

MARKET CAPITALIZATION FACTORS OF THE BULGARIAN PHARMACEUTICAL SECTOR IN PANDEMIC ENVIRONMENT

Galina Zaharieva¹,
Onnik Tarakchian²,
Andrey Zahariev³

Abstract: The article is focused on the changes of the market capitalization in the Bulgarian pharmaceutical sector during the COVID-19 pandemic. The aim of the article is to measure and justify the impact of a set of factors that affect the market capitalization of public companies from the Bulgarian pharmaceutical sector in a pandemic environment. The main performance indicator under consideration is the market capitalization of the leading pharmaceutical companies included in the BGBX40 stock exchange index during the two-year pandemic period (from June 2020 until May 2022). For the purpose of the research, a multiple linear regression model (OLS) is employed with the help of GRETl open-source software. Four of the selected eight impact factors are related to the sales of medical products; three are related to COVID-19 statistics and the last is a stock market index. The results from the analyses evidence a strong relationship between the impact factors and the market capitalization of Bulgarian pharmaceutical companies during the pandemic. The coefficient of determination shows that 96% of the change in the market capitalization could be explained by the change in the factors included in the model. The growth of the market capitalization of the studied Bulgarian companies over a period of 2 years is comparable to that of the world leading pharmaceutical companies that offer COVID-19 vaccines.

Keywords: market capitalization, pharmaceutical sector, COVID-19

JEL: G20, G30, I18.

¹ Assoc. Prof., PhD, Department of International Economic Relations, D. A. Tsenov Academy of Economics, Svishtov, e-mail: g.zaharieva@uni-svishtov.bg

² PhD Student, Department of Finance and Credit, D. A. Tsenov Academy of Economics, Svishtov, e-mail: d010222265@uni-svishtov.bg

³ Prof., PhD, Department of Finance and Credit, D. A. Tsenov Academy of Economics, Svishtov e-mail: a.zahariev@uni-svishtov.bg

Introduction

The cyclic pattern of economic development is based on theoretically sound logic, which, under certain conditions, can be empirically confirmed or rejected. Adjustments of economic cycles can be expected and predictable but they may be due to unexpected global force majeure circumstances. Such a circumstance was the COVID-19 pandemic, which occurred after a ten-year period of steady economic growth. It had a devastating effect on GDP indicators worldwide affecting the economies of whole continents and separate countries. Since the first case reports in China, through the first wave of the virus in Europe and the USA, until the launch of the antiviral vaccines and the mass vaccination, several sectors have been placed on the front lines of public health protection. Along with hospital care and pre-hospital care, the pharmaceutical sector played the role of a major factor in the fight against pandemic waves supporting advanced scientific research on antiviral drugs and vaccines. It was the licensing of the first vaccines that prompted a "return to normality" and a gradual lifting of social isolation measures and travel restrictions.

The **aim** of the article is to measure and justify the impact of a set of factors that affect the market capitalization of public companies from the Bulgarian pharmaceutical sector in a pandemic environment. The study is structured in the following parts: **firstly**, an overview of the main scientific studies in this field; **secondly**, an overview of COVID-19 reflections on the financial state of pharmaceutical companies on global and national level; **thirdly**, data selection and methodology; **fourthly**, empirical findings and discussions based on multiple regression model with eight impact factors calculated with GRETL open-source software.

1. Review of theoretical scientific research

Scientific research regarding the relationship between the COVID-19 pandemic, economic development and market performance of public companies boomed in the period 2020-2021. The pandemic also gave rise to a new branch of research labelled "COVID-19 Economics" (Brodeur, Gray, Islam, & Bhuiyan, 2021). In it, the main economic agents - government, households and companies - are subject to both an independent and a cumulative assessment of the damage from the pandemic including social distancing measures (Barrios, Benmelech, Hochberg, Sapienza, & Zingales,

2021) and a sharp change in the profile of consumption of goods and services (Krastevich & Smokova, 2021). The pandemic also created risks for the main institutions in the credit systems (Prodanov, Yaprakov, & Zarkova, 2022) and, in certain cases, public management bodies directly organized measures to support and preserve businesses regardless of their difficulties with the public finance (Zahariev, et al., 2020a) and fiscal sustainability macro-indicators (Lilova, Radulova, & Alexandrova, 2017).

