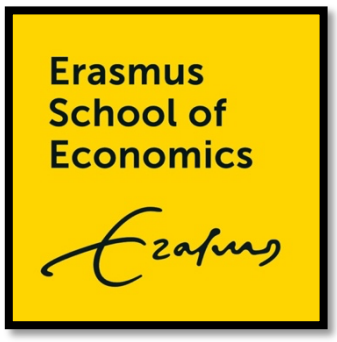
ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
MSc Economics & Business
Master Specialisation Financial Economics



The impact of COVID-19 on economies across the world

Supervisor
Dr. J.J.G. Lemmen

Author
D.S. van Hoogeveen | 525723

Second reader
R. Spigt

Finish date
17 / 03 / 2021

Abstract

This paper provides an empirical analysis of the short-term impact of the first COVID-19 government measure announcement on the abnormal returns of stock market indices of thirty affected economies across the world. Using an event study methodology, I find significant negative abnormal returns for 22 countries with an average overall abnormal return of -1.82%. Emerging economies were hit harder than developed economies, resulting in abnormal returns of -2.53% and -1.11, respectively. Further, using a random effects model with robust standard errors, multivariate regression analysis finds that public health, external dependency and financial health did not have a significant effect on the abnormal returns. However, the results imply that country-specific characteristics do explain abnormal returns. Sentiment-based characteristics, like confidence indices and Google search trends could significantly explain abnormal returns on the stock markets.

Key words: *COVID-19, Event study, Multivariate analysis, Index, Stock returns*
JEL classification: G10, G11, G14, G41
Field: Financial Markets

Table of Contents

List of Tables & Figures

1 Introduction

This event study examines the effect of government measures as a response to the COVID-19 outbreak on stock markets across the world. More specifically, which characteristics determine the short-term impact on abnormal returns of stock markets. Current research mostly focuses on distinct economic effects, but the role investors play on the stock markets is not examined as much. Investors' short-term risk perception of financial markets serves as a valuable tool to gain more knowledge on how future pandemics will be perceived. Moreover, investors tend to update their beliefs and preferences on such events quickly and adapt their portfolios accordingly. This paper analyzes investors' behavior on stock markets during the first stringent government measures. This paper researches thirty stock indices and uses public health, external dependency, country-specific and financial health characteristics to analyze how these might affect investors' behavior during an impactful event.

As of early 2021, plenty of research is available when it comes to disruptive events on global stock markets, but as far as health crises go, there has not been a major worldwide pandemic since the Spanish Flu in the early 19th century. The SARS and MERS viruses did not spread globally and therefore impact across the globe was not of a similar degree. Orlik et al. (2020) acknowledged in early March that the world economy could come to a halt due to the coronavirus, estimating $2.7 trillion in global GDP losses. Yet a month later in April, best scenario analysis by the IMF predicts $9 trillion of losses in global GDP, making it a more adverse economic event than the global financial crisis of 2008/2009 in terms of GDP losses (Gopinath, 2020). As of 2021, global GDP losses are projected at as much as $22 trillion (IMF, 2021). Early predictions have often been underestimated, and long-term predictions on the global economy are ambiguous. Whereas developed economies are in the recovery phase and are projected to reach their 2019 GDP within the next two years, emerging economies will suffer from the economic downturn until at least 2025, reversing the converging trend of GDP per capita between them. The uncertainty caused by the pandemic can be observed across society, with people voluntarily refraining from consumption, decreasing demand to forced closures of businesses, causing decreases in supply. Governments providing stable expectations are important to reduce uncertainty, in order for demand and supply to sufficiently adjust to the situation. Reversing policies too early or often could create chaos for businesses as well. Also, the lack of stability and coordination with neighboring countries results in spillovers and larger unemployment in border areas, which makes policy making even more complex (Guaitoli & Tochev, 2021). Layoffs and loan defaults put further strain on financial institutions and as a result, governments are pressured to assist financially. Furthermore, firms that become more leveraged due to government measures could hold back their investments during the economic recovery. The complexity of government measures along with the lack of recent research have brought about much uncertainty across the world. One way this uncertainty manifests itself on

financial markets on the short term is through overreaction. Dramatic events may give rise to a domino-effect of behavioral biases among investors. Fear of being on the losing end of a stock market crash, could cause large sell-offs of stocks. Conversely, others might try to capture some of the difference and expect reversal, since the market could overreact in the short-term on bad news (Chan, 1988). The large economic downturn leads to the following research question:

"*What is the short-term financial impact of the first announcement of stringent COVID-19 measures on stock market indices and what are the determinants of that impact?*"

To answer this question, stock indices of thirty different countries are examined during the beginning of the pandemic. The event that is used is the first announcement of stringent government measures. This is the first moment when society is really confronted with the magnitude of the pandemic. Movement restrictions, closure of schools, businesses and sporting events induce fear among the general population and investors likewise. Sudden changes in the way of living will inevitably change the way of doing business and therefore create economic downturn.

For that event, the abnormal returns of thirty stock market indices will be analyzed using an event study approach. This approach uses the difference between the expected returns without the event present and actually realized returns in search for abnormality in returns. Furthermore, different types[1] of countries are selected to analyze the differences between them. Additionally, this paper researches the drivers of the short-term impact of the first stringent COVID-19 government measures, using random effects modelling. First, the effect of public health on the short-term impact on abnormal returns is analyzed. Investors' perception of the capacity of healthcare systems to be able to cope with the health crisis might affect their decisions. Second, this paper researches whether external dependency negatively affects short-term abnormal index returns. The pandemic exposed the fragility of the global economy since disruptions in global supply chains caused shortages in many products and travel constraints have hit the tourism and cross-border service industries. It is tested whether the perception of investors is influenced by these factors. Third, country-specific characteristics are analyzed to determine their effect on short-term abnormal index returns. This research will conclude with an analysis whether financial health characteristics of economies affect the short-term abnormal index returns after the first announcement of government measures.

The goal of this paper is to provide a comprehensive understanding on the drivers of the stock market impact of COVID-19 on a global scale. It contributes to current literature by outlining what the main drivers are of economic downturn on equity markets due to COVID-19 and how they differ between

[1] Emerging or developed economies.

emerging and developed economies. Existing literature on the financial impact of health crises mainly focuses on one country and not on a global scale using different types of economies. Furthermore, previous work on pandemics is mainly focused on Asian countries, because SARS, MERS and the Avian Flu were especially prevalent in that area. A global health crisis of this scale has never happened before in modern history, and this research adds to current literature a global approach to the issue. Many researchers have hypothesized about the impact of health crises, but actual data has not been available until this year. This research could therefore provide a better understanding on investors' decision making in future pandemics.

The rest of the paper is structured as follows. Chapter 2 reviews relevant literature related to health crises and as a result of that the economic effects. Moreover, it introduces the hypotheses that are researched in this paper. Chapter 3 describes the data used in the analysis and the methodology to do the analysis. Definitive regression formulas are explained together with the variables used. Chapter 4 comprises the results of the analysis and interpretations. Future implications are included as well. Chapter 5 concludes the research and draw implications and shortcomings.

2 Literature Review

This chapter discusses current literature on the impact that large events, such as pandemics, have on the stock market. Many studies have previously researched the effects of earlier pandemics on financial markets and countries in the short and long term. This relationship is essential to establish a profound understanding of the underlying issues of a pandemic like that of COVID-19. Furthermore, this literature review guides to a clear rationale behind the hypotheses that will be empirically analyzed in the course of time. First of all, a better understanding of the similarities and differences of previous pandemics with the current pandemic will be provided. Thereafter I will cover relevant existing literature on the economic and psychological implications on the stock market.

2.1 COVID-19 and past pandemics

Recent decades have seen a seemingly inexhaustible growth in globalization. As the world is becoming more integrated, transport and migration of goods and services increase likewise. Whereas the increase of this integration can considerably increase the standard of living across the world, it also gives rise to unprecedented worldwide threats (Wu et al., 2017). Wu et al. (2017) investigate infectious diseases in China and find that the increase of income growth, urbanization and globalization may aggravate risks of zoonotic diseases.[2] They argue that places where these phenomena cross paths – mostly in the developing world with growing metropolitan areas – are a hotbed for disease development. Especially in areas where humans are frequently in contact with a range of animals increases the risk of transmission, like the wildlife markets in southern Asia (Morse et al., 2012). Management of these hotspots in especially China is therefore pivotal to prevent and restrain new potentially global diseases. The onset of these influenza viruses onto humans is not a novel circumstance, however. Over the past centuries several influenza viruses have developed into epidemics or pandemics. Among others, Anthony Fauci, nowadays known for his function as the head of the USA COVID-19 taskforce, characterizes these pandemics as diseases that are novel, have high transmission rates, cover large geographic areas and have a very low existing immunity among the human population (Morens, Folkers & Fauci, 2009).

In modern history, the most notable pandemic is the Spanish Flu[3], which infected over 500 million people or one-third of the world population and killed at least as many as 50 million (Trilla, Trilla &

[2] Infectious disease caused by a bacterium, virus or parasite that can jump from non-human animal to a human (Andersen et al., 2020).
[3] Spanish Flu: Sometimes referred to as the H1N1 virus, the name of the virus that caused the pandemic.

Daer, 2008). Recent influenza viruses like SARS[4], MERS[5] and the swine flu, can all be tracked back to populous areas in emerging countries. In comparison with the Spanish Flu, however, epidemiological knowledge was present in abundance, providing governments with tactics to adequately contain these viruses (Unger, 2020). In the 100 years since the Spanish Flu there has not been a pandemic of a similar magnitude in terms of damage to health and the economy. Considering the Spanish Flu was present at the end of the first World War, limited research is available on the exact economic implications of the pandemic exclusively. Despite the fact that SARS and MERS did not spread globally, economic consequences were observed on a regional scale. Siu & Wong (2004) found that SARS affected Hong Kong mostly on the demand side. Exports of services, air travel and tourism were the sectors hit hardest. Keogh-Brown & Smith (2008) argue that macroeconomic damage during health crises can mostly be deduced to government policies, resulting in GDP losses of up to 6 billion in several Asian countries and Canada. They hypothesize that dealing with a health crisis is unthinkable without sacrificing economic activity. Kuo et al. (2008) furthermore add that the drop of international tourism also impacted the catering industry, admitting that containment measures play a large role as well. Anyhow, SARS did not have the worldwide impact many anticipated, mainly because the virus was controlled before it could spread worldwide. For this reason, Kuo et al. (2008) add that SARS is a warning shot for what may come in the future.

That warning became reality on the 31st of December, 2019, when Chinese authorities warned the World Health Organization that in Wuhan, a city with a population of 11 million people, pneumonia cases were rising rapidly (Ravelo & Jerving, 2020). The symptoms varied from a cold to having trouble breathing, which eventually led to a complete lockdown of Wuhan on the 23rd of January in order to contain the spread of the virus. Chen et al. (2020) hypothesize that this was too late. The virus had already spread further than Wuhan, and mass travel due to the Chinese New Year on the 25th of January did nothing but accelerate the spread. January the 30th marked the date that the WHO declared the virus as a threat of international concern for the sixth time in history (Sohrabi et al., 2020). Countries outside of China started imposing new measures and recommendations to push the virus back. These recommendations were not uniform across the world, however. Rather than preventing the virus from infiltrating the country, many country leaders merely adopted a reactive response, reacting exclusively when cases started to emerge (Hale et al., 2020). As time went by, concerns about the virus increased and as a consequence, various countries decided to brace the health sector, recommend social distancing and reduce travel. Unsuccessfully, however, because by the 11th of March, COVID-19 was detected in many countries across the world and it was declared a global pandemic by the WHO. Since then, the

[4] SARS: Severe Acute Respiratory Syndrome was a pandemic in 2002 that originates from a civet cat in southern Asia (Yip et al., 2009).
[5] MERS: Middle Eastern Respiratory Syndrome was an epidemic that started in 2012 and originates from a dromedary in Saudi Arabia (Bleibtreu et al., 2019).

world has been under the spell of COVID-19. Overloaded hospitals and following the many deaths due to the disease have justified further measures and lockdowns around the world. Although previous recent viruses were controlled over time, Petersen et al. (2020) argue that there is one important difference that makes COVID-19 an extremely difficult virus to curb. **Table 1** shows that the critical difference is the peak of transmission. Whereas a person infected with MERS and SARS is most contagious a week after the first symptoms, providing an infected person to take measures and isolate before reaching the peak. A person infected with COVID-19 is most contagious on the day of the first symptoms. As a consequence, an infected person might pass the virus on before he feels symptoms. Furthermore, asymptomatic transmission of the virus is possible as well, complicating the process further. This provides little leeway to intervene in time, which was the case with SARS and MERS (Petersen et al., 2020).

Table 1

Overview statistics previous epidemics and pandemics

Note: This table shows a brief epidemiological comparison between the most notable epidemics and pandemics in recent decades. As mentioned by (Morens et al., 2009), the most salient characteristics that define pandemics are used as a comparison.

Measure	**COVID-19**	**MERS**	**SARS**
Outbreak date	December 2019	September 2012	November 2002
Confirmed cases	68.401.725 (12th Dec, 2020)	2.519 (31st Jan, 2020)	8.096 (31st July, 2003
Confirmed deaths	1.560.367	866	774
Morbidity rate	2.28%	34.4%	9.6%
Present in # countries	218	27	29
Transmissibility (R^0)	2.5	< 1	2.4
Peak of transmission (days after first symptoms)	0	7 – 10	6 – 11

Source: (Unger, 2020, p. 8); (Wu & Olson, 2020, p. 9); (Hu et al., 2020); (Petersen et al., 2020, p. 2-3)

COVID-19 is unique in the sense that it has caused worldwide structural change. Differences in measures across regions affect countries in different ways. Due to the interconnected world, a policy measure in one country might impact regions in another country due to the economic spillovers. Historic know-how has proven to be insufficient to hold back the virus completely. Alongside health concerns, measures to contain the virus have caused large disruptions in global supply chains and have affected financial operations as well (Wu & Olsen, 2020). Considering the challenging nature of preventing the spread of SARS-CoV-2[6], investor behavior can vary from day to day as well. The economic outlook of

[6] Medical term of COVID-19.

countries and sectors changes continuously as the process towards curbing the virus advances. The strength of the health sector to cope with many infected and the resilience of financial sectors to catch the economic blows of these disruptions are put to a challenging test.

