

## IMPACT OF THE COVID-19 PANDEMIC ON THE RATES OF RETURN OF SELECTED WSE LISTED COMPANIES

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**Purpose:** Financial crises, stock market crashes and consequently bursts of speculative enthusiasm have been accompanying investors since the 17th century. The first speculative bubble, so-called “tulip mania”, occurred in the Netherlands between 1636 and 1637, while a speculative “fever” spread among the shareholders of the Dutch East India Company from 1636 to 1640. Those events exposed remarkable possibilities and complexity of the financial markets, and later encouraged investors to explore a variety of investment strategies bringing above-average rates of return. However, the question remains: how do modern-day investors react to the market disruptions and which investment strategies are popular among them. The purpose of this paper is to provide an understanding of how and why the COVID-19 pandemic affected the investors’ behavior and the rates of return earned by selected WSE listed companies. An attempt was also made to estimate the sensibility of investing in selected stocks through the use of the basic and most popular fundamental analysis market ratios, i.e. P/E and P/BV. Furthermore, based on selected companies, semi-strong information efficiency of the Polish stock market was assessed, with a particular focus on the COVID-19 pandemic period.

**Methodology:** The paper assesses the rates of return of companies constituting the WIG20 index and selected “covid” companies and calculates P/E and P/BV market ratios to verify how the fundamentals of a given company affect its rates of return. As a measure of relationship strength between the market value and rate of return indicators, the Spearman's rank correlation coefficient and a significance test for the Spearman's rank correlation coefficient were selected.

**Findings:** The research reveals that, during times of violent turmoil and massive panic on the stock markets, an interesting investment strategy that brings above-average rates of return is to build a stock portfolio based on a current trend. All hypotheses formulated were positively verified in the paper.

**Practical implications:** The study's results provide a valuable source of information for stock market investors, particularly individual investors who, when making tough investment decisions, i. e. during stock market crashes or financial crises, can employ strategies that involve building an investment portfolio based on trending companies and achieve above-average rates of return. Furthermore, the suggested investment strategy is adaptable and, over centuries, still effective.

**Originality:** The considerations concentrated not only on identifying an appropriate investment strategy in times of a stock market turmoil, but largely focused around behavioral aspects of investing, which represent an important addition to theories about rational decision-making by investors and the efficiency of financial markets.

**Keywords:** COVID-19 pandemic, rate of return, P/E and P/BV ratios, information efficiency, Spearman's rank correlation coefficient.

**Category of the paper:** Research paper, viewpoint.

## 1. Introduction

Massive turmoil and high volatility of the capital markets, caused by the global COVID-19 pandemic, triggered another speculative bubble, which can be referred to as the “covid bubble”. It has become particularly apparent in certain sectors of the economy, such as medical, biotechnology, game development or IT companies. Despite the fact that such developments do not frequently occur in the history of stock exchange listings, they provide enormous investment and speculative opportunities and consequently translate into a significant capital injection and a radical change in the investment strategies employed in the capital markets. As a result of the COVID-19 pandemic, the market boom has attracted a large number of individual investors to the capital markets, determined to achieve above-average rates of return. In Poland, additional arguments for investing in the stock market were: interest rate cuts, a rise in inflation and extremely low valuations of the companies (in many cases below the valuations of the last financial crisis of 2007-2009). These factors have triggered a wave of mostly uncontrollable stock price advances and improved performance of certain domestic companies. Additionally, in order to better understand company-specific market valuations, the impact of their fundamentals on rates of return was examined, using P/E and P/BV market ratios<sup>1</sup>. Research by S. Basu (1977) reveals that stocks with lower P/E ratios get higher rate of return than those with high ratios. Similarly, R.A. Haugen has conducted a research using both ratios, showing that companies with high P/BV ratio are characterized by the highest risk and the lowest rate of return (Haugen, 1999, pp. 2-10). However, R. Banz (1981) proved that this rate is even higher for companies with lower market capitalization. J. Czekaj, M. Woś and J. Żarnowski (2001) came to analogous conclusions, but pertaining to the Polish stock market and P/BV ratio. They proved that companies featuring low P/BV ratios have brought statistically significant above-average rates of return, as opposed to the companies with high P/BV ratio values. Based on a research conducted by E. Fama and K. French (Fama, French, 1992) concerning all stocks listed on the New York Stock Exchange, the American Stock Exchange and over-the-counter market (Nasdaq) for the 1963-1990 period, with respect to the

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<sup>1</sup> Unlike P/E and P/BV.

relationships between the book value of equity and the market value of the stock, indicate that companies characterized by low P/BV ratios enjoyed 16.4 pp higher rate of return. However, there is a gap in the literature of the subject, in terms of research and analysis, as to the methods of creating securities portfolios based on the trending industries or speculative bubbles compared with P/E and PBV indicators of those companies. That is why, in light of the widespread interest in the matters discussed and the current lack of synthetic considerations, supported by empirical examples, in this area, it would seem necessary to conduct a comprehensive analysis of the impact and implications of the “covid bubble” on the listing of selected WSE listed companies and investors' behavior, including P/E and P/BV market ratios.

The purpose of this paper is to provide an understanding of how and why the COVID-19 pandemic affected the investors' behavior and the rates of return earned by selected Warsaw Stock Exchange (WSE) listed companies. An attempt was also made to estimate the sensibility of investing in selected shares through the use of the basic and most popular fundamental analysis market ratios, i.e. P/E and P/BV.

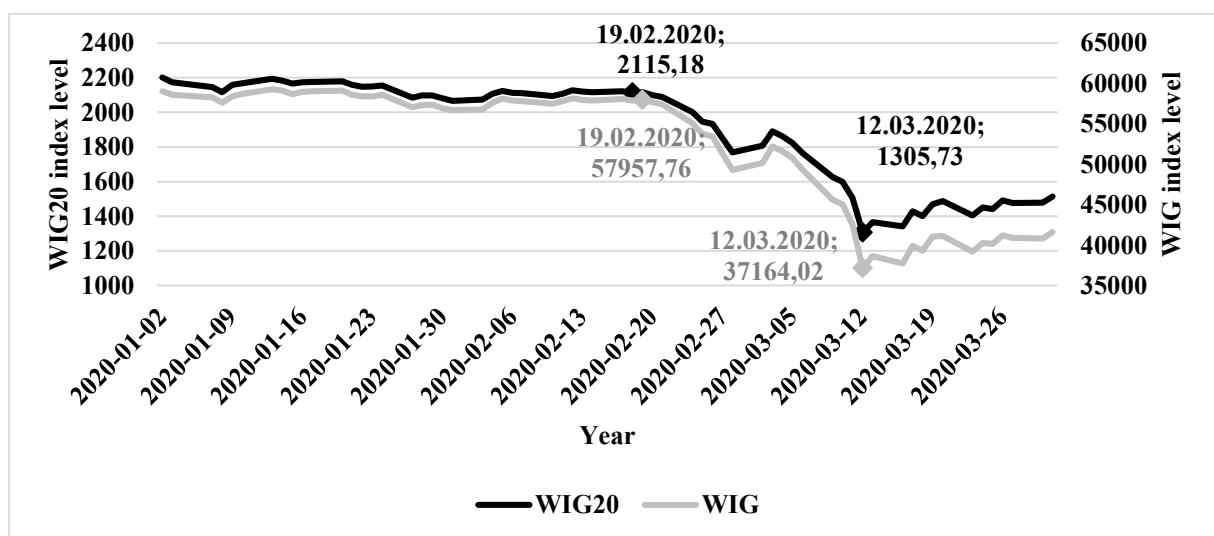
This paper presents the results of research aimed at verifying the following hypotheses:

