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Comparison of the financial market conditions in Poland and selected countries during the pandemic and the Russian-Ukrainian war

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ABSTRACT

The initial period of the COVID-19 pandemic and the outbreak of the Russian-Ukrainian war had a significant impact on financial markets. The aim of the work is to analyse the behaviour of selected segments of the Polish financial market in the initial period of the pandemic and war. The research is based on two measures of risk, relative and absolute. The research covers the period from 24 February 2022 to 22 August 2022. The research focuses on segments of the Warsaw Stock Exchange through the analysis of the following indices: WIG, WIG20, mWIG40, sWIG80, NCIndex, industry indices, and the TBSP treasury bond market index. The Warsaw Stock Exchange indices are also compared using variation coefficients and standard deviations with indices of selected world stock exchanges. After the start of the war, declines in the Warsaw Stock Exchange occurred with a delay of over a month. They can be linked to specific EU actions in the area of sanctions against Russia. Both risk measures indicate a similar response to the main indices, which can be interpreted as the high level of development of the Warsaw Stock Exchange, as compared to other stock exchanges.

JEL classification: C43, C49, D53, E44, G50

Keywords: capital market, financial market, COVID-19 pandemic, Russian-Ukrainian war, measures of risk, market indices.

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The initial period of the COVID-19 pandemic and the outbreak of the Russian-Ukrainian war were unprecedented events that had a significant impact on financial markets. Due to earlier research on the beginning of the pandemic presented in the works (Żebrowska-Suchodolska et al., 2021, 2022) covering about half a year (from 19 November 2019 to 15 May 2020), it was also decided to cover the half-year period of the beginning of the Russian-Ukrainian war (from 24 February 2022 to 22 August 2022). It seems that the assumed period largely reflects the "shock" of financial markets to events such as the pandemic and war. In the latter case, they were dealing with a series of actions by the European Union in the form of sanctions imposed on all projects in which Russia was involved. Undoubtedly, they have an impact on the behaviour of entities operating on capital markets. Therefore, the aim of the work is to a large extent a qualitative, but supported by elements of quantitative analysis, comparison of reactions of selected segments of financial markets to the initial period of the pandemic and the Russian-Ukrainian war. The work focuses on the Polish stock market as the basic element of the capital market. Therefore, in the first place, the behaviour of the segments of the Warsaw Stock Exchange was compared by analysing the following indices: WIG, WIG20, mWIG40, sWIG80, NCIndex, and the TBSP treasury bond market index. It should be noted that the indices describe qualitatively different segments of the stock market, primarily determined by the size of companies (except for the TBSP index). Thus, the knowledge of a large or small correlation between the percentage changes of indices shows investors' interest in more or less risky markets. In the analysed periods, markets described by stock indices were relatively strongly positively correlated, but this is not always the case. This information is important in itself, as it shows that investors attributed a similar risk to individual market segments, understood qualitatively as the volatility of prices of fundamental companies (WIG20), relatively smaller ones (mWIG20, sWIG80) or even speculative ones (NCIndex). Due to editorial limitations, a detailed analysis of industry indices was abandoned, leaving only a comparison of variation and standard deviations (risks) in both analysed periods. The Polish capital market operates within the framework of the European Union, so it was decided that it is worth looking at how it behaves in comparison to other stock markets. For the purpose, quotations of the WIG20 index were compared with the German DAX index and the French CAC index. It was decided that the situation of the United Kingdom after its recent departure from the EU is worth analysing as it is still part of the European market. Moreover, due to the special involvement of the USA in helping Ukraine and leading the anti-Russian campaign, the DJIA index was included in the analysis. In the final part of the work, quotations of EUR, USD, and GBD to PLN were dealt with, as an indicator of the situation in the currency market from the point of view of the Polish zloty.