Economic difficulties were particularly pronounced on global (Roleders, Oriekhova, & Zaharieva, 2022), regional (Sabitova, Shavaleyeva, Lizunova, Khairullova, & Zahariev, 2020c) and municipal (Prodanov & Naydenov, 2020) level. The pandemic affected the global supply chain as well as the conventional extractive industries (Deneva & Grasis, 2020). The crisis also created conditions for a sharp increase in the demand for information services (Shishmanov, Popov, & Popova, 2021) and technological solutions for teleworking and distance learning (Bezgin, et al., 2022f). However, the most important manifestation was related to the dramatic corrections of the stock indices, the prices of strategic raw materials and the market capitalization of leading companies (Cumar & Kumara, 2021). A range of studies addresses the influence of COVID-19 on the stock market changes, but from a different perspective. In their research on the relation between COVID-19 pandemic and stability of stock market Buszko, Orzeszko and Stawarz found that pandemic affects all industries but the pharmaceutical industry is strongly responsive according to profitability, volatility, turnover compared to the others (Buszko, Orzeszko, & Stawarz, 2021). Raifu investigates the response of stock market returns to daily growth in COVID-19 confirmed cases and deaths in 14 African countries using OLS and Panel Vector Autoregressive methods. His findings show that stock market returns react negatively and significantly to daily growth in COVID-19 confirmed cases in some countries, while the influence of confirmed deaths is insignificant. (Raifu, 2021).

Another research on the response of stock markets to the pandemic in the BRICS countries shows strong and negative effects during the first two months (30 to 60 days) of the initial confirmed cases, with effects diminishing over time. (Chavali, Al Samman, & Jamil, 2021). Similar conclusions draws the research of Alzyadat and Asfoura (Alzyadat & Asfoura, 2021). Ayati, Saiyarsarai, & Nikfar describe the short-term and the long-term impacts of COVID-19 on the pharmaceutical sector. They relate the short-term impacts with a change in the demand for pharmaceutical products as a result of induced demand for different types of medicines for home and hospital use,

supply shortages, panic buying and stocking, etc. In the long term the impact can be identified in approval delays, moving towards self-sufficiency in pharm-production supply chain, industry growth slow-down, etc. (Ayati, Saiyarsarai, & Nikfar, 2020).

2. COVID-19 reflections on the financial state of pharmaceutical companies on global and national level

The COVID-19 pandemic affected negatively a number of small, medium and large enterprises in various sectors of the economy, but at the same time, it had a positive effect for certain companies operating in sectors such as information technology, wholesale and retail trade, consumer-discretionary sectors, and healthcare. The negative effects of the pandemic stimulated international institutions, governments, research institutions, non-governmental organizations and the private sector to focus their efforts on the development of a vaccine against COVID-19. The majority of vaccines approved for limited use were developed by companies in the US, China, and Russia (Felter, 2021). Among the first approved and most widely used vaccines are those of Moderna© (in 86 countries), BioNTech© and Pfizer© (in 146 countries) and AstraZeneca© (in 140 countries), and, later on, that of Johnson&Johnson (in 111 countries). China also approved 4 vaccines that were used by other countries, and Russia developed two vaccines.

