THE IMPACT OF COVID-19 RELATED RESTRICTIONS ON RETURNS FINANTIAL STOCK MARKET INDICES

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

MA in Business and Financial Economics

Kyiv School of Economics

2020

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CHAPTER 1. INTRODUCTION

The year 2020 came out to be extremely unpredictable and eventful. Nevertheless, we do need to take into account the economic-related forecasts from the year 2019 as lots of major and valuable events happened back there and the consequences are still occurring: US presidential elections anticipation, China and US trade war and Brexit. Considering those, the IMF forecasted moderate global economy growth of around 3.4%.

However, the outbreak of coronavirus (COVID-19) that has turned out into pandemic, started in December 2019 in the city of Wuhan, China, put the world into the state it has never been plunged before. On April 25, 2020, the virus has already affected more than 5 500 000 people in almost all countries, having killed over 340 000 thousand. Starting from January 22, 2020, The World Health Organization (WHO) started monitoring this situation and presented daily reports about cases of newly infected, dead and recovered. The pandemic has invoked significant concerns about public security and health all over the world.

Some experts were afraid of pandemic causing significant damage to the economy globally even at the start of January. Moreover, considering the fact that all the events used to be consistently brought up by media with shocking and frightening headlines and information that not always passes verification stage. Hence, the market had to react representing the attitude of the masses

The statistics of the spread of the disease as at 25th of May in countries we consider in this study is reported in the table below. We can observe that USA is the absolute leader among the countries in terms of population affected.

Table 1: COVID-19 statistics (as at 25th May 2020)

Countries	Newly infected	Deaths	Recovered
Global	5 495 061	346 232	2 231 738
USA	1 662 302	98 220	379 157
United Kingdom	252 379	37 237	-
China	84 102	4 638	79 352
Japan	16 581	830	13 612
Italy	230 158	32 877	141 981
Spain	235 400	26 834	150 376
Germany	180 600	8 309	161 199
South Africa	23 615	481	11 917

The large-scaled spread has shortly become disastrous to the economy globally, causing severe impairment to the supply chain and production itself. The measures to stop the spread of the virus have deprived the economic activity all over the world. Attempts to lower the actual transmission rate of the disease and to help the healthcare systems sustaining liabilities, nearly all the governments have applied a range of public healthcare measures such as school and factory closures, international travel restrictions, and countrywide lockdowns. The imposed quarantine and corresponding measures that are believed to be necessary have brought about an economic slump that globally affected both production and supply but also international trade, flows of FDI, international tourism, travels and of course, international financial markets. Such an impact that hesitates the economy is not only destructive but also causes high-level uncertainty. As a result, high-quality estimation of growth expectation that is usually done by businesses, policymakers and market participants appears to be hardened or even impossible.

Among the most affected countries we see the world's largest and most progressive economies (G7 and China). The consequences for the economy may consist of diverse impacts depending on certain factors which include the straightforward impact of quarantine measures, the extent of intensity at which the direct economic effects amplify and persist and the required actual duration of the lockdown measures. Three transmission measures can be distinguished for their effect on the global economy. Firstly, travel restrictions imposed at the regional as well as national levels will shorten the flow of goods and services both within countries and across their borders. Secondly, the uncertainty that takes place will transmit into lower households and small businesses spending. Thirdly, such acute declines in the global stock markets, will hurt the real economy if preserved for some time. Further, markets' immersions cause fear and uncertainty, reducing household wealth, and as a result significantly decreasing consumer spending.

Main interest of this paper is to determine the effect the outbreak has on financial stock markets. It is somewhat surprising that previously in the history of stock market reactions to epidemics, the markets had shown relative stability (Kleintop, 2020). Consequently, understanding whether this time the stock market would stay relatively steadfast was the problem that was making investors and policy makers extremely puzzled. Hence, having a better overview now, we try to estimate the effect of the measures implemented by governments on the stock markets to see what kind of return on stock indices values is present to then be able to do a forecast based on government measures-related decisions.

The structure of this paper is as follows: Chapter 2 describes the literature used to study the phenomenon of the outbreak and its effect on economy ; Chapter 3 provides the methodology and model specification; Chapter 4 presents data sources and descriptive statistics of the variables; Chapter 5 is devoted to empirical results and corresponding discussion; Chapter 6 generalizes all findings and provides a brief discussion of possible implementations.

CHAPTER 2. LITERATURE REVIEW

This section is devoted to the review of the articles that are helpful for deep understanding of the matter and needed to construct the proper estimation model. It discusses both theoretical and empirical studies.

2.1 Theoretical part

There were several researchers studying the subject (Mackinlay, Dolley, Famaet al. , etc.). They believed that the event study method reflects how in case of an efficient hypothesis being valid, the influence that the particular effect may have will reflect the change of returns in stock market indices and explain this effect. Consequently, this method is known to be frequently used in economics studies as well as finance empirical studies in order to identify the effect of specific events.

