Hungarian University of Agriculture and Life Sciences

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Impact of COVID-19 pandemic on Stock Markets: Case Study of Hungarian Stock

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I, the undersigned Murad Gurbanov graduate at the Faculty of Economics and Social Sciences in the major of Business Administration and Management, with the type of training full time, at Mate University declare that the submitted BSc/MSc[1] thesis for defence with the title of Impact of COVID-19 pandemic on Stock Markets: Case Study of Hungarian Stock is my own work, where I managed the used literature according to the rules of copy right.

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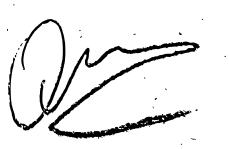

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Short Description of Thesis:

The thesis aimed to assess the relationship between COVID-19 pandemic and Budapest Stock Market. The principal focus of thesis was to identify whether the indicators of COVID-19 pandemic was correlated with the performance indicators of Budapest stock market. The time interval of the analysis was between January 1 and December 31, 2020. The research strategy of gathering data about variables of research was archival research. The multiple linear regression analysis executed to assess the relationship between variables of COVID-19 pandemic and variables of Budapest stock market. The dependent variables of research included four principal dimensions of COVID-19 pandemic, like new cases, new deaths, change in the cumulative cases and deaths compared to the previous day. The results of the analysis showed that the COVID-19 pandemic had empirically negative relationship with the Budapest stock market. Based on the research findings, the research concluded that the Budapest stock market was negatively affected by the COVID-19 pandemic during 2020.

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1. Introduction

1.1 Background

The international business environment has encountered with tremendous challenges as a consequence of the outbreak of novel coronavirus, called COVID-19 pandemic. In particular, the pandemic has affected the way business companies operating throughout the international market because of the government regulations and changes in the customer behavior. On the one hand, the states have developed and implemented various regulations resulting with the interference into the regular operations of the business organizations. The measures related to the temporary lay-offs of employees for ensuring their health safety and integrating remote working systems as an outcome of government regulations have caused additional costs for business organizations. On the other hand, the customer behavior has changed essentially, as the principal concern for them has become preventing their vulnerability to the corresponding infectious disease. Furthermore, the customers have become motivated to purchase primarily pharmaceutical products in the marketplace for improving their physical endurance against COVID-19 pandemic. In addition to abovementioned factors, like government regulations and changing customer behavior, the alterations in the expectations of investors about the profitability of the marketplace have been another challenge being caused by the novel coronavirus, as a volume of investments allocated for a particular market determines its growth and profitability. According to Youssef et al. (2021), one of the main international markets affected by COVID-19 pandemic has been financial market due to the changes in the expectations and behavior of investors in the respective market. In particular, as investors have become more concerned about their health rather than looking for new business opportunities that could boost their financial returns, the withdrawal of investments from financial markets, especially stock markets has become a trend throughout the world (Youssef et al., 2021).

The optimistic view about the prosperity of the financial markets has been replaced with the pessimistic view about another global financial crisis, which has directed investors to either completely stop their operations in financial markets or to limit the volume of their operations. In this regard, the financial markets, including stock, bond and commodity markets have encountered with the possibility of crash because of the aforementioned changes in the

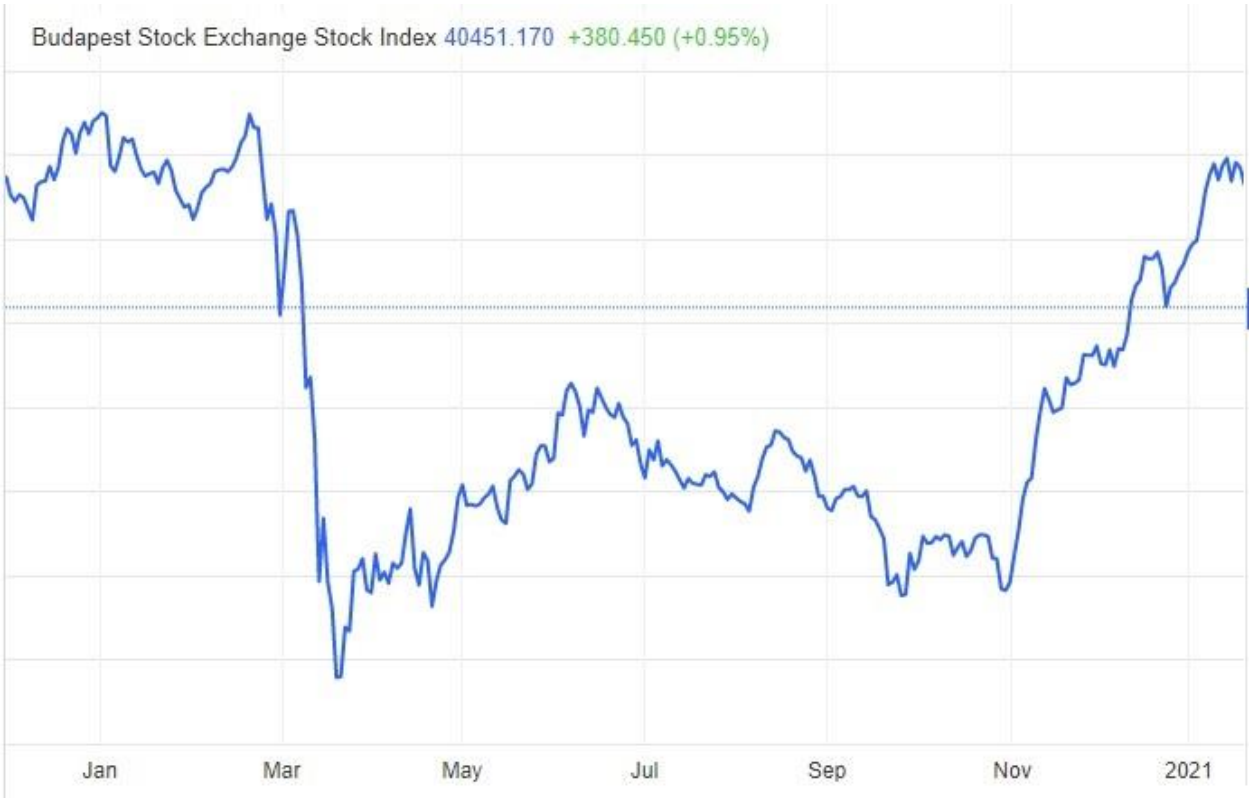
expectations and actual attitudes of investors. According to Ngwakwe (2020), the stock market, as a part of financial market has been severely hit by the novel coronavirus. In fact, the leading stock markets in the global stock market have experienced significant drop in their valuation. In 2020, one of the leading stock markets, Dow Jones Industrial Average (US-DIJA) experienced the decline of about 3,000 points (7.79%), which was followed by a decline of 29,72% in Financial Times Stock Exchange Group (UK-FTSE) and a drop of 26.85% in NIKKEI (Japan-NIKKEI) stock exchange group in the respective year (Liu et al., 2020). Accordingly, the worlds' leading stock markets, like DIJA, FTSE and NIKKE experienced the crash as a result of the COVID-19 pandemic. In this regard, the principal focus of this research was to assess whether the relevant pandemic also affected the Budapest stock market (Hungary-BUX).

