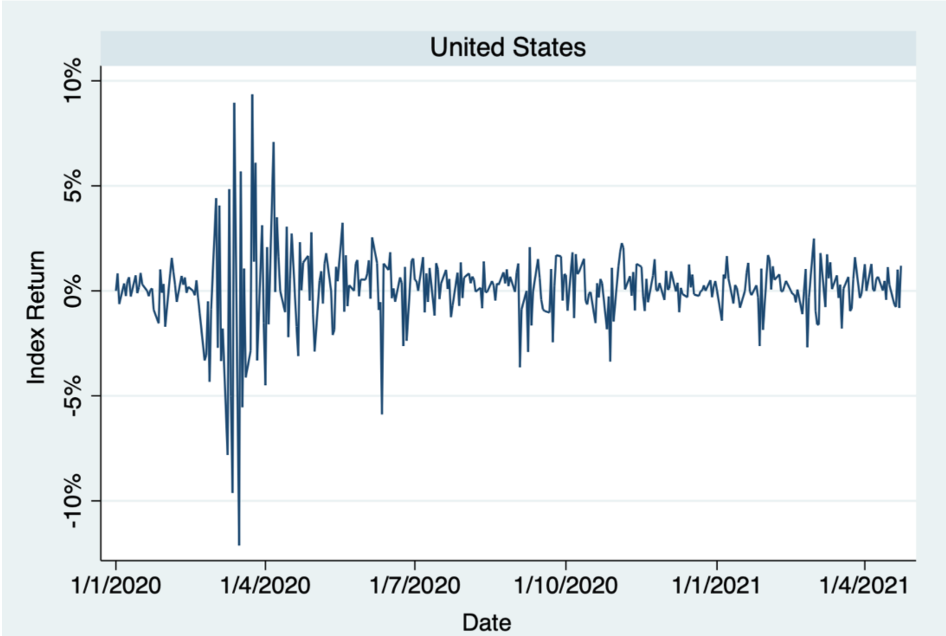
Graph 3 shows the same graphs for all 55 countries in the sample. This graph shows similar patterns for almost all countries in the sample. This worldwide period of extremely high volatility corresponds to the timeframe in which COVID-19 went from an unknown Chinese illness to a public health emergency of international concern (January 30th), to a pandemic (March 11th). This initial period of high volatility is, in most countries, followed by a prolonged period of lower volatility. The high volatility in the earlier period is likely to be caused by a lack of knowledge about COVID-19 and no clear idea what the future would bring. Later, when it became clear that the governments and central banks would offer financial support to ensure organisations would survive the crisis, stock markets started to recover.

Graph 1: Index Returns over time for the Netherlands



Note: Y-axis shows the index returns ranging from -10% to 5% and the X-axis shows the date, ranging from 1/1/2020 until 23/4/2021. An IndexReturns value of 0% indicates that the value is the same as the day before. A value of 10%, for example, means that the index is 10% higher than the day before.

Graph 2: Daily index returns over time for the United States



Note: Y-axis shows the daily index returns ranging from -10% to 10% and the X-axis shows the date, ranging from 1/1/2020 until 23/4/2021. An IndexReturns value of 0% indicates that the value is the same as the day before. A value of 10%, for example, means that the index is 10% higher than the day before.

Graph 3: Daily index returns over time per country

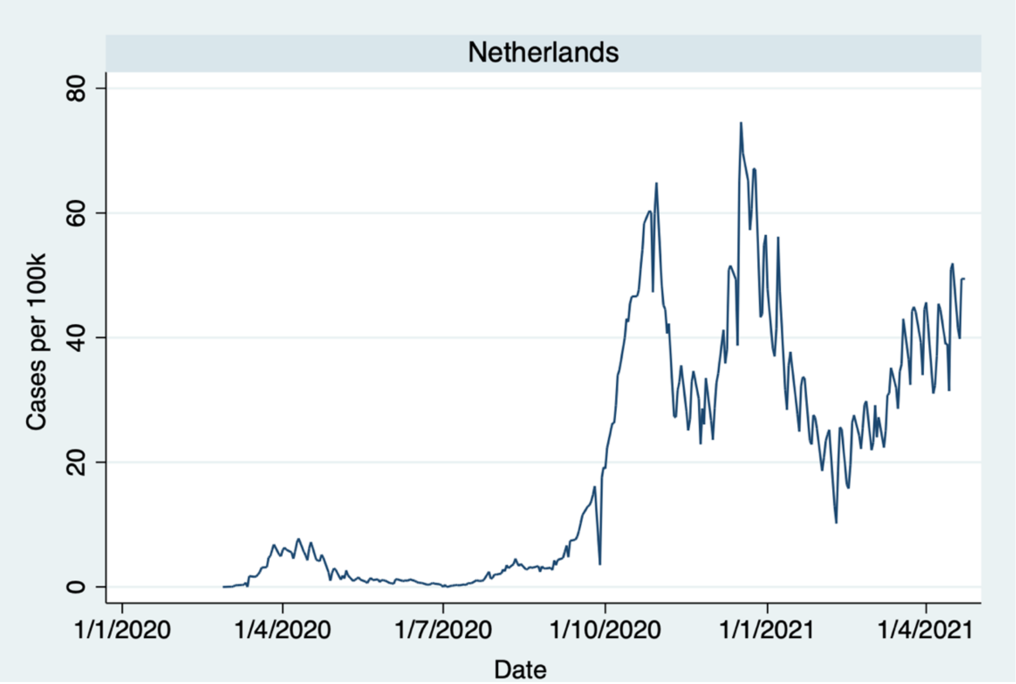
Note: Y-axis shows the daily index returns ranging from -20% to 20% and the X-axis shows the date, ranging from 1/1/2020 until 23/4/2021. An Index Return value of 0% indicates that the value is the same as the day before. A value of 10%, for example, means that the index is 10% higher than the day before.