- H<sub>1</sub>: In the periods of stock market crises, creating investment portfolios based on so-called trending companies results in increased investment efficiency by achieving above-average rates of return;
- H<sub>2</sub>: During the “covid bubble” (all speculative bubbles in general), the above-average rates of return achieved by the “covid” companies resulted from the trend for these companies, rather than their actual financial results or their P/E and P/BV ratios levels.
- H<sub>3</sub>: Speculative bubbles contribute to increased interest in the stock market by the individual investors (rising number of the new investment brokerage accounts and volume).

## **2. Impact of the COVID-19 pandemic on the efficiency of the rates of return of selected WSE listed companies**

Since the 17th century, the global stock markets have been repeatedly facing various economic and financial crises (Kindleberger, 1999; Kenourgios, Samitas, Paltalidis, 2011, pp. 92-106; Dimitriou, Kenourgios, Simos, 2013, pp. 46-56; Luchtenberg, Vu, 2015, pp. 178-203; Yarovaya, Brzeszczyński, Lau, 2016, pp. 96-114), speculative bubbles, or multi-year market slumps (Piech, 2003, pp. 130-131), but it wasn't until arrival of the deadly SARS-CoV-2 virus in Q1 2020 that put the world on a brief standstill, leading to the fastest, shortest, and relatively big stock market crash. The COVID-19 pandemic, described as an exogenous shock (Murawska, 2020, pp. 79-93) or a „black swan” (Taleb, 2020; Yarovaya, Matkovskyy, Jalan, 2020), had a huge impact on the functioning of all the economies around the world, one of its first effects being a mass panic in the capital markets, i.e. sudden and steep stock price declines

in most companies listed on various trading floors. The analysis of historical data revealed that a significant collapse in the value of the global market stock indices began after 19/02/2020, and this trend, depending on the exchange, continued until 12-23/03/2020. The most important stock market indices across all continents saw declines of 25-49% in less than a month (Murawska, 2020, pp. 79-93; Wagner, 2020). For instance, S&P 500 index, tracking the stock performance of 500 large companies listed on stock exchanges in the United States, during 16 trading days has witnessed a 30% decline (Ali, Alam, Rizvi, 2020, p. 100341). In Poland, the worst performing indices after 16 sessions were the WIG20 and WIG, losing 38.27% and 35.88% of their initial value, respectively (Fig. 1). In this context, smaller (sWIG80) and medium (mWIG40) company indices performed slightly better, recording losses of 29.19% and 30.72%, respectively. It is worth noting that within 100 days, almost 30% of wealth has disappeared from stock exchanges globally (Ali, Alam, Rizvi, 2020, p. 100341). Moreover, the research of H. Liu et al. (2020, p. 2800), R. Hong et al. (2020), B.N. Ashrafa (2020, p. 101249) and P. Jaworski (2021, pp. 157-172) conducted on selected stock market indices proved that the outbreak of the COVID-19 pandemic had a significant negative impact on the rates of return of stock exchanges in all countries and areas. Stock indices reacted faster and stronger in Asian countries.

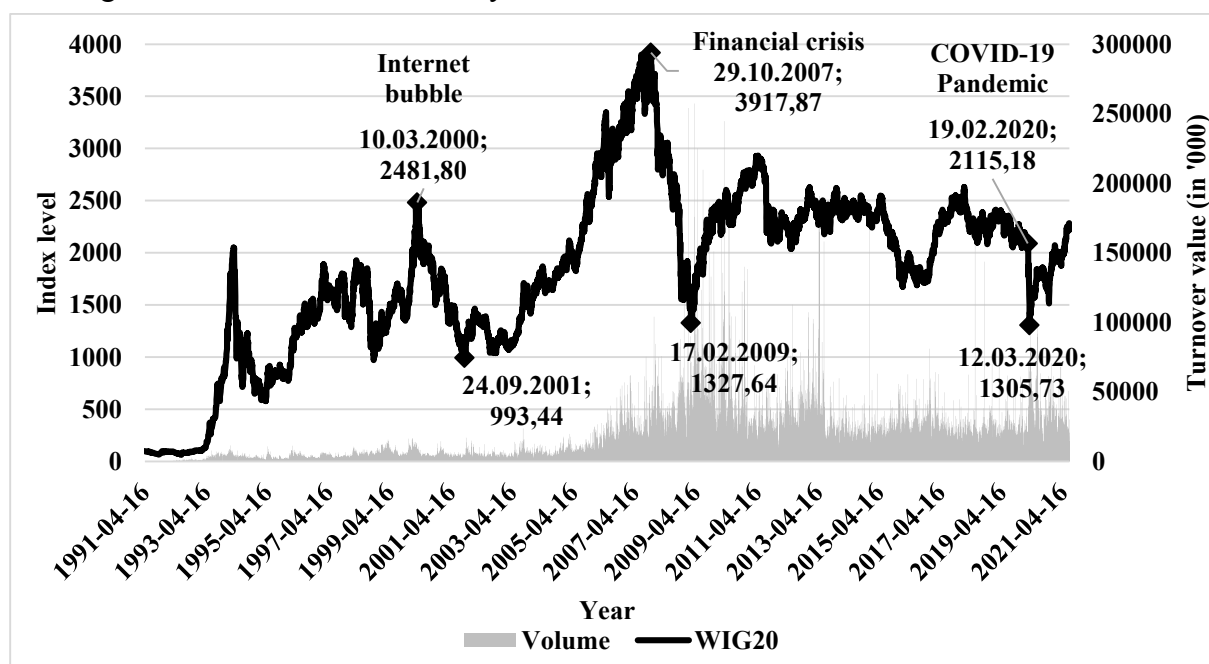


**Figure 1.** WIG20 and WIG indices quotes in Q1 2020.

Source: Own study.