1.2 Research Problem

The stock markets are vulnerable to the changes in the external environment because the stock prices are principally determined by the amount of demand being available for the shares being traded in the relevant markets. In this context, the investor behavior and expectations are the factors shaping the volatility of the stock markets because the investor decisions in stock markets reflect the extent of trust and confidence of investors in the profitability and stability of stock markets. However, the dependence of stock markets on the decision of investors enables the external shocks to have an unexpected and essential impact on the stock markets. In particular, the COVID-19 pandemic is categorized as a type of external shock shaped the investor perceptions about the prosperity of stock markets. In particular, the respective pandemic has generated a speculation about the potential crash in the stock market, as the outcome of the government restrictions on the flow of capital, man or goods across the borders in the international market and the changes in the customers' purchase patterns. Therefore, the stock market crashes have become one of the main implications of the novel coronavirus. In this regard, Hungary was selected as a country for appraising the relationship between novel coronavirus and stock market. Accordingly, the market of analysis in the study was Budapest stock exchange market (BUX). This market was chosen due to the fluctuations in its stock prices during 2020. Despite that the COVID-19 pandemic was emerged in 2019 in Wuhan, China, its implications for European financial market were experienced during early 2020 (Liu et al., 2020). Accordingly, the Budapest stock market also encountered with the fluctuations during early 2020 (Figure 1). During January 1 and February 21, 2020, the stock price of BUX ranged

between 43,431 HUF and 46,141 HUF, which drastically declined after that period (Figure 1). Over a period between February 22 and March 19, the stock prices regularly dropped and stood at 28,007 HUF on March 19, 2020 (Figure 1). Until October 29, 2020, the stock prices of BUX ranged between 37,985 HUF and 32,047 HU (Figure 1). After October 29, 2020, the stock market experienced growing trends in its stock price, which was correlated with the period of launching of vaccination process across Hungary after the invention of vaccines by BioNTech corporation (Uzzoli et al., 2021). Accordingly, the graphical presentation of stock prices in BUX reflected that there was a significant decline in the stock prices during 2020, which corresponded to the emergence and expansion of COVID-19 pandemic within European region. In case of Hungary, the first person was officially announced as being detected with COVID-19 pandemic dated back to March 2, which was almost a week before the starting date of declining stock prices at BUX (Rost et al., 2020).

Figure 1. Budapest Stock Exchange



Source: Trading Economics (2022)

1.3 Research Objectives and Question

The research had a general purpose of appraising the relationship between COVID-19 pandemic and Budapest stock exchange market (BUX). Accordingly, the fundamental focus of the research was to assess the impact of novel coronavirus on the chosen stock market during 2020. In addition to its general purpose, the research also addressed to achieve three specific objectives:

- To assess the relationship between COVID-19 pandemic and stock prices of BUX
- To analyze the relationship between COVID-19 pandemic and volume of BUX
- To identify the relationship between COVID-19 pandemic and stock volatility of BUX
- To propose certain suggestions for executing the further research dedicated to the analysis of relationship between COVID-19 pandemic and stock market

The research also concentrated on responding to the following research question:

- To what extent COVID-19 pandemic affected the stock market performance of Budapest stock market during 2020?

The research hypothesis targeted to verify the existence of empirically positive relationship between COVID-19 pandemic and performance of BUX. The research hypothesis is as following:

- There was a positive relationship between COVID-19 pandemic and Budapest stock market.

1.4 Research Structure

The research on the relationship between COVID-19 pandemic and performance of BUX was organized into five chapters.

This chapter was labelled "**Chapter 1. Introduction**". In this chapter, the impact of recently emerged novel coronavirus on the international market, especially stock market was highlighted along with its challenges. Besides, the chapter presented the general research purpose and objectives, research question and hypothesis.

The next chapter was labelled "**Chapter 2. Literature Review**". In that chapter, the research concepts, like stock market and coronavirus pandemic were explained through review of

relevant literature. The chapter also presented the key aspects of stock market and COVID-19 pandemic that were used as indicators of their performance in the actual life. Besides, the chapter highlighted the theoretical framework and previous researches related to the relationship between COVID-19 pandemic and stock markets.

The third chapter was referred as "**Chapter 3. Research Methodology**". This chapter provided an explanation about the data collection, research design and data analysis process followed by the researcher for analyzing the effect of COVID-19 pandemic on Budapest stock exchange market. The chapter finally presented the methodological constraints of the research.

The following chapter was called "**Chapter 4. Findings and Analysis**". The key outcomes of the data analysis were presented in graphs and tables. Besides, the chapter summarized the interpretation of the key outcomes of the data analysis in compliance with the research objectives and relevant literature on the relationship between COVID-19 pandemic and BUX stock market.

The last chapter was labelled "**Chapter 5. Conclusion**". That chapter summarized the key aspects of each abovementioned chapters and provided concluding remarks about the outcome of data findings and analysis. The chapter also included the recommendations proposed for further research on the similar research topic.

2. Literature Review

2.1 Conceptualization of Stock Market

The stock market refers to a marketplace in which the shares are traded between sellers and buyers (Haiyue et al., 2020). In particular, the stock markets enable the publicly listed companies to issue their shares for sale in the marketplace for the purpose of generating financial capital to expand their business operations (Haiyue et al., 2020). Thus, the stock markets are also considered as equity or share market, as shares of relevant companies are issued for sale. In the respective market, the traded commodities are stocks and shares of publicly listed companies. The stock markets are broadly grouped into two categories, such as primary stock market and secondary stock market. The first one is regarded as marketplace in which the companies issue their shares to raise their financial capital for the first time (Khatib and Nour, 2021). Therefore, the primary stock market ensures the process of offering the equities of companies to the purchase of buyers for the first time. The latter one is considered as a marketplace in which the shares of the companies are exchanged between buyers and sellers through stock exchange (Khatib and Nour, 2021). According to Wagner (2020), the principal objective of stock market is to ensure and ease the capital movements from buyers to sellers. In this regard, the buyers are considered as investors looking for the profitable investment opportunities in the stock market, and sellers are usually companies willing to generate financial capital for the organizational growth. Accordingly, the key participants in the stock market are investors who are considered as buyers of shares, and traders willing to sell the shares at fair prices. There is also stock broker acting as intermediary between investors and traders for realizing the transaction. In this study, the stock market was referred as a marketplace in which the investors were able to buy the shares at BUX being issued by traders.

2.2 Functions of Stock Market

According to Siddiqui (2009), there are three primary functions of stock markets. The first function of stock market is related to its capability of determining equilibrium price for a particular share. In particular, the stock markets provide a chance for determining the price of shares based on the interaction between investors and traders (Sidduqui, 2009). The next function of stock market is associated with its capability to offer mechanism for generating financial capital for both sellers and buyers. While sellers, especially companies use stock markets as a means for raising financial capital for their operations in the short-run, the buyers

use stock markets as tool for generating financial returns from their shares in the long-run (Siddiqui, 2009). The third principal function of stock market is related to its ability to reduce the transaction costs. The interaction between buyers and sellers of shares are realized without need for intermediaries, which reduces the transaction costs of trade and, consequently, produce efficient environment for the business interaction (Siddiqui, 2009).