2.2 Economic impact of COVID-19

Barro, Ursúa & Weng, (2020) researched the difference of the economic impact of COVID-19 versus the Spanish Flu, and argue that the most detrimental global events of the past 150 years were World War I, the Great Depression[7] and World War II. The Spanish Flu happened during a completely different social, political and economic climate and is therefore improper to compare with COVID-19 in terms of economic consequences. With regard to capital markets and the economy as a whole, COVID-19 can thus be considered the most destructive health crisis in modern history (Baker et al., 2020a). In line with previous research of Keogh-Brown & Smith (2008) and Kuo et al. (2008) about the economic effects of the more recent pandemic SARS, Baker et al. (2020a) find evidence that the magnitude of the COVID-19 itself only partly explains negative economic effects. They hypothesize instead that government restrictions are the main driver behind the economic contraction and disruption of capital markets. Social distancing directly interferes with the way the service industry does its business, which oftentimes involves physical contact. Also, greater integration and interconnected worldwide supply chains further increase the possibility of spillovers between regions and countries (Tatem, Rogers & Hay, 2006).

Verikios et al. (2016) studied cross-border spillovers during epidemics and pandemics, and find several channels through which economies could be affected. They argue that one of the first observations during pandemics is that many households in infected areas restrain their demand in cross-border products and services. As a result, regions that heavily depend on tourism and trade of services see large drops in demand. However, it is suggested that on the other side of the spectrum, supply is oftentimes disrupted as well. Airports and shipping restrictions break up supply chains early or extend shipments. Likewise, McKercher & Pine (2006) analyzed in an earlier study focused on travel in particular, that influenza affected areas might see a contraction of the tourism sector between 20 and 70 percent. The contraction depends on the seriousness of a virus and is mainly induced by a drop of demand and restrictions by governments. In a more comprehensive study, McKibbin & Fernando (2020) investigate the possible macroeconomic spillovers of COVID-19 in China on G20 countries based on seven scenarios. These scenarios are seven forecasts of the development of SARS-CoV-2. They model health resilience of countries against various macroeconomic variables. Together with decreases in labor input, private investments and the value of the equity market, they argue that exports, imports and

[7] Worldwide economic depression that started in 1929 until the late 1930s. It began in the United States as a result of a major stock market crash. Worldwide GDP fell by an estimated 15%.

transportation are significantly affected by the virus. The breakup of this supply chain can tremendously reduce supply in countries that have strong ties with China. The exact role of global supply chains during pandemics is further investigated by Bonadio et al. (2020). In a sample of 64 countries, their results show an average drop of 29.6% in GDP during the breakup of the global supply chain. Over three quarters of the contraction of GDP, 23.3%, is attributable to foreign shocks. Interestingly, they suggest that economic downturn would only be slightly worse if supply chains were mostly nationalized instead of global (-30.2%). They argue that renationalizing[8] supply chains diminish the benefits of international supply chains, which is the spread of risk. Resilience only seems to increase if a renationalized country imposes a less severe lockdown than former trading partners.

In addition to the contraction of tourism and trade, lockdowns affect non-essential businesses in multiple ways. Besides increasing transportation times, little to no revenue during a lockdown puts businesses at a larger risk of becoming insolvent. Defaults on rent and payroll expenses further aggravate layoffs and put a strain on loan payments. These small and medium enterprises (SMEs) play a vital role in every economy, according to reports from the OECD (2017). They report that SMEs account for 70% of employment and generate over 50% of all value in developed economies' GDP. Considering emerging economies comprise of more informal businesses, formal businesses still account for over 50% of employment and one thirds of GDP. Safeguarding SMEs from becoming insolvent due to lockdowns is therefore crucial to alleviate economic downturn and facilitate a swift recovery afterwards. McKibbin & Fernando (2020) argue that governments must impose monetary and fiscal policies to lighten disruption in the economy and ensure stability while the lockdown continues. Reputable countries are often able to do so and take on government debt. Wu & Olsen, (2020) agree and make further comments on the commercial banking sector. They argue that a stable and reliable banking sector plays a large role in alleviating economic blows and financing the recovery as well. A resilient financial sector will be able to catch blows on the economy by making new loans or postponing loan repayments by companies. Moreover, in the long-run, it is in their best interest as well, because companies defaulting on loans could be detrimental to their loan portfolio. Demirgüç-Kunt et al. (2020) investigated balance sheets of banks after financial policy changes during COVID-19 and could confirm that they were often affected worse than corporates in other sectors, indicating that banks did indeed absorb losses in the economy.

Close co-operation between commercial banks and central banks is therefore crucial given the mutual purpose to reduce stress in financial markets. At present, central banks have implemented several measures in order to ensure more liquidity and stability in the economy. Carstens (2020) reports that

[8] Renationalizing is described as changing international supply chains to within country supply chains, offering governments and firms to insulate themselves and reduce spillovers (Bonadio et al., 2020).

many central banks have been using quantitative easing[9] (QE) since the beginning of the pandemic as a measure to increase the money supply in the economy using their reserves. QE is an unconventional policy, but there was little wiggle room to cut interest rates, since those were zero or negative before the pandemic already. As a result of the substantial purchases of assets, balance sheets of central banks are now at records highs. Negative interest rates on deposits of commercial banks at central banks further refrain commercial banks from saving instead of spending in their respective economy. Moreover, central banks partially fund national governments' deficits by purchasing government bonds (IMF, 2020). Measures by central banks therefore incentivize commercial banks and governments to increase the money supply as well. To ease the tightening of financial markets, these measures are supposed to drag firms and households through the pandemic with short term emergency liquidity support, like payroll support. A robust financial sector and close cooperation between central banks, commercial banks and governments might alleviate stress on financial markets and prevent investor confidence to decrease.

2.3 Psychological effect on financial markets

Uncertainty in markets is one of the main drivers of stock and bond market prices (Connolly, Stivers & Sun, 2005). An unstable economic outlook could cause investors to sell their stocks or move to safer securities, possibly creating a crunch. Given the fact that COVID-19 spread quickly through unprepared countries, fear of catching the novel virus increased at the same time. Lack of uniform government measures across the world and doubts about what is yet to come have brought about high volatility spikes across stock markets (Engelhardt et al., 2020). In their research about volatility in stock markets, they find that high societal trust of investors in a countries' government significantly lowers stock market volatility. Additionally, high trust in fellow citizens affects stock markets in a similar way. In a broader study on uncertainty, Baker et al. (2020b) build on this view in another paper, where they investigate the connection between stock market volatility, newspaper-based economic uncertainty and subjective uncertainty in business expectation surveys. They claim that the novelty of COVID-19 has given rise to unprecedented uncertainty for households and companies. Concerns about the danger of the virus, time period until a vaccine is developed, duration of lockdowns and social distancing and business survival. Especially the closure of non-essential businesses[10], brings about much uncertainty. In anticipation of closure of businesses, layoffs are a big concern and directly affect the economy on the demand side. This is in line with earlier work by Jonas (2013), who investigated pandemic risk. He

[9] Quantitative Easing (QE): "Unconventional policy of central banks where they purchase longer-term securities from the open market to increase money supply and encourage lending. When short-term interest rates are approaching zero, regular market operations are no longer effective". (Investopedia, 2020).

[10] Closure of non-essential businesses has been a widely used policy measure to constrain the spread of the virus (Hale et al., 2020). This generally comprised of closure of all businesses except supermarkets, pharmacies, hospitals and other health-related businesses.

argues that during the SARS outbreak 60% of economic downturn could be attributed to people's avoidance reactions and accompanying shift in demand and supply. Efforts to avoid infection are often at a higher cost than the disease itself. He continues by arguing that clear communication and information is therefore key to keep uncertainty, and in turn economic loss within limits. Although Jonas (2013) and Verikios et al. (2016) agree that governments rather than the healthcare sector is tasked with protecting its people from a virus. However, according to Baker et al. (2020b), it is a large source of uncertainty among investors nonetheless. They find evidence in unemployment rates in the United States, which stood at a 67-year record low in February of 2020. Since the economic outlook changed at an astounding speed, decreased consumer spending induced layoffs that resulted in 6.6 million jobless claims only four weeks later (Chaney & Morath, 2020). The uncertainty therefore varies a lot between countries. Employment laws are different and tend to be harsher in the United States compared to the Netherlands for example. Moreover, the differences of institutional quality cannot be overlooked either. Many Western democracies tend to be less obedient with following government advice compared to more authoritarian regimes. Doubts about certain policies become a political instrument and exacerbate the uncertainty in the financial markets. Additionally, countries with low corruption and high government trust could affect the uncertainty in financial markets as well.

Uncertainty goes hand in hand with resilience of the health and financial sector. A weak health sector not only increases fear of the virus itself, but also expedites the need for stringent government intervention, like lockdowns (Barro et al., 2020). It is therefore crucial to alleviate the economic downturn by keeping morale up during a pandemic. According to Fan (2003) and Jonas (2013), the best ways to achieve this goal is to reduce investor uncertainty by providing clear information to citizens to withhold them from decreasing their demand in the economy. Furthermore, strengthening the health sector and implementing clear fiscal and monetary policies reduces this uncertainty as well. Rational and confident consumers and producers are pivotal to keep the economy going (Lee & McKibbin, 2004; Verikios, 2011; Wu & Olson, 2020).

The exact long term economic consequences and thus the resilience of the financial sector will be observable after the pandemic. In the short term, however, overreaction is a common side issue on stock markets when uncertainty is high. Whereas proponents of the Efficient Market Hypothesis (EMH), coined by Malkiel & Fama (1970), suggest that information is directly incorporated in prices, overreaction contradicts this. Most critique on the EMH comes from behavioral economists, arguing that anomalies in human behavior go against an important assumption of this hypothesis: rationality among investors. Behavioral biases, like loss aversion, overconfidence and overreaction, do not mean the EMH is fundamentally wrong. Instead, a more extensive framework like the Adaptive Market Hypothesis (AMH) might be more sufficient (Lo, 2005). In one of the earliest researches on overreaction, De Bondt & Thaler (1985) argue that the arrival of unexpected or dramatic news might

move investors to overreact. Uncertainty about the direction and magnitude of the stock market forces investors to cover losses and sell their risky asset. If many investors do so, this effect will amplify, stock markets will fall and as a consequence, more investors are likely to follow. Accordingly, Niederhoffer (1971) finds that stock market returns of high-impact world events tend to be negative for a couple of days, but oftentimes recover a bit within the first five days, confirming the initial short-term overreaction. In more recent research, Fabozzi et al. (2013) add to this view by distinguishing a directional effect and magnitude effect, finding evidence that higher initial returns are frequently followed by larger adjustments in the following days. Cheong, Ariff & Subramaniam (2020) found that this was the case on the financial markets following COVID-19 relevant events. Particularly significant negative events displayed significant signs of reversals, although differences were observed per country. They finally conclude that differences in macro- and micro-level responses of governments across countries are likely the main reason behind those differences of return reversal.

2.4 Hypothesis development

The purpose of this paper is to assess what the short-term effect is of COVID-19 on the stock markets. More specifically, Bonadio et al. (2020), Baker et al. (2020a) and Keogh-Brown & Smith (2008) and more previous literature suggest that the main reason behind an economic downturn is due to government measures and restrictions. Short-term impact is therefore analyzed starting at the moment of the first stringent government policies. For this reason, the research question is established as follows:

"*What is the short-term financial impact of the first announcement of stringent COVID-19 measures on stock market indices and what are the determinants of that impact?*"

The research question itself is broad and will be broken down into multiple, more specific hypotheses to reach a narrower approach to obtain an appropriate analysis of the research question. To analyze what the main determinants of the impact on the stock markets are, I will first analyze whether there is a significant short-term abnormal impact on the stock markets at all. Keogh-Brown & Smith (2008) investigated the economic effects of SARS and argued that health crises often result in economic downturn as well, but that is contingent on the severity of the virus, uncertainty in financial markets and possible government interventions. To test whether it is true that COVID-19 has had a significant effect on stock markets, hypothesis (1) will be tested:

> *H_0: COVID-19 lockdowns have led to no significant short-term decrease of a countries' abnormal stock market index returns.* (1)

> *H_1: COVID-19 lockdowns have led to a significant short-term decrease of a countries' abnormal stock market index returns.* (1)

Wu et al. (2017) argue that certain factors dramatically increase the risks of zoonotic diseases. Fast income growth, urbanization and globalization combined with a lot of contact with a variety of wild animals aggravates the chances of new, deadly diseases jumping over to humans. Growing, highly dense metropolitan areas in the developing world are therefore one of the hotbeds for disease development, like the wildlife markets in southern Asia (Morse et al., 2012). The countries where such diseases originate from, face financial and health challenges very suddenly, whereas developed economies had time to brace the economy. Furthermore, emerging economies tend to have less available resources to alleviate stress on the financial and health sector, but are not reliant on trade as much as developed economies (McKibbin & Fernando, 2020). Hypothesis (2) will test whether this is the case.

H_0: COVID-19 has not led to larger decreases of the abnormal returns of stock market indices in emerging economies than advanced economies. (2)

H_1: COVID-19 has led to larger decreases of the abnormal returns of stock market indices in emerging economies than advanced economies. (2)

Barro et al. (2020) argued that one of the biggest differences between COVID-19 and the Spanish Flu is that nowadays healthcare is much more advanced. Comparing mortality rates is therefore improper to do. More advanced healthcare systems will result in fewer deaths and as a consequence might decrease uncertainty of the public. As Engelhardt et al. (2020) and Baker et al. (2020b) suggested, high uncertainty often results in low investor trust and high stock market volatility. Hypothesis (3) will investigate whether differences in public health determine changes in stock returns.

H_0: Worse public health does not have a significant negative effect on the cumulative abnormal returns of stock market indices. (3)

H_1: Worse public health does have a significant negative effect on the cumulative abnormal returns of stock market indices. (3)

Another consequence of stringent government policy is the disruption of supply chains and decrease in travel (Bonadio et al., 2020; McKibbin and Fernando 2020; Wu et al., 2017). Countries that depend to a large extent on trade and travel, like tourism, are therefore expected to experience a large GDP loss (Bonadio et al., 2020). Verikios et al. (2016) argue that spillovers can aggravate this effect. Hypothesis (4) will test whether this is observable in stock markets of chosen countries.

H_0: Higher dependency on other countries does not have a significant negative effect on the cumulative abnormal returns of stock market indices. (4)

H_1: Higher dependency on other countries does have a significant negative effect on the cumulative abnormal returns of stock market indices. (4)

The perception on the well-being of a country by society, and investors in particular, is an important driver of uncertainty in financial markets (Connolly, Stivers & Sun, 2005). General knowledge on the prosperity of a country can alleviate or aggravate that uncertainty (Jonas, 2013). Hypothesis (5) will test whether general macroeconomic characteristics and societal confidence has an effect on index returns.