Significant stock market discounts always prompt investors to seek similarities with previous periods to predict the scope of current declines. For this reason, the recent crash was mainly compared with the financial crisis of 2007-2009 (Sharif, Aloui, Yarovaya, 2020) and the “Dot-com bubble” of 2000-2001. For instance, the scope of the WIG20 index declines in the said periods was significantly greater, i.e. 59.97% and 66.11%, compared to the scope of index declines during the pandemic (38.27%), but it is also important to note that the declines were clearly longer (Fig. 2). Therefore, the crash caused by the COVID-19 pandemic, due to its unpredictability, uniqueness and dynamism, presented a rare investment opportunity in the

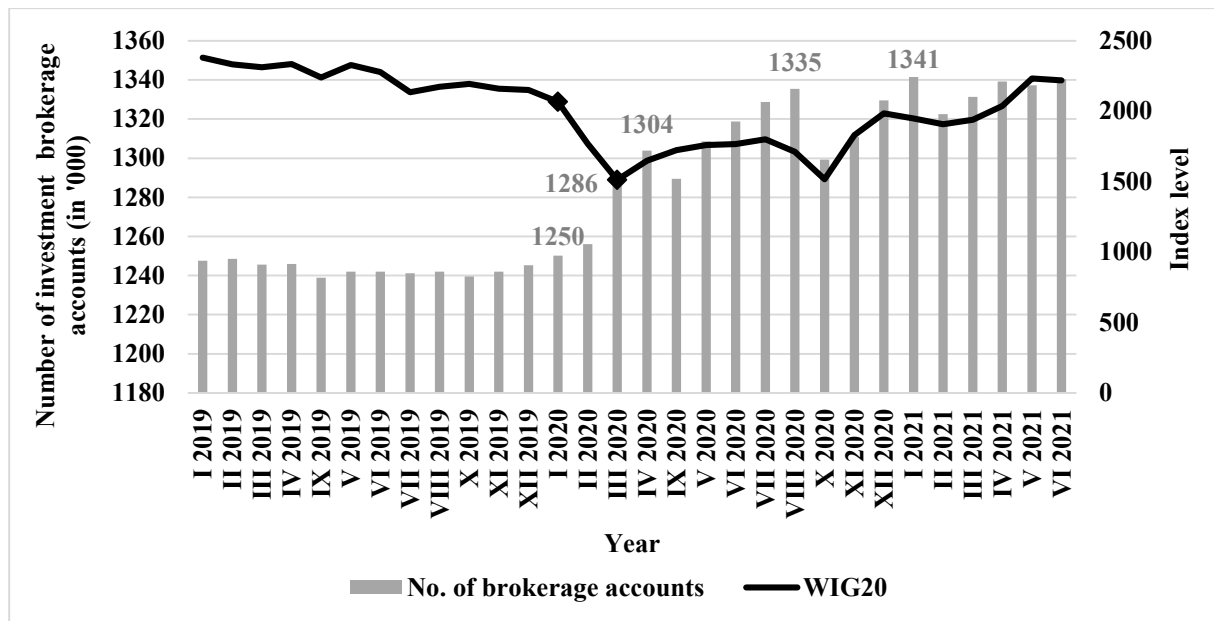
stock markets. However, it should not be forgotten that the risk of global financial markets increased significantly in response to the pandemic, and individual stock market responses were clearly linked to the severity of the outbreak in each country. The great uncertainty of the pandemic and the related economic losses have made markets highly volatile and unpredictable (Zhang, Hu, Ji, 2020, p. 101528). On the other hand, every huge turmoil in the capital markets has always attracted a large number of new individual investors and profiteers who are looking to quickly multiply their capital and generate above-average rates of return by utilizing the inefficiency of the global stock markets<sup>2</sup> (Haugen, 1999). Figure 3 illustrates a rapid increase of the investment brokerage accounts (particularly at the onset of the pandemic in March and April 2020) in view of fluctuations of the WIG20 index value. Bringing in new investors also translates into turnover increase (Fig. 2), which has a positive effect on improving liquidity and promotes the development of the stock exchanges, as some of the shareholders will certainly stay in the market long-term. Similar conclusions were also presented in the work of M. Chiah and A. Zhong (2020, p. 101784), where the impact of COVID-19 on the trading volume on exchanges around the world was analysed.



**Figure 2.** Historical listings and turnover value of the WIG20 index.

Source: Own study.

<sup>2</sup> The stock market's information efficiency concept is described by, among others, E.F. Fama: *Efficient Capital Markets: A Review of Theory and Empirical Work*, "The Journal of Finance" May 1970, Vol. 25, No. 2, pp. 383-417; R. Bula: *Information efficiency and the price behavior of WIG20 stock market prices* Economic Studies 177/2014, pp. 152-167; R. Slepaczuk: *Capital market anomalies in light of the efficient market hypothesis*, "E-Finance: Financial Internet Quarterly", no. 1/2006, pp. 1-12.



**Figure 3.** The number of investment brokerage accounts in light of the WIG20 index value changes during the COVID-19 pandemic.

Source: Own study.

### 3. Research methodology

To verify the hypotheses, a rate of return assessment of the WIG20<sup>3</sup> companies was made (as a benchmark of the Polish stock market) as well as selected “covid” companies (so-called trending companies), i.e. companies which benefited the most from the coronavirus pandemic and were the most popular in the eyes of investors, as they were characterized by either high liquidity (significant daily turnover) or a significant capitalization increase. Therefore, 10 companies were selected, mainly from the pharmaceutical, medical and biotechnology industries, but also from the computer and electronics industries, all of which were in great demand due to off-site work and remote learning. The comparison also features X-Trade Brokers<sup>4</sup> as an example of a company that indirectly benefited from the COVID-19 pandemic by attracting new clients who opened a large number of investment accounts or paid fees more frequently by making more high-risk trades (Tab. 1).

<sup>3</sup> Only companies included in the WIG20 index were taken into account, following the revision made on 20/12/2019.

<sup>4</sup> Besides X-Trade Brokers, only one broker is listed on the WSE, namely IPOPEMA Securities. This company was characterized by a similar trend towards a change in financial results in 2020 as X-Trade Brokers and generated a rate of return of 127%.