In addition to the abovementioned functions of stock market, there are also additional functions. The stock markets ensure the price transparency referring to availability of information about current and historical prices of shares and the number of shares traded in the stock markets (Shaik, 2021). Therefore, the availability of detailed information about stocks provides an opportunity for buyers to analyze and make the right decision, accordingly. Another function of stock markets is related to their role in ensuring liquidity. The stock markets enable the traders to convert the shares into the cashes without influencing their market price (Shaik, 2021). Once there is a need for financial capital, the stock market provides an easy-access to the financial capital via selling the assets in its marketplace. Another principal function of stock market is related to its price discovery potential because the stock market determines the best price for the shares that is agreed by traders and investors.

2.3 Performance Indicators of Stock Market

There are certain indicators reflecting the performance of stock market. The most common indicator of stock market performance is stock price, referring to an amount required for the purchase of a share of publicly listed company (Ramelli and Wagner, 2020). The principal reason leading to an increase in the stock prices of the companies is the investor expectations. If the investors perceive the company as growing and profitable organization, they become motivated to purchase its shares, which contributes to the increase in the demand for the shares of relevant company in the stock market and, accordingly, the stock prices increase. Therefore, the sound increase in stock price is regarded as the well-functioning and stable stock market performance. The second important indicator of stock market performance is stock volume referring to a number of equities being exchanged in the stock market (Ramelli and Wagner, 2020). The stock volume functions as an indicator of the strength of stock market because it reflects how many purchase transactions realized between buyers and sellers. Therefore, the increase in the stock volume is considered as an increase in the stock market performance. The stock market volatility is also considered as an important indicator of stock market. While stock

price and stock volume are positively correlated to the stock market performance, the stock volatility is negatively connected to stock market. In particular, an increase in stock volatility is regarded as a decline in the stock market performance (Shaik, 2021). As the stock volatility reflects the rate of change in the stock prices, the increasing stock volatility means the instability in the stock market due to the increases or decreases in the stock prices (Shaik, 2021). In this study, stock prices, stock volume and stock volatility were perceived as a set of indicators of the performance of Budapest stock market; thus, the data about the corresponding indicators were collected to assess the impact of COVID-19 pandemic on the chosen stock market.

2.4 Conceptualization of COVID-19 pandemic

After the outbreak of novel coronavirus in 2019, the pandemic has become the main concern of international community. The concept of pandemic is explained as a particular epidemic expanded across the world rather than being restricted to a specific geographical area (King et al., 2020). Thus, the transmission of a specific infectious disease from the status of epidemic to pandemic depends on the scope of expansion of the respective disease. In this regard, if an infectious disease expands across the world, it is considered as pandemic. In this context, novel coronavirus is a typical pandemic, as its influence scope is not restricted to a specific geographical area. In particular, COVID-19 pandemic is defined as novel coronavirus affecting physical health of the people throughout the world (King et al., 2020). The novel coronavirus is also referred as an infectious disease being triggered by SARS-CoV-2 virus (King et al., 2020). This virus is considered as pandemic because the virus spread worldwide.

There are three principal features of COVID-19 making it be considered as pandemic. The initial feature of novel coronavirus is related to its rate of explosive transmissibility. The explosive transmission refers to the capability of an infectious disease to spread across people at high rate (Bambra et al., 2020). The transmission capability of novel coronavirus is high as people are subject to being infected to the respective disease through physical contacts and air. The latter tenet of novel coronavirus is associated to its geographical expansion. The respective pandemic has expanded across the world by affecting the living condition and way of living throughout international community. The final principal characteristics of novel coronavirus making it be regarded as pandemic is linked to its extent of impact on the physical health of infected people. The respective virus threatens the livelihood of people due to the absence of immunity among the people against the respective infectious disease. The main goal of this research is to assess

how the novel coronavirus that was considered as pandemic affecting every sphere of life affected the performance of stock market in selected country.

2.5 Theoretical Framework

In the existing literature, certain theories were created for explaining the role of external factors in shaping the stock market performance. In particular, the relevant theories focus on explaining factors shaping the behavior of investors and traders in the stock market, which in return, determines the stock market performance. Random Walk Theory is the commonly utilized theory for explaining the stock market performance. According to the respective theory, the stock market performance is conditional to the contents of information that flows among the investors and traders about its future prosperity (Khatib and Nour, 2021). In this context, the condition of stock market depends on the contents of information being shared among the stock market participants about the value of operating in the relevant market. Accordingly, the stock market is defined as a reflection of information flowing about the value of shares in the respective market. If the content of information produces expectations about future prosperity and profitability of stock markets, the performance of the stock market increases as the demand for shares increase in the corresponding market.

Another theory initiated to explain the determinant of stock market performance is considered as Greater Fool Theory. This theory assumes that the stock market performance is conditional to the extent of willingness of buyers to pay for overpriced and overvalued shares (Khatib and Nour, 2021). Accordingly, the buyers who are willing to make overpayment for the shares in the stock market are defined as “greater fools” whose purchase intention and decisions positively contribute to the performance of stock markets (Czech et al., 2020). In a particular stock market, the stock prices and volumes increase to the point at which there does not exist demand for overpriced shares; thus, the traders accomplish to sell the overpriced shares that do not reflect their actual values until the number of greater fools willing to buy the products reach to zero. Then, the positive expectations of investors are replaced with the perception of possible decline in the value of their stocks, which leads them to massively withdraw their investments from shares, which potentially increases the likelihood of stock market crash (Czech et al., 2020).

Although abovementioned theories provided explanation for the reasons leading to the changes in stock market performance, these theories disregarded the impact of unforeseen events on the contents of information about stock markets and behavior of "greater fools" in the stock market. In this regard, Black Swan Theory was created to relate the potential impact of unforeseen events on the stock market performance. The concept of "black swan" is considered as an unforeseeable event shaping the perceptions of investors and traders about the prosperity of stock markets (Czech et al., 2020). If the event is defined as negatively correlated to the stock market, that event leads to the flow of negative contents about future profitability and prosperity of stocks, which in return, leads the investors to sell their shares for avoiding potential losses in future (Czech et al., 2020). In this context, novel coronavirus is regarded as an unforeseeable event occurred throughout the world, which generated pessimistic views about the stability and profitability of stock markets in the world; thus, it has led to the decline in the stock market performance, including BUX as a result of the changes in investor behavior.

