

# The Impact of the COVID-19 Pandemic on the WIG-Energy Stock Exchange Index

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**Abstract:** The COVID-19 pandemic, which has been ongoing since 2020, has caused very big changes in many areas of life around the world. The biggest changes were recorded in the economies of individual countries. Changes also appeared in indices on stock exchanges. The situation was similar on the Warsaw Stock Exchange, both on the main and sectoral indices. The main objective of the article was to analyze the impact of the number of COVID-19 cases on the WIG-Energy index. The Persona method was used. As a result of the research, it was found that taking into account the period from the beginning of the pandemic to the end of 2021, the number of patients does not affect the stock market index of the energy sector. However, if the analyses have been made for individual waves of the pandemic, then as the seasons of COVID-19 disease continue, the number of infections moderately affects the stock market index. The greatest impact was recorded in the first two weeks of the pandemic, in which the correlation coefficient was -0.977.

**Keywords:** pandemic; correlation; stock exchange; energy sector

**JEL Classification:** I15; O11; Q49

## 1. Introduction

The COVID-19 pandemic, which has been ongoing since 2020, has caused very big changes in many areas of life around the world. The biggest changes were recorded in the economies of individual countries. In Poland, based on official data from the Central Statistical Office (2021), gross domestic product in 2020 decreased in real terms by 2.8% compared to an increase of 4.5% in 2019. Similarly, domestic demand decreased in real terms by 3.7%, compared to 2019, when an increase of 3.8% was recorded. Subsequent macroeconomic indicators also show the negative impact of the pandemic on the economy Polish, such as gross accumulation, which decreased in real terms compared to the previous year by 12.2%.

This situation also significantly affects revenues from the markets operated by the stock exchange. Everything that happens in the Polish economy is reflected in the daily stock quotes. The situation was similar on the Warsaw Stock Exchange, where significant changes in individual indices were recorded. This was mainly due to restrictions on conducting business activity, announcing aid programs and granting tax reliefs. However, the biggest factor influencing the changes in the stock market was the increase in uncertainty in the financial markets, which directly affected the volatility prevailing on the capital markets, which was reflected in the value of turnover and capitalization of companies (Dietl et al., 2021).

Changes, those larger and smaller, affected virtually all stock market indices. It is no different also in the case of quotations within the WIG-Energy index, which brings together companies involved in economic sectors related to energy. This is a very significant sector that includes energy raw materials, power generation, as well as distribution. As everyone knows, the costs of energy production have a significant impact on the economy of the country and the world, mainly on its growth. In turn, transactions related to companies involved in energy sectors affect financial markets (Jennings, 2012). As Gajdka and Schabek (2013) point out, the increase in oil prices affects the deterioration of macroeconomic results on a global scale, and this is associated with a deterioration in the situation on global equity markets. On the other hand, in the case of entities related to the energy industry, any increase in oil prices causes many benefits for them and usually does not succumb to downward trends. As initially the pandemic caused a significant reduction in energy demand, and thus a decrease in the prices of energy raw materials, it was decided to analyze the impact of this situation on the activities of companies listed on WIG-Energy. Therefore, the purpose of this article was to examine the impact of the COVID-19 pandemic on the WIG-Energy index. According to previously conducted studies on the impact of the COVID-19 pandemic on the main WIG index, two hypotheses have been adopted.

H1 hypothesis – in the period from March 1, 2020 to December 31, 2021, the amount of Sars CoV-2 virus infections has a moderate impact on the WIG-Energy index.

H2 hypothesis – the greatest impact on the WIG-Energy index was observed in the first two weeks of the COVID-19 pandemic.

## **2. Methodology**

In order to achieve the main goal and verify the hypotheses, a linear relationship between the number of infections with the Sars-Cov2 virus and the WIG-Energy index indicator was examined using the Pearson correlation coefficient. Thanks to this, the strength and direction of the linear relationship between the above variables was determined. According to the interpretation, when the correlation coefficient ( $r$ ) is between 0–0.3, the correlation is weak. In the case of a result of 0.3–0.5, we are dealing with a moderate correlation. A coefficient in the range of 0.5–0.7 indicates a strong correlation, and an  $r$ -factor of 0.7 to 1 shows that the correlation is very strong (Buda & Jarynowski, 2010).

Data for the period from March 1, 2020 to December 31, 2021 were used for the study. Calculations of the impact of variables on each other for the entire given period were made, and a correlation study of two variables in periods of four waves of the pandemic was also carried out. According to the number of decreases and increases in seasonal infections, it was assumed that the first wave of the pandemic in Poland lasted from March 1, 2020 to August 10, 2020. The second wave fell from August 11, 2020 to January 25, 2021. The next increase in infections began on January 26, 2021 and lasted until July 31, 2021. This was the so-called third wave. Finally, the correlation in the fourth wave falling on the period from August 1, 2021, to the end of the study period, was examined.