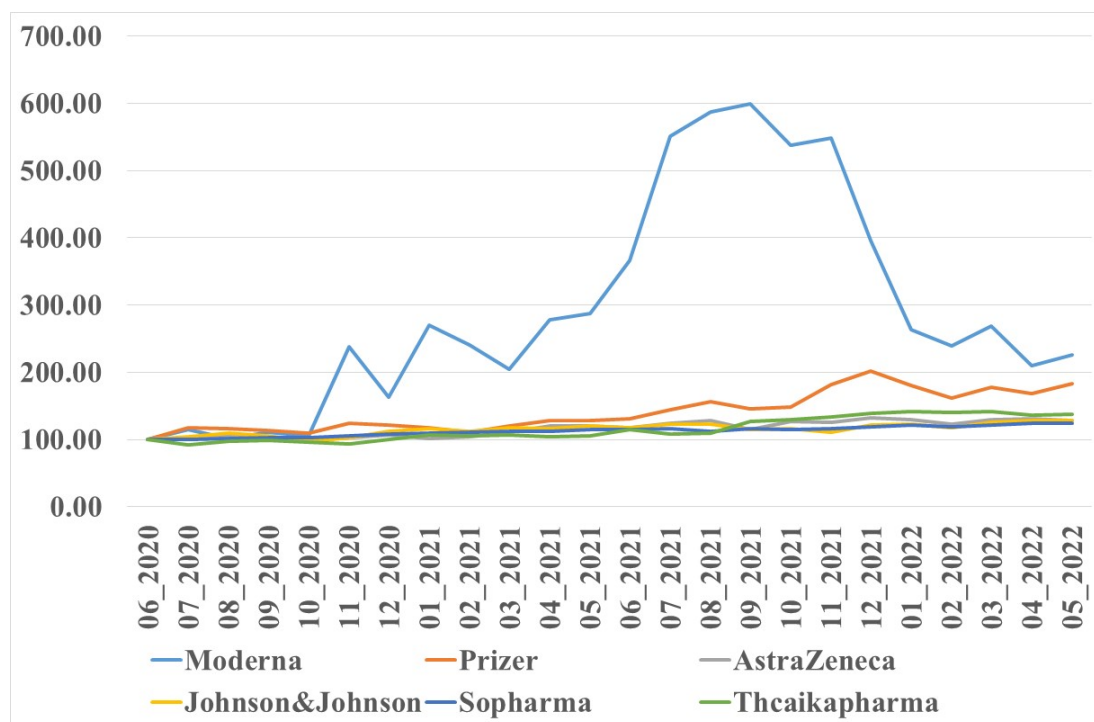
The initial efforts of these companies to develop a vaccine against COVID-19 had a positive effect on their financial performance. One of the leading companies in this field, BioNTech©, reported a revenue of EUR 5,532.5 million for the fourth quarter of 2021 (BioNTech, 2022), while for the same quarter of the previous year its income from sales was only EUR 345.4 million. As of December 31, 2021, the company reported a total annual revenue of EUR 18,976.7 million, which is many times higher than its revenue of EUR 482.3 million for 2020, and this increase, according to the company, is mainly due to the huge demand for their COVID-19 vaccine. Moderna© (with stock exchange code MRNA) also reported an increase of their revenue for the fourth quarter of 2021 (Moderna, 2022) of USD 7.2 billion compared to USD 571 million in 2020. The increase in 2021 was generated by larger sales, as for Q4 of 2021, USD 6.9 billion of their revenue was from the sale of 297 million doses of the company's COVID-19 vaccine. In the fourth quarter of 2020, the company sold 13 million doses of their COVID-19 vaccine generating a revenue of USD 200 million.

AstraZeneca©'s (AZN) financial report also showed positive results with a 41% increase of their revenue to USD 37,417 million in 2021 (including revenue from COVID-19 vaccines) compared to 2020. Non-vaccine revenue increased with 26% to USD 33,436 million (AstraZeneca, 2022). Pfizer©'s (PFE) 2021 revenue was USD 81.3 billion, an increase of USD 39.6 billion (95%) compared to their 2020, including an operating income growth of USD 38.4 billion (92%) and currency exchange gains of USD 1.2 billion (3%) (Pfizer, 2022). The company's operating income from sales of products other than Comirnaty© and Paxlovid© increased by 6%. In 2022, the company expects a revenue of USD 32 billion from the sales of Comirnaty© under supply contracts signed at the end of January 2022.

Johnson&Johnson© (JNJ) also reported an increase of their income from sales of pharmaceutical products for the last quarter of 2021 and for 2021 (USD 52,080 million) overall compared to 2020 (USD 45,572 million), with the report highlighting that a part of this increase is due to the sale of their COVID-19 vaccine. In 2021, the company reported an income from vaccine sales of USD 2,385 million, of which 634 million were generated in the US market (Johnson&Johnson, 2022). The main conclusion from the review of the performance of the global suppliers of COVID-19 vaccines is that the pandemic has generated global demand and increased the financial performance of the most successful ones with BioNTech© ranking first and followed by Moderna©. At the other extreme is AstraZeneca©, whose initial bulk orders were offset by negative assessments by the World Health Organization and national medical authorities regarding the adverse effects of their vaccine.