2.5 Previous Researches

The emergence of novel coronavirus has generated an academic interest for assessing its scope of impact on various aspects of business environment. In this regard, the stock market has been identified as the vulnerable aspect of financial market, which has been severely affected by the relevant pandemic. Hence, a set of researches undertaken to appraise how the stock markets have been influenced by the novel coronavirus. One of the relevant studies was executed by Alzyadat and Asfoura (2021) to identify the impact of COVID-19 pandemic on the performance of stock market. In this particular research, the selected stock market for obtaining secondary data was Tadawul All Share Index (TASI) of Saudi Arabia (Alzyadat and Asfoura, 2021). The time interval of the research was a period between 15th March and 10th April 2020. The obtained secondary data was assessed via Vector Auto-Regressive and Impulse Response Function methods (Alzyadat and Asfoura, 2021). The variables of research included the stock prices and stock volume as dependent set and number of COVID-19 cases and deaths as independent variables. The results of analysis revealed that TASI negatively responded to the growth in the value of independent variables. In particular, the research identified that as the number of deaths and infections related to COVID-19 pandemic increased the stock market prices and volumes declined relatively (Alzyadat and Asfoura, 2021). According to Alzyadat and Asfoura (2021),

COVID-19 negatively affected the performance of TASI due to its impact on the investor perceptions about the risks of keeping their shares for future.

Another study executed by Hatmanu and Cautisanu (2021) to assess if the stock market was adversely affected by the outbreak of COVID-19 pandemic in Romania. The unit of analysis in the respective research was Bucharest Exchange Trading (BET) index. The time horizon of the analysis was between 11th March and 30th April 2020. The generated data was assessed through Autoregressive Distributed Lag (ARDL) (Hatmanu and Cautisanu, 2021). While the independent variables of research included the daily number of COVID-19 cases and the growth rate of the respective cases, the dependent variables included the stock prices and stock volumes of BET. The results of analysis found out that the increases in the independent variables, such as daily number of COVID-19 cases and its growth rate negatively affected the stock prices and stock volumes in case of BET (Hatmanu and Cautisanu, 2021). According to Hatmanu and Cautisanu (2021), the growth in the rate of COVID-19 cases has statistically negative association with the stock price and volume of BET, as an increase in the number of people infected to the COVID-19 pandemic resulted with decline in the performance of BET index. In particular, the researchers highlighted COVID-19 pandemic as the principal determinant of the decline in the stock prices and volumes of BET during the chosen time interval (Hatmanu and Cautisanu, 2021

Bouhali et al. (2021) also analyzed the relationship between COVID-19 pandemic and stock market. The sample of stock markets in the relevant research included the stock markets in US, Switzerland, UK, South Korea, and Japan. The time interval of the analysis was 21st December 2020 and 30th June 2021 (Boahali et al., 2021). Due to its efficiency and flexibility, the DCC GARCH model was used as a means for analyzing collected data about the stock prices and volume of returns in the stock markets of chosen countries and the death rates, infection rates of COVID-19 pandemic along with vaccination against the pandemic. The research principally focused on comparing the performance of the chosen countries' stock markets before and after the vaccination process. The researchers revealed that before the vaccination process, the stock prices and stock returns were negatively affected by COVID-19 pandemic due to the nature of empirical relationship between these indicators of stock market performance and variables of COVID-19 pandemic. Besides, the vaccination rates were identified as positive contributor to

the stock prices and stock returns in the chosen countries as findings of data analysis showed that the vaccination rate was statistical predictor of stock prices and stock returns. According to Boahali et al. (2021), the stock markets were negatively affected by the COVID-19 pandemic, and the vaccination process contributed to the growth of stock market performance in the chosen countries.

2.6 Research Gap

The research gap was considered as the limitations of the available research in explaining the relationship between COVID-19 pandemic and stock markets. The initial research gap was related to the absence of one of the key indicators of the stock market performance, such as stock volatility. In the existing studies, this indicator of stock market defined as the rate of change in the stock prices was not integrated into the data analysis process (Alzyadat and Asfoura, 2021; Hatmanu and Cautisanu, 2021; Boahali et al., 2021). However, the stock volatility could reflect the scale of fluctuations emerged in the stock markets as an outcome of COVID-19 pandemic; thus, this research gap was responded in this study through integrating the stock volatility into the data analysis process. The second research gap was related to the lack of application of the theoretical frameworks to the process of analyzing and explaining the relationship between stock markets and COVID-19 pandemic. In particular, the available studies provided the lack of explanation about the reasons leading variables of COVID-19 pandemic to influence the stock market performance (Alzyadat and Asfoura, 2021; Hatmanu and Cautisanu, 2021; Boahali et al., 2021). In this regard, the theoretical framework should be used as a means for further justifying the impact of COVID-19 pandemic on stock markets. The current thesis also addressed this research gap via integrating the theories of stock market into the data analysis and results process for explaining the reasons leading the COVID-19 pandemic to influence the stock market performance in case of Hungary.

3. Research Methodology

3.1 Research Design

The research design was described as the plan to execute a research project through defining the data generating strategy, choice, and horizon (Kothari, 2004). Accordingly, its first pillar was the strategy utilized for producing data about stock market performance and COVID-19 pandemic. In this study, the strategy of data collecting was archival research which is referred as a method of collecting data through publicly accessible records (Kothari, 2004). In particular, the data about stock prices, volumes and volatility of Budapest stock market and the number of COVID-19 cases, death and growth rates were obtained from the publicly accessible data platforms. In case of Budapest stock market, the data was obtained from investing.com online platform and data about COVID-19 cases in Hungary was obtained from worldometers.info online platform. The principal reason for using archival research in this study was that the strategy enabled to obtain data about research variables in an efficient and time-saving manner.

The research choice was the next pillar of the design, which reflected the researcher's preference of either combining qualitative and quantitative data or using only one form of data (Kumar, 2011). Based on the researcher's preference, the studies are divided into two groups, like mono-method studies and mixed-method studies. In mono-method studies, the researcher prefers either qualitative data or quantitative data that is perceived as the most suitable for the research topic (Kumar, 2011). However, in mixed method, the researcher prefers to combine both of data to generate comprehensive conclusion (Kumar, 2011). In this study, the data of stock market performance and COVID-19 pandemic was quantitative; thus, the research choice of study was mono-method.

The last pillar of research design, time horizon was related to the period being investigated by a researcher for achieving the research purpose. There are two types of time horizon being available for researchers, which are cross-sectional and longitudinal (Kumar, 2011). While the first one is defined as research being executed one time in a data collection process, the latter one is referred as the collection of data several times during data collection process. In this study, the time horizon of research was longitudinal because the collected data covered a time interval ranging between January 1 and December 31, 2020. Therefore, the research aimed to analyze the impact of COVID-19 pandemic on BET over an aforementioned time interval.

3.2 Data Collection Process and Analysis

The data collected for this study was characterized as secondary data because the data about the performance indicators of Budapest stock market and COVID-19 cases in Hungary was gathered from publicly available and accessible database. The secondary data about Budapest stock market and COVID-19 pandemic provided a chance to save time and cost. The collected secondary data was quantitative data because the values in the dataset were represented with values. In particular, the data was defined as numerical form of quantitative data because the numbers included in the dataset were numerical values rather than categorical values utilized for categorizing values in the generated data.