**Table 1.**  
*Characteristics of “covid” companies*

Name of the company	Symbol	Index*/Market	Sector	A product that is in demand in the market
ASBISc Enterprises PLC	ASB	sWIG80	computers and electronics	notebook; smartphone; CPU
Mabion	MAB	mWIG40	biotechnology	vaccine
Mercator Medical	MRC	WIG	pharmaceutical and medical	gloves
PZ Cormay	CRM	sWIG80	pharmaceutical manufacturing	test
BioMaxima	BMX	NewConnect	biotechnology	test
Biomed-Lublin Serum and Vaccine Production Plant	BML	WIG	pharmaceutical manufacturing	plasma-derived medical product
Blirt	BLR	NewConnect	biotechnology	test
Inno-Gene	IGN	NewConnect	biotechnology	test
Harper Hygienics	HRP	Alert list /WIG**	cosmetics and household chemistry	hand sanitizer
X-Trade Brokers	XTB	WIG	stock exchanges and brokerage offices	brokerage account

\* Index inclusion following the revision made on 20/12/2019.

\*\* WIG Index inclusion following the revision made on 19/06/2020.

Source: Own study.

To check the impact of a company's fundamentals on the rates of return for all companies, the P/E and P/BV market ratios were calculated. Research by S. Basu (1977) revealed that stocks with lower P/E ratios get higher rate of return than those with high ratios. However, R. Banz (1981) proved that this rate is even higher for companies with lower market capitalization. J. Czekaj, M. Woś and J. Żarnowski (2001) came to analogous conclusions, but relevant to the Polish stock market and P/BV ratio. They proved that companies featuring low P/BV ratios (so-called companies with value potential) have brought statistically significant above-average rates of return, as opposed to the companies with high P/BV ratio values (so-called companies with growth potential). Despite the fact that the research presented represents an important contribution to the discussion on the rejection of the efficient market hypothesis, the matter remains unresolved to this day. Therefore, this article aims to complement the above considerations, taking into account an unusual time of the stock market crash triggered by the COVID-19 pandemic.

In order to illustrate significant changes in the rates of return earned by individual companies, analyses were conducted, not only during the stock market crash triggered by the SARS-CoV-2 virus, but also during periods preceding and following it, that is, from 03/01/2018 to 30/06/2021. However, the research on the relationship of the companies' fundamental ratios, namely P/E and P/BV, covered the 2017-2019 period and the following year's stock rates of return, respectively. As a measure of relationship strength between the market value and rate of

return indicators, the Spearman's<sup>5</sup> rank correlation coefficient and a significance test for the Spearman's rank correlation coefficient were selected. A nonparametric  $t$  test was conducted to determine whether the estimated correlation was statistically significant. The closer the value of the Spearman coefficient is to 0, the weaker the monotonic relationship between the analyzed characteristics. Therefore, the following hypotheses were adopted:

$H_0$ :  $\rho = 0$  (this is no monotonic relationship between the two characteristics in the sample),

$H_1$ :  $\rho \neq 0$  (this is a monotonic relationship between the two characteristics in the sample).

Next, p-value calculated by a test statistic was compared with significance level of  $\alpha$  (assumed  $\alpha$  value = 0.05), thus:

- if p-value  $> \alpha$ , there are no grounds to reject  $H_0$ ;
- if p-value  $\leq \alpha$ ,  $H_0$  should be rejected by assuming  $H_1$  (the correlation is significant).

#### 4. Research findings

A research conducted on the Polish stock exchange clearly indicates that during the COVID-19 pandemic, companies from sectors directly or indirectly involved in the fight against the SARS-CoV-2 virus were most successful. Among the so-called “covid” companies with above-average rates of return are:

- companies that produced and distributed drugs, PCR and antigen tests, hand sanitizers, masks and disposable rubber gloves (pharmaceutical, medical and biotechnology companies),
- companies that provided the necessary hardware and software for learning and remote learning and off-site work (IT companies),
- companies that provided entertainment for children and youth (game development companies).

Table 2 shows the rates of return of the “covid” companies during the year of the pandemic, as well as immediately before and after it.

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<sup>5</sup> Similar research featuring, however, the Tau-Kendall coefficient can be found in the work of M. Kalinowski, G. Krzykowski: *Semi-strong information efficiency of the Polish stock market at a time of the financial market instability*, *Annales Universitatis Mariae Curie-Skłodowska Lublin, Sectio H*, vol. XLVI, 2/2012, pp. 71-82.



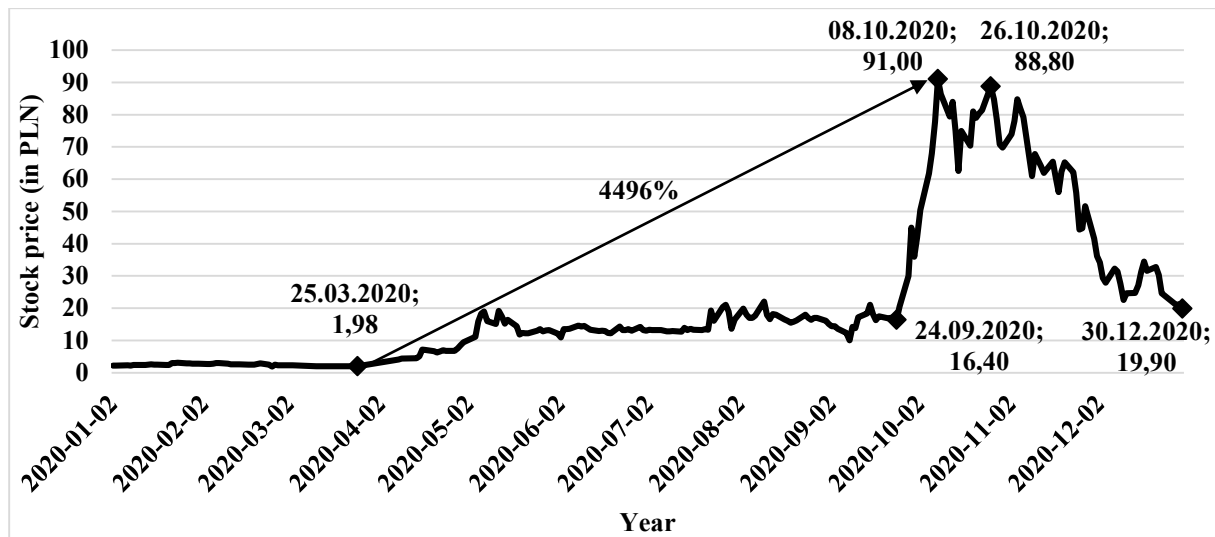
**Table 2.**

*Simple rate of return of the “covid” companies in the period from 03/01/2018 to 30/06/2021*