The reported positive results due to the increased demand for vaccines and other medicines against COVID-19, developed by leading pharmaceutical companies, give reason to expect similar results for the Bulgarian enterprises, although on a different scale. It is to be noted that only two of the operating Bulgarian pharmaceutical companies are publicly traded, and namely "Tchaikapharma" AD and "Sopharma" AD, thus only they qualify for a study of the impact of COVID-19 on market capitalization. These companies are included in the BGBX40 index of the Bulgarian Stock Exchange. They are also the companies with the largest market capitalization compared to all other publicly traded companies in Bulgaria. Tchaikapharma High Quality Medicines AD – Sofia / THQM is of the higher market capitalization (Bulgarian Stock Exchange, 2022a). Its leading product range is in the "Cardiovascular System" therapeutic group (64%), followed by "Respiratory System and Antibiotics" (17%). The market capitalization at the end of the wave of Omicron variant of COVID-19 as of May 2022 is EUR 7.98

with 84.5 million shares or a total market value of EUR 0.674 billion. The second company in the BGBX40 index is Sopharma AD – Sofia / SFA (Bulgarian Stock Exchange, 2022b). It has a strong export orientation on a scale of 60% of sales, incl. through a network of subsidiaries abroad. In its product range, the leading therapeutic group is "Nervous system" (34%), followed by "Digestion and metabolism" (27%), "Cardiovascular system" (11%), "Respiratory system" (7%), etc. The market capitalization of the company as of 31.05.2022 is EUR 2.26, with 134,797,899 ordinary shares or a total market value of EUR 0.305 billion. Although leaders in the capital market of an economy with a GDP of more than EUR 75 billion (for 2022), both companies, on a global scale, are classified as small and medium-sized enterprises, of a potential for major players in the business with pharmaceutical products (Ferris, Sun, Savard, Suresh, & Mishra, 2021).



Sources: 1) <https://finance.yahoo.com/>; 2) <https://www.infostock.bg/>

Figure 1. Monthly closing prices of the stocks of world and Bulgarian leading pharmaceutical companies (June 2020 – May 2022)

In sync with the above presented positive financial effects/results for the leading international pharmaceutical companies, the data on the share price movement of the global producers of COVID-19 vaccines and their Bulgarian competitors show a positive increase in market capitalization for

the period from June 2020 to May 2022 in the range of +24.80% for the Bulgarian "Sopharma", through +27.66% for "Johnson&Johnson", through +41.88% for "Tchaikapharma" to +126.34% for "Moderna" (Figure 1). For comparative purposes, all closing prices of shares of the six companies have been considered as a base of 100 as of June 2020 and converted into index numbers. The dynamics of the stock market value of these companies (Table 1) shows a positive beta, high values of R^2 , but also a significant standard deviation compared to the average for the period, which for the market capitalization growth leader "Moderna" reaches 162.75 basis points.

Table 1.

Indicators of trend in market capitalization and dynamics of stock market quotations per share of benchmark pharmaceutical companies

(June 2020 – May 2022; June 2020 = 100)

	MRNA	PFE	AZN	JNJ	SFA	THQM
Average	291.88	141.26	116.08	115.00	112.57	115.13
Min	100.00	100.00	98.75	97.50	100.00	92.50
Max	599.38	201.77	132.61	128.32	124.80	141.88
Max-Min	499.38	101.77	33.86	30.83	24.80	49.38
StDev.S	162.75	28.73	11.74	8.55	7.50	17.71
Linest	11.59	3.67	1.53	1.02	1.03	2.34
R2	0.25	0.81	0.85	0.71	0.95	0.88

Source: Author's calculations based on data from 1) <https://finance.yahoo.com/>;
2) <https://www.infostock.bg/>

The above presented data, as well as the findings of the referenced studies, constitute a point of departure to research the impact of COVID-19 on the market capitalization of Bulgarian pharmaceutical companies.

3. Data and methodology

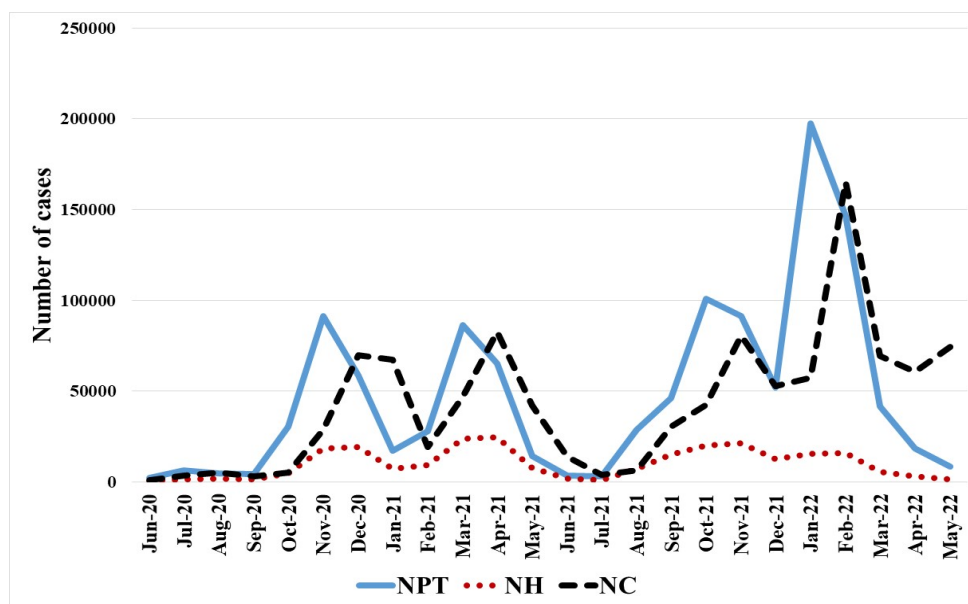
To achieve the aim of the study, we applied the multiple linear regression model with OLS estimator:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_n X_{in} + \varepsilon_i, \quad (1)$$