6.2 Confirmed COVID-19 cases per country

In this section I will explore the number of confirmed COVID-19 cases per country. Graph 4 shows the daily number of confirmed COVID-19 cases per 100.000 inhabitants per day for the Netherlands. Several waves are clearly visible. The timing of the first wave corresponds to the large increases in volatility that were seen in the first three graphs. Graph 5 shows the same graph for the United States. Like the Netherlands, the United States experienced several waves. The wave that starts around the beginning of October has, amongst other reasons, been explained by students going back to school and the change of seasons, from summer to autumn.

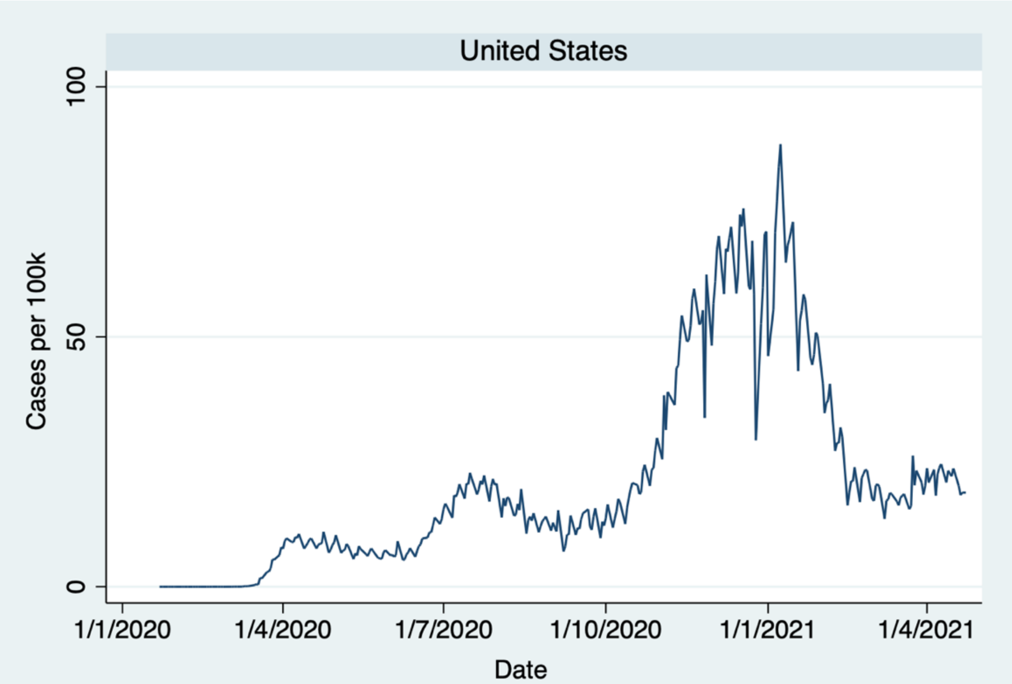
Graph 6 shows the same information as graphs 4 and 5 for all 55 countries in the sample. This graph shows that nearly all countries in the sample have similar wave patterns. Another striking observation from graph 6 is that it seems that some countries hardly had any cases at all. There are several explanations for this phenomenon. It could be that a country really did have very little infections, relative to its population, but it could also be that some underdeveloped countries, like Nigeria, were not able to test their citizens on the same scale as a developed country, like Spain, causing a high number of COVID-19 cases to remain unnoticed. In the analysis this problem is circumvented by using the growth rate instead of the number of cases per 100.000 citizens.

Graph 4: Daily number of confirmed COVID-19 cases per 100.000 inhabitants for the Netherlands