Study of Wang et al. took a deeper look into the impact of infectious outbreak on the performance of stocks in biotechnology industry showing the anomalous returns because of statuory diseases

The theory that is widely used by researchers analyzing the effect of the COVID-19 outbreak and related measures usually include references to the framework of The Black Swan Theory. Originally, it was developed by N. Talib (2001,2007). The name of the phenomenon is self-descriptive implying something extremely rare to happen. Particularly, the theory describes the occasion when an unexpected, believed to never happen situation takes place and results in drastic changes to the economy. The theory definitely fits the recent outbreak effect and it should be considered. As the entire global community was overwhelmed given the unique nature of the massive quarantine, economic experts support the idea of diversification of the investment portfolio to

cushion the Black Swan effect. It serves the reason for the popularity of diversification in the period of the spread of the virus.

2.2 Empirical part

There is plenty of literature that investigates recessions by Jagannathan et al (2013); Bentolila et al, (2018), Stiglitz (2010); Mian and Sufi (2010), however the cause of the current 2020 global recession seem to be novel for modern history. Recent outbreak has brought about a new recession type that is different in terms of its trigger. For instance, the cause for Asian debt crisis in 1997 was the Thai baht collapse which generated panic and started a region-wide financial crisis shortly later followed by economic recession in Asia by Radelet and Sachs (1998). Considering the 2008 global financial crisis and its transition into a recession, the cause could be put as loose monetary policy which led to creation of a bubble that was followed by subprime mortgages which in addition to fragile regulatory structures in the sector of banking led to the disaster studied by Allen and Carletti (2010). Above mentioned works as well as some others are impactful for our study by suggesting that the economists' expectations were likely biased towards rather soft passing of the outbreak.

The literature on the impact of COVID-19 related measures on the economy is growing rapidly as it is the most recent phenomenon with such a significant influence. An example of analysis of the economic impact from influenza can be found in the paper of Schoenbaum (1987) which shows that a massive-scale epidemic may result in an economic loss. Additionally, the study of M.Meltzer and N.Cox (1999) looks deeper into the potential macroeconomic deviations caused by the influenza pandemic that took place in the USA and evaluates several interventions that relate to vaccines. Findings in the paper state that a couple hundred thousand deaths cause a loss of around $150 billion

and it is valuable for its contribution to understanding how crises may impact the economy and corresponding policies' responses to those.

As the pandemic is in process of development and the aftermath is not yet available, research on the topic of impact on economics is yet at an early stage and comes to be still emerging. A study conducted by R. Baldwin and B. Mauro (2020) considers the effect on general macroeconomy and list of factors as trade, finance, supply chain, travel, banking, etc. Additionally, IMF, World Bank, OECD and BIS have many works aimed to simulate the outcome based on the previous experience and real-time data. Research work of Beck (2020) covers finance and banking risks occurred due to pandemic and the findings suggest that there exists three main factors that those risks depend on: the degree of economic effects globally, fiscal and monetary responses to the shocks and regulatory responses addressing possible bank fragility. These findings come to be very useful for our study suggesting the variable list to analyze the issue.

An impactful article for understanding the adverse shock of the pandemic to the growth rates and productivity is written by L. Fornaro and M. Wolf (2020). The authors consider standard New Keynesian model with representative-agent economy having endogenous technological change and sluggish traps. The value added includes analysis of the supply shocks due to lockdowns and other social distancing measures. Different forms of fiscal policy effects in the calibrated New Keynesian model was the scope of a study of F. Castro (2020). Implications and conclusions of the studies are of high interest for our research.

Finally, coming close to the topic of our study, R. Baldwin and E. Tomiura (2020) have conducted a research trying to find direct effect to the flow of labor and businesses. From the results it is clear that the output of goods and services has rubbed through sharp reduction. Work of N. Gormsen et al. (2020) further studies the stock price and

future dividend replies to the epidemic. Authors use it to back outgrowth expectations of a potential recession. These findings help us get an overview of the reactions present on the financial markets and get an idea of the cause chain.

Another economic paper that intends to study how the stock market was affected by covid-19 is a study by Phan and Narayan in 2020. The economists analyze top 25 countries that had been impacted by the global pandemic (number of cases and death related to the covid-19) and use daily time-series data on 25 states stock returns to reveal any patterns in policy responses and stock exchange reaction. While analyzing the data, authors found an important insight: the data signaled possible overreaction of the market at the early stages of the virus spread. However, even when countries reached more than 100,000 cases, the feedback of 50 % of the market was positive, showing possible market correction. (Phan and Narayan, 2020).

Some economists analyze not only the impact of covid-19 on the financial performance of the stock exchange, but also the impact of the previous pandemics on the market that took place in 1918–1919, 1957–1958, and 1968 (Baker, et al. 2020). The results of the paper suggest that state restrictions on the business activeness and voluntary social distancing are the key reasonings for the explanation of why the U.S. stock exchange performed worse when the covid-19 struck, compared to the previous pandemics.