where Y_i is the dependent variable that represents the market capitalization of the company "i". The right side of the equation presents the coefficients b_0, b_1, \dots, b_n , and the explanatory variables X_{i1}, X_{in} , that represent the factors influencing the dependent variable and ε_i is the random error term. Such a model is widely used in scientific research focused on the relation of COVID-19 and market capitalization (Shaikh, et al., 2022).

The data for the included factors was obtained from different sources following different procedures. A step-by-step model elaborating the selection procedure (Zahariev, Angelov, & Zarkova, 2022) was applied to a set of factors influencing the market capitalization of the two pharmaceutical companies. The first step of the model is related to historical data of the market capitalization indicator⁴. The data for 24 monthly closing prices (in the period June 2020 - May 2022) were used. For both public companies operating in the sector $Y_1 = \text{"Tchaikapharma"}$ (stock code THQM / 7TH) and $Y_2 = \text{"Sopharma"}$ (stock code SFA / 3JR), the data was obtained by the Bulgarian Stock Exchange (BSE). The second step of the model focused on selection of influencing factors. Based on the theoretical background 8 independent variables were selected from 13 initially evaluated factors. All the data – ad valorem and quantitative was converted into index numbers with a value as of June 2020 = 100. The evaluated and selected factors belong to three groups of independent variables.

The first group of factors are based on COVID-19 data, whose dynamics influence the company's market valuation (Nurhayati, Endri, Aminda, & Muniroh, 2021). This group includes three natural indicators obtained from the national COVID-19 statistics. We consider these indicators as factors that influence the demand for pharmaceutical products, i.e. patients with positive tests (NPT), hospitalized patients (NH), and cured patients (NC), see Figure 2.



Source: <https://coronavirus.bg/bg/statistika>

Figure 2. Monthly average cases of COVID-19 in Bulgaria (June 2020 – May 2022)

⁴ Note. The resulting market capitalization indicator is the product of the spot price of one share multiplied by the number of registered shares of each company.

For the sake of data comparability, the period until June 30, 2020 is not taken into account. The three selected indicators for the model are: NPT – total monthly Number of new Positively Tested for COVID-19; NH – total monthly Number of new Hospitalised patients; and NC – total monthly Number of Cured people (Worldometer, 2022). All data from COVID-19 statistics are in index numbers with June 2020 = 100.

The second group consists of one influencing factor, which is the index BGBX 40, representing the broadest index of BSE with the forty most traded Bulgarian public companies. The Stock Exchange closing value of the index at the end of the month was selected for the model.

The last group of factors is based on the sales at end prices reported on monthly basis by the main non-public and public pharmaceutical companies on the Bulgarian domestic market (IQVIA Institute for human data science, 2021). Four selected indicators refer to this group: total sales of non-public pharmaceutical companies for the system across all distribution channels (NPCSAC), public companies sales to all distribution channels (PCSAC), public companies direct sales to hospitals (PCSH) and public pharmaceutical companies retail sales through the pharmacy network (PCSR) (Sahu & Mohanty, 2022).

After selecting independent variables, the model takes the following form:

$$MCAP_i = \alpha + \beta_1 NPT + \beta_2 NH + \beta_3 NC + \beta_4 BGBX40 + \beta_5 NPCSAC + \beta_6 PCSAC + \beta_7 PCSH + \beta_8 PCSR \quad (2)$$

where $Y_i = MCAP_i$ (as price per share of company “i”, which, after having been multiplied by the number of ordinary shares gives us the market capitalization of the given pharmaceutical company “i”); α – constant, β_i - coefficients.