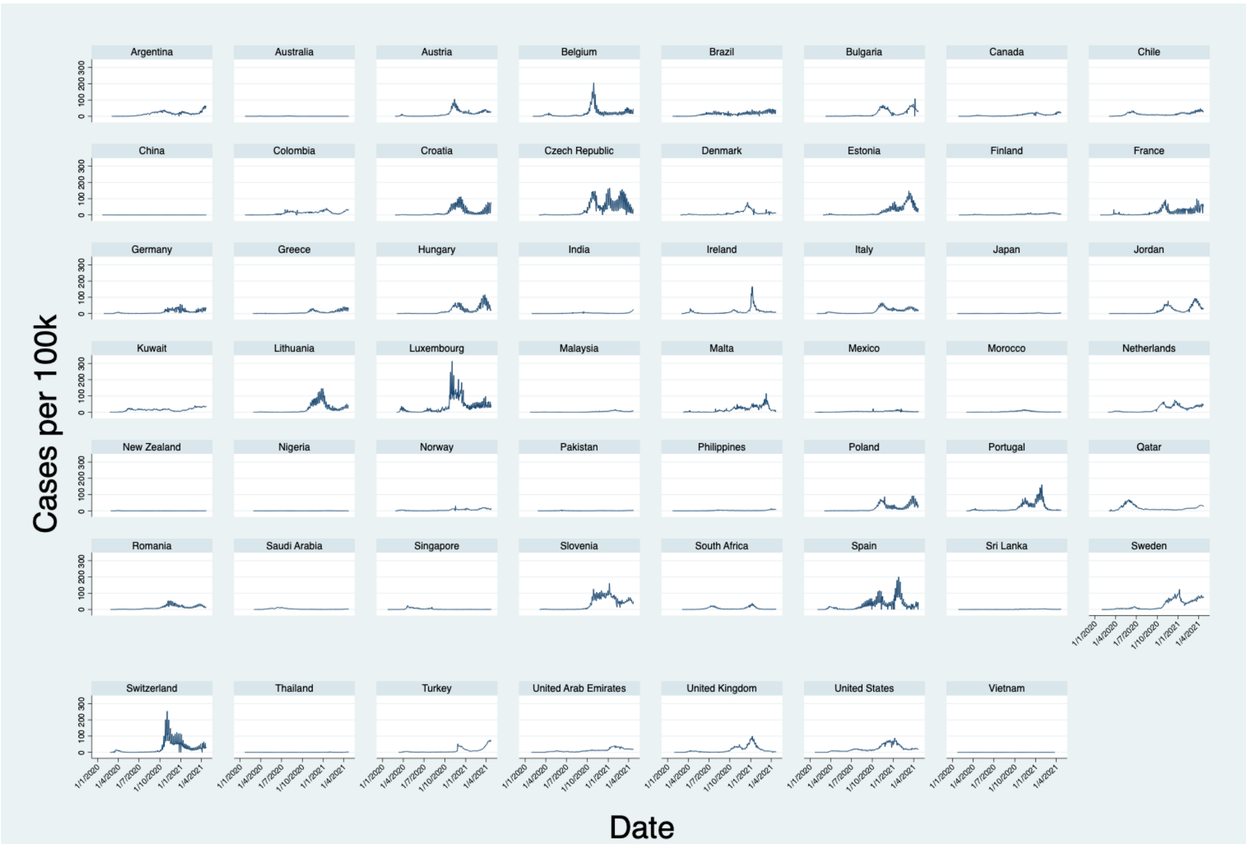
Note: Y-axis shows the number of confirmed cases per 100.000 inhabitants, X-axis shows the date

Graph 5: Daily number of confirmed COVID-19 cases per 100.000 inhabitants for the United States over time.



Note: Y-axis shows the number of cases per 100.000 inhabitants, the X-axis shows the date.

Graph 6: Daily number of confirmed COVID-19 cases per 100.000 inhabitants per country over time.



Note: Y-axis shows the number of cases per 100.000 inhabitants, the X-axis shows the date.

6.3 Summary of all variables

Moving on, table 2 shows a summary of all relevant variables, indicating their number of observations, mean, standard deviation, minimum value, and maximum value. From this table no problems become apparent. The minimum and maximum values are all within their respective possible ranges.

6.3.1 Index returns

The variable IndexReturn shows the average return of the stock market indices. It has a mean of 0,0179, meaning that, on average, the stock markets rose with 0,018% per day. The respective minimum and maximum are -19,18 and 13,45, which correspond with a drop of almost 19,2% and an upward surge of 13,5%, these seem to be extreme numbers, but they are not unheard of in times of crises. Historical examples include 'Black Monday' on which the Dow Jones index dropped a record-breaking 22% on a single day.

6.3.2 Confirmed COVID-19 cases

The other variable of interest is the daily growth in confirmed COVID-19 cases. This variable is calculated by taking the difference between the natural logarithm of day t and day t-1 and multiplying this by 100. This gives the percentage change in confirmed COVID-19 cases in discrete time. The mean of this variable is 1,872, indicating that, on average, the number of confirmed cases rose with 1,87% per day. The minimum is -355,53 indicating that on this occasion, the number of cases dropped over 3,5 times as low as the day before. The maximum is 390,36, indicating that on this occasion, the number of confirmed cases was 3,9 times higher than the day before.