H_0: Country-specific characteristics cannot significantly explain deviations of the cumulative abnormal returns of stock market indices. (5)

H_1: Country-specific characteristics can significantly explain deviations of the cumulative abnormal returns of stock market indices. (5)

To dampen the economic downturn of a health crisis that turns into an economic crisis, a resilient financial sector is pivotal. A resilient financial sector can prevent or delay insolvency and therefore safeguard SMEs and large companies. This sector is important, because banks are able to catch blows to many companies and facilitate the recovery (Wu & Olsen, 2020). While stringent government measures hurt the economic activity, counteracting with relief packages could help as well. Fiscal and monetary policy by governments could therefore reduce investor uncertainty on stock markets. Whether this is possible depends on the financial condition of banks and governments. The financial capability of countries to do so will be tested with hypothesis (6).

H_0: Worse financial health does not have a significant negative effect on the cumulative abnormal returns of stock market indices. (6)

H_0: Worse financial health does have a significant negative effect on the cumulative abnormal returns of stock market indices. (6)

3 Data description

3.1 Stock market data

Table 2 depicts the countries that will be investigated in this event study, and their corresponding index that covers the majority of that countries' stock market. To analyze the differences between economies worldwide, a wide variety of indices are chosen. The different sets of indices cover developed and emerging economies covering large geographical areas in every continent. The developed economies comprise of the traditional G7[11], supplemented with Australia, the Netherlands, Spain, Belgium, Ireland, New Zealand, Sweden and Switzerland to reach a total of 15. The emerging economies that will be used in this study are the traditionally known "BRICS[12]" countries, supplemented with Argentina, Mexico, Turkey, Indonesia, Morocco, Chile, Egypt, Greece, Poland and South-Korea to reach 15 countries to keep the distribution of economies the same. All economies taken together resemble the current G20, supplemented with 10 other economies. The G20 accounts for approximately 85% of the Gross World Product (GWP), 80% of trade and two-thirds of the world population (Europa-nu). Concerning the geographical spread, the sample of countries include 14 countries from Europe, 2 from Oceania, 6 from Asia, 6 from the Americas and 3 from Africa. Considering the validity and reliability of data must be uphold, the sample contains more economies from Western countries. The chosen indices for each country are actively traded and cover a substantial share of the stock market of that particular country. All data of the 30 indices are retrieved from GFD – Finaeon and crosschecked for reliability and validity on investing.com. The dates range from 01/01/2019 until 31/01/2020.

As a proxy for the global market, the MSCI All-Share is used, which contains more than 3.000 constituents and accounts for 85% of the global free-float market capitalization (MSCI). Furthermore, it represents not only 23 developed economies, but 26 emerging economies as well. Hence, it is more suitable to use as a global market index, especially when analyzing differences between different countries covering large geographical areas.

[11] G7: Canada, Germany, United Kingdom, United States, France, Italy and Japan.
[12] BRICS: Brazil, Russia, India, China and South-Africa.

Table 2

Selection of dependent variable (stock indices)

Note: The table shows the indices that are used per country. Chosen indices are the most traded index of that country in case there are more than one. The Market Index that is used is the MSCI All-Share.

Country	Stock Market Index	Country	Stock Market Index
Australia	S&P ASX 200	Argentina	S&P Merval
Belgium	BEL 20	Brazil	Bovespa
Canada	S&P/TSX 300	Chile	S&P CLX
France	CAC 40	China	Shanghai SE
Ireland	ISEQ All-Share	Egypt	EGX 100
Germany	DAX 30	Greece	Athens General
Italy	FTSE MIB 40	India	BSE Sensex
Japan	NIKKEI 225	Indonesia	IDX Jakarta Composite
Netherlands	AEX	Mexico	S&P/BMV IPC
New Zealand	New Z SE All-Share	Morocco	Casablanca All-share
Spain	IBEX 35	Poland	Warsaw 20
Sweden	OMX30	Russia	MOEX
Switzerland	SMI	South-Africa	FTSE/JSE 40
United Kingdom	FTSE 100	South-Korea	KOSPI 100
United States	S&P 500	Turkey	Istanbul BIST 100
World	MSCI All-Share		

Source: Investing.com and GFD Finaeon.

Table 3 provides the summary statistics of the chosen indices. Daily returns are retrieved from 01/01/2019 until 31/03/2020. The table shows that over half of the countries have a small negative return on average during those 15 months. This is noteworthy, because stock markets are generally not expected to decrease over long periods of time. The negative average return might indicate that COVID-19 or other events have had a large impact on worldwide stock markets during this period. Furthermore, the lowest daily return also shows that over half of the countries have experienced a negative return in the double-digits, which most likely took place during the last 2 months of the sample. This can be analyzed more thoroughly in Appendix B. During the whole period the volatility hardly differs between countries, but the difference in volatility between February and March is large. With the exception of China, all countries saw the volatility on the stock market increase, sometimes with as much as 300%. This roughly coincides with worldwide COVID-19 events, like travel bans and business closures, that took place in March for most countries across the world.

Table 3

Summary statistics of daily index returns

Note: The country column presents the index taken from that particular country, and MSCI All-Share represents the market index. These can be found in **Table 2**. The number of **Obs.** is the number of trading days between the 1st of January, 2019 until 31st of March, 2020. The **Mean** column is the mean index return during this period in %. **SD** presents the standard deviation of the returns in %. The **Min.** and **Max.** column present the minimum and maximum return of the index during the chosen time period in %. The index MSCI All-Share represents the market index, covering developed and emerging economies.

Country	Obs.	Mean	St. D	Min.	Max.
Argentina	302	.002	3.834	-3.793	10.250
Australia	318	-.018	1.452	-9.700	7.001
Belgium	317	-.020	1.552	-14.210	7.638
Brazil	315	-.042	2.326	-14.780	13.908
Canada	314	-.008	1.671	-12.344	11.957
Chile	311	-.115	1.614	-12.922	7.954
China	300	.045	1.288	-7.725	5.600
Egypt	244	-.115	1.667	-12.712	8.774
Greece	307	-.003	2.127	-13.388	7.785
France	317	-.008	1.550	-12.276	8.389
Germany	314	-.008	1.549	-12.238	10.975
India	305	-.052	1.593	-13.152	6.979
Indonesia	307	-.092	1.280	-6.578	10.190
Ireland	318	-.008	1.538	-9.936	6.941
Italy	315	-.007	1.745	-16.923	8.925
Japan	298	-.003	1.310	-6.080	8.038
Mexico	312	-.058	1.183	-6.422	4.26
Morocco	309	-.044	1.067	-8.818	5.448
Netherlands	318	.008	1.371	-10.752	8.970
New Zealand	314	.034	1.552	-9.654	12.721
Poland	310	-.122	2.127	-13.277	6.540
Russia	309	.026	1.319	-8.282	7.718
South-Africa	312	-.022	1.541	-9.922	8.228
South-Korea	307	-.011	1.438	-7.450	7.784
Spain	319	-.060	1.540	-14.059	7.818
Sweden	316	.026	1.367	-10.571	7.089
Switzerland	316	.037	1.153	-9.11	6.195
Turkey	311	.015	1.569	-8.071	5.982
United Kingdom	315	-.045	1.383	-10.873	9.053
United States	312	.025	1.742	-11.984	9.382
MSCI All-share	328	-.011	1.375	-9.513	8.392

3.2 Independent variables data

Table 4 below presents the independent variables that will be used to test the hypotheses. All data has been checked for validity and feasibility and is kept daily. The COVID-19 related data is found in datasets of 'Our World In Data', assembled by Oxford University, who focus on global issues, like poverty, diseases and climate change. In this dataset daily data regarding COVID-19 has been assembled from government publications for each country in the world. This also includes general data on the subject of health of the population of all countries in the world. Missing or incomplete data is supplemented with COVID-19 Pandemic data retrieved from the Humanitarian Data Exchange.

Remaining economic and financial data is retrieved from the data catalogue of the World Bank. This dataset contains thousands of variables that are kept since 1960 until today on issues ranging from the economy to consumer behavior. The majority is yearly data, most recently updated at the end of each year. All data is crosschecked for reliability with general charts and tables from the World Health Organization and Global Financial Data – Finaeon. Missing data is supplemented from Statista.com, the OECD (OECD) and CEIC (CEIC). Further specific explanations of the variables can be found in the Table 4. Recent data of claims on central government (% of GDP) and credit to the private sector (% of GDP) of Canada and Argentina could not be retrieved from aforementioned sources. The correct manner to calculate this variable is complex and not clear from the database, hence these two countries are omitted from these variables. Furthermore, Consumer Confidence Index surveys and Business Confidence Index surveys are held at a high standard to be included in the World Bank Database. Argentina, Morocco and Egypt did have an index measuring business and consumer confidence, but using different metrics. They are therefore not included in the dataset.

Table 4

Selection of independent variables with explanation

Explanatory Variable	Abbreviation	Explanation
Hospital beds (per 1.000)	*HospitalBeds*	Hospital beds per 1.000 people, most recent year available since 2010.
Life expectancy	*LifeExp*	Life expectancy at birth in 2019. Proxy for general health.
Human Development Index (HDI)	*HDI*	Index Based on three factors. Closer to 1 is a result of a higher level of human development. 1. Health (longevity) 2. Level of education 3. Standard of living
Group at risk (% of population)	*GroupAtRisk*	Percentage of people that are 65+. These are generally considered to be of large risk to die of COVID-19, as a percentage of total population.
Stringency index	*StringencyIndex*	Index that aggregates nine metrics into a measure of stringency of government policy. The nine metrics are: school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirement; public information campaigns; restrictions on internal movements; and international travel controls.
Total cases (per million)	$Cases_{total}$	Total number of confirmed cases per day per million. Differences in testing policy might affect this number.
Total deaths (per million)	$Deaths_{total}$	Total number of confirmed deaths per day per million. Differences in reporting when a death is a COVID-19 related death might affect this number.
Health expenditure (% of GDP)	*HealthExpenditures*	Percentage of government expenditure to GDP. High health expenditures could indicate more public trust in the health sector. High government expenditures
Density of population (km^2)	$Density_{population}$	Measure in km^2. A highly dense would indicate easier transmission for COVID-19.
Current Account Balance (% of GDP)	*CurrAccBal*	Exports minus imports plus net income from abroad as a percentage of the GDP of the country. A surplus will be added to the balance sheet, while a shortage means more money is leaving the country than going in.
International Tourism (% of GDP)	*Tourism*	International tourism revenue as a percentage of total exports. A high value indicates that a country has a large dependence on tourism.
Foreign Direct Investment (inflows, % of GDP)	*FDI*	Net cross-border inflows of money from foreign investors. This includes equity investments, short and long-term capital investments in companies and reinvestments. Dependency on foreign capital might influence behavior on capital markets.
Overall Trade (% of GDP)	*Trade*	Imports and exports of all goods and services as a percentage of GDP. Dependency on either export, import or both when a country has a large trade factor.
GDP per capita	*GDPpc*	Average income per capita at purchasing power parity. Measures whether people can provide themselves with necessary resources and welfare of the country in general.
GDP Growth (%)	GDP_{growth}	Indication whether country was in a growing or shrinking state at the time when COVID-19 appeared.

Government debt (% of GDP)	*GovDebt*	Depicts the financial state of a country. High government debt might indicate that a country cannot take on much extra debt or, on the other hand, might indicate that a country is able to lend because of good credit ratings.
Consumer Confidence Index	*CCI*	CCI index measures trust of households concerning the future economic outlook. A high number indicates that consumers perceive the next 12 months as optimistic. An optimistic future generally leads to high consumption and low saving. Household spending on consumption is therefore a key economic indicator.
Business Confidence Index	*BCI*	A high value in BCI index indicates much confidence from the point of view of businesses. A high number would therefore indicate that businesses expect their output to grow and their business to create revenue.
Google Trends Index	*GoogleTrends*	Relative measure of Google searches of the word "coronavirus". Indication of the interest of a population or region in a certain subject.
Unemployment rate (% of total working population)	*Unemployment*	Unemployment is one of the greatest fears to rise during pandemics. If this rate has a very high value, even more unemployed people could have disastrous effects for an economy.
Bank capital to assets ratio (%)	*CapToAssets*	Capital to assets ratio is a measure of liquidity of banks. Since the financial crisis of 2008/2009, banks are required to hold increasing amounts of capital depending on the risk profile of their assets. A high ratio indicates that banks are more capable of dealing with economic downturn. A higher ratio could allow banks to alleviate stress for households and companies.
Claims on central government (%)	*ClaimsOnGov*	Claims on central government presents the amount the government owes commercial institutions in that particular country. Measured as a percentage of GDP.
Domestic credit to private sector by banks (% of GDP)	*CredToPriv*	Refers to the proportion of GDP commercial banks are owed by the private sector. A large percentage indicates that commercial banks have many outstanding loans, and are therefore heavily affected by business closures.

Table 5 shows the summary statistics of the explanatory variables explained in table 4. Considering the country selection was based on achieving a good representation of developed and developing economies, it is no surprise that there is a large difference of some variables between those countries. The large between variation becomes clearer when looking at variables like unemployment, trade or $GDP_{percapita}$, for example. Unemployment varies from 2% to 28%, trade from 26% to 239% and $GDP_{percapita}$ from $2.000,- to $82.000,-. Other variables, like $Cases_{total}$ and $Deaths_{total}$ rely a lot on testing capacity of a country. Testing capacity and truthfulness of reporting correct cases and deaths remains a point of discussion since testing and reporting standards tend to differ across countries. To minimize these differences, I have chosen several variables that are standardized by an index, like CCI, BCI, StringencyIndex and GoogleTrends. Moreover, to provide sufficient proportionality, where possible, variables are measured in the percentage of their own GDP.

Table 5

Summary statistics of independent variables

Note: The **Variable** column presents the independent variable that will be used in the regression. Further explanations can be found in **table 4**. The number of **Obs.** is the number of countries that are used to obtain the information. The **Mean** column is the mean number of the variable. **SD** presents the standard deviation of the variable. **Skew** presents the skewness. The **Min.** and **Max.** column present the minimum and maximum value of the variable during the time period. HospitalBeds is the number of beds available per thousand in 2019. LifeExpectancy is the expected lifespan of citizens of a country in years in 2019. HDI is the Human Development Index based on three indicators, where 1 presents the highest level of development in 2019. GroupAtRisk presents the percentage of citizens of age 65+. StringencyIndex is a measure of strictness of government-imposed measures. $Cases_{total}$ is the number of cases per million per country. $Deaths_{total}$ is the number of deaths per million per country. HealthExpenditures presents the spending of a country on the health industry in % of GDP in 2019. $Density_{population}$ presents a measure of proximity of the number of people living of a country in km^2. CurrentAccBalance is the ratio of exports minus imports plus net income from abroad as a percentage of GDP in 2019. Tourism is the share of tourism in GDP in 2019. FDI presents net inflows in Foreign Direct Investment in percentage of GDP in 2019. Trade is the overall dependency of imports/exports as a percentage of GDP in 2019. $GDP_{percapita}$ is the Gross Domestic Product per person in dollars in 2019. GDP_{growth} is the growth of the Gross Domestic Product in 2019. GovernmentDebt presents the percentage of its own GDP a government owes. CCI presents the Consumer Confidence Index benchmarked at 100. BCI presents the Business Confidence Index benchmarked at 100. Google Trends is an index that keeps track of Google search results of the word 'Coronavirus'. Unemployment is the amount of people without a job as a percentage of the national workforce. BankCapitalToAssets is the percentage banks keep as capital against the assets on their balance sheet. ClaimsCentralGov presents the amount the government owes commercial institutions in that particular country. CreditToPrivateSector presents how much of a countries' GDP is lend to the private sector and households by other financial institutions like banks in 2019.

