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THE EFFECT OF FIRST COVID-19 DIAGNOSIS ON STOCK MARKET RETURNS

Bachelor's thesis
International Business Administration, specialization in Finance and Accounting

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Tallinn 2020

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ABSTRACT

This paper examines the impact of the first COVID-19 infection on stock market returns. A stock market return of each sample country is investigated five- and ten days after the first COVID-19 illness case is confirmed in the operating region. The aim is to find out was there any effect of the virus case diagnosed to the stock market return and if there were any indicators to explain the reaction. Based on Efficient Market theory stock markets react very rapidly to new information published and thus the hypothesis of a negative shift in the stock market closing price was established. Multiple regression analysis took place to evaluate the dependency of chosen economic variables. Results showed a relatively small decline in closing prices of stock markets in five and ten days after the first COVID-19 finding. Rank was the only significant variable to explain the stock market returns. It was found that region stock markets do not operate with full independency, which is why the global spreading of the virus and economy turbulence were the main triggers for any country's stock markets. To conclude, there is too much noise to make appropriate interpretations of the immediate effect of COVID-19 to region stock markets.

Keywords: COVID-19, stock market return, regression analysis

INTRODUCTION

COVID-19 pandemic has shaken the balance of the world during the first months of the year 2020. The actions of nations to slow down the spreading of the virus have had costs to businesses, health care systems, and to the social capital of humans. While the consumers are not purchasing goods and services as in normal circumstances, global economic turnover decreases and causes issues at individual and national levels.

The exponential increase in COVID-19 infections combined with an oil price war between Saudi Arabia and Russia has created historical shocks to stock markets around the world. One of the leading stock market indexes of the United States of America, Dow Jones Industry Average, dropped by 2,000 points on 9th of March, which is considered one of the greatest fluctuations ever experienced in one trading day (The News 2020). During the exceptional times it has been widely studied what the long-term consequences of the pandemic to the global economy may be.

The thesis will study the relationship between the COVID-19 outbreak and stock markets at the country level. It is unknown if the first diagnosed illness case had an impact on region stock markets returns and if there was any indicators to explain the possible change. The research questions are defined as following: What was the stock market return five and ten days after the first positive diagnosis of COVID-19 in a country was found? If there was a change in closing prices, what the direction of the change and the magnitude were. Furthermore, the research aims to find out which factors could explain the possible fluctuation in the stock market? The theory presented further on suggests that stock markets react rapidly to new information published and thus the shifts in closing prices are expected. Increased uncertainty about the future and a decrease in economic turnover estimate a negative shift in stock market closing prices. The movements in the stock market closing prices are studied with respect to five chosen economic indicators.

The topic is chosen because of the currency of the COVID-19 situation having a great impact to society globally. According to the information the author has been looking for there are no similar studies made yet. The pandemic of COVID-19 is one of its kind and there has not been similar event happened in modern time characterized in globalized economy. Due to the short period of existence COVID-19 outbreak, the focus of the study is on the first quartile of the year 2020. The study will provide in-depth information about the development of stock market return during the

unexpected circumstances. However, the subject is extremely timely and most likely to be studied already while this paper was under the process, which means the uniqueness of the study cannot be guaranteed.

The data analysis is based on stock market returns in 33 countries that declared a COVID-19 infection. The collection phase discovers the stock market return of each country at the date of diagnosis, as well as five and ten days later. The data is generated with five explanatory variables in order to cover possible differences in the reactions. To conduct a proper analysis and find relevant answers for the behavior of stock market returns, a multiple regression analysis is compiled.

The thesis is divided into three different chapters. The first chapter presents the theory of Efficient Markets, which is used to provide theoretical foundation for the hypothesis. Literature review denotes similar studies made, that have either used similar theory foundation or studied other global events in respect to economy and stock exchanges. The second chapter conducts the data collection phase, as well as the equation of regression analysis and the formulation of hypotheses. The third chapter presents empirical results and brings out the results of hypotheses testing, whether the predictions made are accepted or rejected. The chapter also discusses about the findings of the hypotheses testing. Lastly, the conclusion of the research is applied, as well as the list of references and the Appendix.

1. THEORETICAL OVERVIEW

A stock market index is a subset of stocks from a selected stock market or an industry. It collects the average value of selected stocks presenting the current mood of the market. By using indexes, traders are able to get an overview of prices, trading volumes, and volatilities (Fontanills 2001). By applying major indexes as benchmarks for other stock markets the relevant comparison among different stock exchanges can be established.

The relationship between a stock market index and the macroeconomy is notable. Factors linked to the movements of stock prices are usually related to the international or domestic economic, social or political events and market sentiments or expectations (Singh 2010). When the economy is experiencing growth, firms are anticipating gaining more value and makes shares of the company more attractive. If the stock market is expecting a recession, the scenario is upside down; share price will decrease, and the businesses do not have assets to invest. As a result, the economic growth will slow down.