6.3.3 News coverage

The next set of control variables are those extracted from the Ravenpack Finance for Panic database, they quantify the media portrayal of the Coronavirus situation. The first one is the Panic Index; this index shows the percentage of all news that is about a combination of COVID-19 and panic or hysteria. In my sample, the minimal value is 0,08, indicating that 0,08% of all news mentions a combination of COVID-19 and panic or hysteria, the maximum value is 83,05 and the mean is 5,46. The Media Coverage Index and Media Hype Index are quite similar, they both indicate the percentage of COVID-19 mentions in the news. The difference is that the Media Coverage Index corresponds to the percentage of news sources that cover the Coronavirus, while the Media Hype Index corresponds to the percentage of all news that covers the Coronavirus. In the sample, the Media Coverage Index has a minimum value of 6,05 and a maximum value of 96,48, meaning that at the peak, 96,48% of all news sources covered COVID-19 related news. The mean for the Media Coverage Index is 60,72. For the Media Hype Index, the minimum value is 4,86 and the maximum value is 97,23, this means that at the peak 97,23% of all news was about the Coronavirus. The mean for the Media Hype Index is 48,56. The final variable in this set is the Sentiment Index, this index represents the overall sentiment of the news. It is scored on a range from -100 to 100, with -100 being the most negative sentiment, 0 being neutral and 100 being the most positive. The minimum value for the Sentiment Index in this sample is -97,21 and the maximum value is 51,07. This means that at the low point, the sentiment was almost entirely negative, while at the highest point, the sentiment was quite positive. The mean is -8,61, meaning that the average sentiment was somewhat negative.

6.3.4 Government interventions

Next are the variables related to government policy, the first one is the Economic Support Index, this index, scored on a range from 0 to 100, indicates the amount of economic support that is provided by the government, it comprises an income support measure and debt/contract relief measure A value of 0 represents no support and a value of 100 represents full economic support. As can be seen in the table, the minimum and maximum values of the Economic Support Index are 0 and 100, and the mean is 53,137. The next variable is the Stringency Index. This variable is a measurement of how strict the government-imposed closure and containment measures are, as well as the public information campaigns they run. Similar to the Economic

Support Index, this variable is also scored on a scale from 0 to 100, with 0 being no measures, and 100 indicating full measures on all aspects. Like the Economic Support Index, the minimum and maximum values of the Stringency Index are also 0 and 100. The final variable in this set is the containment and health index, this index contains the information that is included in the stringency index, combined with information about health measures, such as the testing policy and investment in vaccines. Like the previous two variables, the minimum value for this variable is 0, but the maximum value is only 91,96. Indicating that at no point in time, a government imposed all measures at the same moment.

6.3.5 Culture

The next set of control variables are the cultural variables. The first is the Freedom score, this score is built up from 10 political rights indicators and 15 civil liberties indicators. All these indicators are scored on a range of 0 to 4, with 0 being the lowest freedom and 4 the highest. These values are then added together to come up with the overall freedom score. A score of 0 means that a country has no freedom at all, and a score of 100 means that a country is completely free. The minimum score of this variable in the sample is 7, and the maximum score is 100. The other three cultural variables are individualism, uncertainty avoidance and long-term orientation, these variables are part of the Hofstede (2011) cultural dimensions. These three cultural dimensions are scored on a range from 0 to 100. Where 0 means that a country is not individualistic, uncertainty avoiding or long-term oriented at all, and 100 means that a country is completely individualistic, uncertainty avoiding or long-term oriented. For individualism, the minimum score in the sample is 13 and the maximum score is 91, for uncertainty avoidance this range is 8 to 100, and for long-term orientation it is 13 to 87.

6.3.6 Control variables

The final set of control variables are the key asset pricing factors. First, the price to earnings ratio. This ratio can give information about whether a stock, or an index is over- or undervalued. In this sample, the average P/E ratio is 17,43, this is slightly higher than the historical average P/E ratio found by Baek and Lee (2018), which was 15,43. The standard deviation is slightly higher as well, 7,07 compared to 6,62. The minimum is roughly the same 4,2 in this sample and 4,41 and the sample of Baek and Lee (2018) and the maximum is somewhat lower 58,7 as compared to 86,84. Therefore, these values can be perceived as normal. The next control variable is the beta, this variable displays the relation between the index returns of a country and those of the world index. A beta of 1 means that the country index has the same volatility as the world index. A beta of 2 means that the country portfolio has a volatility which is two times as high as that of the world index. A negative beta means that the volatility of the country portfolio has an inverse relationship with the volatility of the world index. In this sample, the average beta is 0,71, with a minimum of -0,18 and a maximum of 2,31. The final variable in this sample is the momentum. The momentum is the average index return of the 12 months prior to time t. A momentum of 0 means that the index value is the same as 12 months earlier, a momentum of 0,01 would mean that the average daily return over the past 12 months was 1%. The average momentum in this sample is 0,0000499, which translates to an average return of 0,00499% per day. The lowest momentum in the sample is -0,00302, which translates to an average daily return of -0,302% and the highest momentum is 0,00310, which translates to an average daily return of 0,310%.