The data analysis methods used to analyze the stock market performance and COVID-19 related data along with the relationship between these two concepts included descriptive statistics and multiple regression analysis. In context of descriptive statistics, the frequency distribution about the stock prices, stock volumes, stock volatility, deaths and infections related to COVID-19 pandemic in Hungary was used to provide general understanding about the situation during the chosen time horizon for this study. In case of regression analysis, the relationship between dependent and independent variables was assessed to accomplish research objectives (Table 1). The dependent variables included the indicators of the performance of chosen stock market, such as stock price, stock volume and stock volatility.

Table 1. Dependent and Independent Variables of Research

Dependent Variables (Indicators of performance of Budapest Stock Market	**Independent Variables (indicators of COVID-19 pandemic in Hungary)**
Stock price **Stock volume** **Stock volatility**	Number of deaths (daily) = New Deaths Number of infected people (daily) = New Cases Change in the percentage of total deaths (in comparison to previous day) = Cumulative Deaths Change in the percentage of total infections (in comparison to previous day) = Cumulative Cases

There were three models for regression analysis in this study (Table 2). The first model aimed to assess how the stock prices of BET influenced by the indicators of state of COVID-19 pandemic in Hungary. The second model was devoted to appraising the impact of independent variables, which assessed the state of COVID-19 in Hungary on the stock volume of BET. The third model was designed to assessing how stock volatility was influenced by the COVID-19 pandemic during selected period for this study.

Table 2. Models of Regression Analysis

Scope of Regression Analysis	**Models**
The First Model: Stock price	$Y_p = a + b_1 * X_1 + b_2 * X_2 + b_3 * X_3 + b_4 * X_4 + g$
Stock volume	$Y_v = a + b_1 * X_1 + b_2 * X_2 + b_3 * X_3 + b_4 * X_4 + g$
Stock volatility	$Y_t = a + b_1 * X_1 + b_2 * X_2 + b_3 * X_3 + b_4 * X_4 + g$
Y_p = Stock Price **Y_v = Stock Volume** **Y_t = Stock Volatility** **a = intercept** **g =**	X_1 = Number of deaths (daily) X_2 = Number of infected people (daily) X_3 = Change in the percentage of deaths (in comparison to previous day) X_3 = Change in the percentage of infections (in comparison to previous day)

3.3 Limitations of Research Methodology

There are two principal limitations of research methodology. Firstly, the research findings in the current study might well be further improved through adding other indicators of stock market performance of BEX. In particular, the current study could be improved via integrating stock price changes, stock volume changes and moving averages. The inclusion of these variables into the data analysis and findings process would provide an opportunity to assess and identify the impact of COVID-19 pandemic on various aspects of stock market. Secondly, the results of current study could be further improved if the stock market performance of BEX was compared to post-Covid-19 period. Since the stock markets have not recovered after the development and

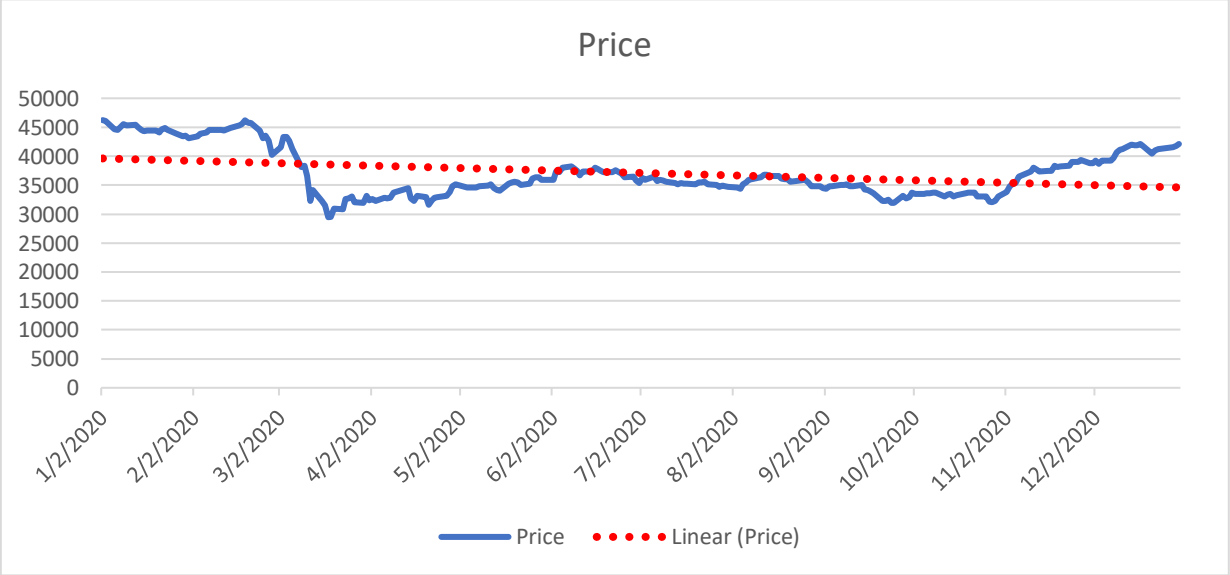
expansion of vaccination against COVID-19 pandemic, it was difficult to collect reliable and accurate data about performance of BEX after novel coronavirus and, accordingly, to assess the changes in the performance of BEX. However, comparing performance of BEX during and after COVID-19 pandemic could provide a chance to statistically identify the extent of impact of the respective pandemic on the stock market.

4. Findings and Discussion

4.1 Analysis of Budapest Stock Market

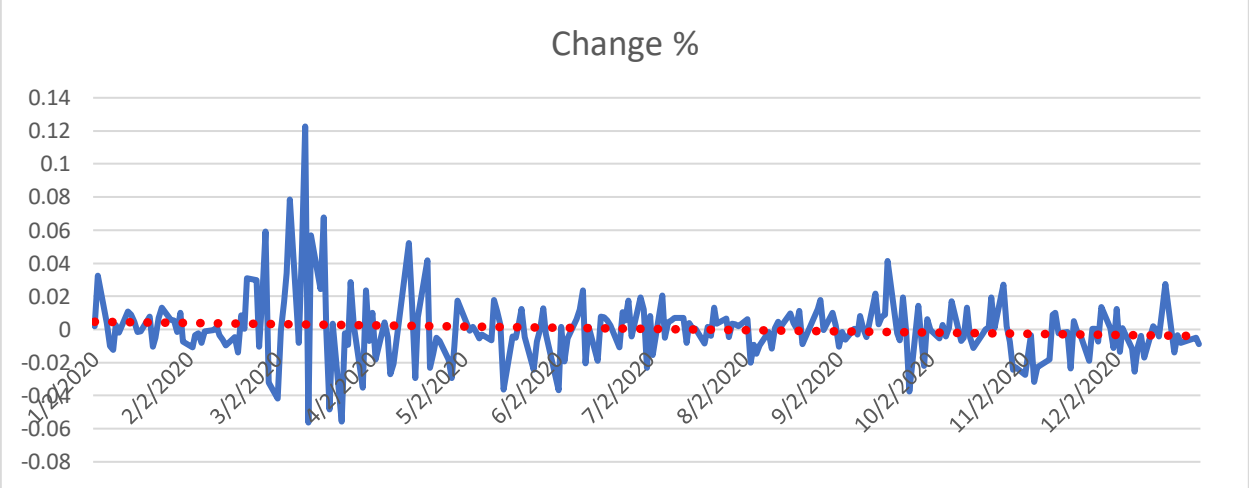
This section of research presents the analysis of the overall performance of Budapest stock market during 2020. Figure 2 demonstrates the stock prices of BUX throughout 2020. In particular, BEX in case of stock prices experienced significant fluctuations throughout 2020, which could be considered as significant threat to the stability of the respective stock market. Prior to the outbreak of COVID-19 pandemic, the stock price of BUX stood between 46 thousand and 40 thousand Hungarian forint (HUF) (Figure 2). However, after the emergence of COVID-19 pandemic in Hungary on March 2020, the stock market experienced quick and significant drop in its exchange prices. In particular, the stock prices of BUX dropped to sharply to around 36 thousand HUF. After the respective decline, the BUX had encountered significant fluctuations in its stock prices throughout 2020. In particular, the stock prices of BUX reflected declining trend during 2020, which was regarded as a threat to the long-term sustainability of the respective stock market. The declining stock prices in BUX reduced the incentives of participants at the stock markets to purchase the stocks from Budapest stock exchange because of their perceptions about the possibility of losing money if they invested in the respective market.