In principle, different sectors of industries react differently to global events and news published. During the outbreak of COVID-19, telecommunications, and health care industry indexes have fluctuated less compared to transportation and energy industries (Ramelli and Wagner 2020) which implies the behavior of defensive and cyclical industry sectors. Industries with a position of constant demand regardless of the economic circumstances are more defensive for indirect global events, like pandemics. Once a single region stock market index presents the average value of the stock market, a certain event may not seem as radical as it is for an individual sector or business. This is a relevant point of view while evaluating the impact of an individual event in stock markets.

According to the theory of Efficient Markets, all kind of information released to publicity tends to move the stock prices of any markets. This paper proposes the Semi-Strong Form of Efficient Market theory as the foundation to predict the development of stock market returns during the pandemic. Furthermore, the model of Random walk is applied to widen the perspective of the theory.

1.1 Efficient Market Hypothesis

The theory of Efficient Markets created by Eugene Fama (1969) states the full reflection of stock market prices to all information provided for the economy. According to this hypothesis, for each individual it is possible to estimate shifts in stock market returns based on the information published. When the news are released into public, the information is incorporated rapidly to the standing stock market prices (Malkiel 2003). All information refers to any event or news which is directly or indirectly linked to the performance of an industry, business, or similar. The theory excludes the possibility of an individual investor to constantly beat the stock markets even if the full reflection of markets is present. Efficient Market Hypothesis is available for any financial instrument, but further on the stock market point of view is only referred.

The theory of Efficient Markets investigates the possibility of perfect and sufficient public information used in trading decisions. Fama (1969) claims the market being fully reflecting when:
1. There are no transaction costs
2. All information is available for everyone without expenses
3. Current circumstances and prices of each instrument are mutually agreed.

The failure of efficiency may take place while these statements are not met, leading to slow and insufficient use of information. The inefficiency gives an advantage for ones with private knowledge about stock prices and reforms stock prices as inefficient (Enowbi 2009). Still, the guidelines presented are not necessary when executing the market efficiency. They are only stated as a recommendation for more sufficient conclusion.

The hypothesis is constituted from three stages of information provided. The Weak Form of the Efficient Market Hypothesis describes the incorporation of information to stock price movements that have happened in history. The Form suggests that data about the prices from the past is the only relevant information to use while aiming for making profit in the markets. Technical tools or analysis cannot be used by the investor. The second form of the Efficient Market Hypothesis, The Semi-Strong Form, denotes the fully reflection of information received into stock prices, which enables a one to earn a profit (Shleifer 2000). This Form refers to all the news concerning business politics announced to the public, which may include information about the earnings and dividends of the company, for instance. In Semi-Strong Form there is no any predictions available to anyone since the data would not result any advantage for an individual. Finally, the Efficient Market Hypothesis suggests the Strong Form, in where the reflective information is partly public but also

share of information is for private users only. Among the investors, the last form is the most valuable while giving an advantage towards others. The problem with the Strong Form is the high chance of information leaking into publicity, which again reflects the prices excluding the given advantage. Efficient Market Hypothesis usually concentrates on the first two forms of efficiency since it is providing the most realistic way of predicting the stock market returns (Shleifer 2000).

1.2 Random walk theory

The Random walk model is an alternative way of analyzing the behavior of financial markets and it is often associated with Efficient Market Hypothesis. Burton G. Malkiel, the journalist of "A Random Walk Down Wall Street" (1973) suggests that prices of securities are independent of each other and it is impossible to fully predict themin advance. Malkiel estimates the nature of tomorrow's asset prices reflect only the news received today, which means that stock markets are not able to reflect information about similar events from the past. When the model holds, stock prices tend to move randomly and individually. For this reason, likewise with the Weak Form of Efficient Market Hypothesis, technical tools and analysis are not giving any advantage to predict the stock market returns. Due to the unpredictability, Random walk model attends to explain human mistakes in stock markets that eventually lead to fluctuations of the financial security prices. A confrontation between Efficient Market Hypothesis and Random walk model often presented. In this research the Random walk model is used as a secondary theory for the discussion of the hypothesis testing.

1.3 Incorporation to COVID-19

The reaction of the stock markets to the pandemic of COVID-19 can be incorporated with the Semi-Strong Form of Efficient Market Hypothesis. The aim is to find a connection between the movements in stock markets and the released information about a new diagnosis of COVID-19. During the observed period all parties have equally been able to reach the information published about the pandemic. By modifying the Efficient Market Hypothesis to the studied event, the history information incorporated with the newest infection diagnosis is expected to indicate the change in stock market returns. Any predictions were not available in the beginning, which holds the Semi-Strong Form of Efficient Markets in this research. Conversely, the approach of Random walk

model is able to explain the unpredicted movements in returns. During the pandemic only today's information reflects tomorrow's returns. Random movement of the price and independency with historical values explain the possible absence of fluctuation in stock market returns in investigated time period.

1.4 Literature review

Stock market indexes follow very closely the economic cycle. In addition to economic related issues, some unexpected domestic events like natural disasters or epidemics reflect the same behavior of stock markets. Based on the theory presented and the following chapter of literature overview the reaction of the COVID-19 illness case in the operating stock market region can be established.