2. LITERATURE REVIEW

The global crisis caused by the COVID-19 pandemic, which started in China, has spread to all countries of the world. It affected the economies, and earlier, the world stock exchanges. The reaction of world stock exchanges took place earlier when information about the first cases of the disease in China appeared. It was then that the stocks began to fall. However, the biggest drop occurred on the days when individual countries began to announce lockdowns. Because the largest reaction of the stock markets took place in the initial phase of the pandemic, many studies focus on the initial period. Then, the pandemic hurt global stock exchanges (He et al., 2020), (Scherf et al., 2022). The impact in the initial period of the pandemic was the strongest in Asian emerging markets (Topcu, Gulal, 2020). The reaction of stock markets also changed over time depending on the stage of the pandemic and the number of cases (Ashraf, 2020). Research on the impact of COVID-19 was also conducted for individual industries. Natural gas, food, healthcare, and software stocks posted strong positive

returns, while oil, real estate, entertainment, and hospitality stocks fell sharply (Mazur et al., 2021). Financial markets were also studied in terms of their volatility (Mirza et al., 2020), (Yousef, 2020) or in terms of the relationship between COVID-19 and basic economic indicators (Uddin et al., 2021).

The return of stock markets to their pre-pandemic state had barely occurred, and here was another reason for the crisis of the world's economies and stock markets. It was the year-long war in Ukraine. The reaction was instantaneous (Izzeldin et al., 2023). On the day of the attack, the S&P 500 index fell by more than 10% from October 2020. The reactions of most global stock indices were also negative with the largest reaction on the day of the invasion (Boungou, Yatié, 2022). The invasion of Ukraine in 2022, generated negative cumulative abnormal returns for global stock indices (Boubaker et al., 2022). Stock exchanges of Hungary and Russia were the first to react, then Poland and Slovakia. The reaction took place the day before the invasion. Stock markets of Australia, France, Germany, India, Italy, Japan, Romania, South Africa, Spain and Turkey reacted the day after the invasion (Yousaf, 2022). For commodity markets, the results were in line with those for stock markets except for intensity (Izzeldin et al., 2023). However, depending on the country and its involvement in the war, the response was different (Ahmed et al., 2022). Also, depending on the industries, the response varied. In the EU countries, the sector strongly affected by the war was the manufacturing sector. The finance and services sectors also showed a negative impact, even more so than the industry (Sun et al., 2022).

The events of the outbreak of the pandemic and the war in Ukraine are called black swans in literature (Antipova, 2020), (Mielus, 2022). The European financial market has been negatively affected by Russia's aggression (Nimani, Spahija, 2023). Comparing the effects of the COVID-19 pandemic and the war in Ukraine, there was a lot of exchange rate volatility during both crises. However, greater exchange rate instability occurred during the war than during the pandemic. Also, in the case of financial markets, the war had a more significant impact on them than the pandemic (Mielus, 2022). A negative relationship was observed between war and the rate of return of the EU stock exchanges (Burdekin, Siklos, 2022), (Frey and Kucher, 2001), (Goel et al., 2017), (Hudson, Urquhart, 2015, 2022).

In light of the cited review of literature, the authors analyse the behaviour of selected segments of the Polish financial market in the initial period of the pandemic and war, filling the gap in the latter period research. The basis is two measures of risk, relative (coefficient of variation) and absolute (standard deviation). Based on superficial observations, it can be hypothesized that the comparison of both periods depends significantly on which risk measure we use. In the case of the Polish market, the relative measure indicates a slightly different dominance of the war period, as compared to the pandemic period than the absolute measure. Another hypothesis results from the comparison of Polish market indices with selected foreign markets and states that the Polish market does not stand out from other markets.

3. METHODOLOGY AND DATA

The basis for the analysis of the initial periods of the pandemic and war is the risk measured by the variation of the time series percentage return rates of indices and currencies. For variation comparison purposes, quotients of statistical coefficients of variation were calculated:

$$V = \frac{\left(\frac{\sigma}{\overline{r}}\right)_{war}}{\left(\frac{\sigma}{\overline{r}}\right)_{pandemic}}.$$
(1)

Where σ is the standard deviation of the sample and \bar{r} the mean rate of change. The traditional interpretation of the variation coefficient was taken as the standard deviation per unit value of

the average daily rate of return, so it is a relative measure of risk. The sign of the V coefficient depends on the sign of the average rates of return in both periods, so a positive value is interpreted as compatibility of the trends prevailing in the markets during the pandemic and war, regardless of whether it is dealing with an upward or downward trend. On the other hand, a negative value proves opposite tendencies of changes. In addition, a positive value and less than 1 indicates less variation during the war, as compared to the pandemic period, and greater than one, the opposite situation. A negative value of V and less than -1 proves greater variation during the war (absolute values of variation are then greater than 1), while greater than -1 corresponds to the opposite situation. In both cases, it is dealing with opposite trends prevailing in both periods.