The anecdotal evidence suggests that the number of infected cases and number of deaths related to the covid-19 has an adverse effect on stock market performance. The recent paper using panel testing to examine the relative performances of stocks in relation to COVID-19, reveals that both the daily growth in total confirmed cases and in total cases of death caused by COVID-19 have significant negative effects on market returns around all companies. (Al-Alwhadhi, et al, 2020)

CHAPTER 3. METHODOLOGY

In this section we discuss the approach to study the related topic and our findings regarding the best model to estimate and be able to expect the most unbiased coefficients given the data we could find.

The emergency of public health could spread the effect to the economy because the returns in the stock market appear to be the barometer for investors' expectations and faith in the economic prospects. The pandemic creates uncertainties worldwide, hence increasing stock investors' anticipation and creating pessimistic sentiments regarding future returns. Such an effect explains why the change in stock market prices seem to change. In order to study the factors affecting such change and account for the cumulative change on the market, we take specific returns of market indices for various countries experiencing large scaled impact of the spreading disease as our dependent variable.

Even though the magnitude or the duration of the pandemic remain highly uncertain, its effect on the economy and consequently on the stock markets, depend on the public health measures' success to minimize the spread and at the same time maintain economic activities on the acceptable level. The problem is to find the optimal balance in the measures stringency as well as help out industries and households to overcome the consequences with the lowest losses possible. In this regard, economies are trying to commit the proper policy measures to survive the effects and come back to normalcy. The measures are aimed to stimulate GDP-intensive sectors, change the policy rates in order to provide cash facility and liquidity to support small businesses. Therefore, the way governments decide to deal with the need to implement such policies indirectly affect stock markets but this effect is important to account for in the model.

Many studies prove the negative relationship of stock returns and interest rates. The reason is the fact that decrease of the interest rate normally leads to increase of capital flows into the stock market and expected rates of return while the opposite encourages more bank savings and lower flow to the stock market. Additionally, the pandemic shock creates an enormous pressure on the corporate cash reserves which causes the necessity to reevaluate the proper rate. Based on this, we consider adding interest rates into the model.

Another noticeable change effect comes from the travel restrictions imposed by countries. Inability to efficiently organize transportation or total cut off of the supplies lead to the situation when companies are left without the opportunity to produce the goods or deliver services they have to in order to stay profitable. The restrictions were imposed for a moderate amount of time and resulted in a substantial change of the performance of firms and large companies. Apart from this, the lockdown policy that originally aimed to restrict people from physical contact led to considerable drop in demand for some particular services as well as decreased general goods and services consumption. Such an effect is believed to be significant for the stock market prices and consequently, for the global indices.

Based on the reasoning of the above findings and methodology, we can assume the following hypotheses:

H0: The restrictions of internal movement and the restriction of international movements that were imposed by governments have significantly negative effect on continuously compounded returns of stock market indices.

Correspondingly, the alternative hypotheses have opposite statement that could be shown below:

H1: The restrictions of internal movement and the restriction of international movements that were imposed by governments have got positive effect or no effect on continuously compounded returns of stock market indices.

The model our research refers to is found in the study of M. Alawadhi (2020). It considers the effect of the outbreak of the Covid-19 on the stock market returns. This study researches the effect of a pandemic disease on stock market outcomes, especially COVID-19 spreading infectious disease on the stock market of the China - Shanghai Stock Exchange Composite Index and Hang Seng Index. To examine the influence of this outbreak on stock returns, they exploit a panel regression approach consist of two assessments, such as daily growth in total deaths caused by COVID-19 and daily growth in total confirmed cases. Commonly, for such study use classical event study technique, but in this case the peak of the event is not the opening date and this continue duration several days. The researchers as Hsiao(2014) and Baltagi(2008) claim that using panel data methodology decrease some econometric issues, serving as multicollinearity, estimation bias and determines the relationship across time between the dependent variable and independent ones. Consequently, for this analysis were apply panel approach to estimate

the response of returns of the indices in relation to Covid-19 outbreak, adding controlling variables that specify the different characteristics of firms.

They obtain the next model:

$$DR_{i,t} = \beta_0 + \beta_1 C19_{i,t-1} + \beta_2 X_{i,t-1} + \epsilon$$

$DR_{i,t}$ - return of stock i at day t, regressed on the lagged values of firm return predictors

$C19_{i,t-1}$ - either daily growth in total confirmed cases of deaths caused by Covid-19

$X_{i,t-1}$ - vector of a firm-specific characteristics, consist of the natural logarithm of daily market capitalization and daily market-to-book ratio.