Before starting empirical research on the basis of the collected material, derived from official statistics of the Ministry of Health (disease rates) and quotations of WIG-Energy indexes from

the GPW Benchmark portal, a short, theoretical analysis of the topic was carried out on the basis of available source materials. The COVID-19 pandemic was mentioned, as well as information on WIG-Energy was presented. In the analysis of the obtained research results, methods of data interpretation were used, in particular the descriptive and graphic method (graphs).

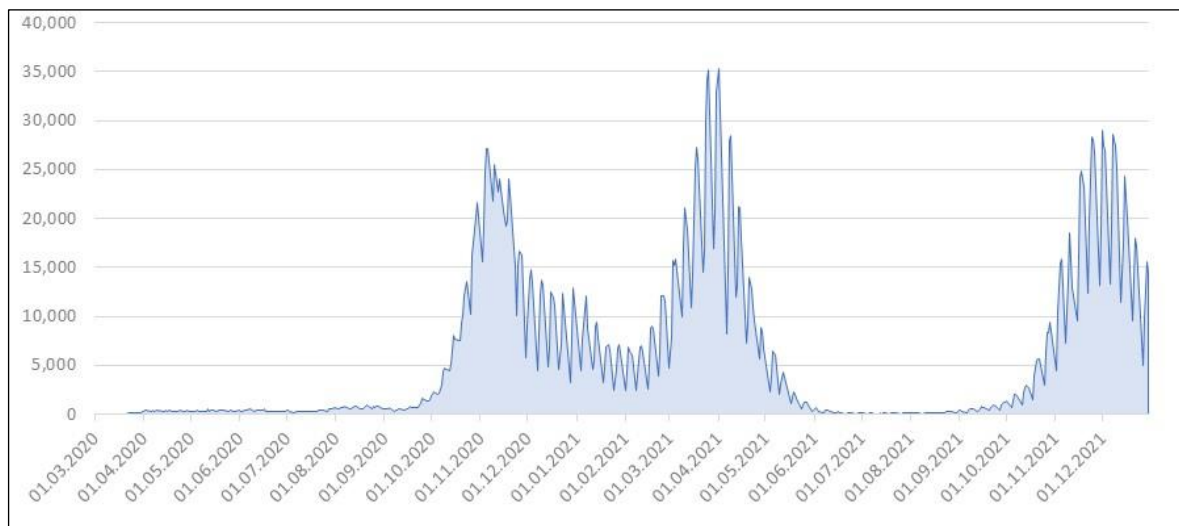
### **3. Results and Discussion**

The COVID-19 pandemic has caused many negative effects in everyday life, social life and, above all, in the global economy. However, this is an opportunity for economists to conduct numerous studies, because so far, such serious phenomena have been recorded in the existing economic crises. Changes were observed that were unusual, deviating from the pattern of seasonal and cyclical changes established for the economy. The pandemic has hit almost every sector of the economy, and the restrictions introduced by this have hit most companies. Research conducted by experts from the Warsaw School of Economics showed that only 9% of the surveyed enterprises did not feel the negative effects of restrictions in economic life introduced as a result of the COVID-19 outbreak, and every fourth considered them severe (Adamowicz, 2021). In this article, the analysis of research results and discussion was preceded by a presentation of the history of the development of the COVID-19 pandemic, with particular emphasis on its division into four stages (the so-called pandemic waves). The next subsection describes the WIG-Energia index, which brings together companies belonging to the Polish energy sector. The last subsection contains the empirical part of the article, which presents the impact of the pandemic on the WIG-Energia index.

#### *3.1. Pandemic COVID-19*

The first officially reported case of COVID-19 in the world was registered in the Chinese city of WUCHAN on December 31, 2019. Several days later, the World Health Organization (WHO) declared the COVID-19 outbreak a public health emergency of international concern. Subsequently, after the deaths from this disease began to spread around the world, the WHO declared the COVID-19 pandemic on 11 March 2020 (Singh et al., 2020).