Figure 2. Stock Price of Budapest Stock Exchange Market



The declining stock prices of BUX was also reflected in the changes in the stock prices of the respective market. The highest level of declines in the stock prices of BUX was experienced in March 2020, which corresponded with the first-time detection of the COVID-19 cases in Hungary. On March 11, 2020, the stock price of BUX compared to the previous day dropped by 12%, which was the highest level during 2020 (Figure 3). The stock prices of BUX reflected the fluctuations throughout the year due to instable and ambiguous changes in the stock prices. Throughout 2020, the stock prices of BUX followed by both positive and negative changes in their valuations, which potentially caused the lack of intention among the investors to allocate their financial funds to the respective stock market due to the lack of stability in the respective market.

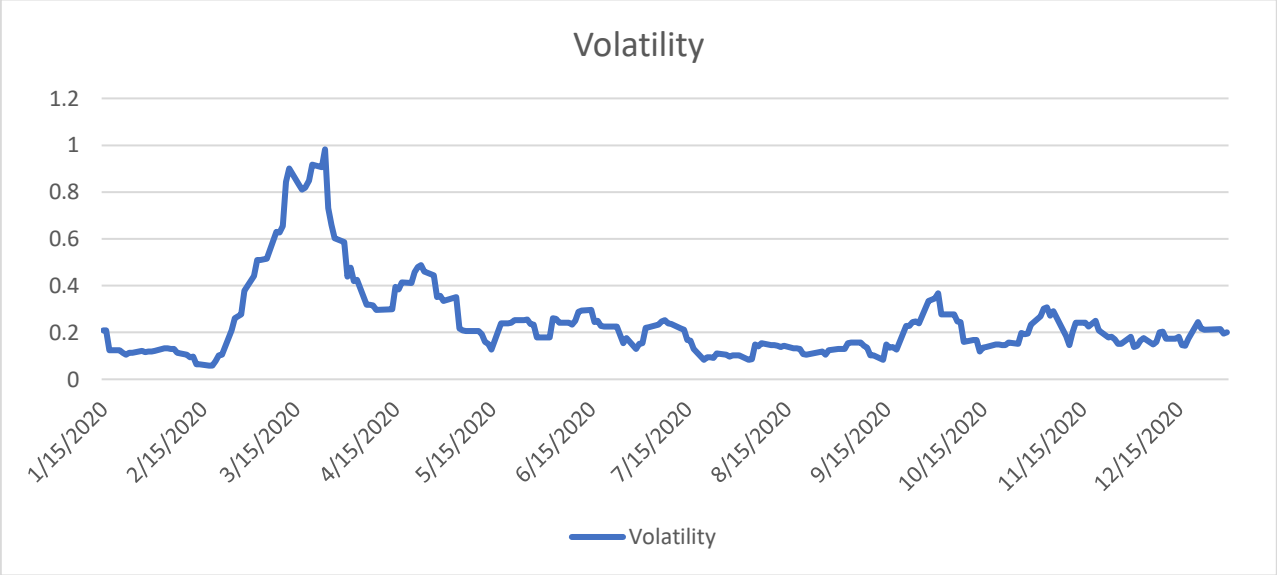
Figure 3. Stock Price Changes of BUX



The volatility of BUX was another principal indicator reflecting the performance of the selected stock market during 2020. Figure 4 shows that prior to the outbreak of COVID-19 pandemic in Hungary, the Budapest stock market had experienced low volatility rate. In particular, during January and February 2020, the volatility rate in BUX stood below 0.2 (Figure 4). However, there was a sharp increase in the volatility of the BUX during March 2020, as the volatility rate of BUX rocketed to about 1 in March 24, 2020 (Figure 4). Later that the volatility rate of BUX mainly stood between 0.2 and 04 (Figure 4). The overall trend of volatility rate in BUX stock market during 2020 was declining (Figure). Thus, the year of 2020 was characterized as

significantly volatile period for Budapest stock market, which was another principal indicator of the strength and stability of stock market from the perspective of buyers in the stock markets. Thus, the volatile BUX could led the buyers in the stock market to either sell their current stocks or to avoid investing in the stocks in BUX, which led to decline in the stock prices of BUX.

Figure 4. Volatility of BUX



The abovementioned indicators of Budapest stock market indicated that the performance of BUX changed after March 2020. The decline in stock price and stock price changes could be triggered by the volatility of the BUX during 2020; however, the cause of the volatility in the BUX stock market could be associated with the COVID-19 pandemic, as the period of fluctuations in the BUX corresponded with the emergence of COVID-19 pandemic in Hungary. Accordingly, the research principally focused on empirically finding the relationship between the indicators of BUX stock market and COVID-19 pandemic to verify that the fluctuations in BUX in case of stock price, stock price changes and volatility rate were principally caused by the outbreak and expansion of novel coronavirus.

4.2 Relationship between COVID-19 Pandemic and BUX Stock Market

There were three regression models that were designed to assess the impact of novel coronavirus on BUX stock market. Each model addressed a particular indicator of stock market, such as stock price, stock volume and stock volatility. Besides, the main outputs of regression results used for achieving the study purpose included adjusted r-square, significance value and

coefficient of each variable included in the regression models. The adjusted r-square was referred as a variable reflecting the competency of the regression models to predict the change in each indicator of Budapest stock market. In this case, the range between 0.7 and 0.9 was considered as a suitable level for adjusted r-square to conclude that the constructed model was enough competent for prediction of the changes in the dependent variable (Kumar, 2011). The significance value was referred as an indicator reflecting the existence of empirically significant relationship between the variables of the regression analysis. In this case, the significance level of 0.05 was considered as a maximum point of concluding the existence of empirical relationship between relevant variables (Kothari, 2011). Thus, if the p-value of specific variable was less than 0.05 level, it was concluded that there existed statistical relationship between the respective variable and dependent variable in this study. The last key value being analyzed in this section was coefficients of independent variables. In particular, the coefficients of independent variables reflect their nature of relationship with the dependent variable, which could be either positive or negative (Kothari, 2011). If the coefficient of a specific independent variable of this study was negative, it was concluded that there existed negative relationship between the corresponding variable and dependent variable.