Jagric *et al.* (2005) tested the accuracy of Efficient capital market theory with six Eastern European Economics. The hypothesis of the research suggested the rapid adjustment of security prices from the moment when any new information that might have had an influence on a country's markets was released. In the analysis the authors applied the Hurst exponent with the main capital markets of each target country used. Authors found the selection of time series as a crucial element for the sensitiveness of frequencies, which is why the sliding time window was applied into the analysis. The addition of sliding time window enabled the authors to evaluate more precise reaction time of the stock markets. As a result, almost every stock market investigated reacted to an event that was concerned meaningful in the research. The analysis also gave out high values of returns at the beginning of the period under observation, especially while using the sliding time window. Even though the time window revealed precise results, there was a lower probability to predict returns in smaller markets.

The attack of 9/11 in the United States of America has been one of the significant events during the 2000 century and the impacts of the attack on economics, the short and long term, have been widely studied. Jørgensen and Nielsen (2017) incorporated the Efficient Market Hypothesis with the 9/11 terror attack in their research journal. The authors used an event study methodology to estimate the multidimensional effect of 46 separated terror attacks on the stock market indexes of OECD-countries. After conducting a relevant research for ten hypotheses, the authors concluded the terror attack with the highest number of casualties in the first place had the most significant

and rapid reaction to stock market index returns. An interesting finding was the irrelevancy of geographical distance of attack and influenced stock market; while the terror attack was considered as an international threat, a similar reaction of a foreign stock market return than a domestic one was experienced.

The case study made by Quaye *et al.* (2016) concerned about the impact of Brexit announcement including the domestic and global perspectives. The initial claim was that depending on the form of information given, a reaction of the voting result of Brexit in several different financial determinants can be found. The case study showed multidimensional results from different industry levels, domestic and global indexes, bonds, and such. Empirical findings showed a reduction of 7.2% to FTSE 250 index instantly after the vote result about divorcing from the European Union. The finding was highly emphasized in the research journal, since the index observed tracks all relevant firms in Great Britain and that is why it is considered as one of the most accurate reflections of the British economy. From the global point of view, the economy experienced a loss worth of two trillion USD just 24 hours after the decision was announced. Even though the information about the voting date of Brexit was known for almost four months beforehand, the stock markets did not show any reflection about the event until the decision was made. The authors opposed the Efficient Market Hypothesis with the behavioral finance as well as psychological sensitiveness of an investor. The human sentiment of an investor was concluded as better interpretation for security prices than any other economic indicator.

When looking at other epidemics and their influence on stock markets, few similar studies confirm the theory of Efficient Markets working successfully. The epidemic of Severe Acute Respiratory Syndrome, SARS, is the most relatable epidemic to COVID-19 in this century. A study made by Chen *et al.* (2018) used time-varying cointegration to investigate the long-term effect of SARS on Asian stock markets with a 10-year time gap. The chosen sample countries were categorized according to the magnitude of contagion. The authors found a relative strong correlation between the epidemic and stock market prices in China. Additionally, geographically close stock markets encountered fluctuation while the country nearby had an active epidemic.

Nippani and Washer (2004) made a research about the impact of SARS in affected countries. The hypothesis estimated a negative stock market return in countries where the epidemic was encountered. S&P 1200 Global Index was used to compare the average shift of each stock market. The authors used the closing prices for each infected country and compared the change of them

with Global Index in short and long-term time windows. Conventional t-tests, non-parametric, and Mann-Whitney tests took place in data analysis, which revealed the absence of a negative impact of SARS in most of the countries. China and Vietnam were the exceptions with having significant impact of SARS in their stock market returns. From the sample countries, only Vietnam had significantly low stock market index value compared to the global index. As a result, the authors rejected the initial hypothesis and questioned the argumentation of media about negative impact of SARS in affected countries.

2. DATA AND METHODOLOGY

The second chapter describes the data collection process and the analysis methodology. The equation of regression is presented, as well as the explanations of the most relevant indicators of the analysis outcome. In addition, independent variables of the analysis are explained and hypothesis for each variable is stated.

2.1 Data collection

A stock market index is created to implicate the average return of a certain stock market. Indexes are an optimal tool to implicate the current mood of the stock exchange without contributing one certain company or industry sector. The method of cross-sectional data is used to collect index data from the selected countries.

Cross-sectional data consists of *n* numbers of samples that are equally categorized in a larger entity, such as firms and countries (Franses 2002). The usage of cross-sectional data gives an advantage to collect data about board activities which is provided by the samples by themselves. In this paper, 33 countries that diagnosed a COVID-19 infection represent the sample observations (Appendix 1). Countries included to the study are systematically selected by the author with the following criteria. First, all the countries selected as the samples were required to operate at least one sufficient stock exchange and a stock market index. Second, the nations reported the outbreak of COVID-19 without having certain updated macroeconomic indicators were omitted from the analysis. The presence of economic indicators is important, because they will be applied into the analysis as independent variables. Historical data about stock market closing prices were mostly collected from Investing.com excluding few countries (Estonia) which's information was not updated in the primary source as desired. The selection between more than one general index of the country was done by the author who has chosen the most relevant index according to the index construction method and its trading volume. The historical data of the stock market return is incorporated with the date of sample country's first outbreak. The records of daily outbreaks are collected by European Centre of Disease Prevention and Control.