In Poland, the first case of Sars CoV-2 infection was found on March 6, 2020 in a patient who returned to the country from Germany. From that day on, the number of new cases of the disease began to increase (Figure 1). In turn, the first fatal case was recorded on March 12, 2020. During the analysis period, from March 1, 2020 to 31.12 2021, the pandemic continues continuously around the world, taking on seasonal increases and decreases in infections. In Poland, it was assumed that by the end of 2021 there were four waves of the pandemic. The first wave, which lasted until August 10, 2020, had the mildest course, with more than 840 infections per day recorded at its peak. In the second period, the number of cases was much higher, as on November 7, 2020, 27,875 patients with Sars CoV2 arrived. In turn, the greatest number of new infections were in the third wave. Here, 35,251 people fell ill with COVID-19 on April 1, 2021. In the further period, from June 2021, the number of new infections stabilized and amounted to less than 200 people per day. However, the autumn period of 2021 brought a renewed increase in infected people, where on December 1, 2021 it exceeded 29,000 patients (Coronavirus in Poland, 2022).



**Figure 1.** Daily number of new infections for SARS-CoV-2 in the period from 01.03.2020 to 31.12.2021 in Poland (www.koronawirusuna.pl)

### 3.2. WIG-Energy

The Warsaw Stock Exchange (WSE) is a Polish stock exchange with its registered office in Warsaw. It is a public joint-stock company aimed at providing the possibility of stock exchange trading in securities (such as shares, bonds, pre-emptive rights, etc.) and non-securities financial instruments (such as options, futures contracts) admitted to stock exchange trading. It was created on April 12, 1991, and the first listing included five companies. Since 1994, the Exchange has been publishing various indices. Currently, there are 24 indices, which include companies that meet various criteria, such as the value of the portfolio or the industry to which the companies belong. Some indices are derived from others. One of such indices is WIG-Energy, often referred to as a sectoral sub-index. The calculation started on 4 January 2010 (GPW, 2013). The base value for this index is the quotations from December 31, 2009. The base value, i.e. the value from the base date, is 3,998.60 points for this index. The portfolio of this index includes companies included in the WIG index belonging to the energy sector (Gajdka & Schabek, 2013). The index initially included 4 companies, currently it includes 12 entities (GPW, 2021). The companies listed in WIG-Energy are domestic and foreign enterprises. The WIG-Energy index may include only companies that belong to the WIG index and have at least 10% of shares in free circulation, and the value of these shares is greater than EUR 1 million (Appendix to Resolution No. 866/2019).

### 3.3. Impact of the Covid-19 Pandemic on Stock Indices

The initial information about the emergence of a new disease and the associated deaths among civilian communities caused quite a lot of chaos on a global scale. Very high uncertainty, the announcement by various governments, nationwide collective quarantines, contributed to the economic collapse. Global GDP decreased by about 3-5% of the planned growth rate. On the world's stock exchanges, a fairly strong reaction of stock prices and stock indices was noted. Stock markets began to fall sharply. Many STUDIES on COVID-19 analyzing the reactions of stock prices have shown concern in trading in domestic and

international stock markets. For example, the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) stopped trading with a circuit breaker on March 13 and March 23, 2020, twice in 15 days. Similarly, in March 2020, the US stock exchange used the circuit breaker four times in 10 days (Singh et al., 2020). As you can see, most stock markets have reacted negatively to the COVID-19 crisis. It was similar in Europe, where the Main Index of the British market on March 12, 2020 recorded a decrease of about 10%. On the other hand, the Tokyo Stock Exchange index fell by about 20% compared to the highest level of December 2019 (Zhang & Hamori, 2020).

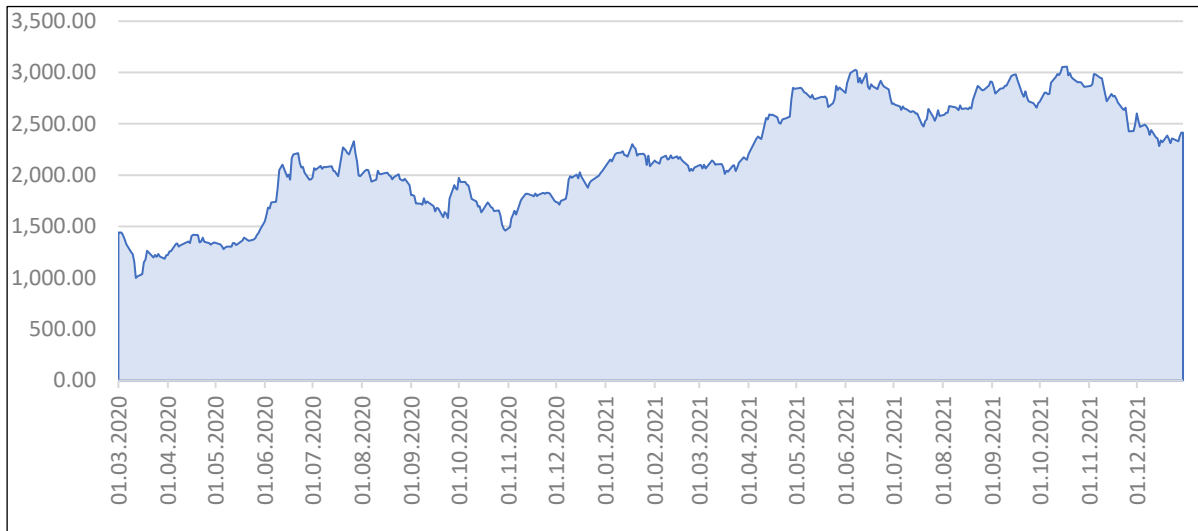
In the past, there have already been periods when a pandemic was declared. Based on a literature review by Jaworski (2021), one such was the SARS epidemic, which led to the financial crisis in Asia. Interestingly, this crisis did not affect countries on other continents. In turn, the Ebola epidemic has caused negative effects only in African countries. The Zika virus, on the other hand, did not contribute to the decline in stock market indexes in South American countries.