Table 3 presents the key findings of the 1st regression design being constructed to assess how various indicators of COVID-19 pandemic were related to the stock price of BUX during 2020. The results of this regression design showed that adjusted r-square of the constructed model was 0.713. Thus, the 1st regression model is referred as statistically effective model in predicting the changes in stock price of BUX because of adjusted r-square falling within the interval of sufficiency. Therefore, the adjusted r-square meant that 71.3% of fluctuations in stock prices of BUX during 2020 was predicted by the indicators of COVID-19 pandemic included in the regression model, such as number of new cases, cumulative cases, new deaths and cumulative deaths. The next principal output of first regression analysis was significance level of indicators of COVID-19 pandemic in Hungary. There were three principal indicators of COVID-19 pandemic, such as number of new cases and percentage of change cumulative cases and deaths had statistically significant correlation with the stock price of BUX during 2020. Because the significance levels of aforementioned three indicators of COVID-19 pandemic had significance values that were less than 0.05, there existed empirical relationship between them and stock price of BUX. The final value being used to analyze the relationship between stock prices of

BUX and COVID-19 pandemic was standardized coefficients. All of the identified three indicators of COVID-19 pandemic, such as new cases, cumulative cases and cumulative deaths had negative coefficients, such as -0.421, -0.785 and -0.637, respectively. Thus, there was negative relationship between three indicators of COVID-19 pandemic and stock prices of BUX during 2020. Accordingly, the increase in either of three indicators of COVID-19 pandemic, like new cases, cumulative cases or cumulative deaths was followed by a decline in the stock prices of BUX during 2020. Hence, the findings of the 1st regression model showed that the indicators of COVID-19 pandemic, like new cases, total cases and total deaths were statistical determinants of the changes in the stock prices of BUX during 2020. Therefore, an increase in the new cases, cumulative cases and cumulative deaths was expected to cause a decline in the stock prices of BUX during 2020. The Random Walk Theory is well suited for explaining the reason leading the pattern of decline in stock prices after an increase in the level of cases and deaths in COVID-19 in Hungary. Since information about increasing the new and total COVID-19 cases and total COVID-19-related deaths created a pessimistic perception among the shareholders about the future prosperity of life as well as the stock markets, they became motivated to sell their shares in the stock market, which caused a decline in stock prices due to an increase in the number of shares being sold in the Budapest stock exchange as an outcome of COVID-19 pandemic.

Table 3. The Findings of the 1st Regression Design

Adjusted R^2	**.713**	
Dependent Variable - Stock Price of BUX		
Independent Variable	**Standardized Coefficient (Beta)**	**Significance**
New Cases	-.421	.000
Cumulative Cases	-.785	.004
New Deaths	-.028	.614
Cumulative Deaths	-.637	.000

Table 4 provides the main findings for the 2nd regression design of this study, which intended to identify how the indicators of COVID-19 pandemic were related to the stock volume of BUX

during 2020. As in case of abovementioned model, the adjusted r-square was the initial value being analyzed in the second regression design because it reflected the capability of the designed model to predict the changes in the stock volume of BUX during 2020. The adjusted r-square of 2nd regression design was 0.747, which fell within the interval of sufficiency; thus, the model was considered as statistically effective to anticipate the changes in the stock volume of BUX during 2020. In this regard, the adjusted r-square showed that 74.7% of fluctuations in the stock volume of BUX during 2020 was predicted by the changes in the indicators of COVID-19 pandemic included in the second regression model of research. Furthermore, the significance values of two indicators of COVID-19 pandemic, such as number of new cases and percentage of cumulative deaths related to COVID-19 pandemic had significance values being below the significance level of 0.05. Thus, the aforementioned two indicators of COVID-19 pandemic had empirically significant relationship with the stock volume of BUX during 2020. In addition, the coefficients of these indicators of COVID-19 pandemic, like number of new COVID-19 cases and percentage of COVID-19 related deaths had positive coefficients, such as 0.293 and 0.170. Thus, the positive coefficients of new COVID-19 cases and cumulative deaths meant the existence of positive correlation between them and stock volume of BUX during 2020. Thus, the increase in the level of either new COVID-19 cases or percentage of total COVID-19 deaths was tracked by the increase in the stock volume of BUX during 2020. Accordingly, an increase in the number of people being infected to COVID-19 cases and increase in the percentage of total number of deaths compared to the previous day functioned as precedes about the increase in the stock volume in BUX during 2020. The Greater Fool Theory could explain the reason for an increase in the stock volume in case of an increase in the COVID-19 cases and deaths in Hungary. From the perspective of this theory, an increase in COVID-19 cases and deaths functioned as a factor of transforming the positive perceptions of shareholders with their negative perceptions about the future prosperity of the Budapest stock market, which caused them to exchange their shares with the money in BUX during 2020; thus, the stock volume of BUX increased during 2020 as an outcome of the changes in the perceptions of greater fools about sustainability of operations in BUX, which was triggered by COVID-19 pandemic.

Table 4. The Findings of the 2nd Regression Design

Adjusted R^2	.747	
Dependent Variable - Stock Volume of BUX		
Independent Variable	**Standardized Coefficient (Beta)**	**Significance**
New Cases	.293	.001
Cumulative Cases	.657	.147
New Deaths	-.028	.681
Cumulative Deaths	.170	.007

Table 5 demonstrates the basic findings of research for the 3rd regression model, which aimed to assess how the indicators of COVID-19 pandemic was related to the stock volatility of BUX during 2020. The adjusted r-square of this model was 0.769, which was within the sufficiency level determined for competent regression model in this study. In this regard, the respective value of adjusted r-square indicated that 76.9% of changes in the stock volatility of BUX during 2020 was anticipated by the changes in the indicators of COVID-19 pandemic in Hungary. As in case of the 1st regression model, there were three indicators of COVID-19 pandemic, like new cases, cumulative cases and cumulative deaths had significance values falling below significance line of 0.05. Thus, these indicators of COVID-19 pandemic had empirical correlation with the stock volatility of BUX during 2020. Besides, the coefficients of new cases, cumulative cases and cumulative deaths were 0.569, 0.682 and 0.633, respectively. The positive coefficients of these indicators of COVID-19 pandemic meant that there was positive relationship between COVID-19 pandemic and stock volatility of BUX. Thus, an increase in the number of new COVID-19 cases, percentage of total COVID-19 cases or deaths were followed by an increase in the volatility of BUX during 2020. The Black Swan Theory could explain the reason for an increase in the stock volatility of BUX during 2020, which went hand-in-hand with the COVID-19 pandemic. From the perspective of this theory, the emergence and expansion of COVID-19 functioned as an unexpected event in the stock market, which shaped the behavior of shareholders negatively at BUX during 2020. Once the number of new cases,

cumulative cases and deaths increased during 2020, it generated the effect of unexpected event at the BUX during 2020, which led to the fluctuations in the stock prices relatively.