2.2 Regression analysis

Regression analysis is a statistical method to predict a certain outcome by an independent factor. The analysis defines the level of relationship between the studied dependent variable and an individual variable, which is estimated to have a relation to the primary phenomenon. Regression is often applied into any empirical research level for prediction or explanation purposes. Depending on the number of individual variables the analysis is found either simple regression or multiple regression, while simple model finds one dependent and independent variable and multiple regression considers more than one independent variable.

The formula of multiple linear regression analysis is defined as

$$Y_i = b_0 + b_1 X_1 + b_p X_p + \varepsilon \quad (1)$$

where

Y_i - Dependent variable,

b_0 – Intercept,

b_p – Coefficient for Independent variable X_p,

X_n – Independent variable,

ε – Error term.

The dependent variable Y_i denotes the outcome of the equation, as well as the appearance of the studied subject. B_0 represents the intercept of the formula and it is applied to form the slope for the equation. The intercept conducts the value of Y_i while all the other variables are equal to zero. (Sullivan 2016). The following parameter in the equation, b_p, represents the relative change in Y_i when the respective independent variable X_p experiences a change of one unit. The statement holds wen all the other independent variables are considered to be constant and their dependency is excluded. The subindex $_p$ counts respectively the number of explanatory variables applied to the equation. The variable ε denotes the residual error of the formula and it is adapted to represent the idea of having only estimated parameters of b. In that scenario the outcome is not considered fully significant. If the constant term B_o and explanatory variables are unable to interpret the result, the error can be applied as the main explanation for Y_i (Franses 2002).

The dependent variable of the regression analysis defined as Y_i represents the changes in stock market closing prices in given periods of time, which are five-day and ten-day after the first COVID-19 finding. The percentual difference experienced from the return on the first day after COVID-19 illness case is the final representation of each observation. The usage of two separate time models enables a comparation of volumes and widens the relevance of the research. Both day ranges are considered as individual dependent variables, which requires two separate multiple regression analysis. Independent variables remain identical in both models.

To interpret the outcome of the regression, few values are considered as the estimators of accuracy. The first section of the outcome presents the values of *R*s, which indicate the overall functionality of the model and plot the proportional value of fitting. (Montgomery *et al.* 2012). The range of *R*s apart from 0 to 1, which means the fittest values nearby the 1 are targeted. The outcome of regression analysis represents several *R*s with slightly different meanings and all three values of *R*s are under the consideration when analyzing the results.

Besides of values of *R*s, the significance of the model is evaluated with the F-statistics. In this study the contribution is in the value of the significance F. To evaluate the significance of the variation, the significance F presents a null hypothesis that suggests to exclude all the independent variables from the model while the accuracy of the outcome remains the same. When the value of significance F is above the desired level, the p-values of each explanatories are left automatically insignificant for closer examination. In other words, the acceptance of the null hypothesis means that the relevancy of independent variables is equal to zero and only intercept is used to denote the outcome of the dependent variable. Conversely, the null hypothesis can be rejected when the value of significance F is below the desired significance level. In this case the independent variables are considered as a relevant addition for the study. The level of significance applied into the analysis is 0.1. It is aimed for having significantly relevant results to make applicable conclusions.

Apart from F-test the aim is to examine the p-values of explanatories. The p-value defines the decision whether the explanatory variable is significant for the analysis and it should be included to the model. Having a p-value above the defined significance level, the independent variable is statistically insignificant and it should be extracted from the model. Subtracting the irrelevant variables increase the overall accuracy of the regression analysis. If the p-value of an independent variable falls below the desired level, it is estimated to be relevant and the value of coefficient *b* of each respective explanatory *X* shall be taken into account. The value plots the change in the

dependent variable while the independent variable shifts by one unit. Positive value of the coefficient refers to same direction of Y_i and X. Conversely, if the correlation between X and Y_i is negative, any additional change in X shifts the value of Y_i to the opposite direction by the value of the coefficient.

2.3 Predictions

The initial aim of the research is to investigate if the outbreak of COVID-19 had an effect on stock market returns. The secondary aim is to find the elements that could explain the findings of the initial problem. Based on the Semi-Strong Form of theory of Efficient Markets, stock markets fully reflect all the new information published and thus it is expected to notice a change in stock market closing prices after the first published positive case of COVID-19. The stock market return is expected to be negative because of increased economic turbulence caused by the exceptional circumstances encountered. Firstly, the initial hypothesis is presented, which is followed by the presentation of explanatory variables and respective hypotheses. The initial hypothesis concerning the stock market return is the follows:

H0 = The stock market is negatively affected by the first positive COVID-19 finding.