Our model is similar in a way we try to account for both direct disease effects (number of infected) and estimate the effect obtained on returns. However, we take into account a wider range of variables which allows us to differentiate between different effects as well as observe the overall impact. We expect the effect to be determined better by the factors specified above and all together we come up with the model below:

Model specification:

$$Return_{i,t} = \beta_0 + \beta_1 Int\_restr_{i,t} + \beta_2 Ext\_rest_{i,t} + \beta_3 Inf_{\ i,t} + \beta_5 IR_{i,t} + \beta_6 Lock_{i,t} + \epsilon$$

Where,

$\text{Return}_{i,t}$ – returns of stock market indices, calculated as continuously compound parameter

$Int\_restr_{i,t}$ - restrictions of in-country movements

$Ext\_restr_{i,t}$ - restriction of international movement

$Inf_{i,t}$ – daily growth number of infected (confirmed cases)

$IR_{i,t}$ - interest rates

$Lock_{i,t}$ - days under lockdown

i – index by country

t – business day of the week

One of the criteria for validating data analysis is to check the data for the concept of stationarity. This concept is important because stationary processes are easier to analyze. Due to the presence of stationarity, it is possible to assume the absence of trends, seasonality and draw conclusions about cause-and-effect relationships. There are several verification options that make it possible to establish with a high probability that the batch is generated by a stationary process. These are visual, autocorrelation function graphs and parametric tests (unit root tests).

When determining which of the methods to use, then with the highest probability of a particular result, you must rely on the testing. There are such: Dickey-Fuller test, KPSS test, Zivota and Andrews test and others.

Therefore, in our study, we conducted the Dickey-Fuller test, since it is one of the most common in determining stationarity and obtained the following results:

Table 2. Results of Dickey-Fuller test

	Return	**Infect**
SSE composite	0.47	0.01
DAX	0.545	0.0465
IBEX35	0.758	0.204
Nikkei 225	0.493	0.01
FTSEMIB	0.674	0.345
SA40	0.396	0.99
FTSE_100	0.617	0.334
S&P_500	0.359	0.218

The ADF test is one-sided: the stationarity hypothesis is considered by default as an alternative hypothesis. As a null hypothesis, the presence of a unit root is considered, which means the presence of a non-stationary series. According to the test, we obtain a value that we compare with the critical (p-value = 0.01). If the value is equal to the significance equation 0.01, then this series can be considered stationary (the hypothesis of the presence of a single root). If the result of the test value is greater than the critical one, then there is no reason to reject the hypothesis of the presence of a unit root (the series can be considered non-stationary).

CHAPTER 4. DATA

Data for most of the used variables were collected from the source 'Oxford COVID-19 Government Response Tracker (OxCGRT) database'. This is a new database that assemble policies of governments regarding the outbreak. Our dependent variable data were collected from the website "Trading View".

Our sample period allows us to determine effect of "stay-at-home" policies on stock market performance during the outbreak of coronavirus. For analysis we use data from 1 January, 2020 to 25 May, 2020 in the following eight countries: United States of America, United Kingdom, China, Germany, Spain, Italy, Japan and South Africa.

We derive information of stock market returns from the leading stock market indicators in the 8 countries: S&P 500 (USA), FTSE 100 (UK), SSE-composite (China), DAX (Germany), IBEX 35 (Spain), FTSEMIB (Italy) , NIKKIE 225 (Japan) and SA 40 (South Africa).

Table 3: Definition of the used stock market indices

Abbreviation	Country	Definition
SSE compisite	China	Shanghai Composite Index
DAX	Germany	Deutsche Aktien Xchange (DAX) Performance Index
FTSE MIB	Italy	FTSE Milano Indice di Borsa (MIB) Index
Nikkie225	Japan	Nikkei 225 Index
IBEX 35	Spain	Literally Spanish Exchange Index
SA40	South Africa	South Africa 40 index
FTSE 100	United Kingdom	Financial Times Stock Exchange (FTSE) 100 Index
S&P 500	USA	S&P 500 Companies

In addition to describe our data, we can observe a short cart of definitions our exogenous control variables:

Table 4. Details on some used variables

Name	Measurement	Coding	Definition
Restriction of in-country movements	Ordinal	0 - no measure	Record restrictions of in-country movements between regions
		1 - recommendation to restrict travelling between cities and regions	
		2 - restrictions of internal movement	
Restriction of international movement	Ordinal	0 - no measure	Record restrictions of policy for external travels
		1 - monitoring arrivals	
		2 - apply quarantine for arrivals from regions	
		3 - prohibit arrivals and total closure of the border	
		4 - Total border closure	

Monitoring different measures that taken to keep the spread of the Covid-19 since March have broken many economic activities worldwide. Large-scale income losses and jobs, along with a solid degree of uncertainty regarding the economic outlook, have caused a significant drop in both business investment and consumer spending.

Common responses that were implemented by different governments over the world, cover countries that we consider include workplace and school closings, bans on

public gatherings, stay-at-home orders, travel restrictions, different income support, track location and other interventions to contain the spread of the virus.