Variable	Obs.	Mean	SD	Skew	Kurt	Min.	Max.
HospitalBeds	30	4.056	2.980	1.60	5.19	.53	13.050
LifeExpectancy	30	78.999	4.490	-1.19	3.85	64.130	84.630
HDI	30	.847	0.093	-.81	2.30	.640	0.944
GroupAtRisk	30	14.414	5.893	-.06	2.08	5.159	27.049
StringencyIndex	30	37.034	19.644	.28	2.77	0	85.19
$Cases_{total}$	150	29.990	47.524	1.85	5.43	0	206.114
$Deaths_{total}$	150	.600	1.716	5.15	33.33	0	13.678
HealthExpenditures	30	8.460	2.954	.38	3.50	3.142	16.960
$Density_{Population}$	30	149.435	151.351	1.22	3.41	3.202	527.967
CurrentAccountBalance	30	.199	4.532	.43	4.31	-11.560	12.256
Tourism	30	8.504	6.874	1.30	3.54	1.523	26.377
FDI	30	1.214	3.101	-2.86	12.07	-11.997	4.596
Trade	30	73.752	45.047	1.98	7.23	26.389	239.215
$GDP_{percapita}$	30	30367	22911	.53	2.31	2104	81993
GDP_{growth}	30	1.989	1.865	.64	3.22	-2.163	6.109
GovernmentDebt	30	72.431	47.363	1.62	6.19	16.5	237.7
CCI	26	98.977	1.778	.96	6.34	95.27	105.001
BCI	27	97.697	1.953	-1.46	5.52	91.600	100.98
Google Trends	150	69.2	21.136	-.38	2.15	20.00	100.00
Unemployment	30	7.415	5.356	2.16	8.29	2.291	28.181
BankCapitalToAssets	26	9.086	2.700	.79	2.88	5.218	15.632
ClaimsOnGovernment	28	23.800	28.478	2.73	12.15	-8.089	145.042
CreditToPrivateSector	28	86.441	42.315	.51	2.18	24.024	174.588

Furthermore, the table shows that most variables have moderate positive and negative skewness, meaning they have long tails to the right and left. $Deaths_{total}$ and FDI both have a high skewness. The kurtosis of the variables is high for most variables, with very high values for ClaimsCentralGov and $Deaths_{total}$. These high values mean that some variables experience heavy tails and peakedness, which is mainly due to large differences between some countries.

4 Methodology

For this research the methodology is divided into three sections. First, the general structure of an event study is explained, which comprises of the rationale behind the event date, event windows and estimation period. Second, the methodology to test the impact of the first stringent government announcement on stock returns is explained. Third, the methodology to test the impact of public health, external dependency, country-specific characteristics and financial health on index returns are explained.

4.1 Structure of the event study

Fama et al. (1969) argued that stock prices react quickly to new information and built models to calculate abnormal returns. An important assumption is that markets are more or less efficient, where investors act rational (Malkiel & Fama 1970). When information reaches investors, stock prices should react accordingly to that news. Especially in the digital era, where information spreads quickly, investors, traders and companies with investments in stocks quickly respond to big events. To capture the effect of an event, Fama et al. (1969) compared the normal relation[13] between the return of a stock with a market index, to a period during a big event. The difference could then be attributed to that particular event. Using this methodology, a wide variety of events, and their impact on stock markets can be analyzed. Political events, like elections, legislative announcements or, a recent example, the British exit from the European Union can be analyzed. The same goes for the impact of measures and announcements concerning pandemics. Since markets during large events are not always rational, overreaction might take place in the short-term (Fabozzi et al., 2013). Therefore, to be able to attribute deviations in returns to a certain event, event dates, windows and estimation periods must be determined very carefully to prevent noise in the event study.

In this particular event study, the event dates differ. The reason is because COVID-19 struck countries at different moments. I choose the event date as the moment the first stringent restrictions are imposed in the country. That is the moment when society first really feels the consequences of COVID-19, and fear of economic downturn should increase. Exact dates per country are described in Appendix A, and are retrieved from the Assessment Capacities Project dataset, which is a collection of all government announcements and measures across the world including sources. The event date that is chosen is the day of the restriction announcement if it's a trading day, or the first trading day after if it was not a trading day.

[13] Normal relation being a situation without big events largely influencing a stock.

The event window serves the purpose of being the timeframe during which the effect of the event should be visible on the stock markets without noise. An event window might be negative, to incorporate insider information, or anticipation of an event that happened in other countries earlier. A very short event window might not suffice because not all information is incorporated on stock markets, but long event windows can have issues as well. If the event window is longer, the possibility that new measures interfere with the event increase. The abnormal returns must include the least noise of other events as possible, or the deviations in stock market returns are not fully attributable to the chosen event. The event window will therefore be a 3-day and a 5-day event window. Information has been absorbed in the stock markets for the largest part (Malkiel, 2003). Day zero is the day of the event itself, and only trading days are taken into account. If restrictions are announced on a non-trading day, the closest oncoming trading day will serve as day zero.

The estimation period is the period during which no significant event happened that had a large impact on stock prices. Using the estimation period, the 'normal return' will be calculated. The estimation period will start over a year before the event, on the 1st of January, 2019 until the 1st of January 2020. The estimation period is the 'normal return', as it excludes COVID-19 related events, because it was not spread throughout the world at the time. Approximately 250 trading days are used in the calculation to dilute the impact of small events that might have happened in between as well. Using the normal return using the estimation period the, the expected returns can be derived calculated using a benchmark for the market[14].

4.2 Methodology of event study

To determine whether the announcement of the first government measures led to significant short-term decreases, an event study method will be used to test hypothesis (1). Hypothesis (1) is stated as follows:

H_0: COVID-19 lockdowns have led to no significant short-term decrease of a countries' abnormal stock market index returns. (1)

The goal is to calculate the abnormal returns (AR) of every country index: the difference between expected returns and realized returns. If returns deviate significantly during the event window, the hypothesis is rejected. To calculate the abnormal returns, the alpha (intercept) and the beta (slope) of the known returns of the estimation period must be determined using the market model, that is described as formula **(1)** below. In this formula, $ER_{i,t}$, the normal (expected) return, is calculated. The alpha coefficient $\alpha_{i,t}$ is the intercept of stock and denotes the excess return of the index. The beta coefficient

[14] The benchmark used in this study is the MSCI All-Share, which covers both nearly 50 of the largest economies across the world.

$\beta_{i,t}$ is the slope of the stock and denotes the sensitivity compared to general market movements. $R_{m,t}$ is the rate of return of the chosen proxy for the market, the MSCI All-Share, and $\varepsilon_{i,t}$ is the market disturbance. The alpha and beta are calculated using an Ordinary Least Squares regression (OLS), and after that the expected return can be calculated as follows:

(1) $$ER_{it} = \alpha_i + \beta_i R_{Mt} + \varepsilon_{it}$$

Using the expected return, the abnormal return can be computed by subtracting the expected returns from the realized returns of the index.

(2) $$AR_{it} = R_{it} - ER_{it}$$

When the abnormal returns are compounded during the event window, the Cumulative Abnormal Return is calculated (CAR). The chosen event windows were (-1,1) and (-2,2) meaning that the compounded abnormal returns of 3 and 5 days, respectively, are tested for significance. Using these CARs, I will test hypothesis (1): whether country-specific indices significantly decrease more than expected using the market model due to COVID-19 related events. To test the significance, one sided t-tests are used.

(3) $$CAR_i\ (t_1, t_2) = \ \Sigma_{t=t_1}^{t_2} AR_{i,t}$$

(4) $$t_{\,CAR} = \frac{\overline{x} - \mu_0}{\sigma/\sqrt{n}}$$

Where $\overline{x}$ is the mean of the sample or the country-specific index, μ_0 is the mean of the market index, the MSCI All-Share. Furthermore, $\sigma/\sqrt{n}$ is the sample standard deviation divided by the root number of the observations in the sample, more commonly known as the standard error. A statistically significant t-score of the abnormal returns would indicate that they deviate significantly compared to the expected return using the market model during the event window. This would mean that stock market reactions during the event window deviate due to COVID-19 measures

To test whether emerging economies are hit harder than developed economies, the average of the abnormal returns (AAR) during the (-1,1) and (-2,2) will be compared with each other. The AAR is tested for significance using a one-sided t-test. The hypothesis that is tested is as follows:

H_0: COVID-19 has not led to larger decreases of the abnormal returns of stock market indices in emerging economies than advanced economies. (2)

(5) $$AAR_t = \frac{1}{N} \Sigma_{i=1}^{N} AR_{i,t}$$

(6) $$t_{AAR} = \frac{\overline{x} - \mu_0}{\sigma/\sqrt{n}}$$

4.3 Methodology of multivariate regressions

For hypotheses 3, 4, 5 and 6, multivariate regressions will be performed. For all four hypotheses, the CAR of event window (-1,1) and (-2,2) is used as the dependent variable. The four hypotheses including the regressions are stated as follows:

H_0: Worse public health does not have a significant negative effect on the cumulative abnormal returns of stock market indices. (3)

$$CAR_{i,t} = \alpha + \beta_1 HospitalBeds + \beta_2 LifeExp + \beta_3 HDI + \beta_4 GroupAtRisk + \beta_5 StringencyIndex + \beta_6 Cases_{total} + \beta_7 Deaths_{total} + \beta_8 HealthExp + \varepsilon_{i,t}$$

HospitalBeds is the number of hospital beds per thousand, LifeExp is the life expectancy in years, HDI is the Human Development Index, GroupAtRisk is the percentage of the population older than 65 years, StringencyIndex is an index to measure the stringency of measures present, $Cases_{total}$ is the total number of reported cases, $Deaths_{total}$ is the total number of reported deaths and HealthExp presents the health expenditures measured in percentage of GDP.

H_0: Higher dependency on other countries does not have a significant negative effect on the cumulative abnormal returns of stock market indices. (4)

$$CAR_{i,t} = \alpha + \beta_1 CurrentAccBalance + \beta_2 Tourism + \beta_3 FDI + \beta_4 Trade + \varepsilon_{i,t}$$

CurrentAccBalance presents the current account balance as a percentage of GDP, Tourism the international tourism revenue measured as a percentage of GDP, FDI the foreign direct investment inflows measured as a percentage of GDP and Trade presents the overall trade measured as a percentage of GDP.

H_0: Country-specific characteristics cannot significantly explain deviations of the cumulative abnormal returns of stock market indices. (5)

$$CAR_{i,t} = \alpha + \beta_1 GDP_{percapita} + \beta_2 GDP_{growth} + \beta_3 GovDebt + \beta_4 CCI + \beta_5 BCI + \beta_6 Unemployment + \beta_7 Density_{population} + \beta_8 Googletrends + \varepsilon_{i,t}$$

$GDP_{percapita}$ presents the amount of money per person measured in dollars, GDP_{growth} is the economic output growth of an economy as a percentage, GovDebt the amount debt a government has as a percentage of its GDP, CCI presents the consumer confidence index, BCI the business confidence index, Unemployment the number of unemployed people as a percentage of the working force, $Density_{population}$ the density of a country measured in km^2 and GoogleTrends presents an index to measure public interest of the word 'coronavirus' on Google.

H_0: Worse financial health does not have a significant negative effect on the cumulative abnormal returns of stock market indices. (6)

$$CAR_{i,t} = \alpha + \beta_1 BankCapitalToAssets + \beta_2 GovDebt + \beta_3 ClaimsCentralGov + \beta_4 CreditToPrivSector + \varepsilon_{i,t}$$

BankCapitalToAssets is a ratio of liquidity for banks, GovDebt is the debt of a government measured relatively to GDP, ClaimsCentralGov is a ratio measuring the debt of a government to commercial institutions measured as a percentage of GDP and CreditToPrivSector refers to the proportion of GDP banks are owed by the private sector.

Before running each regression, variables have been checked for correlation using Pearson's Correlation Matrix. The variables 'GroupAtRisk' and 'HDI' that were used to test hypothesis (3) showed significant and high correlation with other variables and were therefore omitted from the regressions beforehand. The Pearson Correlation Matrices can be found in Appendices E1, F1, G1 and H1.

The dataset that has been used to perform the multivariate regressions is structured as panel data. The data is clustered around each country and multiple types of variables are included. Some of the explanatory variables have little to no within-variance during the event window, since most macroeconomic and financial data is only available either monthly, quarterly or yearly. Between-variation across countries, however, is much higher than within-variation. According to Bell & Jones (2015) and Bell, Fairbrother & Jones (2019) this is an indication that using a random effects model might already be the most suitable choice. They argue that using panel datasets with low within-

variation could lead to an omitted variable bias, which could distort the purpose of the model. Results of Hausman tests confirmed their view, because every test was either flawed due to omitted variables, or significantly pointed towards the random effects model. Before running the regressions, I ran a Breusch Pagan Lagrange Multiplier test as a last check whether Random Effects or OLS is the best model to use. Breusch & Pagan (1980) explain that the null hypothesis in the LM test reads that there is no significant difference across units. For all regressions, the null hypothesis was rejected. Every regression has therefore been executed with the Random Effects model. Per hypothesis, I followed a modelling approach going from 'general to specific', dropping the least significant variables each time, unless there was no significance to begin with. To control for autocorrelation and heteroscedasticity in advance, robust standard errors have been used, according to Hoechle (2007). He mentions that the standard errors using his Stata commands are robust to disturbances that arise due to heteroscedasticity and autocorrelation, and can be easily be implemented by *'cluster'* and *'robust'* commands in Stata.