The research conducted by the Authors showed that the main stock market index in Poland – WIG initially reacted quite significantly. However, quite quickly the situation began to return to normal. The Management Board of the Exchange quite quickly implemented a number of actions that contributed to minimizing various risks. Several strategies have been adopted to suit different situations. Among the main activities, procedures have been implemented to reduce the risk of infection and the spread of Sars-Cov-2 coronavirus infection, including remote work. Ongoing monitoring of compliance of the scope and quality of services provided by external suppliers was carried out. The most important decision was to maintain the continuity of services provided. All the above actions had a positive impact on the increase in turnover on the stock exchange markets, which resulted in an increase in revenues and generated profits (GPW, 2021).

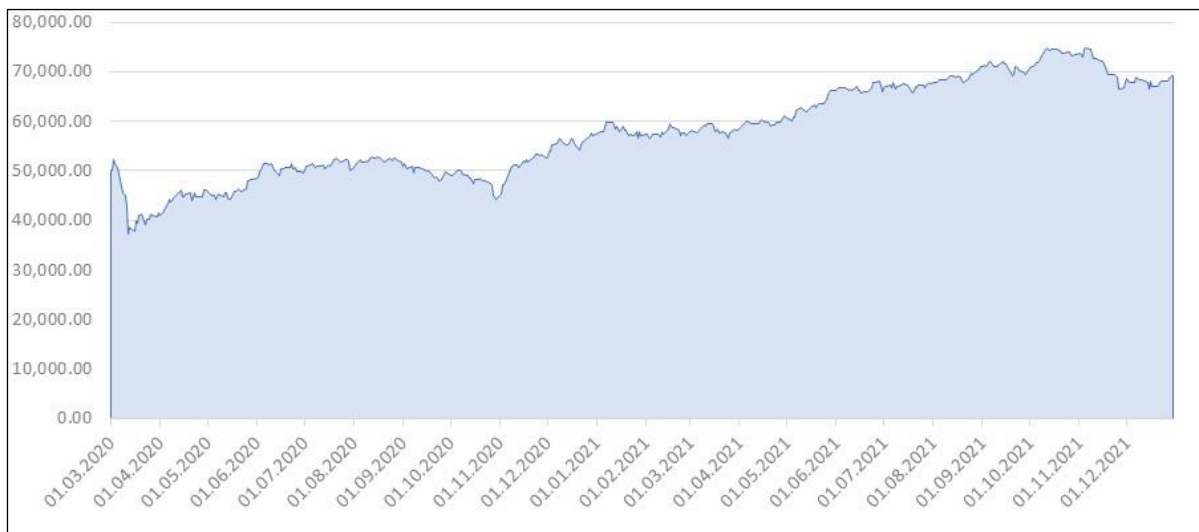
On the Warsaw Stock Exchange, along with the announcement of the pandemic, a definite decrease in quotations in March 2020 can be seen (Figure 2). In the following months, the index increased gradually, and in November 2020, during the period when the second wave of the pandemic intensified, another collapse took place. Since December 2020, there has been a long-term upward trend, lasting until the autumn of 2021, when the fourth wave of infections began to hit.

#### *3.4. Impact of the Covid-19 pandemic on the WIG-Energia stock market index*

In the WIG-Energy index, in contrast to the WIG index, one can notice a much greater irregularity and lack of a typical trend (Figure 3). In the first weeks of the pandemic, as in the case of the main index, a fairly large decline in quotations was found. Soon after, in April and May, the WIG-Energy index stabilized at a fairly similar level, to recover decisively in the summer. In turn, autumn 2020 brings further declines, this time small. However, at the beginning of 2021, a gradual recovery on the stock exchange in the field of energy companies begins. It is only in the autumn of 2021, where the fourth wave of the pandemic appears, that declines are visible.