This data provides a systematic measure across governments and across time to understand how government responses have evolved over the full period of the disease's spread. However various governments have adopted measures in substantially different ways in terms of speed of adoption and time having them in place. Analyzing these inputs help us to understand how governments responses progress over the full period of the pandemic's spread.

The indicators that describe below could be interpreted such as stringency mark, which accounts for the rigidity of the lockdown and policies to contain and restrict people's behavior.

With the value of returns of the indices being our dependent variable, we expect it to be dependent on :

1) restriction of internal movements, which has different levels of stringency: from (0)- no measure to (2) require closing
2) restriction of external movement, which also has different levels of stringency: from (0)- no measure to (4) Total border closure
3) number of infected that measures daily new confirmed Covid-19 diagnosed cases
4) monetary policy rates – as established interest rate by government
5) days under lockdown – measure as amount of days the population is under quarantine

The descriptive statistics and correlation table can be found below.

Table 5: Coefficient corellation table

	Return	Int_restr	Ext_restr	Inf	IR	Lock
Return	1.00					
Int_restr	-0.56	1.00				
Ext_restr	-0.50	0.57	1.00			
Inf	-0.17	0.39	0.26	1.00		
IR	0.25	-0.01	-0.06	-0.14	1.00	
Lock	-0.29	0.58	0.41	0.46	0.08	1.00

Based on the observed results of pairwise correlation we can conclude that our model potentially has low chances of presence of multicollinearity

Table 6: General statistics summary of variables

Variable	Obs	Mean	Std. Dev	Median	Min	Max
Return	761	-0.13	0.14	-0.1	-0.47	0.06
Int_restr	761	0.89	0.88	1	0	2
Ext_restr	761	1.82	1.56	2	0	4
Inf	761	2203	5855	53	0	48529
IR	761	1.31	2.13	0.27	-0.54	6.5
Lock	761	18.42	26.8	0	0	122

The table presents the summary statistics of the data used which includes such variables as: returns of stock market indices, restrictions of internal movements, restriction of international movement, interest rates, days under lockdown during all

analyzing period. Observing these results, we can notice that the maximum cumulative stock return during this period reaches 6%, as opposed to the minimum of -47%. The daily cumulative number of infected has the highest level at 48529 people.

Summarising key economic responses of governments worldwide, the key economic response is categorized as lower of interest rates. As we know, this policy introduced to support economic activity and help minimise the longer-term damage for economy. This means cheaper loans for business and households that reduced the costs faced by consumers, businesses and other players. Many central banks adopted expansionary monetary measures in order to use interest rate adjustments to stimulate the economy, as shown in table .

Table 7: Interest rates in the selected countries

Countries	As of January 1	As of February 1	As of March 1	As of April 1	As of May 1
USA	1.75	1.75	1.25	0.25	0.25
United Kingdom	0.75	0.75	0.75	0.1	0.1
China	4.15	4.05	4.05	4.05	3.85
Japan	-0.1	-0.1	-0.1	-0.1	-0.1
Italy	-0.383	-0.383	-0.424	-0.363	-0.273
Spain	0.43	0.42	0.27	0.52	0.82
Germany	-0.3	-0.31	-0.47	-0.54	-0.45
South Africa	6.5	6.25	6.25	5.25	4.25

As we can observe, in the United States the monetary rates started change from the end of January and have been declined during other next couple of months. As for the May 1, the value of interest rate of USA reached at 0.25%. With reference to this, we

detect that the reduction during all analyzing period was the biggest comparing to other countries.

In the most countries monetary response on economic consequences caused by pandemic started later. Aside from Covid-19 started disposed from China, accordingly this country had the first fallout and cut down of their interest rate on February.

Nevertheless, we also consider country, which has not any change in their monetary policy. This country is Japan. While the coronavirus outbreak is already disrupting global supply chains, slowing industrial activity and Japan is not an exception, central banks decided to use other monetary and financial tools to support economy and increase public spending. Just to be clear, the issue for most central banks with the negative interest rate comes to be the fact that they have few tools left for stimulation of the economies in the event of such major disruption.

In the period from 19 February to 24 March there were some considerable drops of stock market indexes. Corresponding graphs are shown the cumulative returns calculated based on continuously compound returns of these indices included in our study are below:

Figure 1. Returns of S&P 500 index in the period of outbreak, in percent

Had the lowest peak at 38%

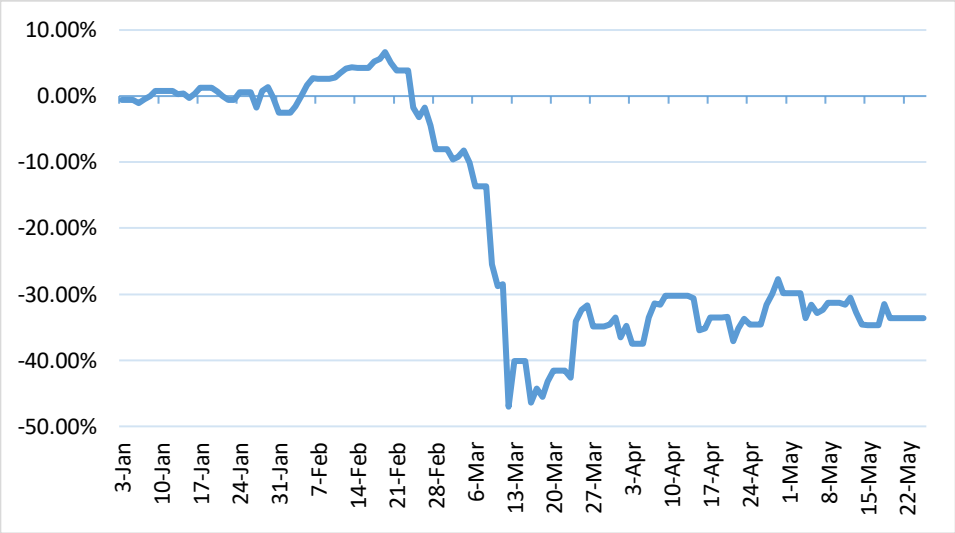

Figure 2. Returns of FTSE MIB index in the period of outbreak, in percent

Had the lowest peak at 47%

Figure 3. Returns of IBEX 35 index in the period of outbreak, in percents

Had the lowest peak at 46%

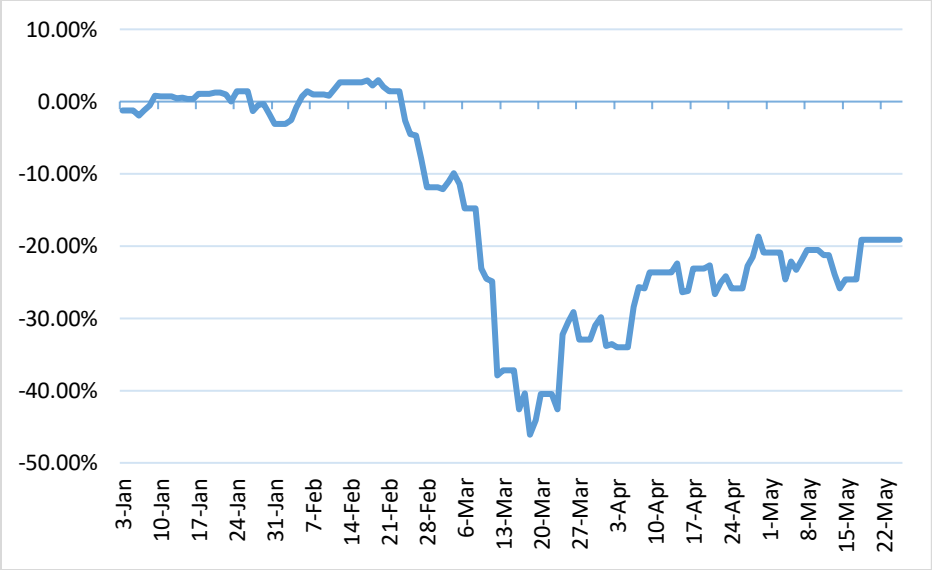

Figure 4. Returns of DAX index in the period of outbreak, in percents

Had the lowest peak at 46%

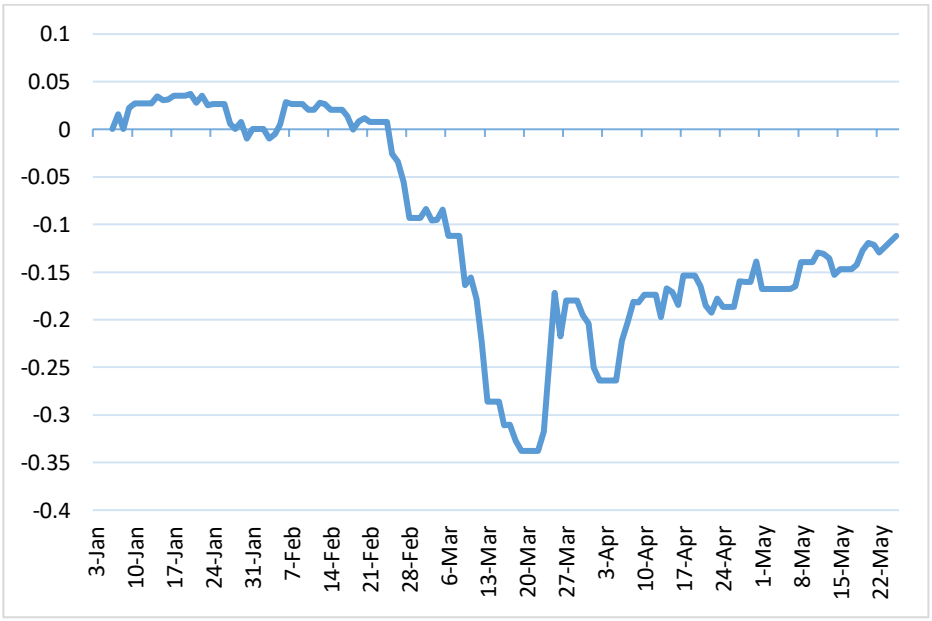

Figure 5. Returns of Nikkie 225 index in the period of outbreak, in percent

Had the lowest peak at 33%

Figure 6. Returns of FTSE 100 index in the period of outbreak, in percent

Had the lowest peak at 42%

CHAPTER 5. RESULTS

The results of the regression model are reported in Table 8.

Table 8: Results

Coefficients	Int_restr	Ext_restr	Infect	MP	Lock	R-squared
Total	-0.074***	-0.023***	0.0017*	0.015***	0.0003	**0.403**
SSE compisite	-0.014**	-0.011*	-0.005**	-0.156*	-0.0006*	**0.529**
DAX	0.119***	-0.141***	0.005	0.24*	0.003***	**0.899**
IBEX 35	-0.191***	-0.043***	0.005*	0.164 *	-0.0008	**0.953**
Nikkie225	-0.211***	0.019**	-0.07*	NA	0.001*	**0.776**
SA40	-0.057	-0.07**	0.155*	-0.084*	-0.003*	**0.509**
FTSE_100	0.039**	NA	-0.002	0.587***	0.002***	**0.873**
S&P_500	0.0006	-0.011*	0.002**	0.211***	0.003***	**0.876**
FTSE MIB	-0.04**	0.014*	-0.05***	1.257 ***	-0.006***	**0.887**
Significant codes:			0 (***)	0.001(**)	0.05(*)	
The variable "Infect" is in thousands						

The overall regression which includes all the indices suggests that even though restriction of in-country movements as well as restriction of international movement show negative statistically significant effect on returns of indices prices, monetary policy of interest rates changes and confirmed cases of Covid-19 generally show positive significant effect at 99.9% and 99% confidence levels correspondingly. As for restriction on internal movement, switching from no measures to "recommend closing" as well as transition to "require closing" is associated with the decrease in returns of indices prices by 7.4%. At the same time, international travel restrictions show 2.3% decreases returns of the prices per each transition "No measures" - "Screening" - "Quarantine arrivals from high-risk regions" - "Ban on high-risk regions" - " Total border closure". Both

restriction coefficients are highly statistically significant even at 99.9% confidence level. Considering monetary policy effect, it is observed that monetary measure tend to increase the value of returns, the coefficient are significant at 99.9% confidence level. The model suggests that each extra percentage point of interest rate affects returns of indices prices by increasing them by 1.5%. Disease related variables are significant at 95% level and suggest that raise of the infected by 1000 people increases the value by 0.17%