5 Results

5.1 Short-term impact on index returns

To test hypothesis 1, the short-term impact on each country-specific index returns, the abnormal returns are compounded using equation (1), (2) and (3). Table 6 shows the Average Abnormal Returns (AAR) of the event that the first stringent measure was imposed or announced by the government. The corresponding 3-day event window can be found in appendix C. Below, table 6 shows that most countries saw their stock market returns decrease on average during those five days. Moreover, the majority of the decreases in these countries are statistically significant. The countries that saw positive abnormal returns were Sweden, the United Kingdom and the United States for both event windows. A reason for the latter two could be that a decent number of constituents of the UK and US index are included in the market index, the MSCI All-Share. This could entail that these indices move together closely with the market index, and as a result, achieve similar returns and have low abnormal returns. Although Sweden did impose restrictions, their strategy to battle COVID-19 has been vastly different from other countries. The Swedish government promised a much less invasive response, by choosing not to impose stringent lockdowns and focusing on slowing down the virus instead of full mitigation (Ludvigsson, 2020). This approach led to fewer restrictions on businesses across the country, and might have had some influence on investor confidence in Swedish companies.

The overall large significant negative responses therefore provide evidence against hypothesis (1), that the announcement of the first measures did not lead to a significant short-term decrease in stock returns. Further analysis of the abnormal returns, but viewed independently, show that during the five-day event window abnormal returns varied considerably, which can be found in Appendix D. For example, Brazil experienced 9.71% abnormal returns on the fourth day of the (-2,2) event window, and -7.29% the day after. As is explained earlier, Appendix B shows that stocks became highly volatile during the month March. This could be the reason behind the varying abnormal returns. Another explanation could be investor overreaction on financial markets that is often corrected within a few days (Niederhoffer, 1971; Fabozzi et al. 2013). This finding corresponds with research by Cheong, Ariff & Subramaniam (2020), who found that markets quickly adjusted to COVID-19 related news. Whether this can be attributed to recovery of overreaction, or investor response to positive news like relief packages is unclear.

Table 6

Average abnormal returns per country (-2,2)

Note: The column *Country* presents the country from which the index returns are used. *AAR (-2,2)* provides the Average Abnormal Returns for that specific country on the event date that is further explained in **Appendix A**, and two days before and after. The significance is indicated with an asterisk and is computed with a one-sided t-score test. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Event 1					
Country	**AAR (-2,2)**		**Country**	**AAR (-2,2)**	
Argentina	-1.57		Japan	-1.28	*
Australia	-2.12	***	Mexico	-1.14	*
Belgium	-2.78	***	Morocco	-4.26	***
Brazil	-1.73	**	Netherlands	-0.37	
Canada	-0.05		New Zealand	-3.97	***
Chile	-4.11	***	Poland	-1.17	*
China	-2.24	**	Russia	-1.91	***
Egypt	-4.01	***	South-Africa	-2.39	***
Greece	-2.47	**	South-Korea	-3.72	***
France	-0.57		Spain	-2.41	***
Germany	-1.55	***	Sweden	1.55	
India	-3.23	***	Switzerland	-1.13	***
Indonesia	-2.52	***	Turkey	-1.50	
Ireland	-1.32	**	United Kingdom	0.95	
Italy	-2.62	***	United States	0.98	

5.2 Differences between emerging and developed economies

To test hypothesis 2, whether emerging economies are hit harder than developed economies, equation (5) is used to calculate the AAR. Table 7 presents the economies divided between emerging and developed economies. When the average abnormal returns over the five-day period of the event window (-2,2) are averaged, the differences are large. Developed economies' indices decreased on average by 1.11% during the five-day period. The emerging economies' indices decreased on average by 2.53% during the same period. Developed economies performed 1.42% better, on average. After closer examination, there might be some reasons for this. First of all, zoonotic diseases tend to originate from emerging economies (Wu et al., 2017). SARS, MERS and COVID-19 are all traced back to middle eastern and south-east Asian countries. Countries where COVID-19 appeared early on had less time to prepare economically and socially.

Table 7

Average abnormal returns "first stringent measure"
Developed vs. Emerging economies (-2,2)

Note: The column *Country (Dev.)* and *Country (Em.)* presents the developed and emerging country, respectively, from which the index returns are used. *AAR (-2,2)* provides the Average Abnormal Returns for that specific country on the event date that is further explained in **Appendix A**, and two days before and after. The significance is indicated with an asterisk and is computed with a one-sided t-score test. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Event 1					
Country (Dev.)	**AAR (-2,2)**		**Country (Em.)**	**AAR (-2,2)**	
Australia	-2.12	***	Argentina	-1.57	
Belgium	-2.78	***	Brazil	-1.73	**
Canada	-0.05		Chile	-4.11	***
France	-0.57		China	-2.24	**
Germany	-1.55	***	Egypt	-4.01	***
Ireland	-1.32	**	Greece	-2.47	**
Italy	-2.62	***	India	-3.23	***
Japan	-1.28	*	Indonesia	-2.52	***
Netherlands	-0.37		Mexico	-1.14	*
New Zealand	-3.97	***	Morocco	-4.26	***
Spain	-2.41	***	Poland	-1.17	*
Sweden	1.55		Russia	-1.91	**
Switzerland	-1.13	***	South-Africa	-2.39	***
United Kingdom	0.95		South-Korea	-3.72	***
United States	0.98		Turkey	-1.50	
Average	-1.11		Average	-2.53	

5.3 Public health characteristics

To test the third hypothesis, whether worse public health does not have a significant effect on index returns, the abnormal returns that can be found in appendix C are compounded. for the event windows (-2,2) and (-1,1) to obtain the cumulative abnormal returns. Subsequently, these CARs are used as the dependent variable to test hypothesis 3. The results of this regression, using multiple explanatory variables are presented in table 8 and appendix E2 for event windows (-2,2) and (-1,1), respectively. The multivariate regressions have been corrected for heteroscedasticity and autocorrelation using the robust standard errors by Hoechle (2007). Before this regression, a Pearson's correlation matrix has been created to test for multicollinearity among the variables. The Pearson's correlation matrix in appendix E1 shows that two variables, HDI and GroupAtRisk had high and significant correlation with

other variables. To decrease noise with other explanatory variables, these variables have been omitted from the regression.

Table 8 shows that the daily stringency index (StringencyIndex) of government measures and health expenditures (HealthExpenditure) are significant in both models at 1%. The sign of the StringencyIndex coefficient is negative and the sign of HealthExpenditure is positive with values of -.0009 and .0066, respectively. The difference of the StringencyIndex and HealthExpenditure coefficients with the first and the second model is minimal, and still significant at the 1% level. For the event window of (-1,1), as shown in appendix E2, the signs are similar, but the HealthExpenditure is significant at the 5% level. Moreover, when different time windows are used, the coefficients of StringencyIndex and HealthExpenditure are slightly lower, at -.0011 and .0043, respectively.

Table 8

Regression results of CARs on public health variables (-2,2)

Note: This table shows the regression results of two models to test the third hypothesis. The event window is (-2,2) where day zero is the day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. *LifeExp* presents the life expectancy in years, *StringencyIndex* is an index to measure the stringency of measures, $Deaths_{total}$ is the total reported death count, *HealthExpenditures* is a countries' health expenditures as a percentage of GDP, $Cases_{total}$ is the total reported case count and *HospitalBeds* is the number of hospital beds per 1.000. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR	(2) CAR
LifeExpectancy	-.0010	-.0013
	(.0016)	(.0013)
StringencyIndex	-.0009***	-.00089***
	(.0003)	(.0003)
$Deaths_{total}$	.0040	.0029
	(.0053)	(.0039)
HealthExpenditure	.6556***	.6519***
	(.1940)	(.2035)
$Cases_{total}$	-.00007	
	(.0003)	
HospitalBeds	-.0002	
	(.0023)	
Constant	.0128	.0309
	(.1144)	(.0938)
Observations	900	600
R^2	.11	.1041
Adjusted R^2	.0978	.1033
F-Statistic	6.225	6.98

The signs of these two explanatory variables are expected. A higher stringency entails stricter measurements imposed by the government, which would lead to more contraction in the economy which in turn results in a more negative effect on the CAR. Similarly, a 1% increase in HealthExpenditures would result in a less negative, or positive CAR. A 1% increase in government health expenditures improves index returns by a .6556%. Jonas (2013) and Verikios et al. (2016) argued that governments, rather than the health sector is tasked with mitigating pandemics, and evidence from stock markets prove this might be true. Although the coefficient of health expenditures is statistically significant, it is not realistic to argue that increasing health expenditures in the future would be beneficial in alleviating stress in decreasing stress on the stock markets. Having a solid healthcare system does help in the short term, but is a difficult metric for governments to quickly improve in. Furthermore, expenditures in healthcare might be too broad of a variable to capture the exact reason why it has a significant positive relation with the CARs of indices. To obtain more knowledge on the exact relationship, it could be a good idea to break down health expenditures into several more specific variables.

The other four explanatory variables were not statistically significant, which was surprising for some of them. The CAR cannot be explained by the amount of hospital beds available or the life expectancy of a country when making investing decisions, which sounds reasonable. However, the total deaths and cases did not significantly explain the CAR as well. One big shortcoming of this dataset and of this pandemic in general, is that the number of cases heavily depend on testing capacity. Some countries tested a lot early on, and some barely had testing capacity at all. The requirements to consider a death a COVID-19 related death also differs a lot between countries. According to the BBC (2020), Russia deliberately played down their COVID-19 cases and deaths, and there are rumors the same goes for other countries. Early data on cases and deaths might not be reliable. Similar to findings of Baker et al. (2020a), government restrictions tend to be of much higher influence on economic disruption and contraction of capital markets than health related factors in countries. When it comes to public health, most explanatory variables play no role, or a minor role in investing decisions. Therefore, H_0 of hypothesis 2 cannot be rejected: Worse public health does not have a significant negative effect on index returns.

5.4 External dependency characteristics

Before testing whether a high dependency on other countries has a negative effect on index returns, all variables for this regression are tested for multicollinearity, which can be seen in appendix F1. Robust standard errors by Hoechle (2007) are used to correct for possible heteroscedasticity and autocorrelation. To test this hypothesis, the CAR has been used as the dependent variable. Table 8

presents the regression results of the CAR of event window (-2,2) on external dependency variables. The corresponding results for event window (-1,1) are presented in appendix F2.

Table 9

Regression results of CARs on external dependency variables (-2,2)

Note: This table shows the regression results of three models to test the fourth hypothesis. The event window is (-2,2) where day zero is the day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. *Tourism* presents tourism revenue as a percentage of GDP, *Trade* the overall trade measured as a percentage of GDP, *FDI* the foreign direct investment inflows measured as percentage of GDP and *CurrAccBal* presents the current account balance as a percentage of GDP. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR	(2) CAR	(3) CAR
Tourism	-.2110**	-.2144***	-.2223***
	(.0857)	(.0826)	(.0769)
Trade	-.0184	-.0151	-.0162
	(.0224)	(.0175)	(.0220)
CurrAccBal	.0635	.0499	
	(.1450)	(.1359)	
FDI	-.0672		-.0138
	(.3842)		(.3511)
Constant	-.0124	-.0153	-.0136
	(.0212)	(.0175)	(.0215)
Observations	600	450	450
R^2	.083	.082	.080
Adjusted R^2	.057	.063	.061
F-Statistic	2.745	3.377	3.160

Surprisingly, only tourism significantly predicts the CAR at the 5% level in model 1, and 1% in models 2 and 3. In appendix F2, there was no significance at all. This result comes as a surprise, because the announcement of stringent government policy means that disruption of many sectors is coming soon. This will disrupt supply chains of products and decrease services by reducing travel (Bonadio et al., 2020; McKibbin and Fernando 2020; Wu et al., 2017). Economies that are financially dependent on tourism and trade, are therefore expected to see larger disruptions to their economy, further increasing expectations of layoffs and lost revenue. However, apart from tourism during an event window of (-2,2), this effect wasn't observed for trade, the countries' current account balance and foreign direct investments. An increase of 1% of tourism relative to total exports, would negatively impact the CAR of the index by .2110%. Kuo et al. (2008) and Verikios et al. (2016) predicted that the tourism sector would suffer substantially due to government restriction, which is in line with the findings of this paper.

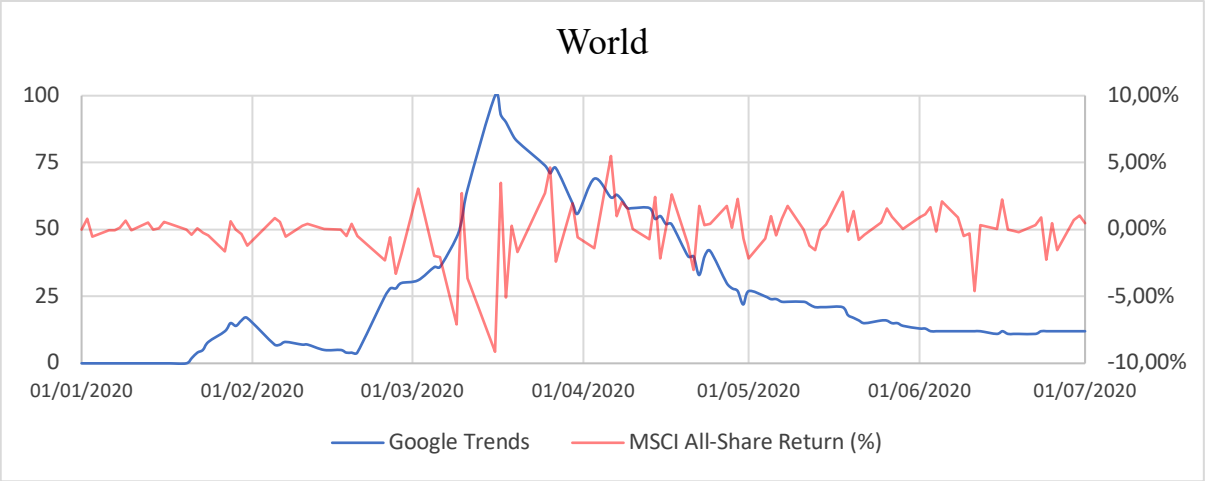
However, other variables did not show a significant relation with the CARs. An argument could be that indices of countries contain too few trade dependent companies. Another reason could be that investors anticipated supply side disruptions would be minor. In future research, using trade data per sector[15] could be useful. The insignificant relationship between the CARs and three out of four variables gives reason that H_0 of hypothesis 4 cannot be rejected: Higher dependency on other countries does not have a significant negative effect on the CAR of the stock index returns.