Company	Rate of return [%]			
	2018	2019	2020	I-VI.2021
ASB	-22.70	49.90	<b>166.47</b>	168.87
MAB	-23.36	-7.23	-73.93	226.17
MRC	-36.84	-7.88	<b>3963.94</b>	-38.69
CRM	-28.85	-13.62	<b>13.41</b>	3.58
BMX	-14.92	-17.51	<b>649.99</b>	1.58
BML	-36.75	-2.78	<b>753.33</b>	2.07
BLR	-21.25	74.62	<b>1611.95</b>	-23.18
IGN	-32.39	-14.88	<b>812.84</b>	-47.16
HRP	-83.78	-33.50	<b>1706.25</b>	-23.74
XTB	-1.12	-7.38	<b>365.58</b>	-5.33
<b>Arithmetic average</b>	-30.20	1.97	996.98	26.42

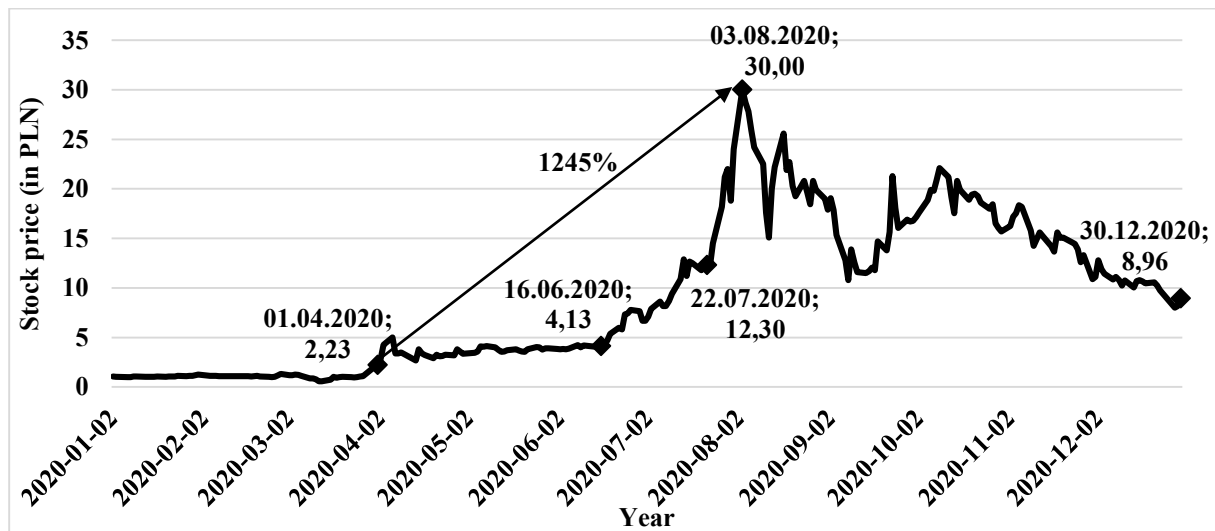
Source: Own study, based on data from the [www.stooq.pl](http://www.stooq.pl) portal.

The highest rate of return for the entire 2020 was generated by Mercator company, that is 3963.94% (Table 2). The company earned almost PLN 1 billion by manufacturing disposable rubber gloves, a product under demand in all hospitals, medical and commercial facilities worldwide. Another company that saw a rapid improvement in its financial performance was Harper Hygienics (net profit in Q1 2020 amounted to PLN 821,000, whereas in Q2 2020 it amounted to PLN 5,940,000), specializing in the sale of different types of disinfectants. Harper earned an impressive rate of return as early as the 1st half of 2020, amounting to 1181.25%, and by the end of the year it was even higher at 1706.25%. All the biotechnology companies, which competed in production and distribution of tests to detect the SARS-CoV-2 virus and, subsequently, COVID-19 antibody tests also performed excellently. As an example, Blirt generated a rate of return of 1611.95% in 2020 and Biomaxima a rate of 649.99%. However, Inno-Gene and Biomed-Lublin provided investors with the highest session turnover values and therefore spectacular profiteering opportunities. In the first instance, euphoria erupted when Inno-Gene informed, in the fall of 2020, that it had entered into an agreement to distribute and promote RT Lamp Fast Detection Kit tests in the United Kingdom and Ireland, with the value of the agreement estimated at more than PLN 50 million. Then, the stock price climbed rapidly to PLN 91, i.e. in just 11 trading sessions (from 24/09/2020 to 08/10/2020), the investor could earn a rate of return of 454.88% (Fig. 4).



**Figure 4.** Impact of the COVID-19 pandemic on Inno-Gene stock price volatility in 2020.

Source: Own study, based on data from the [www.stooq.pl](http://www.stooq.pl) portal.



**Figure 5.** Impact of the COVID-19 pandemic on Biomed-Lublin's stock price volatility in 2020.

Source: Own study, based on data from the [www.stooq.pl](http://www.stooq.pl) portal.

Biomed-Lublin, on the other hand, became notorious for the first time back in March 2020 when it was revealed that Biomed-Lublin was one of three European manufacturers to start testing the potential of an anti-tuberculosis vaccine in strengthening the coronavirus immunity. Then the company announced that it had launched efforts to develop a coronavirus treatment based on the convalescents' plasma, resulting in significant interest from investors. At the beginning of July, Biomed-Lublin even climbed at the top of Bankier.pl's ranking of the most popular WSE listed companies, and in June it was included in the mWIG40 index because of its rapid increase in capitalization (over PLN 400 million) and a high turnover (Hajdamowicz, 2020). The rate of return that could be generated by investing in Biomed-Lublin

stock mid-June and selling it at its peak a month and a half later, i.e. 03/08/2020, was a staggering 626.39% (Fig. 5).

Looking at the rates of return of the “covid” companies, two other aspects should be highlighted. First, it should be noted that the above-average, or rather gigantic rates of return were observed not only in companies that offered a unique or even essential product at the time (such as Mercator Medical, Harper Hygienics or Blirt), but also in companies that were only planning to develop such a product (Inno-Gene or Biomed-Lublin). As history shows, it is the other group of companies, with so-called potential, that is all too often insanely trending among investors and gives rise to speculation. A number of individual investors, especially beginners who want to become rich in a short time by exploiting depressed stock prices, follow “buy the rumors, sell the news” strategy, which consequently leads to the choice of trending companies without any reasonable justification. Thus, it can be concluded that the “covid” boom was to some degree driven solely by euphoria among investors, rather than by improvements in the companies' actual financial performance. Interestingly enough, while observing historical stock price data (stock valuations were often completely detached from fundamentals), it was perceived that for many investors, absence of profits was not a problem, as they believed that these profits would come in the future. Inno-Gene company is, again, a good example, where the management board itself increased the stock price by making official announcements about sky-high contracts that were not corresponding to reality. These were only plans, forecasts and opportunities that have not translated in any way into the company's financial performance. As a result, the Financial Supervisory Authority intervened, and the company temporarily suspended its operations. Eventually, the absence of specifics and actual agreements triggered panic, causing steep declines in the stock price.