Table 5. The Findings of the 3rd Regression Design

Adjusted R^2	**.769**	
Dependent Variable - Stock Volatility of BUX		
Independent Variable	**Standardized Coefficient (Beta)**	**Significance**
Number of New Cases	.569	.000
Number of Cumulative Cases	.682	.003
Number of New Deaths	.018	.834
Number of Cumulative Deaths	.633	.002

5. Conclusion and Suggestions

The research findings showed that the stock price of BUX during 2020 was negatively correlated to the indicators of COVID-19 pandemic, like new cases, cumulative cases and cumulative deaths. Besides, the research identified that the stock volume of BUX during 2020 was positively correlated to the indicators of COVID-19 pandemic, like new cases and cumulative deaths. Finally, the study revealed that the stock volatility was negative correlated to the new cases, cumulative cases and cumulative deaths associated with COVID-19 pandemic. Accordingly, the research concluded that there existed statistically negative relationship between COVID-19 pandemic and Budapest stock market during 2020.

The overall results and interpretation of the regression analyses in this study revealed that there existed negative relationship between COVID-19 pandemic and stock market performance of BUX during 2020. In particular, the indicators of COVID-19 pandemic functioned as precedes of the changes in the stock market performance of BUX during 2020. In regard with stock prices, there existed negative correlation between stock prices of BUX and COVID-19 pandemic. In cases of stock volume and stock volatility, there existed positive correlation between stock volume and stock volatility of BUX and indicators of COVID-19 pandemic. The results of regression analyses also complied with the relevant researches conducted to ascertain the relationship between COVID-19 pandemic and stock market (Alzyadat and Asfoura, 2021; Hatmanu and Cautisanu, 2021; Boahali et al., 2021). The present study identified that the stock market performance of BUX was negatively correlated to the indicators of COVID-19 pandemic during 2020.

There are two suggestions for the investors that are interested in investing in BUX stock market. The first one is that the post-pandemic period is expected to generate an increasing trend in the stock prices so that it could be rational to invest in BUX stock market, as it would generate significant returns for them. The second one is that the stock volatility is expected to decline in the post-pandemic period if there does not emerge an external shock for the BUX. Hence, it could be profitable for investors to purchase the stocks from BUX due to its potential returns in near future.

6. Summary

The emergence and spread of novel coronavirus worldwide affected every sphere of business environment. The way business companies operating has altered as a result of the new regulations and needs for ensuring the health of employees against the infectious disease. Accordingly, the COVID-19 pandemic also affected the stock markets due to the replacement of the optimistic views of buyers and sellers about the future prosperity of the stock markets. Therefore, this thesis assessed whether the emergence of COVID-19 pandemic within the territories of Hungary had statistically affected the performance of Budapest stock market.

In this thesis, there were two principal concepts, including stock markets and COVID-19 pandemic. The stock market was referred as a marketplace in which the investors were able to purchase the equities at Budapest stock exchange being issued by traders. The COVID-19 pandemic was referred as infectious disease that spread worldwide. There were three theories identified as basis of theoretical framework of this study for explaining the potential impact of COVID-19 pandemic on the stock market performance of BUX, which were Random Walk Theory, Greater Fool Theory and Black Swan Theory.

The research was based upon the archival research that enabled to access to and gather the data about the stock prices, volume and volatility of BUX as well as the COVID-19 cases and deaths in Hungary. The time interval of the analysis covered a period between January 1 and December 31, 2020. The principal tool utilized to assess the generated data was multiple linear regression analysis. Accordingly, there were three regression designs constructed to identify how different aspects of stock market performance of BUX, such as stock price, stock volume and stock volatility were affected by the different indicators of COVID-19 pandemic, like new cases, new deaths, cumulative cases and cumulative deaths.

The research findings enabled to accomplish the purpose of study, as the results and analysis highlighted that during 2020, the stock prices in BUX were negatively correlated to the variables of COVID-19 pandemic, such as new cases, cumulative cases and cumulative deaths. In addition, the findings of study showed that during the respective time, the BUX stock volume was positively correlated to the variables of COVID-19 pandemic, such as new cases and cumulative deaths. Furthermore, the study results presented that the stock volatility of BUX was negatively correlated to the variables of COVID-19 pandemic, including new cases, cumulative

cases and cumulative deaths. Therefore, the research summarized that there was empirically negative relationship between COVID-19 pandemic and BUX during 2020. These findings of the study also were in accordance with the results and conclusions of the researches in the relevant literature (Alzyadat and Asfoura, 2021; Hatmanu and Cautisanu, 2021; Boahali et al., 2021).

There were two proposals for further researches of analyzing the relationship between COVID-19 pandemic and stock markets. The first recommendation was related to analyzing the stock market performance before and during COVID-19 pandemic. The comparison of the stock market performance before and during COVID-19 pandemic via independent T-tests would provide a chance to statistically reveal whether there existed the changes in the stock market performance. The second recommendation was related to conducting the research after full recovery of the stock market from the impact of COVID-19 pandemic. The comparison of stock market performance during and after COVID-19 pandemic would enable to further elaborate the relationship between these two variables. Accordingly, the time interval of the analysis should be expanded in future researches to reveal the extent of impact of COVID-19 pandemic on the stock markets.

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Appendix

Table 1. Model Summary for Stock Price

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.799[a]	.739	.713	.73963

a. Predictors: (Constant), CumulativeDeaths, NewCases, NewDeaths, CumulativeCases

Table 2 Coefficients for Stock Price

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.161	.153		176.979	.000
	NewCases	-.199	.033	-.421	-6.044	.000
	CumulativeCases	-.303	.001	-.785	2.927	.004
	NewDeaths	-.391	.373	-.028	-.506	.614
	CumulativeDeaths	-.219	.047	-.637	-4.616	.000

a. Dependent Variable: StockPrice

Table 3 Model Summary for Stock Volume

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.782[a]	.766	.747	.74417

a. Predictors: (Constant), CumulativeDeaths, NewCases, NewDeaths, CumulativeCases

Table 4 Coefficients for Stock Volume

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.419	.597		53.510	.000
	NewCases	.884	.622	.293	3.459	.001

	CumulativeCases	.047	.274	.657	1.456	.147
	NewDeaths	-.856	.907	-.028	-.411	.681
	CumulativeDeaths	.591	.365	.170	3.712	.007

a. Dependent Variable: StockVolume

Table 5 Model Summary for Stock Volatility

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.787[a]	.782	.769	.93033

a. Predictors: (Constant), CumulativeDeaths, NewCases, NewDeaths, CumulativeCases

Table 6. Coefficients for Stock Volatility

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.928	.955		18.334	.000
	NewCases	.159	.029	.569	5.435	.000
	CumulativeCases	.203	.001	.682	3.015	.003
	NewDeaths	-.144	.685	.018	.210	.834
	CumulativeDeaths	.128	.042	.633	3.059	.002

a. Dependent Variable: StockVolatility