Table 2: Summary of all important variables

Variable	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**
Index Return	18.790	0,0179	1,73	-19,18	13,45
Daily growth in confirmed cases	15.617	1,872	56,34	-355,53	390,37
Panic Index	15.119	5,459	6,891	0,08	83,05
Media Coverage Index	15.178	60,747	14,197	6,05	96,48
Media Hype Index	15.178	48,559	14,727	4,86	97,23
Sentiment Index	15.178	-8,610	14,534	-97,21	51,07
Economic Support Index	18.501	53,137	32,656	0	100
Stringency Index	18.485	55,067	25,500	0	100
Containment & Health Index	18.491	53,083	22,518	0	91,96
Freedom Score	18.845	72,911	27,642	7	100
Individualism	18.845	48,776	21,773	13	91
Uncertainty Avoidance	18.845	65,091	21,431	8	100
Long-term Orientation	17.473	45,654	20,032	13	87
PE Ratio	18.790	17,426	7,074	4,2	58,7
Beta	18.790	0,706	0,385	-0,181	2,305
Momentum	18.682	0,0000499	0,000817	-0,00302	0,00310

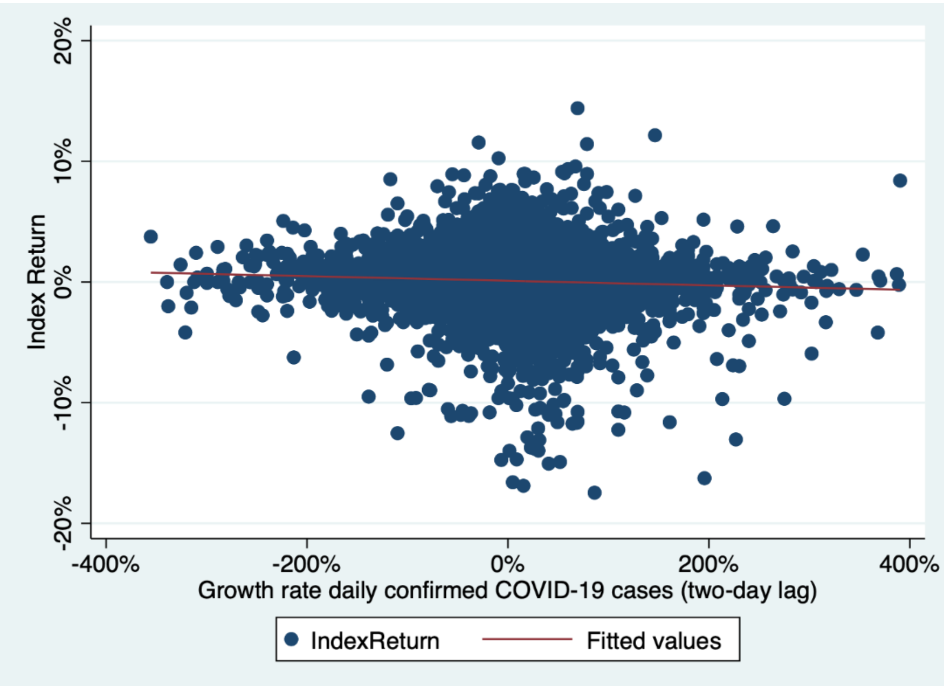
Note: Table contains the number of observations, the mean, the standard deviation, and the minimum and maximum value of all important variables in the dataset.

6.4 Index returns and daily growth

In this section, I will introduce the key relationship of this paper, the relationship between index returns and the daily growth in confirmed COVID-19 cases, with a two-day lag. This lag has been implemented because the number of confirmed COVID-19 cases is not available in real time. It takes about a day for the national authorities to process and publish the number of confirmed cases. The statistics of day 1 are often disclosed after the markets have closed on day two, meaning that implications of the newest COVID-19 statistics are, at the earliest, incorporated at the beginning of day 3. This idea is enforced by a simple regression on the growth of the number of confirmed cases and the index returns. Without any lags, or with only one lag, this relationship is insignificant, while with two lags, there is a significant relationship.

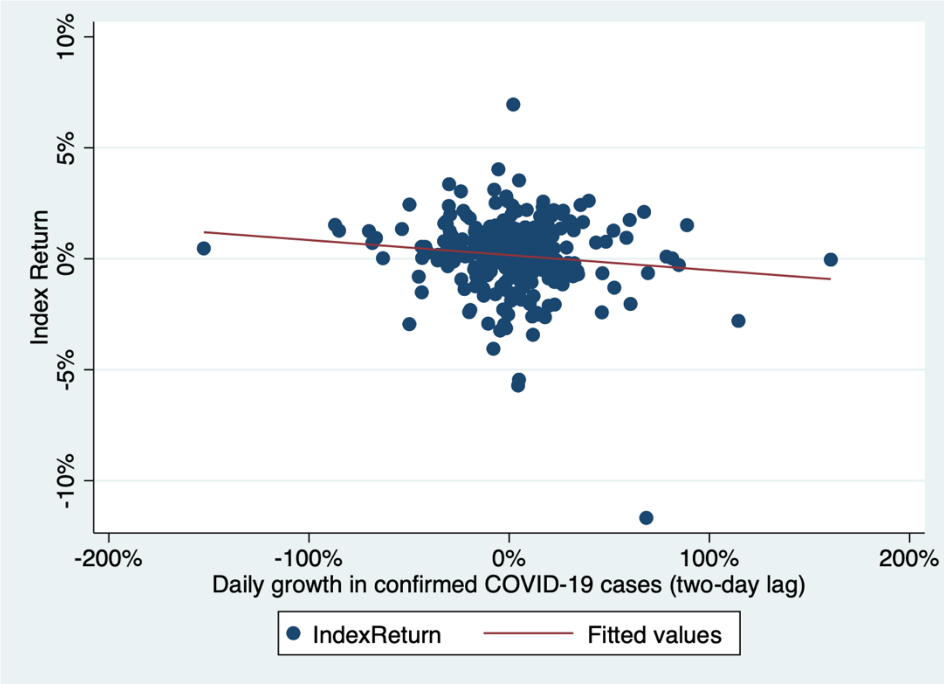
Graphs 4 and 5 show the nature of this relationship through a combination of a scatterplot and a line with the fitted values. Graph 2 shows this relationship for the entire sample of 55 countries, and graph 3 shows this relationship for the Netherlands. In both graphs the fitted values show a downwards slope, indicating an inverse relationship between the two. This implies that a higher growth in confirmed cases leads to a decrease in stock values.