The first independent variable applied to the analysis is the Rank. The value of Rank gives out the time order of countries according to the first positive COVID-19 diagnosis is published. The author estimates that the countries with high Rank show smaller changes in stock market valuation. The rapid spread of the disease and new information released about the virus make Rank order a relevant variable. The hypothesis of the independent variable Rank is the following:

H1= Rank has a negative relation to the stock market return.

GDP, as known as Gross Domestic Product, puts together goods and services produced in a specific country at a certain period of time. GDP is one of the key indicators of overall performance of the economy which is why the economic cycle is considered upward sloping once GDP growth of 2 to 3 percent is reached. Gross domestic product of the year is calculated by adding together private and government consumption, gross investment, government investment, and trade of balance (imports – export). The result is the monetary value of a country's production. The basic

formulation of GDP can be modified several ways for finding different aspects of the country's performance.

GDP is found as a relevant indicator for the impact of coronavirus. Several studies have shown (Chatziantoniou 2013; Hsing 2011) a positive relationship between gross domestic product and stock market indexes. High GDP per capita implies stable situation of a country's economy, which is further on linked to behavior of stock markets. The data of GDP per capita measured in million US dollars from each country is collected and applied as an explanatory variable into the analysis. Due to the high distribution of GDP per capita in the sample countries, natural logarithm from each GDP per capita is taken. Natural logarithm enables comparing the countries with different economic baseline by diminishing the sample size over the relative change. It ignores the inequality of absolute values of observed countries and emphasizes the actual growth of GDP as the number of inhabitants increases. The method is often applied to a linear regression analysis with cross-sectional data (Wooldridge 2012). The most recent information (2019) about GDP per capita of the sample countries is collected from Worldbank.org. A minor effect of COVID-19 for the countries with high GDP per capita value is expected and the hypothesis is stated as the following:

H2= GDP per capita has a positive relation to stock market return.

Trade ratio is the sum of exports and imports that a country trades with others. It holds all goods and services traded per year measured as a share of a country's gross domestic product (Worldbank 2020). The ratio of trade is considered as an effective measure to describe the importance of international trade for an economy since a high share of trade indicates the country being relative dependent on other nations. Countries with high share of trading may face financial difficulties during the pandemic which is leading to a fluctuation in stock market returns. Based on this assumption, the hypothesis takes place as follows:

H3= The share of trade per GDP has a negative relationship to stock market return.

The Consumer confidence index, hereafter referred to as CCI, is a ratio of optimism amongst the citizens about activities of spending and savings (McWhinney 2018). The index is usually found via survey done for the citizens including questions about consumers' feelings towards the current condition of economy. As a result, CCI predicts the economic activity of people whether they are

feeling confident to purchase or preferring to save money. The index responds actively to a nation's fiscal health, which is why it is considered as one of the key indicators of the economic performance. While incorporating CCI into the analysis, studies have found the relationship between the Index and stock markets (Fisher 2003). The level of optimism reflects upward sloping stock market indexes and, conversely, uncertainty among the consumers indicates relatively sensitive stock markets. In this research, the latest values of CCI are following the adjusted neutral level of 100 units. All of the sample countries have conducted their consumer confidence surveys during the early months of the year 2020. Author estimates that correlation between CCI and stock market return is found and thus hypothesis is defined as following:

H4= Consumer Confidence Index has a positive relation to stock market return.

During the pandemic of Coronavirus, traveling and tourism industries have been affected the most. Restrictions of movements and closing of borders were the first precautions which were applied by the governments in order to avoid further spreading. This has damaged the tourism industry. Author estimates this is a relevant parameter for the study. The contribution of traveling and tourism is applied to the research by taking the percentual share of traveling and tourism in gross domestic product and using the proportion as one independent variable. The World Council of Travel and Tourism listed the share of traveling and tourism per GDP as percentage of each country in 2019. Countries with strong dependency on traveling and tourism is expected to encounter relatively great fluctuation in stock returns. This is why the last hypothesis of the research is defined as follows:

H5= The share of traveling and tourism industry in GDP has a negative correlation to stock market return.

3. RESULTS AND FINDINGS

In this chapter the initial change in each sample stock market is conducted and analyzed. To make the difference between separate regression analyses, the five-day scenario is referred as Model 1 and the ten-day scenario as Model 2. The outcomes of regression analyses are explained and the key findings are discussed. Conducting the analysis with the equation presented and inserting variables according to the model, multidimensional outcome is found.

3.1 Empirical results

The initial aim is to study the development of closing prices in both Models. Due to the currency variability among the sample countries, the percentual change of each country is taken to comply a comparable table of values. Appendix 1 presents the sample countries as well as the chosen indexes and the date of first COVID-19 finding. Appendix 2 refers the percentual changes in stock market closing prices per each sample country. Table 1 describes the statistics of the observations as percentage points. In there the average shifts in stock market closing prices are -1,38% in Model 1 and -4,22% in Model 2. The values of standard deviation 3,88 and 8,27 respectively indicate the high frequency of values of changes nearby a zero. The range presents the absolute variability of values, which is 15,87% in Model 1 and 31,11% in Model 2. Minimum values found are -11,55% and 25,12% and the maximum values of the models are 4,32% and 5,99% respectively. The median of the Models falls 0,66% and 1,37% respectively. The calculations of the Table 1 are based on the data presented in Appendix 2.