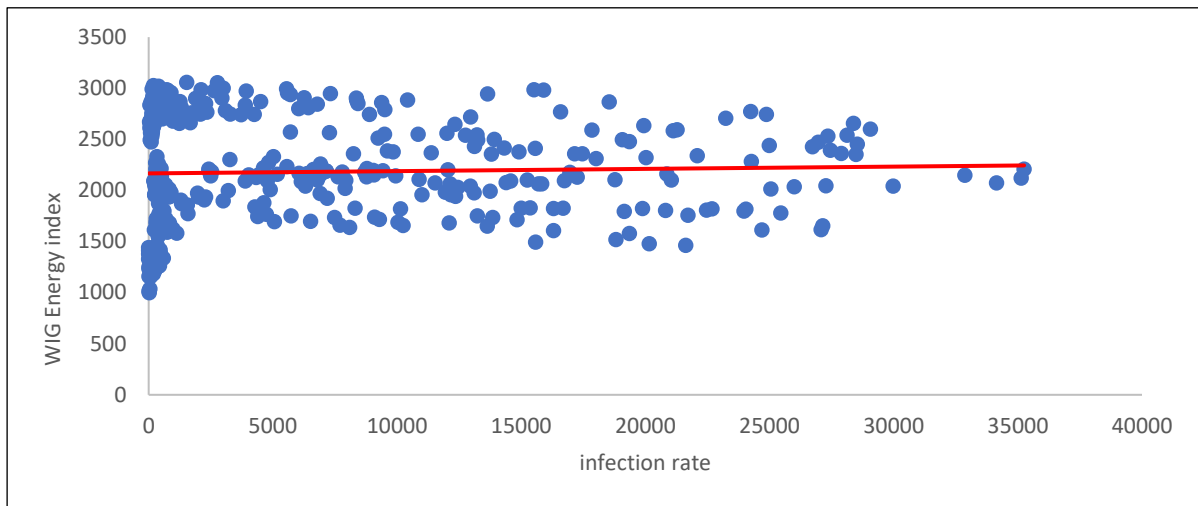
**Figure 2.** Quotations of the main WIG index in the period from 1 March 2020 to 31 December 2021 (money.pl)



**Figure 3.** Quotations of the WIG-Energy index in the period from 1 March 2020 to 31 December 2021 (money.pl)

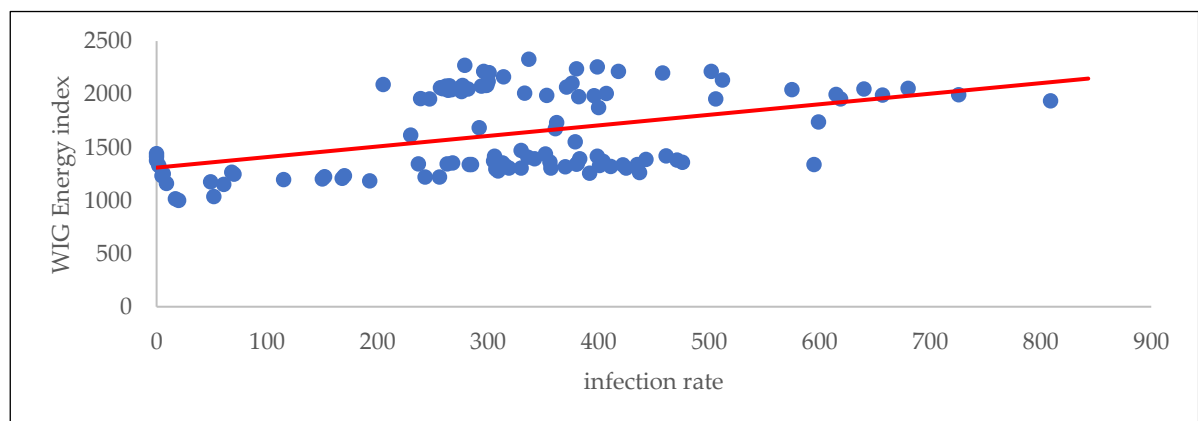
However, in order to check whether these downward and upward trends are directly due to the pandemic and the number of infections, a study of the impact of two variables was carried out using the correlation coefficient mentioned in the methodology.