Graph 4: Scatterplot and fitted values line for the relationship between daily index returns and the daily growth in confirmed COVID-19 cases with a two-day lag for the entire sample



Note: The Y-axis shows the daily index return in percentages, the X-axis shows the growth rate in the number of confirmed COVID-19 cases in percentages.

Graph 5: Scatterplot and fitted values line for the relationship between daily index returns and the daily growth in confirmed COVID-19 cases with a two-day lag for the Netherlands



Note: The Y-axis shows the daily index return in percentages, the X-axis shows the growth rate in the number of confirmed COVID-19 cases in percentages.

7. Benchmark results

The results of the baseline analysis are presented in table 3, as can be seen in this table, a variety of factors has a significant effect on stock price returns during the COVID-19 period. In this chapter I will discuss those factors, starting with the most important one, the growth rate of daily confirmed COVID-19 cases.

As becomes apparent from table 3, the growth in the number of confirmed COVID-19 cases with a two-day lag has a statistically significant, inverse relationship with the index returns. Practically this means that the higher the growth in the number of confirmed cases, the worse the index returns are two days later. This effect is significant at the 1% level. Implementing a two-day lag makes sense since the number of confirmed COVID-19 cases on a certain day is not available immediately. In the Netherlands for example, the number of confirmed cases of the day before is often announced late in the afternoon of the day after, causing the market to react on the third day. This theory is confirmed by the fact that a one-day lag did not have a significant effect on the index returns. Without any lag, the effect of the growth in confirmed cases has a significant, positive effect on the index returns. This might sound odd, but it can be explained by the fact that a high growth rate on a certain day means that the number of cases the day before was lower, having a positive effect on the index returns. Furthermore, the effect is also economically significant. It has a coefficient of -0,00106, this means that a mere 1% increase in COVID-19 cases decreases the index return with 0,00106%. The average daily index return is 0,0179, so a 16,89% increase in confirmed daily cases offsets the average daily growth entirely. To put this into context, the median daily growth in the number of cases, on days with a growth rate higher than zero, is 22,31%. Therefore, during a period with an increasing number of infections, on a median day the index return is -0,0057% instead of 0,0179%.

7.1 News coverage

In the remainder of this chapter, I will discuss the significance and coefficients of the control variables, starting with the news coverage. There are four variables in the category news coverage: the panic index, the media hype index, the media coverage index, and the sentiment index. The panic index is an index that corresponds to the percentage of news articles that mention COVID-19, as well as panic-related keywords. In this analysis, the panic index variable does not have a significant impact on the index returns. The same is true for the sentiment index, this index measures the average sentiment of news articles concerning COVID-19. The other two variables do have a significant effect on the index returns. The media hype index has an inverse relationship on the index returns, meaning that when a higher percentage of news articles mentions the coronavirus, the index returns worsen. The media coverage index on the other hand, has a positive relationship with the index returns. This means that when more different news sources mention the coronavirus, the index returns improve. This could mean that positive news is announced by more different sources, while negative news is reported more extensively, by a smaller number of sources. Both factors are significant at the 5% level.

7.2 Government interventions

The next category is government interventions, this category contains three variables: the economic support index, the stringency index, and the government response index. The economic support index, which is an indicator of the amount of economic support the government provides, is not significant. The next variable in this set is the stringency index, this index, which contains information about the strictness of a variety of closure and containment measures, is significant at the 1% level and has a positive coefficient. Therefore, in this analysis, stricter containment measures lead to better index returns. Finally, the containment and health index, this index is an extension of the stringency index, it contains the same information about the strictness of closure and containment measures, but it combines this information with information about health measures, such as testing policy and investments in vaccines. This index has an, at the 5% level, significant, negative effect on the index returns. This could be explained by the fact that a better testing and tracing policy leads to more confirmed cases, which, in turn, has a negative effect on index returns.