However, analyzing effects on each index separately, we observe much higher R squared as well as different coefficient signs and magnitudes of coefficients. In every regression except the Spain, South Africa and Italy returns on stock market indices, the value effect of lockdown days shows from 0.1 to 0.3 percent decrease for the extra lockdown day.

The most peculiar results are observed in the regression of SSE Composite in China. All the coefficients except monetary policy appear to be completely insignificant which suggests that most of the selected variables did not have any impact on the value of the stock index, so we may conclude that China stock market remained relatively more resistant to the pandemic. Such a result is somewhat expected as China is known for being well-prepared to infectious diseases.

DAX index is different from the overall model and most other ones by its sign of the international travel restriction coefficient. The coefficient is also the highest among negative ones and impies 14.1% decrease for each restriction amplification. Additionally, lockdown days have a negative effect of 0.3% per extra day which is similar to the other model results. This model shows the biggest amount of significant coefficients results comparing to others. Adding to it, the effect from monetary policy is statistically not different from zero that concludes that it doesn't affect the returns of index value.

As for IBEX 35, main differences can be seen for coefficient of internal movement restrictions. We observe a 19.1% decrease in the return of index for each

restriction expansion. Additionally, we observe negative effect of restriction of international movement by 4.3% on our dependent variable switching from one measure to other. At the same time, number of lockdown days is statistically not different from zero so for the given data we conclude it is not affecting on returns of index value. Disease related variable is significant at 95% level and inform that increase of the infected by 1000 people cause increase of the returns by 0.5%.

Considering Nikkie, we find another rather standing out sign for the internal movement being -21.1% per each restrictive measure implemented and this index has the biggest effect of this variable. Also a positive effect of lockdown days is present, suggesting each day to increase the value by around 0.1%. An increase of newly infected for 1000 people seems to be associated with 0.35% decrease on returns of index value. Also, Japan is the only country from the list that has no changes to the interest rate over the period of the outbreak so in the table, the value of coefficient is shown as 'NA'.