Table 1. Descriptive statistics of 5-day and 10-day return (%)

	5-day return	10-day return
Mean	-1,38	-4,22
Median	-0,66	-1,37
Mode	-0,3	-
Standard Deviation	3,92	8,27
Range	15,87	31,11
Minimum	-11,55	-25,12
Maximum	4,32	5,99
Count	33	33

Source: Author's calculations based on data from Appendix 2

The regression analysis conducted in Microsoft Excel shows the goodness of fitting in Multiple R values of 48,45% for Model 1 and 69,37% for Model 2. These values indicate 51,55% and 30,63% probabilities to explain the outcome with other variations. The evaluation of relevancy adjusted to the sample size used, which is Adjusted R^2, gives out the percentage values of 9,3% and 38,51% chances to explain the results with the used input. Standard Error of the models are 3,73 and 6,48 respectively.

The null hypothesis in F-statistics suggests using the model without independent variables, resulting as appropriate outcome of the data. The regression analysis gave out the values of Significance F 0.1792 and 0.0022 respectively. Once the settled significance level is 0.1 the null hypothesis is accepted in Model 1 and rejected in Model 2. The rejection of Model 2 indicates the results being significant when the independent variables are applied in. Conversely, the null hypothesis accepted in Model 1 denotes that the use of explanatories is not relevant in the five-day scenario. Once the independent variables are not applicable to add into the Model 1, the intercept is considered as the major indicator for the specific result of the dependent variable.

The Rank represent the most significant p-values in both Models, which are 0,014 and 5,39E-05 respectively. The coefficients of -0,19 and -0,61 indicate negative correlation between the variables and stock market return. P-values of other explanatories in Models are above the predefined significance level of 0.1, which leave them insignificant for closer examination. Substantially high p-values and relevantly low coefficients denote the poor relation of explanatories with the dependent variable. Due to accepted null hypothesis of F-statistics in Model 1 the explanatories do not imply any additional value for the five-day scenario. Even with the rejected value of Significance F the p-values of independent variables in Model 1, excluding Rank, are above the significance level. The relevancy of using any explanatories conducted is absent in Model 1, which is why the coefficient of the intercept (0,528) in five-day scenario is the most significant value to interpret the dependent variable.

Table 2 conducts the analysis of variables, including p-values, t-Stats, Standard Errors and Coefficients towards the dependent variables. In Model 1 the dependent variable is the stock market return five days after the positive COVID-19 case is found. Similarly, the dependent variable in Model 2 denotes the same values with the time gap of ten days.

Table 2. Analysis of coefficients

Model 1: 5-day return				
Variable	coefficients	standard error	t-Stat	p-value
Intercept	0,528	12,767	0,041	0,967
Rank	-0,191	0,073	-2,606	0,015
logGDP /capita	0,052	0,125	0,416	0,680
Trade/GDP	0,092	0,157	0,588	0,561
CCI	0,013	0,015	0,929	0,361
Tourism/GDP	-0,562	1,486	-0,378	0,708
Model 2: 10-day return				
Variable	coefficients	standard error	t-Stat	p-value
Intercept	-4,253	22,172	-0,192	0,849
Rank	-0,610	0,127	-4,787	0,000
logGDP /capita	0,059	0,218	0,270	0,789
Trade/GDP	-0,041	0,273	-0,150	0,882
CCI	-0,004	0,025	-0,174	0,863
Tourism/GDP	0,513	2,581	0,199	0,844

Source: Author's calculations compiled by Microsoft Excel

3.2 Findings

The main hypothesis in this study was the initial change in stock market prices:

H0 = The stock market is negatively affected by the first positive COVID-19 finding.

Based on the mean values of stock market returns in both models we can accept the hypothesis with the average fluctuations of -1,48% and -4,22% respectively. However, the relatively low average values are notable as well as relatively low values of standard deviations. Standard deviations of 3,92 in Model 1 and 8,27 in Model 2 indicate a high frequency of small changes in prices in both time models. Model 1 presented intrinsically smaller standard deviation compared to Model 2. There was a notable revelation of substantially high maximum increase of an index since only a decrease in stock market was expected to find.

Besides the initial hypothesis, several additional hypotheses were defined to explain the development of the dependent variable. The first of them was describes follows:

H1= Rank has a negative relation to stock market return.

According to the multiple regression analysis and results presented the H1 is confirmed with coefficient value of -0,690 in Model 2. This means a decrease of 0,69 in a stock market price while Rank increases per one unit. Substantially small p-value of the investigated independent variable supports the acceptance of the hypothesis. In Model 1 presented decent p-value of 0,015 with coefficient of -0,191. However, the significance F in five-day scenario accepted the null hypothesis, which made the independent variable irrelevant. Thus, the H1 is confirmed in Model 2 but rejected in Model 1.