5.5 Country-specific characteristics

Most people, including investors, in early 2020 did not anticipate that it would become a strange year. Figure 1 below illustrates the relative search popularity of the word "coronavirus" against the daily returns of the MSCI All-Share. It displays a clear increase in volatility spikes during the period when Google searches peaked. To test hypothesis 5, whether country-specific characteristics can explain the abnormal returns, another random-effects regression is performed. Table 9 presents the results of the regression between the (-2,2) CARs and country-specific characteristics. Appendix G2 presents the same regression for the event window (-1,1). First, the variables have been checked for multicollinearity, which can be found in appendix G1. Thereafter, they were corrected for heteroskedasticity and autocorrelation using robust standard errors by Hoechle (2007).

Figure 1

Google Trends activity against MSCI index return



The results show clear significance at the 5% or 1% in models 1, 2 and 3 for BCI (Business Confidence Index), GoogleTrends, GDPpc (per capita), CCI (Consumer Confidence Index) and $Growth_{growth}$. BCI, Googletrends and GDP_{growth} are all negatively correlated with the CARs. A 1% increase in GDP_{growth}

[15] Exporting and importing data of several sectors instead of just trade, e.g., Manufacturing, agricultural, energy import/export dependency.

would therefore result in a decrease of .7994% of the CAR. Wu et al. (2017) argued that areas that are high in income growth, urbanization and globalization are often hotbeds for diseases. These are often developing markets with high growth rates opposed to developed markets, that are growing at a lower stable rate. Developed economies generally also have fewer economic resources to alleviate panic on stock markets. The negative sign is therefore in line with general literature on pandemic risk.

Table 10

Regression results of CARs on country-specific characteristics (-2,2)

Note: This table shows the regression results of three models to test the fifth hypothesis. The event window is (-2,2) where day zero is the day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. $GDP_{percapita}$ presents the amount of money per person measured in dollars, GDP_{growth} is the economic output growth of an economy as a percentage, *GovDebt* the amount debt a government has as a percentage of its GDP, *CCI* presents the consumer confidence index, *BCI* the business confidence index, *Unemployment* the number of unemployed people as a percentage of the working force, $Density_{population}$ the density of a country measured in km^2 and *GoogleTrends* presents an index to measure public interest of the word 'coronavirus' on google. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR	(2) CAR	(3) CAR
BCI	-.0138***	-.01267***	-.0119***
	(.0040)	(.0038)	(.0031)
GoogleTrends	-.0014***	-.0013***	-.0014***
	(.0002)	(.0002)	(.0002)
GDPpc	9.20e-07***	9.21e-07***	8.59e-07***
	(2.57e-07)	(2.52e-7)	(2.64e-07)
CCI	.0108**	.0086**	.0092**
	(.0046)	(.0038)	(.0040)
GDP_{growth}	-.7994**	-.9162**	-.9903***
	(.3317)	(.3623)	(.3719)
GovDebt	.0114	.0111	
	(.0131)	(.0138)	
DensityPop	-.00004	-.00005	
	(.00006)	(.00006)	
Unemployment	.0653		
	(.0993)		
Constant	.3189	.4300	.2988
	(.5093)	(.4532)	(.4319)
Observations	1315	1015	715
R^2	.316	.306	.284
Adjusted R^2	.267	.272	.255
F-Statistic	N/A	12.76	17.16

A similar increase in GoogleTrends causes the CAR to be negatively affected by -.0014. Figure 1 shows a similar negative relation. However, the sign of BCI is negative and statistically significant as well, which is counterintuitive and therefore surprising. In the (-1,1) event window the sign is flipped, but is not significant, though. Reason behind this could be too low within-variation of the observations. On the contrary, a similar metric of confidence, but that of consumers (CCI), shows a positive and statistically significant coefficient with the CAR. Higher consumer confidence is results in a higher CAR for both the (-2,2) and (-1,1) event window.

The population density did not have any statistical significance. Naturally, this variable does matter when it comes to the spread of the virus, but similar to the hospital beds and life expectancy variable, it does not turn out to be of decisive value for investors. Government debt and the unemployment rate might play a more important role later on in the pandemic, when actual layoffs start happening and governments must decide on possibilities for relief packages as a consequence of closure of non-essential businesses. At the moment of the first stringent measure, these things might not have happened on a large scale yet, and therefore have little predictive power of the CAR.

The significant relationship at the 1% level between the CARs and over half of these variables gives reason that H_0 of hypothesis 5 should be rejected: Country-specific characteristics can significantly explain deviations of index returns. An important question remains, however, what are country-specific characteristics.

5.6 Financial health characteristics

Table 10 below presents the results of hypothesis 6, whether worse financial health has a negative effect on index returns. The results are for event window (-2,2), and the results for event window (-1,1) can be found in appendix H2. Before running the regression, variables have been checked for multicollinearity using Pearson's correlation matrix, which can be found in appendix H1. Robust standard errors by Hoechle (2007) are used to correct for heteroskedasticity and autocorrelation. For this regression, the CAR is used as the dependent variable.

The results for both event windows show that the chosen explanatory variables do not explain statistically significant explain the CARs. This is surprising, since a resilient and healthy financial sector is essential in the short and long term to sustain stable economic growth (Wu & Olsen, 2020). Whereas stringent government policy will contract the economy, good prospects of relief packages in the future to alleviate stress and drag the economy through the pandemic is important for investors. However, after further inspection of the variable government debt (GovDebt), claims on the government (ClaimsOnGov) and credit to the private sector (CredToPriv), there could be a reason for the lack of

significance. A large debt ratio can be understood as the inability of a country of company to take on even more debt. Contrarily, you could infer that a large debt ratio is the result of being creditworthy. Tables 6 and 11 show the index returns of countries that are perceived as being "developed and rich" and "emerging and poor". Emerging economies on aggregate have much smaller government debt than developed economies. The reason is presumably twofold: these economies either refrain from government lending, because they do not need higher spending, or they are not able to due to bad credit worthiness, which makes lending very expensive. The same reasoning goes for the amount of debt owed to the government by commercial institutions and the amount of debt owed by the private sector to commercial institutions.

Table 11

Regression results of CARs on financial health variables (-2,2)

Note: This table shows the regression results of one model to test the sixth hypothesis. The event window is (-2,2) where day zero is the day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. *CapToAssets* is a ratio of liquidity for banks, *GovDebt* is the debt of a government measured relatively to GDP, *ClaimsOnGov* is a ratio measuring the debt of a government to commercial institutions measured as a percentage of GDP and *CredToPriv* refers to the proportion of GDP banks are owed by the private sector. The dependent variable is the Cumulative Abnormal Return (*CAR*). he robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR
CapToAssets	.1528
	(.3253)
GovDebt	-.0146
	(.0183)
ClaimsOnGov	.0345
	(.0517)
CredToPriv	.0149
	(.0195)
Constant	-.0689
	(-.0499)
Observations	565
R^2	.0230
Adjusted R^2	N/A
F-Statistic	.25

6 Conclusion

6.1 Discussion of results

At the moment, in early 2021, the pandemic is still a prevailing issue across the world. It is the first time in recent history that a disease has had such a large impact on every thinkable country. The impact has reached far beyond just health issues, since government measures and panic among investors have put an incredible amount of stress on financial markets. Long-term consequences are slowly surfacing, but definite conclusions remain a matter of time. The short-term impact, however, can be assessed already. This research aims to provide evidence on the drivers that have or have not been of influence on equity markets in the short-term.

More precisely, this paper has researched the short-term impact of the announcement of the first stringent COVID-19 measures on equity markets across the world. Using thirty economies, accounting for sufficient geographical spread and economic maturity, numerous variables are tested for their explanatory power of stock market fluctuations. The short-term impact is analyzed during three- and five-days event windows, with the middle day being the first trading day after the first stringent government measure announcement. This allows to capture stock market fluctuations one or two days before and after the event date. The resulting abnormal returns during this time window are then cumulated and multiple variables are tested for their explanatory power. The research question used to analyze the determinants of deviations on the stock markets was stated as follows:

"*What is the short-term financial impact of the first announcement of stringent COVID-19 measures on stock market indices and what are the determinants of that impact?*"

To test what the determinants of investors are to alter their investing behavior during a certain event, multiple subject matters are analyzed. Thereafter, independent variables are chosen to test hypotheses based on those subjects. First and foremost, the event study provided evidence that countries did experience a significant decrease in abnormal returns due to the announcement of the first COVID-19 government measures. The first hypothesis is therefore rejected, meaning that announcement of stringent government measures did negatively impact the stock markets. Thus, this event clearly created fear among investors, who reacted by selling off stock. Apart from Sweden, the US and the UK, the returns of the majority of all thirty countries' indices decreased significantly. Closer examination of the abnormal returns of each country showed that several countries experienced high volatility during the event window, with returns fluctuating heavily from large decreases to large increases. A possible explanation is that overreaction took place, but that is out of the scope of this research.

The second hypothesis, that the announcement of government measures did not cause a larger decrease on emerging economies' abnormal returns of stock market indices than those of developed economies could be rejected. On average, the AAR of emerging economies' indices decreased more than that of developed economies. Emerging economies experienced a decrease in AAR of 2.53%, compared to a decrease of 1.11% for developed economies. That is probably mainly due to investors' perception of the way those governments would handle the economic downturn. Emerging economies often have fewer stable governments and less economic freedom to put multiple generous relief packages in place. A definitive explanation could not be inferred on using this dataset.

For the third hypothesis, I did not find clear evidence that public health has a significant negative effect on abnormal returns of stock market indices. Although the stringency of the announced measure at the time and health expenditures did have significant explanatory power, the majority of the public health indicators were not significant. This could mean that investors did not look at public health when making investing decisions around the time of the first stringent measures. This is, however, in line with literature, that suggests investors tend to resort to direct and indirect economic consequences of measures instead of the actual fear of illness due to the disease. Furthermore, the number of cases and deaths did not explain the changes in returns, which was not expected. After further examination, these variables are heavily reliable on testing capacity and reporting standards, which may have skewed this relation.

The fourth hypothesis, that countries with a higher foreign dependency saw no significant negative decrease in abnormal returns could also not be rejected. Out of FDI, the current account balance, trade and tourism, only the latter could significantly explain the abnormal returns of countries' indices. Literature indicated that tourism and trade are the sectors that should expect to suffer from the measures the most. Still, only tourism showed this significant decrease. Investors either did not take trade statistics in account when making their investment decisions, or might have paid attention to other variables. Disruption in supply chains has been a big problem in the beginning of the pandemic, but the chosen variables might not have been specific enough. For future research, it might be better to make clear distinctions between types of trade. Dependency on import of energy, food or basic utilities could give more clarity on the exact relationship between abnormal returns and trade dependency.

For the fifth hypothesis, I argued that the perception of well-being of a country by society could be of great importance when it comes to behavior on financial markets that should be reflected in returns. The hypothesis is accepted, meaning that there are sufficient country-specific characteristics that significantly explained abnormal returns. Societal and investor certainty or trust, however, is difficult to quantify. Besides known indices that are based on consumer or business confidence, culture and pre-existing unobservable societal issues can play a large role as well. Business confidence, for example is

not a metric solely to measure trust when it comes to pandemics. Brexit in the UK[16], political issues in the US, pre-existing economic downturn in Turkey[17], OPEC oil trade war of Russia[18] heavily influence societal trust during the same period as well. Isolating this with the pandemic is challenging.

The sixth hypothesis, that worse financial health had no significant negative effect on abnormal returns on stock market indices could not be rejected. This is surprising, since the expectation is that investors would look closely at financial factors. Especially since bailouts and relief packages are expected from countries with strong economies. After further inspection there might be a logical explanation. The variables used to measure financial health might have a counterintuitive effect. A high ratio of the capital to assets ratio, government debt, claims on central government and credit to the private sector can indicate several things. For example, high government debt might indicate that a country cannot take on even more debt, because interest expenses would become very high. On the other hand, a high government debt could indicate that a country is very creditworthy, and can borrow cheaply.

6.2 Limitations and recommendations

The most important limitation of this study is that most hypotheses need a more extensive approach to exactly determine its effects. At first, many variables seemed to represent the hypothesis well, but more detailed variables should be used in the regressions to really dive into the causes of the abnormal returns of stock market indices in depth. An option could be to investigate intraday data or to analyze whether investors adjusted their portfolio towards companies within the same index. After the government first imposed stringent measures, investors might have shifted their capital from leisure and utilities towards tech, for example. Furthermore, spillovers on markets proved to be hard to control for. Once it was clear as day that the virus would enter northern European countries, the market may have already adjusted a bit. Especially economies that have dealt with diseases before were able to brace their society. The geography could play a role as well, since it is easier to curb the virus by cutting off travel from and to neighboring countries from an island. Further, the external dependency variables show for instance the dependency on trade, but not where that trade flows are coming from. For future research, the distinction between general trade data and bilateral trade data could be a worthwhile addition. There is a large difference between two neighboring countries that primarily exchange products and services with each other, compared to a country trading with the whole world. This paper does not sufficiently encompass these differences. Also, this paper could not account for culture or policy quality. Trust in a good

[16] UK: Around the time the first measures of COVID-19 were announced, a deal between the UK and the European Union was not decided yet.
[17] Turkey: Arguably due to poor economic policy, Turkey has been in a debt and currency crisis since 2018, causing high inflation, plummeting of the Lira, high borrowing costs and high default rates.
[18] Russia: Trade war between Saudi-Arabia and Russia caused oil prices across the world the plummet. The break-up of dialogue caused the fall of the OPEC alliance, inducing much uncertainty and price decreases in markets.

government is very important in reducing uncertainty in financial markets. Lastly, robustness checks used in this paper are possibly prone to type 1 error: The rejection of a true null hypothesis. When an event increases the variance of the returns, induced volatility could cause over rejection of the null hypothesis when executing a simplified t-statistic. Boehmer, Masumeci & Poulsen (1991) developed a standardized cross-sectional test to correct for these type of events. This paper, however, investigates an event date that differs per country, which complicates the validity of the correction using the BMP-test. Although the methodology performed in this paper is intended to be as accurate as possible, I was not able to fully correct for these errors. The t-tests used in this paper can still be interpreted in the same way, but might be prone in some way to induced volatility. Future research could provide more clarity on the differences between these robustness checks when using one event date instead of multiple different dates.

The practical relevance of these results can be translated into advice governments, but also for investors on stock markets. It is clear from this research that governments decisions heavily impact the stock markets, when announcing stringent measures. By understanding better how and why markets react following stringent measures, governments could develop better policies in the future. Panic selling and large decreases on stock markets often indicate that something is happening in society as well. Understanding one, could help understand the other. Using this dataset, it is not clear that governments could prevent fluctuations on the stock markets by increasing public health, changing its dependency on other countries or change their financial health. However, the general perception of investors did matter. The most likely lesson that could be drawn from this research is that investors' confidence has a large impact on stock markets, which is expected. The fluctuations during the event window were large, indicating that there may have been overreaction among investors. In the sense of investing, in the future it could be profitable to go short in volatility contracts, for example. To understand this, confidence surveys and closely watching trends might could give a time advantage when choosing to sell stocks. If not, panic selling has probably been a large reason behind the current decrease in returns.