In addition, standard deviations of quotations during the pandemic and war period were compared by calculating their ratio:

$$R = \frac{\sigma_{war}}{\sigma_{pandemic}}.$$
 (2)

The R factor is related to the risk measured by standard deviation and treated as an absolute measure of risk (not related to average rates of return). A value greater than 1 proves a greater dispersion of quotations during the war, as compared to the pandemic period, i.e. a riskier period from the point of view of market participants. On the other hand, less than 1 corresponds to the opposite situation. Of course, it should be remembered that greater risk does not have a negative interpretation, because greater variation creates greater investment opportunities, but also greater potential losses.

The data was taken from the stooq.pl portal. The considered time series concerned daily quotations. In the case of quotations of foreign indices, the lengths of the series slightly differed due to different days off from quotations, not the same in different countries. However, the fact was omitted as the differences concerned two days in the case of the DAX index and three days in the case of the WIG20. In addition, it should be noted that the period under investigation begins three months before the first case of the disease in Poland. In contrast, the period of war is exactly on the day of the aggression, not earlier. It is due to the obvious fact that cases in other countries preceded the emergence of a pandemic in Poland, and therefore everyone expected infections in our country as well. In contrast, the war broke out unexpectedly, so there is no waiting period for it to start in the data used.

4. RESULTS

4.1. Trend on the Warsaw Stock Exchange

First of all, the situation on the Warsaw Stock Exchange was examined by comparing the WIG, WIG20, mWIG40, sWIG80 NCIndex, and the TBSP treasury bond market index. A comparison of quotations is included in Table 1.

It is obvious at first glance that during the pandemic, they were dealing with a clear sharp decline in share indices, followed by a fairly steady increase. Only in the case of the New Connect market, the index quite abruptly exceeded the peak of quotations from the period of the beginning of the pandemic. The situation is different in the case of the bond market. The TBSP index recorded a slight decrease at the beginning of the pandemic and quickly began to grow dynamically, reaching a local minimum in mid-March, thus reacting to the emergence of the pandemic in Poland. The decline coincides with the period of sharp declines in stock markets measured by other indices.



Table 1 Main indices of Warsaw Stock Exchange (logarithmic scale)

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Source: own study.

The behaviour of stock indicators in the first days after the start of the war is completely different. Equity indices are clearly on the rise, reaching their maximum at the turn of March and April, followed by a rather rapid decline. In the next period, they are dealing with increases, but smaller than during the pandemic. In the case of the TBSP index, there is a gradual decline, which reaches its minimum only at the end of June. The results of the analysis of coefficients of variation and standard deviations are presented in Chart 1. In both cases, the values are arranged in ascending order.

Chart 1

Ratios of variation coefficients and standard deviations for the main WSE indices



Source: own calculation.

It should be noted that, except for the bond market, coefficients of variation ratios are positive, so the trends at the onset of the pandemic and the war are consistent. In the case of the TBSP index, the coefficient of variation during the pandemic period was more than two times higher in absolute value than during the war period, and the trends were opposite, which means that the variation during the war period was higher than during the pandemic period. Taking into account the other indices, only on the small companies market described by the sWIG80 index the pandemic period was characterized by greater variation than the period of the beginning of the war, the V coefficient is less than one. In other cases, the variation during the war was greater than during the pandemic. Against this background, the New Connect market stands out and the variation ratio is higher by an order of magnitude, as compared to other markets. The risk ratio graph shows a completely different situation. The New Connect market is characterized by the smallest value of the R-factor, so the dispersion of the rates of return around the average value during the pandemic was greater than during the war. A similar situation applies to other segments of the stock market, except the treasury bond market. In this case, the dispersion of quotations was much greater during the war.

In the case of Polish industry indices, only variation coefficients and standard deviations in both periods are presented, as the presentation of the trends would take up too much space. As a consequence, results are shown in Chart 2 below.

Chart 2

Ratios of variation coefficients and standard deviations for WSE industry indices



Source: own calculation.