The rest of the hypotheses were stated as the following:

H2= GDP per capita has a positive relation to stock market return.
H3= The share of trade per GDP has a negative relationship to stock market return.
H4= Consumer Confidence Index has a positive relation to stock market return.
H5= The share of traveling and tourism industry in GDP has a negative correlation to stock market return.

The abovementioned hypotheses from H2 to H5 need to be rejected due to the substantially high p-values with low values of coefficients. There was no enough significance to use all the explanatories as fundamental indicators for the dependent variable either of the models. In Model 2, excluding Rank, p-values of the hypotheses ranged from 0,7 to 0,8. This finding indicates very high irrelevancy of the chosen explanatories. Coefficients in 10-day return were also found quite low, only the share of travel and tourism industry per GDP presented a decent value of coefficient (0,513). Still, due to high p-value it is not included to test the hypothesis. In Model 1 it was not appropriate to use independent variables for predicting the outcome of the dependent variable.

From the R values the level of probabilities found can be considered suitable, although relatively low. While investigating the values of Multiple R and R-squared, quite high probabilities of explaining the variations with other indicators outside the models were found. Relevantly low values of Adjusted R^2 especially in Model 1 may reflect too many explanatory variables used. According to the Woodridge (2012) the Adjusted R-squared disapproves any addition insert of new of independent variable and for this reason the value of Adjusted R-squared is often found low with usage of many independent variables. Significance F in 10-day return was 0,002, which rejected the null hypothesis and found independent variables meaningful for the analysis. However, the level of rejecting the null hypothesis of F-statistics in Model 1 was not reached with

the significance F value of 0,179, which indicates the values of independent variables represented fitting the model as well they were equal to zero. The relevancy of studying the phenomenon with the five-day time scenario disappeared while using the significance level of 0.1. This may indicate for example too low sample size or substantially high variability of the data. In other words, after receiving high value of Significance F, the Model 1 was not applicable analysis to conduct further with the chosen independent variables.

When looking closer to the relationship between the explanatories and dependent variables, the respective values seem to be low and outside of confidence interval desired. The most significant value found was the rank of countries' outbreak, which can be explained by the exponential increase of COVID-19 cases globally. Substantially high-p-values and low coefficients with the GDP per capita, the share of trade per GDP, Consumer confidence Index and the share of travel and tourism industry per GDP confirm the poor relationship with dependent Y_i as well as they do not explain the changes in market price fluctuations. From the author's point of view the outcome of the analysis was not at the level as it was expected to have even though the explanatories were chosen carefully based on the information found.

3.3 Discussion

Poor correlation and insufficiency of the chosen independent variables can be explained with few different factors. Generally, stock returns have a temper to have small fluctuation to both directions and most of the countries with indeterminate change determined can be concluded as normal movement of stock market returns. As it was seen, the timeline of the outbreak was the most significant factor to explain larger fluctuations of a stock market return. While considering the structure of a stock market index, it can be concluded that the index does not imply any detailed information of the market. If one industry of a certain stock market experiences a strong fluctuation after the outbreak is found, it is barely notable in the general stock market index.

Region stock markets reflect not only on its own economical conditions but also the international events and information. The interconnectedness of stock markets has been studied by Raddant and Kenett in 2017, who presented the impact of stock market affecting to one another in multiple sectors. The results of the study showed that separate stock markets are partly dependent on each other and lead by countries that are a relevant impact to global economy. The interconnectedness

of countries in the COVID-19 pandemic can be supported by the negative correlation between Rank and the dependent variable; As the country was ranked low, the negative stock market return was most probability found. The global interconnectedness could be used as an estimator for the poor relation of other independent variables and the dependent variables, even the independent variables were represented relevant for the economy point of view.

Another factor explaining the results of the analysis can be found from the high noise of stock market indexes. Fama claims in his journal (1965) that stock prices are a selection of several random noise collected around, that is often linked to psychological behavior of an investor without connection to real-world events. Additionally, Fama suspects the independency of each individual information released, since the new information published have an influence on stock prices eventually via time series or through a cluster of information. A fluctuation in stock market return was challenging to predict in the beginning, since there was barely knowledge about the behavior of the economy in this kind of event.

Generally, no certain cause and effect relationships were found even though several independent variables with weak correlation among each other were included to the study. This may indicate unrealistic way of thinking about the independency of the economies in a certain region and emphasize the uniqueness of the event encountered.

CONCLUSION

In this research, the investigation of stock market index returns in 33 different countries was executed. The initial aim of the study was to observe the change in stock market values after the first COVID-19 finding in the sample country. The research problem whether there was a notable reaction in stock market returns while new information is released was defined. Two different time gaps were used, which were five days and ten days after the first official virus diagnosis. The attempts were made to explain the changes in stock market returns with five different independent variables, that were chosen based on their relevancy towards the event studied. By using the theory of Efficient Markets and its Semi-Strong form, the estimation of immediate reaction of stock markets returns in both Models was applied. In addition to the initial hypothesis presented regarding the stock market returns, the formulation of hypothesis for each independent variable was made in order to see if the variables had any impact on returns calculated for dependent variable Y_i. The explanatories used were Rank, logGDP per capita, the share of trade per GDP, Consumer Confidence Index, and the share of travel and tourism industry per GDP. The hypothesis testing was executed via Multiple Regression analysis conducted in Microsoft Excel.