The index value of SA40 is one of the few that has no changes related to the change of restrictions in internal movement . At the same time, international travel restrictions have been decreasing the value of the index by 7% for each measure introduced. Also, South Africa is one of the few countries whose policy of decreasing the interest rate resulted in a decrease of the stock market indices by 0.8% for each percentage point. . An extra lockdown day seems to be associated with 0.3% decrease on returns. The coefficient of in-country movements impies 5.7% decrease for each restriction amplification.

Three coefficients of FTSE_100 are significant: internal movement restrictions, monetary policy rate and lockdown days. Two of them stay in the same pattern as most other countries and third – monetary policy – shows a rather distinguishing (the biggest) effect of the measure and raise of each extra percentage point of interest rate is associated with increase of the index return by 58.7%. Also, the UK has not introduced any restrictions on international travel and hence the corresponding coefficient is shown as

'NA' in the table. At the same time, the effect from confirmed cases is statistically not different from zero so for the given data we add up it does not have an influence on our dependent (endogenous) variable.

The value of USA stock market's famous index S&P 500 is the second after South Africa's that shows no change to restriction measures regarding internal travel. All other variables, such as: external travel, monetary measure, number of infected and number of lockdown days have statistically significant values at 95%(external travel) and 99% confidence level correspondingly.On the other hand, monetary policy effect is among the highest and shows a 21.1% returns of index value increase per each raise in the interest rate by 1 percentage point. An extra lockdown day seems to be associated with 0.3% increase in the index value.

Lastly, FTSE MIB index is the one of the two indices that shows all statistically significant coefficients. Three coefficients of this index are significant at 99.9% confidence level. There are: number of infected, monetary measure and lockdown days. Furthermore, restriction of in-country movements has been decreasing the value of the index by 4% from one level of measure to other.

Generally, we observe that models have different patterns and results vary from one index to another. As for the general pattern observed in the 8 separate coefficient models excluding the cumulative one, we can sum up by saying that internal and external travel restrictions do not have consistent effects appearing either significant and positive or significant and negative or insignificant at all. Consequently, this means that we cannot accept neither zero nor alternative hypotheses. Similar results are the case for the number of confirmed cases and lockdown days . The only set of variables that shows more or less consistent and significant effect consists of the monetary policy measure - it is almost everywhere the case that raise in the interest rate by 1 percentage point increase the returns of indices.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

The findings from our model come together to the point that most of the chosen factors have different signs and magnitudes based on the country and index to analyze. In most cases even though models show a high level of explanation of variation of the dependent variable (R squared), coefficients' values in them vary from one to another. Unfortunately, when analyzing the information taken, no explanatory variable showed consistency or constant effect. At this point, we may conclude that countries' stock market returns of indices have different reactions to policies but steady reactions to the virus spread.

The reason for such an outcome may be the difference of the measures magnitude, timings and concrete methods undertaken by countries. We could interpret such results in a way that stock market change is highly dependent on the decisions and reaction speed and quality of the countries' policymakers.

One interesting finding is the persistence of the index in China. Apparently, even considering that the spread began in this country and it started suffering first and had to go through the challenges and huge infectivity rates without having an overview on the virus like other countries did after the first encounter. Despite the fact that the policy variables in the model - internal restriction and restriction of international movement - have smaller magnitudes, it would be a mistake to consider the policies pursued by China as ineffective. The reason is likely to be connected to the fact that that index value has not even dropped drastically in the first place. It was not the ordinary measures like in other countries that stopped that from happening but rather the experience of the government and collective consciousness and awareness of dealing with the epidemic. This shows how important it is to be at least aware if not prepared to the possible pandemic or some similar occasions

Also, the target audience, namely investors who want to take into account the results of the analysis, should understand that although the impact of pandemic results and restrictions are reflected in the returns of indices values, and this is confirmed by our results, there are other factors that can play a significant role.

As the dynamics of the stock market is more due to how investors assess the variable reaction of other investors to different news than the news itself. It is quite appropriate to take into account and analyze the psychology of most market players (not always experienced enough).

As we understand, the index is the result of economic and financial activities of many companies that make up this index. In the situation with the coronavirus, its limitations and even the news that appear every day in large numbers, provoke investors to actively sell their assets, ie shares. But at the same time, the situation may be reversed. As stock markets may decline, as evidenced by the fall in index values, certain stocks should be purchased because they could provide great benefits in the future. At this stage, a very good option would be to consider markets where the number of new diseases and mortality is lower. Alternative solutions may also include considering and investing in a tool such as derivatives or a growing technology industry. Also in such a high-risk time, you can pay attention to the increased demand and development of the virtual money industry and cryptocurrency markets.

In drawing conclusions, it is very important to take into account all possible variables and try to analyze more deeply, as the consequences of the decision can both greatly enrich you and leave you with nothing.

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