7.3 Culture

The final set of control variables are the cultural dimensions, these are long-term orientation, uncertainty avoidance, individualism, and the freedom score. Because of the static nature of these variables, they are multiplied by the number of confirmed cases to find whether they strengthen or weaken the effect the number of cases has on the index returns. Of these four factors, individualism, and the freedom score do not have a significant effect. Long-term orientation, on the other hand does have an effect which is significant at the 5% level. It has a positive coefficient, meaning that a higher long-term orientation weakens the negative effect of an increase in confirmed cases. Uncertainty avoidance also has a significant effect at the 5% level, this coefficient however, is negative. Meaning that countries with higher uncertainty avoidance scores react stronger to an increase in confirmed COVID-19 cases.

Table 3: Benchmark results; The effect of the growth in confirmed COVID-19 cases on daily index returns.

Variable	Coefficient	Standard error
Daily growth in confirmed cases$_{t-2}$	-0,00106***	0,000217
Media Coverage Index	0,00361**	0,00176
Media Hype Index	-0,00350**	0,00169
Panic Index	0,00128	0,00192
Sentiment Index	-0,000721	0,000879
Economic Support Index	0,000511	0,000527
Stringency Index	0,00756***	0,00218
Containment and Health Index	-0,00622**	0,00275
Long-term Orientation * GCC$_{t-2}$	0,00140**	0,000680
Uncertainty Avoidance * GCC$_{t-2}$	-0,00150**	0,000674
Individualism * GCC$_{t-2}$	0,000574	0,000928
Freedom * GCC$_{t-2}$	0,000563	0,000823

*Note: This table summarizes the result from the multiple panel-data model. The dependent variable is the daily national index return. The sample consists of 12.927 observations covering 55 countries over the period between 1/1/2020 and 1/4/2021, a full list of countries is available in appendix 1. This model also includes the four key asset pricing factors: Beta, Momentum, P/E Ratio & Market Value. Asterisks ***, **, * denote significance at 1%, 5% and 10% respectively.*

8. Robustness

In this chapter I will explore the robustness of the effect of the daily growth in confirmed COVID-19 cases by applying a variety of changes to the sample to see whether the effect remains present. The results of this sensitivity check can be found in table 4. As can be seen in this table, the effect is not robust under all sample changes. Each of the rows in the table corresponds to a different sensitivity check. I report only the size of the effect and the number of observations. All control variables that were included in the benchmark analysis are also included in these sensitivity checks.

In the first four rows I have split the sample in different time periods, each spanning a quarter of a year. The first period is the second quarter of 2020. This was the period when COVID-19 became a pandemic. During this period, the growth in confirmed cases is significant at the 1% level, with a coefficient that is 1,5 times as high as it was in the benchmark analysis. In the third quarter of 2020, the effect of the growth of confirmed cases was only significant at the 10% level, with a lower coefficient than in the benchmark analysis. This could be explained by the fact that, as can be seen in graph 6, this was a period of fewer confirmed COVID-19 cases all over the world. The next quarter again shows an effect of the growth in confirmed COVID-19 cases on the index returns that is significant at the 1% level. The coefficient is again 1,5 times higher than the coefficient of the benchmark analysis. This period is, in many countries, marked by the second wave of COVID-19 cases. The final period is the first quarter of 2021, during this period the effect of the growth in confirmed COVID-19 cases did not have a significant effect on index returns. From this analysis we can conclude that the effect is not robust across all time periods but is present particularly during the waves of COVID-19.

The second sensitivity check is based on whether the countries are European. I have chosen for this sample change for two reasons. First, this research is performed from the Netherlands, therefore my focus is more on Europe than on other continents. The second reason is a more practical one. The sample consists for more than 50% of European countries, while other continents only account for 20-25%. For countries in Europe, the effect of the growth of confirmed COVID-19 cases has an effect that is significant at the 1% level, and the coefficient is -0,00152, which is 1,5 times higher than the coefficient of -0,00106 from the benchmark analysis. In non-European countries however, the effect of a growth in COVID-19 cases is only significant at the 10% level, and the coefficient is only -0,000641, which is substantially lower than the coefficient of the benchmark analysis.

The final sensitivity check is based on the freedom level in a country, this is used as a proxy for the level of development in a country. The sample is split up in free countries, with a freedom score of 70 and higher, and not or partly free countries, with a freedom score lower than 70. This analysis shows that the effect is significant at the 1% level in free countries, with a coefficient that is slightly higher than that of the benchmark analysis. In not or partly free countries, the effect is only significant at the 10% level, with a coefficient that is somewhat lower than that in the benchmark analysis. This shows that the effect of the growth in confirmed daily cases is only slightly robust to the level of freedom in a country.

Table 4: Sensitivity analysis of the effect of the daily growth in confirmed COVID-19 cases on index returns.