Ratios of variation coefficients for industry indices show predominance of variation during the war, as compared to the period of the pandemic. Clothing, mining, real estate, fuels and energy are characterized by negative variation ratios, which means that the trends characterized by the average daily rate of return were opposite in both periods. However, the values of the V coefficient are less than -1, so variability of the war period dominates variation during the pandemic. A similar situation applies to industries such as construction, IT, automotive industry, banks and medicines, but in this case, the trends in both periods are consistent. Against this background, the pharmaceutical industry stands out, for which the value of the V coefficient is equal to 29.3. This shows an almost 30-fold advantage of variation during the war, as compared to the pandemic period with the same trend. By contrast, in the case of the chemical, food, and gaming industries, a higher variation prevails during the pandemic, but in the first two cases the trends in both periods are opposite, and in the third they are consistent. At the adopted level of accuracy, the index of media companies was characterized by the same variation in both periods. For ratios of standard deviations R, the values vary in a small range from 0.6 to 1.9. The latter value applies to the food industry. In addition, banks and mining are characterized by the value of R = 1, which means the same risk in both periods. The remaining values of the ratios of standard deviations are less than 1, which proves that there is a slight risk advantage during the pandemic, as compared to the period of the war. As a consequence, it can be concluded that the risks in both borderlands were similar because no industry would stand out from the others.

4.2. Conditions of the Warsaw Stock Exchange and selected Foreign Stock Exchanges

Representative stock market indices are commonly recognized as indicators of the economic situation prevailing on the stock exchanges. Therefore, the research took into account the Polish WIG20 indices and the following indices of the leading European stock exchanges: DAX, CAC40 and FTSC100. Due to the involvement of the USA in helping Ukraine in the war with Russia, the DJIA index of the US stock exchange was additionally taken into account. The table 2 presents the logarithmic scale of market indicators in the initial period of the pandemic and the Russian-Ukrainian war.

In the authors' work (Żebrowska-Suchodolska et al., 2021) concerning the initial period of the pandemic, statistics of stock exchanges were analysed, among others, by comparing the dynamics of declines. However, in the case of the initial period of the war, such an analysis cannot be applied. there are no distinguished sessions when the indices reach their highest and lowest values. In the case of the presented indices, there is a similarity between the quotations during the pandemic and separately during the war. As a consequence, the following comparison is obtained, as shown in Chart 3.



 Table 2

 Indices charts of selected European and American stock exchanges (logarithmic scale)

Source: own study based on stooq.pl.



Chart 3

Ratios of variation coefficients and standard deviations of indices of selected stock exchanges

Source: own calculation

It can be seen that in the case of the American and French stock exchanges, the trends during the pandemic and the war were opposite. Both values are less than -1, but the variation of the DJIA index is three times lower than the variation of the CAC40 index. In the remaining markets, the trends were consistent, but in all cases, the variation during the war was greater than during the pandemic. Against the background, the FTSE100 index stands out with its value approximately seven times higher than that of WIG20 and DAX. An interesting result is shown by the plot of the ratios of standard deviations. In all cases, the pandemic period was characterized by a higher absolute risk (measured only by the standard deviation, not related to the average rate of return), as compared to the war period. However, diversification is small, the smallest value concerns the American stock exchange (0.43), and the largest Polish one is (0.78).

4.3. Comparison of exchange rates of selected currencies to PLN

It was decided to compare exchange rates of EUR, USD and GBP, as a consequence, the chart presents the exchange rates of the currencies with the Polish zloty.



Table 3

EUR, USD and GBP to PLN exchange rates (logarithmic scale)

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Table 3 – continued



Source: own study based on stooq.pl.

Coefficients of the variation of the above quotes are presented in Chart 4.

Chart 4

The ratios of variation coefficients and standard deviations of EUR, USD and GBP against PLN



Source: own calculation.

The charts above refer to the condition of the Polish zloty in the context of the three most important currencies. *V* coefficients are positive in all three cases, so the trends are the same. In the case of the USD/PLN exchange rate, a minimal advantage of variation was observed during the pandemic, as compared to the war period. For the British pound and the euro, variation prevails during the war, but is moderate. However, comparing the risks shows a completely different picture of the situation. Risks associated with the EUR/PLN and GBP/PLN exchange rates are small, not to say negligible, as compared to the USD/PLN exchange rate risk.