On the other hand, following trends is not a bad thing, and has even become a tendency in recent years, assuming that the investor buys stocks of a given company at the right time and then sells them at the right time (this procedure does not assume generating a maximum rate of return). Initially, all companies in the trending industry behaved identically, making it an extremely difficult task to determine which one of them would prove to be a “bull's-eye” in the future. Only after some time, once the companies signed their first big contracts or published their quarterly results, an investor could select a portfolio of noteworthy companies and reject absolute profiteers. The year 2020 presented many opportunities to quickly generate above-average rates of return (this is particularly evident compared to the previous years' rates of return), but only a few, who were able to contain enormous emotions and set future trends, and then took risks through buying shares of often small or unknown companies, succeeded.

The rates of return of the WIG20 companies were also analyzed (Tab. 3). In the year of the COVID-19 pandemic, only 7 companies recorded a stock price increase at the end of 2020. Dino achieved an impressive rate of return of 99.31%. It should be noted that this company benefited indirectly from the pandemic by leveraging changing trends in the economy. As a convenience store chain, mostly located in small and medium towns, Dino has taken over

customers of the large supermarkets or malls. The CCC company was the exact opposite of Dino. It was on the verge of bankruptcy as the government imposed trade restrictions in shopping malls. Until the end of June, CD Projekt, most recognizable Polish game developer, was also performing well, generating a rate of return of more than 37%. Sadly, it was unable to maintain this performance throughout 2020 due to problems with the release of their new game, “Cyberpunk 2077”, which failed to meet expectation of the fans. Among the other WIG20 companies, high rates of return were generated mainly by companies in the mining and energy sectors. Except for KGHM, a company whose stock rate increased in the second half of the year due to a global increase in the price of copper, no particular reasons can be identified for the relatively high rates of return of the other companies. It can only be assumed that investors, based on their fundamental analysis, found the valuation of PGN, TPE or JSW to be too low in relation to their assets [for all companies, the P/BV ratio in 2018-2020 was below 1, revealing the market undervaluation of these companies (Sierpińska, Jachna, 2004, pp. 213-215) – see Tab. 5].

**Table 3.**

*Simple rate of return of the WIG20 companies in the period from 03/01/2018 to 30/06/2021*

Name of the company	Symbol	Rate of return [%]			
		r2018	r2019	r2020	rI-VI.2021
<b>Powszechna Kasa Oszczędności Bank Polski [State Savings Bank]</b>	<b>PKO</b>	-8.93	-12.11	-19.03	30.00
<b>Polski Koncern Naftowy Orlen</b>	<b>PKN</b>	2.52	-16.11	-32.53	30.18
<b>Powszechny Zakład Ubezpieczeń</b>	<b>PZU</b>	1.32	-2.98	-21.65	14.58
<b>CD Projekt</b>	<b>CDR</b>	48.57	85.99	-4.22	-31.13
<b>Bank Polska Kasa Opieki</b>	<b>PEO</b>	-17.11	-4.01	-40.10	51.22
<b>KGHM Polska Miedź</b>	<b>KGH</b>	-18.76	7.18	<b>86.93</b>	-2.83
<b>LPP</b>	<b>LPP</b>	-14.25	13.29	-6.33	58.89
<b>Santander Bank Polska</b>	<b>SPL</b>	-10.45	-12.47	-40.17	36.41
<b>Cyfrowy Polsat</b>	<b>CPS</b>	-6.70	27.92	<b>10.69</b>	0.47
<b>Polskie Górnictwo Naftowe i Gazownictwo</b>	<b>PGN</b>	11.27	-36.92	<b>25.75</b>	19.96
<b>Grupa Lotos</b>	<b>LTS</b>	55.26	-1.46	-51.33	25.64
<b>Polska Grupa Energetyczna</b>	<b>PGE</b>	-16.25	-21.96	-21.36	38.42
<b>Dino Polska</b>	<b>DNP</b>	17.52	48.00	<b>99.31</b>	-4.67
<b>mBank</b>	<b>MBK</b>	-11.63	-7.73	-54.56	74.17
<b>Orange Polska</b>	<b>OPL</b>	-19.50	44.13	-8.85	2.21
<b>Play</b>	<b>PLY</b>	-39.71	62.19	<b>9.74</b>	-*
<b>CCC</b>	<b>CCC</b>	-33.48	-43.68	-24.49	32.05
<b>Alior Bank</b>	<b>ALR</b>	-31.82	-47.85	-43.24	98.39
<b>Tauron Polska Energia</b>	<b>TPE</b>	-27.96	-25.45	<b>59.65</b>	12.76
<b>Jastrzębska Spółka Węglowa</b>	<b>JSW</b>	-32.40	-66.34	<b>7.05</b>	30.11
<b>Arithmetic average</b>		-7.62	-0.52	-3.44	27.20

\* No listings for 2021, as the company was delisted on 31/03/2021.

Source: Own study, based on data from the [www.stooq.pl](http://www.stooq.pl) portal.

By comparing the arithmetic average rate of return of the portfolio composed of the “covid” companies (portfolio 1) and the portfolio composed of the largest and the most liquid WIG20 companies (portfolio 2), it can be noticed that the first group of companies earned significantly higher rates of return (Tables 2 and 3). In 2020, portfolio 1 generated a rate of return as high as

996.98%, while portfolio 2 reported a loss of 3.44%. Observation of the remaining results confirms the assumption that such a good result of the “covid” companies was the result of trends in certain industries, rather than a representation of their long-term work.

Finally, an effort was made to assess an impact of the P/E and P/BV market ratios on the rates of return and to verify whether there is a relationship between these ratios. One of the most commonly utilized market ratios around the world for evaluating the rationality of investing capital in stocks is P/E, which is the stock market price to its net earnings (Marcinkowska, 2011, p. 276; Krysiak, 2011, pp. 399-400). It indicates a number of years required for return of the capital employed to buy stocks, assuming that the company generates profits at its current level. The P/C ratio assumes high values for fast-growing companies that show increasing profits. For investors, it means that the company can distribute increasing profits in the form of dividends in the future, and the stock price will increase. Sadly, it is common for the high P/C companies to be unable to live up to the inflated expectations of investors and, as a result, they see a steep decline in their stock price. Meanwhile, low P/C values are embraced by the companies with little potential for growth and reflect a higher risk level, which investors want to compensate for with higher return on investment margins. Buying low P/C stocks constitutes one of the long-term investment strategies developed by J. Neff (Neff, Mintz, 1999; Celej, 2013, pp. 467-482; Mackiewicz, 2016, pp. 16-20). Also, it is assumed that the larger the company, the lower the P/C value should be.