All in all, there are countless variables that can and should be investigated that directly or indirectly affect each other. That is what makes this topic interesting, but also important. This paper concludes that stock markets across the world saw significant negative returns in the short-term. Emerging economies are impacted harder on the stock markets. Financial health, public health or external dependency did not sufficiently explain the negative impact. Country-specific characteristics did, however. Especially variables measuring confidence or uncertainty explained the negative response on the stock markets.

References

Andersen, K. G., Rambaut, A., Lipkin, W. I., Holmes, E. C., & Garry, R. F. (2020). The proximal origin of SARS-CoV-2. *Nature medicine*, *26*(4), 450-452.

Baker, S. R., Bloom, N., Davis, S. J., & Terry, S. J. (2020). *Covid-induced economic uncertainty* (No. w26983). National Bureau of Economic Research.

Baker, S. R., Bloom, N., Davis, S. J., Kost, K., Sammon, M., & Viratyosin, T. (2020). The unprecedented stock market reaction to COVID-19. *The Review of Asset Pricing Studies*, *10*(4), 742-758.

Barro, R. J., Ursúa, J. F., & Weng, J. (2020). *The coronavirus and the great influenza pandemic: Lessons from the "spanish flu" for the coronavirus's potential effects on mortality and economic activity* (No. w26866). National Bureau of Economic Research.

BBC News. (2020, 29 december). *Russian Covid deaths three times the official toll*. https://www.bbc.com/news/world-europe-55474028

Bell, A., & Jones, K. (2015). Explaining fixed effects: Random effects modeling of time-series cross-sectional and panel data. *Political Science Research and Methods*, *3*(1), 133-153.

Bell, A., Fairbrother, M., & Jones, K. (2019). Fixed and random effects models: making an informed choice. *Quality & Quantity*, *53*(2), 1051-1074

Bleibtreu, A., Bertine, M., Bertin, C., Houhou-Fidouh, N., & Visseaux, B. (2019). Focus on Middle East respiratory syndrome coronavirus (MERS-CoV). *Medecine et maladies infectieuses*.

Boehmer, E., Masumeci, J., Poulsen, A.B. (1991). Event-study methodology under conditions of event-induced variance *Journal of Financial Economics*, 30 (1991), pp. 253-272

Bonadio, B., Huo, Z., Levchenko, A. A., & Pandalai-Nayar, N. (2020). *Global supply chains in the pandemic* (No. w27224). National Bureau of Economic Research.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, *47*(1), 239-253.

Carstens, A. (2020, December 21). How COVID-19 Is Impacting Central Banks. Retrieved January 15, 2021, from https://internationalbanker.com/banking/how-covid-19-is-impacting-central-banks/

Chan, K. C. (1988). On the contrarian investment strategy. *Journal of business*, 147-163.

Chaney, S., & Morath, E. (2020). Record 6.6 Million Americans Sought Unemployment Benefits Last Week. *Wall Street Journal*, *3*.

Chen, S., Yang, J., Yang, W., Wang, C., & Bärnighausen, T. (2020). COVID-19 control in China during mass population movements at New Year. *The Lancet*, *395*(10226), 764-766.

Cheong, C., Ariff, M., & Subramaniam, N. R. (2020). Did Financial Markets Overreact to COVID-19?. *Available at SSRN 3694278*.

Connolly, R., Stivers, C., & Sun, L. (2005). Stock market uncertainty and the stock-bond return relation. *Journal of Financial and Quantitative Analysis*, 161-194.

De Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact?. *The Journal of Finance*, *40*(3), 793-805.

Demirgüç-Kunt, A., Pedraza, A., & Ruiz Ortega, C. (2020). Banking sector performance during the covid-19 crisis. *Demirguc-Kunt A, Pedraza A, Ruiz-Ortega C. Banking Sector Performance During the COVID-19 Crisis. World Bank Policy Research Working Paper*, *9363*.

Engelhardt, N., Krause, M., Neukirchen, D., & Posch, P. N. (2020). Trust and stock market volatility during the COVID-19 crisis. *Finance Research Letters*, 101873.

Fabozzi, F. J., Fung, C. Y., Lam, K., & Wong, W. K. (2013). Market overreaction and underreaction: Tests of the directional and magnitude effects. *Applied Financial Economics*, *23*(18), 1469-1482.

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review*, *10*(1), 1-21.

Fan, E. X. (2003). SARS: economic impacts and implications. (ERD Policy Brief 15). Retrieved from: https://www.adb.org/sites/default/files/publication/28073/pb015.pdf

Fetzer, T., Hensel, L., Hermle, J., & Roth, C. (2020). Coronavirus perceptions and economic anxiety. *Review of Economics and Statistics*, 1-36.

G20. (z.d.). Europa Nu. Geraadpleegd op 24 november 2020, van https://www.europa-nu.nl/id/vi2te1wxxvuz/g20

Gopinath, (2020, April 14). The Great Lockdown: Worst Economic Downturn Since the Great Depression. Retrieved December 22, 2020, from https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/

Guaitoli, G., & Tochev, T. (2021). Do localised lockdowns cause labour market externalities? *Covid Economics 18 February 2021: 46-8,* (69), 46-86.

Hale, T., Petherick, A., Phillips, T., & Webster, S. (2020). Variation in government responses to COVID-19. *Blavatnik school of government working paper*, *31*.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, *7*(3), 281-312.

IMF. (2020, May). *Central Bank Support to Financial Markets in the Coronavirus Pandemic*. https://www.imf.org/en/Publications/SPROLLs/covid19-special-notes

IMF. (2021, January). *Transcript of the World Economic Outlook Update Press Briefing* [Press release]. https://www.imf.org/en/News/Articles/2021/01/28/tr012621-transcript-of-the-world-economic-outlook-update-press-briefing

Investopedia. (2021, 3rd of January). Quantitative Easing (QE). https://www.investopedia.com/terms/q/quantitative-easing.asp

Jonas, O. B. (2013). Pandemic risk. The World Bank

Keogh-Brown, M. R., & Smith, R. D. (2008). The economic impact of SARS: how does the reality match the predictions?. *Health Policy*, *88*(1), 110-120.

Kuo, H.-I. *et al.* (2008) 'Assessing impacts of SARS and Avian Flu on international tourism demand to Asia', *Tourism Management*, 29(5).

Lee, J. W., & McKibbin, W. J. (2004). Globalization and disease: The case of SARS. *Asian Economic Papers*, *3*(1), 113-131.

Lo, A. W. (2005). Reconciling efficient markets with behavioral finance: the adaptive markets hypothesis. *Journal of Investment Consulting*, *7*(2), 21-44.

Ludvigsson, J. F. (2020). The first eight months of Sweden's COVID-19 strategy and the key actions and actors that were involved. *Acta Paediatrica*, *109*(12), 2459-2471.

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *Journal of economic perspectives*, *17*(1), 59-82.

Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The journal of Finance*, *25*(2), 383-417.

Mckercher, B., & Pine, R. (2006). Privation as a stimulus to travel demand?. *Journal of Travel & Tourism Marketing*, *19*(2-3), 107-116.

McKibbin, W. J., & Fernando, R. (2020). The global macroeconomic impacts of COVID-19: Seven scenarios.

Morens, D. M., Folkers, G. K., & Fauci, A. S. (2009). What is a pandemic?.

Morse, S. S., Mazet, J. A., Woolhouse, M., Parrish, C. R., Carroll, D., Karesh, W. B., ... & Daszak, P. (2012). Prediction and prevention of the next pandemic zoonosis. *The Lancet*, *380*(9857), 1956-1965.

Niederhoffer, V. (1971). The analysis of world events and stock prices. *The Journal of Business*, *44*(2), 193-219.

OECD (2017), Enhancing the contributions of SMEs in a global and digitalized economy, Meeting of the OECD Council at the Ministerial Level, Paris [retrieved at: https://www.oecd.org/industry/C-MIN-2017-8-EN.pdf].

OECD (2020), Health spending (indicator). (Accessed on 25 November 2020).

Orlik, Rush, Cousin, & Hong. (2020). Coronavirus Could Cost the Global Economy $2.7 Trillion. Here's How. Retrieved December 22, 2020, from https://www.bloomberg.com/graphics/2020-coronavirus- pandemic-global-economic-risk/

Petersen, E., Koopmans, M., Go, U., Hamer, D. H., Petrosillo, N., Castelli, F., ... & Simonsen, L. (2020). Comparing SARS-CoV-2 with SARS-CoV and influenza pandemics. *The Lancet infectious diseases*.

Ravelo, J., & Jerving, S. (2020). COVID-19—a timeline of the coronavirus outbreak. *DevEx https://www. devex. com/news/covid-19-a-timeline-of-the-coronavirus-outbreak-96396. Accessed*, *1*.

Siu, A., & Wong, Y. R. (2004). Economic impact of SARS: the case of Hong Kong. *Asian Economic Papers*, *3*(1), 62-83.

Sohrabi, C., Alsafi, Z., O'Neill, N., Khan, M., Kerwan, A., Al-Jabir, A., ... & Agha, R. (2020). World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *International Journal of Surgery, 76*, 71-76.

Tatem, A. J., Rogers, D. J., & Hay, S. I. (2006). Global transport networks and infectious disease spread. *Advances in parasitology*, *62*, 293-343.

Trilla, A., Trilla, G., & Daer, C. (2008). The 1918 "Spanish flu" in Spain. *Clinical infectious diseases*, *47*(5), 668-673.

Unger, J. P. (2020). Comparison of COVID-19 Health Risks With Other Viral Occupational Hazards. *International Journal of Health Services*, 0020731420946590.

Verikios, G., Sullivan, M., Stojanovski, P., Giesecke, J., & Woo, G. (2016). Assessing regional risks from pandemic influenza: a scenario analysis. *The World Economy*, *39*(8), 1225-1255.

Wu, D. D., & Olson, D. L. Pandemic Risk Management in Operations and Finance.

Wu, T., Perrings, C., Kinzig, A., Collins, J. P., Minteer, B. A., & Daszak, P. (2017). Economic growth, urbanization, globalization, and the risks of emerging infectious diseases in China: a review. *Ambio*, *46*(1), 18-29.

Yip, C. W., Hon, C. C., Shi, M., Lam, T. T. Y., Chow, K. Y. C., Zeng, F., & Leung, F. C. C. (2009). Phylogenetic perspectives on the epidemiology and origins of SARS and SARS-like coronaviruses. *Infection, Genetics and Evolution*, *9*(6), 1185-1196.

Appendix

Appendix A

List of first stringent COVID-19 related event per country

Note: The *Economy* column presents the country from which an index is used. The *Event Date* shows the first trading day after the event that a government first imposed stringent measures. If measures were announced or taken on a non-trading day, the event date will be the first trading day after. *Type of Measure* briefly presents the contents of the measure or announcement.

Economy	Event Date	Type of Measure
Argentina	Mar 16th	• Closure of businesses, public services and schools
Australia	Mar 16th	• State of emergency declared in Victoria.
Belgium	Mar 12th	• Announcement of closure of schools and non-essential businesses.
Brazil	Mar 16th	• Santa Catarino closed essential businesses. • Borders with Venezuela closed.
Canada	Mar 16th	• Ontario declares state of emergency and schools across the country decide to close.
Chile	Mar 16th	• Borders closed for 14 days.
China	Jan 23rd	• First regions declare state of emergency.
Egypt	Mar 13th	• Announcement that schools and businesses will close
France	Mar 12th	• Announcement on the 12th that all schools, universities and non-essential businesses will close on the 16th.
Germany	Mar 11th	• Announcement that schools will close on the 16th.
Greece	Mar 11th	• Schools announced to close.
India	Mar 16th	• Country wide closure of schools and universities.
Indonesia	Mar 18th	• Borders permanently close for visitors from Iran, Italy, Spain, France, UK and Germany.
Ireland	Mar 13th	• Schools closure until 29th of March.
Italy	Mar 10th	• Lockdown of Lombardy and other northern regions started.
Japan	Feb 27th	• School closures announced starting 2nd of March until early April.
Mexico	Mar 17th	• Just before the weekend (14th), government announced schools would close on the 20th.
Morocco	Mar 16th	• Country-wide school closure announced in the evening of the 13th. • Closed air and sea borders from certain countries including Spain.
Netherlands	Mar 16th	• Closure of schools until April 6th. • Bars, cafes, restaurants, gyms, sex clubs and coffeeshops closed.
New Zealand	Mar 12th	• Complete border closure to announced
Poland	Mar 12th	• School closures until March 25th • State of emergency declared
Russia	Mar 16th	• All flights into Russia suspended, apart from citizens. • Borders closed to all foreigners until May.
South-Africa	Mar 16th	• South-Africa prime minister declares national state of disaster on the 15th. • Country-wide school closure and travel restrictions announced.
Sweden	Mar 17th	• National recommendation to close high schools and universities

Switzerland	Mar 11th	• Closure of all borders and roads to and from Italy.
South-Korea	Mar 17th	• Schools delay start of spring semester
Spain	Mar 10th	• Closure of schools. • Cancellation of travel from and to Italy.
Turkey	Mar 13th	• Closure of schools, restaurants, bars, nightclubs. • Flights banned to and from most European and Asian countries.
United Kingdom	Mar 20th	• School closure announced.
United States	Mar 12th	• President Trump declares national emergency.

Source: ACAPS (Assessment Capacities Project); WHO; World Bank.

Appendix B

Volatility differences February - March

Note: **Appendix B** shows the volatility of each country specific index during critical months of COVID-19. The *Change* column presents the difference in volatility between *February* and *March*.