	Coefficient	Observations
Benchmark result	-0,00106***	12.927
Sample change		
1. Quarter 2, 2020	-0,00152***	2.937
2. Quarter 3, 2020	-0,000747*	3.021
3. Quarter 4, 2020	-0,00156***	3.169
4. Quarter 1, 2021	-0,000520	2.973
5. Europe	-0,00138***	6.955
6. Non-Europe	-0,000641*	5.441
7. Free	-0,00126***	8.903
8. Not free or partly free	-0,000705*	4.024

*Note: Asterisks ***, **, * denote significance at 1%, 5% and 10% respectively.*

9. Conclusion & Discussion

9.1 Conclusion

The COVID-19 crisis had a major impact on stock exchanges worldwide. During the first wave of COVID most, if not all countries experienced a crash in the stock market. This crash was mainly caused by the large uncertainty around the newly developing COVID-19 situation. After this initial crash, stock markets all around the world started to recover at the hand of extensive economic support packages. This led to the purpose of this study, which was to discover the relationship between the growth in the number of confirmed COVID-19 cases and the stock market returns.

The results indicate that an increase in the number of confirmed COVID-19 cases has a statistically and economically significant, negative relationship with the stock market returns. Statistically, the results are significant at the 1% level. Economically, this study finds that a 1% growth in the number of confirmed cases has a negative effect on stock prices of 0,00106%. The average daily index return is 0,0179%, that means that a 16,89% growth in the number of confirmed COVID-19 cases offsets this growth entirely. The median growth rate, on a day with a growth rate higher than zero, is 22,31%. Therefore, when the number of confirmed COVID-19 cases is rising, on a median day, the index return is -0,0057% instead of 0,0179%.

The robustness analysis showed that this effect was not robust for all three-month periods within the sample. The findings were robust in the time periods characterized by the first and second wave of COVID-19, with a coefficient that was 1,5 times higher than that of the benchmark analysis. Furthermore, the robustness analysis shows that the effect is stronger and more significant for European countries, as opposed to the non-European countries in the sample.

Besides the effect of a growth in COVID-19 cases on stock market returns, a variety of the control variables also had a significant effect. Of the four variables related to the news coverage, two had a significant effect. These are the media coverage index and the media hype index. The media hype index, the percentage of news articles that mentions the coronavirus has an inverse relationship on the index returns. The media coverage index, the number of news sources that mention the coronavirus, has a positive relationship with the index returns. Of the three variables related to government interventions, two showed a significant effect. The stringency index, which contains information about the strictness of a variety of closure and containment measures, and the containment and health index, which also contains the information about the strictness of closure and containment measures, but it combines this information with information about health measures, such as testing policy and investments in vaccines. The stringency index has a positive effect on stock returns, while the containment and health index has a negative effect. Finally, of the four cultural variables, two were significant. Long-term orientation, which has a positive coefficient and uncertainty avoidance, which has a negative coefficient.

9.2 Discussion

The results build on the existing evidence found by Zaremba et al. (2021), who also found a significant negative effect of a growth in COVID-19 cases on stock returns. A new insight provided by this research is that the effect is only robust during waves of increased COVID-19 cases. This finding does not challenge the earlier findings, since those findings were based on a much shorter time span, only including the first wave.

Another new insight provided by this research is that European countries have a stronger and more significant reaction to an increase in the growth rate of COVID-19 cases. Further research is required to find the reason behind this difference. For example, it could be due to cultural or economic differences.

A limitation of this study is that this research only uses a pooled panel data regression as compared to the three-step approach taken by Zaremba et al. (2021). This choice has been made for two reasons. The first reason is that this research focuses on the direct effect of a growth in daily confirmed COVID-19 cases, and not so much on the effect of the other variables. Therefore, it was not as important in this paper to perform the first two steps, a single interaction panel data regression and machine learning methodology. The other reason is that this paper uses only a fraction of the variables that were used in the paper by Zaremba et al. (2021), and the variables I used are rooted in pre-existing literature. Therefore, I did not consider it necessary to perform additional steps to find an optimal set of variables. However, future research could be performed using the steps used by Zaremba et al. (2021) to determine whether the outcome of this paper would have been different using that method.

Another limitation which should be addressed by future research is that this research does not include the introduction and spread of vaccines. The introduction of vaccines could be an important reason for the lack of robustness in the first quarter of 2021. Future research is required to corroborate this claim.

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Appendix

Appendix 1: List of countries

1. Argentina
2. Australia
3. Austria
4. Belgium
5. Brazil
6. Bulgaria
7. Canada
8. Chile
9. China
10. Colombia
11. Croatia
12. Czech Republic
13. Denmark
14. Estonia
15. Finland
16. France
17. Germany
18. Greece
19. Hungary
20. India
21. Ireland
22. Italy
23. Japan
24. Jordan
25. Kuwait
26. Lithuania
27. Luxembourg
28. Malaysia
29. Malta
30. Mexico
31. Morocco
32. Netherlands
33. New Zealand
34. Nigeria
35. Norway
36. Pakistan
37. Philippines
38. Poland
39. Portugal
40. Qatar
41. Romania
42. Saudi Arabia
43. Singapore
44. Slovenia
45. South Africa
46. Spain
47. Sri Lanka
48. Sweden
49. Switzerland
50. Thailand
51. Turkey
52. United Arab Emirates
53. United Kingdom
54. United States
55. Vietnam