The survey conducted throughout the period from March 2020 to December 2021 showed that the correlation coefficient was  $r = 0.034$  (Figure 4). This result says that there is no linear relationship and practically the infection rate has no effect on the WIG-Energy index. The pandemic practically does not affect stock quotes throughout the entire research period. This result, causes that hypothesis 1, say that in the period from March 1, 2020 to December 31, 2021, the amount of Sars CoV-2 virus infections moderately affects the WIG-Energy index, in this case it is refuted.



**Figure 4.** Dependence of the WIG-Energy index on the sars-Cov-2 infection rate in the period from March 1, 2020 to December 31, 2021 (own elaboration based on data <http://koronawirusunas.pl> and [money.pl](http://money.pl))

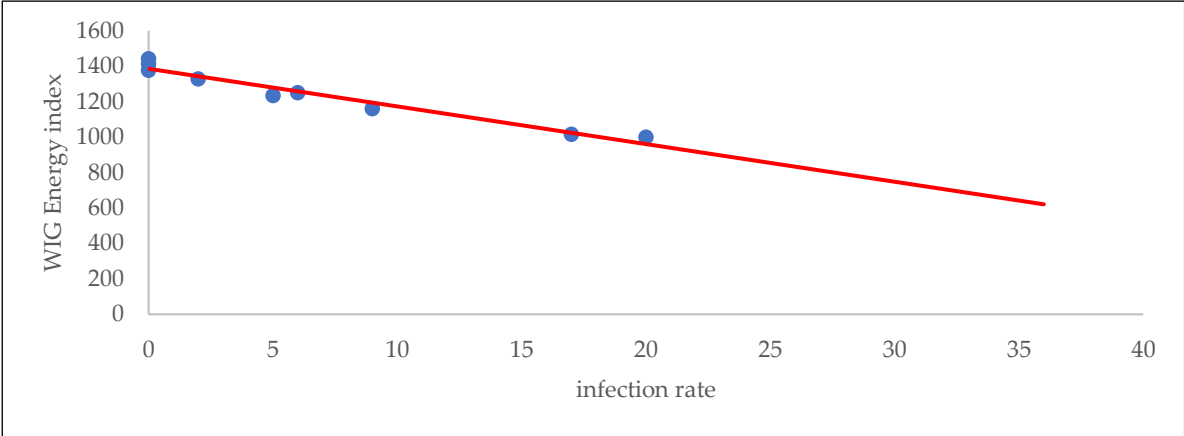
In the analysis of the course of the pandemic, we can see a fairly high variability of infections, which shows a seasonal (wave) character. Therefore, it is widely accepted to define the next waves of the pandemic. Therefore, it was examined how individual waves affected the WIG-Energy stock market index. In the first wave, lasting from March 2020 to around August 10, 2020, the correlation coefficient for the two variables adopted was 0.423, which indicates a moderate relationship (Figure 5). However, the positive indicator shows that as the number of infections increases, the WIG-Energy index also increases. After a deeper analysis of these results, it should be concluded that in the initial period, when the stock market and the entire economy reacted quite violently to the emergence of the pandemic, there was still a small number of infections. Only from month to month of the first wave, the number of infections increased, and the stock market calmed down.



**Figure 5.** Dependence of the WIG-Energy index on the sars-Cov-2 infection rate in the period from March 1, 2020 to August 10, 2020. (own elaboration based on data <http://koronawirusunas.pl> and [money.pl](http://money.pl))

In order to study the first reactions of the stock exchange, the time frame of this survey was shortened to the first half of March 2020 (Figure 6). In this case, the correlation

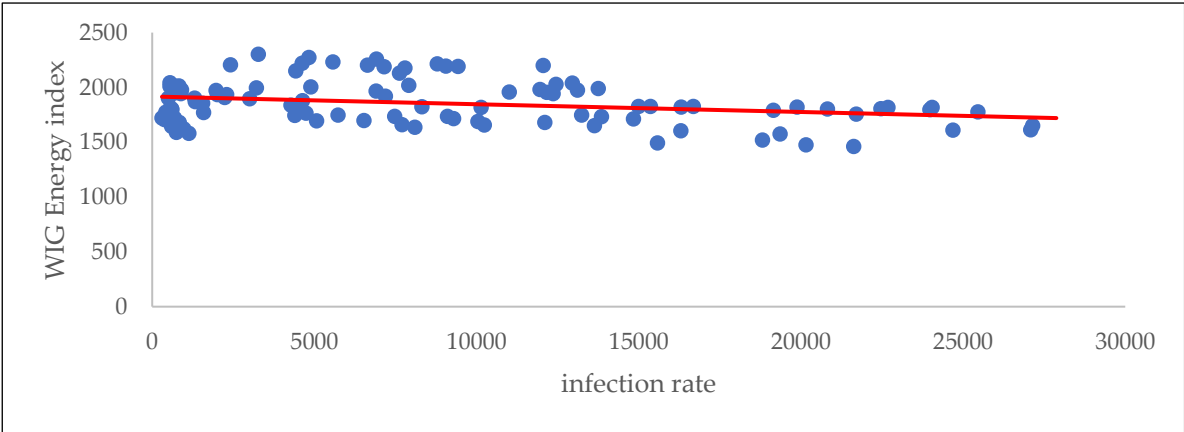
coefficient was  $r = -0.977$ . This indicates a very strong relationship, which shows that as infections increase, the WIG-Energy stock market index drops sharply.