Country	St. D	St. $D_{February}$	St. D_{March}	Change
Argentina	3.834	1.834	6.178	+4.344
Australia	1.452	1.125	4.642	+3.517
Belgium	1.552	1.423	4.978	+3.555
Brazil	2.326	1.932	7.366	+5.434
Canada	1.671	0.850	5.856	+4.006
Chile	1.614	0.930	5.093	+4.163
China	1.288	2.210	1.913	-.297
Egypt	1.667	0.762	4.374	+3.612
Greece	2.127	2.101	6.605	+4.504
France	1.550	1.393	4.734	+3.341
Germany	1.549	1.442	4.575	+3.133
India	1.593	1.232	4.781	+3.549
Indonesia	1.280	0.934	3.845	+2.911
Ireland	1.538	1.516	4.673	+3.157
Italy	1.745	1.880	5.215	+3.335
Japan	1.310	1.259	3.466	+2.207
Mexico	1.183	1.149	3.029	+1.880
Morocco	1.067	0.886	3.290	+2.404
Netherlands	1.371	1.665	4.149	+2.484
New Zealand	1.552	1.498	5.862	+4.364
Poland	2.127	1.534	4.752	+3.218
Russia	1.319	1.237	3.983	+2.746
South-Africa	1.541	1.686	4.645	+2.959
South-Korea	1.438	1.488	4.348	+2.860
Spain	1.540	1.639	4.740	+3.101
Sweden	1.367	1.530	4.048	+2.518
Switzerland	1.153	1.284	3.662	+2.378
Turkey	1.569	1.663	3.337	+1.674
United Kingdom	1.383	1.305	4.226	+2.921
United States	1.742	1.520	5.665	+4.145
MSCI All-share	1.375	1.563	4.428	+2.865

Appendix C

Average abnormal returns "first stringent measure"
Developed vs. Emerging economies (-1,1)

Note: The column *Country (Dev.)* and *Country (Em.)* presents the developed and emerging country, respectively, from which the index returns are used. *AAR (-1,1)* provides the Average Abnormal Returns for that specific country on the event date that is further explained in **Appendix A**, and one day before and after. The significance is indicated with an asterisk and is computed with a t-score test.***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Event 1					
Country (Dev.)	**AAR (-1,1)**		**Country (Em.)**	**AAR (-1,1)**	
Australia	0.14		Argentina	-2.78	
Belgium	-0.89	*	Brazil	-1.68	**
Canada	-3.00	***	Chile	-3.65	***
France	-0.84	*	China	-3.47	***
Germany	-0.85	*	Egypt	-2.86	***
Ireland	-1.40	**	Greece	-0.79	
Italy	-1.79	***	India	-2.17	***
Japan	-1.18	*	Indonesia	-4.24	***
Netherlands	-1.09	***	Mexico	-1.67	**
New Zealand	-4.00	***	Morocco	-4.16	***
Spain	-1.50	***	Poland	-2.62	***
Sweden	2.88		Russia	-0.91	*
Switzerland	-0.80	**	South-Africa	-1.65	**
United Kingdom	0.92		South-Korea	-1.85	**
United States	1.43		Turkey	-2.04	*
Average	-0.80		Average	-2.44	

Appendix D

Abnormal returns per day

Note: The country column presents the index taken from that particular country. The exact indices can be found in **Table 2**. The *days* represent a point in time relative to the event date (first stringent measure announcement). The percentages are the abnormal returns calculated using the Market Model per day of the event window. Both event windows (-2,2) and (-1,1) are therefore included.

Country	Day -2	Day -1	Day 0	Day 1	Day 2
Argentina	-5.90%	-5.49%	5.83%	-8.66%	6.37%
Australia	-5.50%	5.07%	-7.97%	3.32%	-5.55%
Belgium	2.32%	-4.39%	-4.42%	3.52%	-10.92%
Brazil	-6.38%	2.05%	-6.73%	9.71%	-7.29%
Canada	2.03%	-4.81%	0.67%	-4.84%	6.71%
Chile	-8.58%	-1.12%	-8.03%	-1.79%	-1.05%
China	0.36%	-7.96%	-2.62%	0.18%	-1.18%
Egypt	-5.20%	-10.70%	2.61%	-0.48%	-6.28%
Greece	-1.05%	-4.56%	-1.86%	4.05%	-8.92%
France	4.12%	-3.87%	-2.00%	3.37%	-4.45%
Germany	-5.00%	-1.81%	3.64%	-4.38%	-0.20%
India	-4.17%	-3.63%	-5.36%	2.49%	-5.48%
Indonesia	2.56%	-5.26%	-1.71%	-5.75%	-2.41%
Ireland	-3.69%	1.14%	-4.83%	-0.50%	1.28%
Italy	-6.49%	4.32%	-6.26%	-3.42%	-1.26%
Japan	-0.78%	-2.72%	-0.32%	-0.51%	-2.09%
Mexico	-1.24%	-0.48%	-5.31%	0.77%	0.57%
Morocco	-2.93%	-3.43%	-8.05%	-1.01%	-5.90%
Netherlands	5.09%	-4.91%	-1.59%	3.23%	-3.67%
New Zealand	-8.10%	2.84%	-9.30%	-5.54%	0.26%
Poland	5.73%	0.42%	-5.46%	-2.82%	-3.74%
Russia	-2.81%	-3.51%	1.94%	-1.15%	-4.04%
South-Africa	-3.62%	0.56%	-1.75%	-3.77%	-3.37%
South-Korea	-7.64%	-2.35%	-4.47%	1.26%	-5.38%
Spain	-5.80%	2.85%	-5.53%	-1.82%	-1.74%
Sweden	2.91%	2.79%	-0.44%	6.27%	-3.81%
Switzerland	-3.03%	-2.25%	2.02%	-2.17%	-0.22%
Turkey	-3.22%	-3.17%	-0.82%	-2.15%	1.83%
United Kingdom	2.10%	-1.03%	3.60%	0.19%	-0.09%
United States	-1.11%	3.01%	1.81%	-0.55%	1.72%

Appendix E1

Pearson Correlation Matrix of regression (1)

Note: **Appendix E1** shows the Pearson Correlation Matrix for the coefficients used to assess hypothesis **(2)** during the event window (-2,2). Due to large and significant correlation, variables 'HDI and GrAtRisk' are omitted. The remaining variables are used in a multivariate regression analysis, which are presented in **Table 7**. Further description of the variables can be found in **Table 4**. The asterisk indicates a significant correlation between the two variables at the level of 5%.

	CAR	HospBeds	LifeExp	String	CasesTot	DeathsT	HealthExp	HDI	GrAtRisk
CAR	1.000								
HospitalBeds	-0.0337	1.000							
LifeExp	0.0707	0.3691*	1.000						
Stringency	-0.1138	0.1674*	0.1075	1.000					
CasesTotal	-0.0056	0.2424*	0.4429*	0.4048*	1.000				
DeathsTotal	0.0287	0.0058	0.2504*	0.5110*	0.7200*	1.000			
HealthExp	0.3129*	0.2224*	0.5563*	-0.0501	0.2211*	0.0767	1.000		
HDI	0.2266*	0.4149*	0.8601*	0.0268	0.3985*	0.1684*	0.7364*	1.000	
GrAtRisk	0.1786*	0.5398*	0.8151*	0.1704*	0.4094*	0.3181*	0.6465*	0.8357*	1.000

Appendix E2

Regression results of CARs on public health variables (-1,1)

Note: This table shows the regression results of two models to test the third hypothesis. The event window is (-1,1) where day zero is the trading day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. *LifeExp* presents the life expectancy in years, *StringencyIndex* is an index to measure the stringency of measures, $Deaths_{total}$ is the total reported death count, *HealthExpenditures* is a countries' health expenditures as a percentage of GDP, $Cases_{total}$ is the total reported case count and *HospitalBeds* is the number of hospital beds per 1.000. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR	(2) CAR
LifeExpectancy	-.0007	-.00004
	(.0019)	(.0015)
StringencyIndex	-.0011***	-.0012***
	(.0003)	(.0003)
$Deaths_{total}$	.0011	.0040
	(.0040)	(.0044)
HealthExp	.0043**	.0044**
	(.0020)	(.0020)
$Cases_{total}$	-.00018	
	(.0002)	
HospitalBeds	-.0012	
	(.0021)	
Constant	.0309	-.0192
	(.1367)	(.1115)
Observations	540	360
R^2	.17	.14
F-Statistic	5.263	7

Appendix F1

Pearson Correlation Matrix of regression (2)

Note: **Appendix F1** shows the Pearson Correlation Matrix for the coefficients used to assess hypothesis **(3)** during the event window (-2,2). No variables have been omitted. The variables are used in a multivariate regression analysis, which are presented in **Table 8**. Further description of the variables can be found in **Table 4**. The asterisk indicates a significant correlation between the two variables at the level of 5%.

	CAR	CurrAccBal	Tourism	FDI
CAR	1.000			
CurrAccBal	0.1107	1.000		
Tourism	-0.2540*	-0.2538*	1.000	
FDI	0.0356	0.2707*	0.1880*	1.000
Trade	-0.0673	-0.0039	-0.2163*	-0.7200*

Appendix F2

Regression results of CARs on external dependency variables (-1,1)

Note: This table shows the regression results of three models to test the fourth hypothesis. The event window is (-1,1) where day zero is the trading day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. *Tourism* presents tourism revenue as a percentage of GDP, *Trade* the overall trade measured as a percentage of GDP, *FDI* the foreign direct investment inflows measured as percentage of GDP and *CurrAccBal* presents the current account balance as a percentage of GDP. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR	(2) CAR	(3) CAR
Tourism	-.0821	-.0700	-.1054
	(.1333)	(.1282)	(.1207)
Trade	.0142	.0027	-.0185
	(.0216)	(.0127)	(.0218)
CurrAccBal	.1225	.1711	
	(.1489)	(.1286)	
FDI	.2391		-.3421
	(.3684)		(.3250)
Constant	-.0329	-.0227	-.0351
	(.0215)	(.0213)	(.0229)
Observations	360	270	270
R^2	0.054	.045	0.044
F-Statistic	.99	1.273	.57

Appendix G1

Pearson Correlation Matrix of regression 3

Note: **Appendix G1** shows the Pearson Correlation Matrix for the coefficients used to assess hypothesis **(4)** during the event window (-2,2). No variables have been omitted. The variables are used in a multivariate regression analysis, which are presented in **Table 9**. $GDP_{percapita}$ presents the amount of money per person measured in dollars, GDP_{growth} is the economic output growth of an economy as a percentage, *GovDebt* the amount debt a government has as a percentage of its GDP, *CCI* presents the consumer confidence index, *BCI* the business confidence index, *Unemployment* the number of unemployed people as a percentage of the working force, $Density_{population}$ the density of a country measured in km^2 and *GoogleTrends* presents an index to measure public interest of the word 'coronavirus' on google. Further description of the variables can be found in **Table 4**. The asterisk indicates a significant correlation between the two variables at the level of 5%.

	CAR	GDPpc	GDPgr	GovDebt	CCI	BCI	Unempl~t	Densit~p	GoogleT
CAR	1.000								
GDPpc	0.2596*	1.000							
GDPgrowth	-0.2442*	-0.0798	1.000						
GovDebt	0.0475	0.0234	-0.1641*	1.000					
CCI	0.0035	-0.0448	0.6260*	0.0020	1.000				
BCI	-0.0261	0.3599*	-0.3542*	0.3749*	0.0070	1.000			
Unemployment	-0.0729	-0.3965*	-0.2241*	0.1569*	-0.1457	0.0467	1.000		
DensityPop	-0.1431	0.1295	-0.1128	0.1520*	-0.0605	-0.0698	-0.3166*	1.000	
GoogleTrends	-0.2735*	0.0780	-0.0863	-0.1193	0.1962*	-0.0360	0.1137	-0.1185	1.000

Appendix G2

Regression results of CARs on country-specific characteristics (-1,1)

Note: This table shows the regression results of three models to test the fifth hypothesis. The event window is (-1,1) where day zero is the trading day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. $GDP_{percapita}$ presents the amount of money per person measured in dollars, GDP_{growth} is the economic output growth of an economy as a percentage, *GovDebt* the amount debt a government has as a percentage of its GDP, *CCI* presents the consumer confidence index, *BCI* the business confidence index, *Unemployment* the number of unemployed people as a percentage of the working force, $Density_{population}$ the density of a country measured in km^2 and *GoogleTrends* presents an index to measure public interest of the word 'coronavirus' on google. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR	(2) CAR	(3) CAR
BCI	.0019	.0024	.0029
	(.0041)	(.0036)	(.0036)
GoogleTrends	-.0011***	-.0011***	-.0011***
	(.0002)	(.0002)	(.0002)
GDPpc	6.36e-07*	5.48e-07	5.46e-07
	(3.57e-07)	(3.45e-7)	(3.68e-07)
CCI	.0072	.0064	.0064*
	(.0060)	(.0039)	(.0035)
GDP_{growth}	-.0075*	-.0085*	-.0087**
	(.0043)	(.0046)	(.0044)
GovDebt	.0000	.0000	
	(.0001)	(.0002)	
DensityPop	-.00002	-3.13e-06	
	(.00005)	(.0000)	
Unemployment	.0010		
	(.0013)		
Population	-6.50e-12		
	(3.87e-11)		
Constant	-.8556*	-.8178*	-.8736**
	(.4569)	(.4647)	(.3804)
Observations	789	609	429
R^2	.195	.190	.189
F-Statistic	N/A	5.807	7.514

Appendix H1

Pearson Correlation Matrix of regression 4

Note: **Appendix H1** shows the Pearson Correlation Matrix for the coefficients used to assess hypothesis **(5)** during the event window (-2,2). No variables have been omitted. The variables are used in a multivariate regression analysis, which are presented in **Table 10**. Further description of the variables can be found in **Table 4**. The asterisk indicates a significant correlation between the two variables at the level of 5%.

	CAR	CapToAsset	ClaimsOnGov	CurrAccBal	CredToPriv
CAR_	1.000				
CapToAssets	0.0046	1.000			
ClaimsOnGov	0.0688	-0.0802	1.000		
CurrAccBal	0.1107	-0.4634	-0.0510	1.000	
CredToPriv	0.0744	-0.5645*	-0.0680	0.4564	1.000

Appendix H2

Regression results of CARs on financial health variables (-1,1)

Note: This table shows the regression results of one model to test the sixth hypothesis. The event window is (-1,1) where day zero is the trading day of the announcement of the first stringent measures of a government. If that day is not a trading day, the first trading day will be used as day zero. The column *Explanatory Variables* presents the independent variables of the regression. *CapToAssets* is a ratio of liquidity for banks, *GovDebt* is the debt of a government measured relatively to GDP, *ClaimsOnGov* is a ratio measuring the debt of a government to commercial institutions measured as a percentage of GDP and *CredToPriv* refers to the proportion of GDP banks are owed by the private sector. The dependent variable is the Cumulative Abnormal Return (*CAR*). The robust standard-errors are reported between parentheses. ***, ** and * indicate significance levels of 1%, 5% and 10%, respectively.

Explanatory variables	(1) CAR
CapToAssets	-.0024
	(.0031)
GovDebt	.0003
	(.0001)
ClaimsOnGov	-.0005
	(.0006)
CredToPriv	.0002
	(.0001)
Constant	-.0305
	(.0443)
Observations	339
R^2	.132
F-Statistic	3.065