The P/BV ratio, or price to book value, is an indicator illustrating the difference between investors' valuation of a company and its carrying value (Melich, Tuzimek, 2006, p. 315). In other words, the P/BV ratio theoretically indicates how much an investor pays for PLN 1 of a company's net assets. High P/BV companies are greatly regarded by investors as they have good outlook and are characterized by a low level of risk (so-called companies with growth potential). On the other hand, low (below 1) P/BV companies, are undervalued by the market (value potential companies), which may be related to poor asset management by the companies' managers or out-of-fashion industries in which they operate (e.g., mining or energy - low parameters are often caused by a shift from old industries and technologies towards new development models associated with renewable energy sources).

Table 4 shows the values of P/E and P/BV market ratios for selected “covid” companies. By analyzing the value of P/E ratio each year, high volatility can be noticed, which seems natural in the medical and biotechnology sectors. Only X-Trade Brokers was notable for a low P/B value over the years, reflecting the high risk of its business during turbulent times. However, observation of the P/BV ratios indicates an advantage for the growth-oriented companies, which corresponds to their business activities and prospects.

**Table 4.***The value of P/E and P/BV market ratios for selected “covid” companies*

Company/Index	P/E				P/BV			
	2017	2018	2019	2020	2017	2018	2019	2020
ASB	25.37	11.62	11.86	12.28	1.87	1.41	1.68	3.31
MAB	-22.99	-17.25	-16.58	-5.12	-24.58	28.20	-48.96	-3.69
MRC	36.32	14.96	-45.26	4.81	1.51	0.90	0.79	4.30
CRM	-58.07	-3.74	-2.08	-7.65	0.91	0.84	1.17	1.55
BMX	23.09	-32.66	-953.81	15.78	1.08	0.94	0.81	4.48
BML	133.60	-2.02	26.33	125.67	1.36	2.15	1.99	14.95
BLR	-1.96	-6.58	-35.56	15.61	1.31	1.36	2.55	10.02
IGN	24.39	32.35	-71.18	72.12	10.85	5.86	5.16	29.61
HRP	-8.61	-0.88	12.93	11.69	0.55	0.09	0.02	0.37
XTB	5.64	5.09	8.04	5.23	1.31	1.13	0.94	2.37

Source: Own study, based on data from the [www.bankier.pl](http://www.bankier.pl).**Table 5.***The value of P/E and P/BV market ratios for WIG20 companies*

Company/Index	P/E				P/BV			
	2017	2018	2019	2020	2017	2018	2019	2020
PKO	17.84	13.19	10.69	-14.04	1.53	1.26	1.04	0.90
PKN	6.81	8.33	8.54	8.96	1.41	1.29	0.95	0.59
PZU	12.58	11.80	10.49	14.61	2.49	2.54	2.14	1.49
CDR	46.56	128.00	153.24	23.95	10.56	13.96	24.30	12.64
PEO	13.73	12.51	12.18	14.56	1.46	1.25	1.13	0.63
KGH	14.18	10.73	13.45	20.33	1.26	0.93	0.95	1.74
LPP	36.92	28.49	37.99	-80.09	6.66	5.03	4.93	4.96
SPL	17.77	15.47	14.68	18.30	1.80	1.46	1.23	0.70
CPS	16.21	17.31	16.24	16.96	1.32	1.09	1.29	1.34
PGN	12.43	12.43	18.24	4.36	1.08	1.09	0.66	0.73
LTS	6.38	10.31	13.40	-6.69	1.00	1.36	1.22	0.66
PGE	8.67	12.48	-3.76	110.49	0.50	0.40	0.35	0.29
DNP	36.17	30.57	34.36	44.06	8.54	7.76	8.70	12.52
MBK	18.03	13.78	16.32	73.12	1.38	1.18	1.02	0.46
OPL	-126.64	628.62	113.95	188.01	0.76	0.60	0.89	0.82
PLY	22.15	7.09	10.26	13,72*	-40.35	-26.31	27.65	15,66*
CCC	40.89	134.20	-165.27	-3.75	10.66	7.79	4.70	26.43
ALR	2.18	9.73	15.08	-7.12	0.15	1.07	0.56	0.34
TPE	3.87	18.73	-263.49	-1.92	0.30	0.21	0.16	0.31
JSW	4.45	4.55	3.99	-1.97	1.77	0.98	0.30	0.44

\* Data through the end of Q3 2020.

Source: Own study, based on data from the [www.bankier.pl](http://www.bankier.pl).

An analogous analysis was prepared for the WIG20 listed companies. Table 5 indicates that P/E ratios vary, heavily depending on the investors' expectations of future profits for particular companies. An exceptionally high P/E was estimated for CDR in 2018-2019 and OPL in 2018-2020. As for the CDR game developer, the investors expected above-average profits for the company in the coming years, which were to be provided by a new game called “Cyberpunk 2077.” In turn, a high P/E of the telecommunications service provider's stock was associated with investors' hopes of strengthening the company's position in the Polish market as a result of full-scale transformations in its business model, introduction of state-of-the-art technologies that employ AI, and participation in the process of frequency allocation to support

5G technology. Relatively high P/E's were also observed for stocks in the banking (PKO, SPL, MBK, PEO) and food and clothing (DNP, LPP, CCC) sectors. It would appear that investors still recognize immense opportunity for the expansion of banking services in the Polish market, particularly in the areas of loans and online banking. Similar expectations are associated with the food and clothing industries, surely due to the companies' pursuit of market niches (e.g., DNP targets small towns and villages) or concern for low business costs (e.g., manufacturing clothes in Asia due to lower labor costs). In several instances, there were negative P/E's attributable to the losses of individual companies caused by temporary restructurings, regulatory adjustments or other one-off problems.