**Figure 6.** Dependence of the WIG-Energy index on the sars-Cov-2 infection rate in the period from March 1, 2020 to March 15, 2020 (own elaboration based on data <http://koronawirusunas.pl> and [money.pl](http://money.pl))

The above result of the study of the relationship between two variables in the first two weeks of the pandemic allows to confirm the H2 hypothesis – the greatest impact on the WIG-Energy index was observed in the first two weeks of the COVID-19 pandemic.

After the summer stabilization in 2020, from mid-August another wave of the pandemic began, referred to as the second. This is the period when the global and national economies also react to the number of infections (Fig. 7). Based on the analysis, it appears that in the period from August 10, 2020 to January 25, 2021, the correlation coefficient between the number of infections on Sars-CoV2 and the WIG-Energy index is at the level of  $-0.276$ . This indicates a weak relationship between these variables, i.e. an increase in the number of infections, slightly affects the decline of the stock market index.

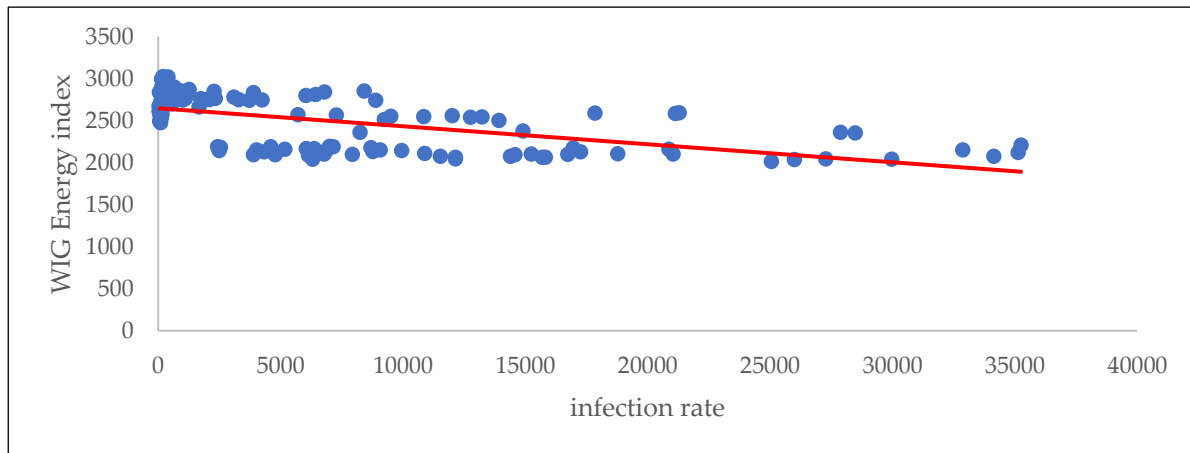


**Figure 7.** Dependence of the WIG-Energy index on the sars-Cov-2 infection rate in the period from 11 August 2020 to 25 January 2021 (Own elaboration based on data <http://koronawirusunas.pl> and [money.pl](http://money.pl))

In the next wave of the pandemic, falling in the period from January 26, 2021 to July 31, 2021, volatility studies showed that the correlation coefficient between the data in question was  $r = -0.607$  (Fig. 8). This indicates a moderate dependence, and as the coefficient is



negative, as the Sars-CoV2 incidence increases, the WIG-Energy stock market index decreases.



**Figure 8.** Dependence of the WIG-Energy index on the sars-Cov-2 infection rate in the period from 11 August 2020 to 25 January 2021 (Own elaboration based on data <http://koronawirusunas.pl> and [money.pl](http://money.pl))

The fourth wave of the pandemic and the increase in cases, falling in the autumn of 2021, contributed to the maintenance of similar research results, where the linear correlation coefficient in this period was  $r = -0.537$ . As in the third wave, the dependence is moderate and the increase in the number of patients slightly causes the index to fall in the stock market.