The study found that first COVID-19 finding had in average a negative effect in both time models used. A negative correlation between stock market return and Rank was found in 10-day return. This means, the greater rank value indicated the higher fluctuation of stock market returns. The H1 concerning the negative relation between the Rank and stock market return was accepted. Other independent variables of both models, 5-day return and 10-day return, did not present any significant relation with stock market returns. F-test suggested accepting the null hypothesis of Model 1, which means poor relevancy of independent variables. In other words, it was more sufficient to keep explanatories equal to zero than having actual values for them.

The poor additional value given by the analysis was explained with the high noise of stock markets: it was challenging to find relationship of a single illness case and stock market return since the markets are affected by several domestic and international indicators. That is why the theory of Efficient Market Hypothesis presented holds with the initial hypothesis faintly. Stock market's temper to react new information published was established. The changes in closing prices in both models were relatively small, which can be related to normal fluctuation of the markets rather than a reaction to COVID-19 illness case found. According to the Random walk theory it is impossible

to predict any stock markets returns and the possible triggers for the movements of the markets. Author of the paper estimates that the research could give out better results by including more sample countries. Until this day almost every country in the world is affected by the COVID-19, so there is capacity for expanding the research further.

The study was conducted during the great spike of the pandemic. The research concentrated on the early events of the crisis and it was concluded that the primary effect of COVID-19 diagnosis to stock market return was relevantly weak. We can still look forward seeing how the pandemic will form the economy during the upcoming months. It seems crucial for studying the relationship of stock markets and the pandemic further on because similar pandemics with huge impact on the global economy are estimated to emerge in the future. Therefore it is important to learn more about the reactions of stock markets in different phases of the crisis.

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APPENDICES

Appedix 1. Sample countries, Indexes and dates of the outbreak

Country	Index	Date of first outbreak
China	China A50	31.12.2019
Thailand	SET50	13.1.2020
Japan	Nikkei225	15.1.2020
South Korea	KOSPI	20.1.2020
United States	S&P500	21.1.2020
Australia	ASX200	25.1.2020
France	CAC40	25.1.2020
Canada	TSX	26.1.2020
Germany	DAX	28.1.2020
Finland	OMXH	30.1.2020
India	SENSEX30	30.1.2020
Italy	FTSE MIB	31.1.2020
United Kingdom	FTSE100	31.1.2020
Russia	MOEX	1.2.2020
Spain	IBEX35	1.2.2020
Sweden	OMXS30	1.2.2020
Belgium	BEL20	4.2.2020
Austria	AXT	26.2.2020
Switzerland	SMI	26.2.2020
Denmark	OMX Copenhangen	27.2.2020
Estonia	OMXB10	27.2.2020
Greece	AGT	27.2.2020
Norway	Bors All-Share	27.2.2020
The Netherlands	AMX	28.2.2020
Iceland	ICEX	29.2.2020
Ireland	ISEQ20	1.3.2020
Czech Republic	PX	2.3.2020
Indonesia	JKSE	2.3.2020
Portugal	PSI20	3.3.2020
Poland	WIG	4.3.2020
Hungary	BUX	5.3.2020
Slovenia	SBITOP	5.3.2020
Slovakia	SAX	7.3.2020

Appendix 2. 5- and 10-day stock market return after the 1st COVID-19 finding

Index	5-day return (%)	10-day return (%)
China A50	-0,30	0,60
SET50	0,90	-0,79
Nikkei225	0,70	-0,37
KOSPI	-0,73	-3,42
S&P500	-2,32	-2,87
ASX200	0,32	-0,26
CAC40	-0,97	2,09
TSX	-0,71	1,20
DAX	-2,56	1,88
OMXH	-0,66	4,70
SENSEX30	-0,30	0,16
FTSE MIB	2,62	5,47
FTSE100	2,11	2,21
MOEX	0,55	1,67
IBEX35	4,32	5,70
OMXS30	3,76	5,99
BEL20	1,37	3,54
AXT	-6,12	-11,63
SMI	-5,34	-7,38
OMX Copenhagen	-1,69	-1,37
Nasdaq Baltic	0,82	1,93
AGT	-0,33	-10,94
Bors All-Share	-0,76	-4,45
AMX	2,06	-12,23
ICEX	-2,45	-4,18
ISEQ20	-1,89	-10,90
PX	-2,26	-10,15
JKSE	2,56	-3,86
PSI20	-4,47	-22,17
WIG	-11,55	-25,12
BUX	-11,43	-20,90
SBITOP	-9,54	-15,73
SAX	-4,65	-7,68

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