By analyzing P/BV ratio value of the WIG20 companies in 2017-2020 (Tab. 5), it was observed that the CDR, LPP, DNP and CCC stocks were characterized by a high level of the ratio, i.e. above 3. In theory, it means that the stocks of these companies were overvalued. However, PGE, OPL and TPE stocks were underestimated. A P/BV below 1 was yet observed in 2019 and 2020 for the stocks of PKN, PGN and JSW. The P/BV values earned do not translate into the rates of return generated by individual companies in the subsequent year, which may indicate a mismatch of theoretical assumptions to current conditions. For example, Play company has reported a P/BV ratio of 27.65 in 2019, which may have given investors an impression that the company is vastly overvalued and therefore should be sold. In fact, the rate of return earned by PLY in 2020 was almost 10% (Tab. 3). The opposite results were obtained for PKN company, for which the P/BV in 2019 was below 1 and the rate of return for 2020 was -32.53% (Tab. 3). Analogous situations were observed in particular years for all WIG20 companies. In view of the above, it can be assumed that today, the analysis of the market ratios such as P/E and P/BV, while still used and featured in the business press that follows global stock listings on a daily basis, no longer serves a key role. While in the last century, the investors mainly followed these parameters in their investment decisions, in the 21st century, massive development of advanced technologies (notably Internet) and developments in the way of operating and conducting business (shift towards innovative industries) render it difficult to estimate value of these parameters. In this light, the thesis by B. Lev and A. Srivastava concerning the US market seems justified. The thesis claims that it has been for at least 30 years that investing in companies with value potential (*value investing*; B. Graham, 1949)<sup>6</sup>, namely, among other things, those characterized by low P/E and P/BV ratios, is not very effective. The authors argue that this method is no longer effective for two reasons, i.e. accounting systems shortcomings, which contributed to poor identification of the valuable companies, and fundamental economic developments, especially slow economic growth, which made it very slow for the *value* companies to recover from crises (Lev, Srivastava, 2019, pp. 1-29). The authors believe that another reason for these changes is also the on-going

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<sup>6</sup> The value investing approach was first described by B. Graham and proved effective in the US market for some 40 years.

popularity and trend towards growth-potential companies (*growth/glamour type*), namely new, innovative companies utilizing not only state-of-the-art technology, but also established by outstanding individuals. This is why individual investors, having witnessed rapid growth of individual IT, game development or biotechnology companies in recent decades, noticed that it is possible to achieve above-average rates of return in relatively short periods, making it no longer necessary to freeze capital for several years to achieve investment success.

Generating above-average rates of return by leveraging current information is in coincidence with equity market inefficiency. Therefore, the lack of correlation between the rate of return and the fundamental P/E and P/BV ratios should be understood as an indication of market efficiency, while the presence of a correlation indicates the likelihood of above-average rates of return.

**Table 6.**

*Spearman's rank correlation coefficient and p-value levels for the two-sided hypothesis of the "covid" companies rank coefficient zeroing*

Correlation / Year	P/E and rates of return		P/BV and rates of return	
	rho	p-value	rho	p-value
2017/2018	-0.1152	0.7588	-0.0424	0.9186
2018/2019	-0.0667	0.8648	0.5273	0.1228
2019/2020	-0.3576	0.3128	0.1152	0.7588

Source: Own study in the R-CRAN statistical analysis package.

**Table 7.**

*Spearman's rank correlation coefficient and p-value levels for the two-sided hypothesis of the WIG20 companies rank coefficient zeroing*

Correlation / Year	P/E and rates of return		P/BV and rates of return	
	rho	p-value	rho	p-value
2017/2018	0.1714	0.4682	0.1489	0.5296
2018/2019	0.3263	0.1602	0.1895	0.4219
2019/2020	0.0947	0.6907	0.0286	0.9064

Source: Own study in the R-CRAN statistical analysis package.

The research revealed that the stock market crash caused by the COVID-19 pandemic, affected the efficiency of the analyzed stock market in Poland to a certain extent (Tables 6 and 7). In the research period 2019/2020, the behavior of the rate of return in relation to the P/C ratio for the portfolios of the "covid" and WIG20 companies contradicts the stock market efficiency, whereby there are no grounds to reject the  $H_0$  hypothesis stating that the variables are independent ( $p\text{-value}_{\text{"covid"}\_companies} = 0.3128$ ,  $p\text{-value}_{\text{WIG20\_companies}} = 0.6907$ ).

In the case of the "covid" companies portfolio, the Spearman rank correlation coefficient indicated equity market efficiency for the 2017-2019 (correlation of P/E and rates of return) and 2017/2018 and 2019/2020 (correlation of P/BV and rates of return) periods. In the period preceding the stock market crash (2018/2019), a moderate correlation between P/BV and the rates of return of the "covid companies" was observed, indicating information inefficiency of the equity market. In the case of the WIG20 companies portfolio, there were no explicit correlations observed, which may indicate information efficiency of the Polish equity market.



Referring to the research presented, it can be concluded that, in the 21st century, the informative value of the P/E and P/BV market ratios, or at least their relationship with the rate of return, is no longer an indisputable source of information that could support an appropriate investment decision. Instead, behavioral aspects and temporary investment trends are becoming increasingly important.

## 5. Conclusions

The steep, yet short-lived declines on all global stock exchanges in Q1 2020 once again revealed the shortcomings of the various stock valuation theories and models, investors' inability to correctly understand company announcements and, most importantly, that financial market participants follow market trends driven by immense emotions. The research revealed that the COVID-19 pandemic quickly evolved into a 'covid' bull market, allowing above-average rates of return to be generated for investors who correctly evaluated future trends and immediately, during this time of uncertainty, invested funds in companies directly or indirectly involved in the fight against the pandemic. The "covid" companies provide a good example, with their stock prices setting new records during consecutive trading sessions, but also significantly increasing their market capitalization and turnover, placing such companies in the ranking of the most liquid and popular WSE listed companies. Mercator Medical was the undisputed business growth leader, with its financial gain amounting to nearly PLN 1 billion and its rate of return reaching a staggering 3964% in 2020. In turn, Inno-Gene and Biomed-Lublin, which sparked investors' imagination with newer and newer, not entirely reliable announcements concerning further expansion of their COVID-19 products, are very much eligible for the "kings of profiteering" title. It's worth noting that the initial panic and chaos, followed by the companies racing to recoup their losses, prompted many new investors and profiteers alike to put their skills to the test in the stock markets, a fact best confirmed by the record data on the number of new investment brokerage accounts created by individual investors (up by 6.4 p.p in 2020).

The conducted research positively verified all of the adopted research hypotheses, which stated that:

- H<sub>1</sub>: In the periods of stock market crises, creating investment portfolios based on so-called trending companies results in increased investment efficiency by achieving above-average rates of return;
- H<sub>2</sub>: During the "covid bubble" (all speculative bubbles in general), the above-average rates of return achieved by the "covid" companies resulted from the trend for these companies, rather than their actual financial results or their P/E and P/BV ratios levels;

H<sub>3</sub>: Speculative bubbles contribute to increased interest in the stock market by the individual investors (rising number of the new investment brokerage accounts and volume).

This article also indirectly addresses the issue of semi-strong information efficiency. The results presented revealed that semi-strong information efficiency varied depending on business conditions, further explaining and strengthening the credibility of the second hypothesis (H<sub>2</sub>). In light of the above, it can be concluded that an attempt was also made to estimate the sensibility of investing in selected shares through the use of the basic and remarkably popular fundamental analysis market ratios, i.e. P/E and P/BV.

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