5. CONCLUSIONS

In summary, it can be stated that major drops in most of the main indices of the Polish stock exchange, apart from TBSP, occurred almost immediately after the outbreak of the pandemic in Poland, Table 1. On the other hand, the decline after the war started with a delay of over a month. It seems that it may be related to the emergence of sanctions against Russia, which did not immediately follow the aggression (similar conclusions are in (Ahmed et al., 2022)). Because they have only just begun to affect the capital market, mainly economic entities, the indices' decline can be associated with specific EU actions, and not with the period of consultations and arrangements. At the same time, there was uncertainty about the further actions of EU decision-makers and the course of the war. The situation began to clear up at the turn of July and August, then the index quotations began to slowly recover from the earlier drops. In the event of

On the other hand, during the pandemic the treasury bond market showed almost uniform growth, which seems understandable, there was a flight of capital to instruments that are much less risky than shares, because of bonds. In the case of the TBSP index, they are government bonds. During the war, however, the market for the instruments fell until the end of July, and then the trend reversed. Just like in the stock market. It seems that this time the factor determining quotations of the TBSP index was Poland's involvement in helping Ukraine and its proximity to the country, which creates additional risk. The analysis of coefficients of variation and standard deviations, Chart 1, seems to confirm the conclusion. During the pandemic, the "advantage" of war was observed, which explains the V value of -2.21. The minus sign indicates opposite trends in both periods. The ratio of standard deviations again indicates the advantage of risk during the war, and it is higher than the values for the other indices. The latter indicates an advantage of risk during the pandemic, all others have values lower than 1. It is worth noting that the ratio of coefficients of variation is negative only for the TBSP index, for the others it is positive. Thus, the stock markets showed the same economic situation in both analysed periods and, exceptionally, the small companies market described by the sWIG80 index was characterized by greater variation during the pandemic, as compared to the war period. Against this background, the New Connect market stands out, the variation coefficient exceeds the V coefficients for the other markets by an order of magnitude. On the other hand, the R coefficient for the market takes the lowest value. Therefore, the New Connect market showed a very high relative risk (coefficient of variation) during the war and a relatively low absolute risk (standard deviation) during the period.

In the case of the analysis of industry indices, variation of the economic situation can be noticed, the same number is characterized by positive and negative V coefficients. In this case, only three industries (chemical, food, and games) indicate the "advantage" of the pandemic. For other industries, values indicating a higher relative risk during the war or the same (media) can be observed. Against the background, drugs with a value of the V factor that is an order of magnitude higher than the other companies stand out. This can be interpreted as a much greater impact of the war on the industry, as compared to the pandemic period. Perhaps it is because during a pandemic there is a demand for a small variety of drugs, as compared to an armed conflict. The absolute risk analysis distinguishes the pandemic period, but not very strongly. For all industries, values are positive and range from 0.6 (drugs) to 1.0 (banks and mining), except for the food industry, for which R = 1.9.

A comparison of both types of risk, relative and absolute, for the Polish stock exchange and selected foreign exchanges shows a similarity in the case of absolute risk, and the period of the pandemic "dominates". All *R* factors are less than 1, ranging from 0.43 (DJIA) to 0.78 (WIG20). On the other hand, dispersion of relative risks is relatively large, from V=9.3 (DJIA) to V=21.5 (FTSE100). However, it should be noted that all values indicate the advantage of the war period, as compared to the pandemic. It can also be said that the WSE does not stand out against the background of the analysed stock exchanges.

A comparison of EUR/PLN, USD/PLN, and GBP/PLN quotations shows that in the case of relative risk, the period of war predominates, only in the case of USD/PLN quotations the V factor is slightly lower than 1 and takes the value V=0.96. All values are positive, which indicates the same economic situation in both periods. Whereas absolute risk says the opposite, the R for USD/PLN is two orders of magnitude higher, as compared to EUR/PLN and GBP/PLN. This can also be explained by large changes in the currency markets, in particular large fluctuations in the EUR/PLN exchange rate. In addition, the role of the US during the war is completely different than during the pandemic, when the country faced difficulties analogous to those that affected other countries.

market does not stand out from the American, United Kingdom, German and French markets. Both risk measures used in the analysis of the pandemic and war periods indicate a similar reaction to the basic indices, which can be timidly interpreted as the high level of development of the Warsaw Stock Exchange.

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