Summing up the analyses of subsequent waves, they show that the number of infections on Sars-Cov-2 in seasonal terms has a moderate impact on the WIG-Energy stock market index. This means that hypothesis 1 – in the period from March 1, 2020 to December 31, 2021, the amount of Sars-CoV-2 virus infections has a moderate impact on the WIG-Energy index, in part it should be maintained, because in the third and fourth waves, in fact, the WIG-Energy index is moderate in terms of the number of infections.

## 5. Conclusions

The COVID-19 pandemic has significantly affected the global and domestic economy. It also had its negative impact on stock exchanges, as evidenced by the research conducted in this article. However, it should be taken into account that the relationship between the number of infections and the indicator of the stock index should be calculated periodically. In particular, the first period, the so-called first wave, was quite specific. Well, the greatest turmoil occurred in the first weeks, after the World Health Organization declared a pandemic. At that time, there were still relatively small rates of illness, while the indicators of the stock market index fell sharply. In this case, in addition to the spread of the disease, the stock market declines were also influenced by uncertainty, lack of medicine, fear from media reports, as well as national quarantine. However, taking into account only the impact of the number of infections on the WIG-Energy index, it was found that in each subsequent wave of the pandemic, this dependence increases.

**Conflict of interest:** none

## References

- Adamowicz, E. (2021) Gospodarka w czasie pandemii. *Gazeta SGH życie uczelni*.  
<https://gazeta.sgh.waw.pl/meritum/gospodarka-w-czasie-pandemii>
- Buda, A., & Jarynowski, A. (2010). *Life-time of correlations and its applications* (pp. 5–21). Independent Publishing.
- Central Statistical Office. (2021). *Produkt krajowy brutto w 2020 r. – szacunek wstępny*. <https://stat.gov.pl/obszary-tematyczne/rachunki-narodowe/roczne-rachunki-narodowe/produkt-krajowy-brutto-w-2020-roku-szacunek-wstepny,2,10.html>
- Coronavirus in Poland. (2022). <https://koronawirusunas.pl/>
- Dietl, M., Borowski, P., Kułakowski, D., & Olszewska, I. (2021). *Skonsolidowane Sprawozdanie Finansowe Grupy Kapitałowej Giełdy Papierów Wartościowych w Warszawie S.A. za rok zakończony 31 grudnia 2020* (pp. 14-15) Giełda Papierów Wartościowych w Warszawie S.A.
- Gajdka, J., & Schabek, T. (2013). Akcje spółek indeksu WIG-ENERGIA na giełdzie papierów wartościowych w Warszawie. *Rynek Energii*, 3, 31-38.
- GPW (Giełda Papierów Wartościowych w Warszawie S.A.). (2013). *Indeksy Giełdy Papierów Wartościowych w Warszawie*, 3-8.
- GPW (Giełda Papierów Wartościowych w Warszawie S.A.). (2021). *Pandemia COVID*.
- Jaworski, J. P. (2021). Neutralizing monoclonal antibodies for COVID-19 treatment and prevention. *Biomedical journal*, 44(1), 7-17. <https://doi.org/10.1016/j.bj.2020.11.011>
- Jennings, W. (2012). Energy stocks as separate portfolio allocation. *Journal of Wealth Management*, 14(4), 70-86. <https://doi.org/10.3905/jwm.2012.14.4.070>
- Singh, B., Dhall, R., Narang, S., & Rawat, S. (2020). The Outbreak of COVID-19 and Stock Market Responses: An Event Study and Panel Data Analysis for G-20 Countries. *Global Business Review*, 097215092095727. <https://doi.org/10.1177/0972150920957274>
- Załącznik do Uchwały Nr 866/2019 Zarządu Giełdy Papierów Wartościowych w Warszawie S.A. z dnia 30 sierpnia 2019 r. w sprawie zmiany Uchwały Nr 42/2007 Zarządu Giełdy z dnia 16 stycznia 2007 r. (z późn. zm.) Szczegółowe zasady konstrukcji i podawania do publicznej wiadomości indeksów i subindeksów giełdowych. [https://www.gpw.pl/uchwaly-zarzadu-gpw?cmn\\_id=108783&title=Uchwa%C5%82a+Nr+866%2F2019&ph\\_main\\_01\\_start=show](https://www.gpw.pl/uchwaly-zarzadu-gpw?cmn_id=108783&title=Uchwa%C5%82a+Nr+866%2F2019&ph_main_01_start=show)
- Zhang, W., & Hamori, S. (2020). Crude oil market and stock markets during the COVID-19 pandemic: Evidence from the US, Japan, and Germany. *International Review of Financial Analysis*, 74. 101702. <https://doi.org/10.1016/j.irfa.2021.101702>