4. Empirical results and discussions

The regression model was applied with GRETL to time series of monthly data for the period June 2020 to May 2022. To be comparable, all selected empirical data had to be adjusted by means of index numbers with a baseline June 2020 = 100. As the Durbin-Watson test value falls into the zone of uncertainty (Table 2 and Table 4), additional autocorrelation tests

were performed. The model was tested for autocorrelation of the residuals with Breusch-Godfrey test and Ljung-Box Q' test, the results of which show the absence of autocorrelation of the residuals around the regression line. The p-values are significantly above 0.05; therefore, the null hypothesis cannot be rejected (Table 3 and Table 5).

After applying the model to Tchaikapharma's market capitalization, the equation takes the following form:

$$\begin{aligned}
 \text{MCAP}_{\text{THF}} = & 46.3 + 0.00824 \cdot \text{NPT} - 0.0127 \cdot \text{NH} + 0.00492 \cdot \text{NC} + 0.730 \cdot \text{BGBX40} \\
 & (16.5) \quad (0.00199) \quad (0.00359) \quad (0.000959) \quad (0.101) \\
 & - 0.173 \cdot \text{NPCSAC} + 5.92 \cdot \text{PCSAC} - 0.811 \cdot \text{PCSH} - 5.17 \cdot \text{PCSR} \quad (3) \\
 & (0.241) \quad (3.19) \quad (0.416) \quad (2.83)
 \end{aligned}$$

(standard errors in parentheses)

The results of the model indicate that the studied factors do not always have the same strength and direction of influence on the market capitalization of the studied pharmaceutical companies.

For "Tchaikapharma", the **BGBX40** factor has the greatest positive impact at a significance level of 1%. The data shows that with one percentage point increase in the factor, the **MCAP_{THF}** dependent variable increases by 0.7295 percentage points. An increase in **NPT** by one percentage point leads to an increase in the market capitalization of the firm by 0.0082 percentage points and in **NC** – by 0.0049 percentage points at a significance level of 1%. **PCSAC** also gives a positive change in the dependent variable. An increase with one percentage point increases **MCAP_{THF}** by 5.9198 percentage points but at a significance level of 10%. **PCSH** and **PCSR** influence in the opposite direction, as a one percentage point increase in their values leads to a decrease of -0.8112 percentage points, respectively -5.1741 percentage points of the depending variable at a significance level of 10%. This can be explained with the product specialization of the company. The last factor - **NPCSAC** - has a negative influence, but is statistically insignificant. The established direction of impact clearly confirms that an increase in the sales of non-public pharmaceutical companies leads to competitive pressure on public companies and vice versa.

MARKET CAPITALIZATION FACTORS OF THE BULGARIAN ...

Table 2.

Multiple regression model of the market capitalization of THQM

Model: OLS, using observations 2020:06-2022:05 (T = 24)					
Dependent variable: MCAP _{THF}					
THQM	Coefficient	Std. Error	t-ratio	p-value	Signif.
const	46.3420	16.4553	2.816	0.0130	**
NPT	0.0082	0.0020	4.150	0.0009	***
NH	-0.0127	0.0036	-3.527	0.0030	***
NC	0.0049	0.0010	5.133	0.0001	***
BGBX40	0.7295	0.1014	7.197	<0.0001	***
NPCSAC	-0.1734	0.2410	-0.7195	0.4829	
PCSAC	5.9198	3.1923	1.854	0.0835	*
PCSH	-0.8112	0.4158	-1.951	0.0700	*
PCSR	-5.1741	2.8324	-1.827	0.0877	*

Significance codes: '***' <1%; '**' 1% to 5%; '*' 5% to 10%

Mean dependent var	115.1329	S.D. dependent var	17.7054
Sum squared resid	289.4487	S.E. of regression	4.3928
R-squared	0.9599	Adjusted R-squared	0.9384
F(8, 15)	44.8306	P-value(F)	0.0000
rho	-0.1438	Durbin-Watson	2.2114

Table 3.

LM test for autocorrelation up to order 1 of THQM

Null hypothesis: no autocorrelation				
Test statistic: LMF = 0.39562				
with p-value = $P(F(1, 14) > 0.39562) = 0.539488$				
Breusch-Godfrey test for first-order autocorrelation				
OLS, using observations 2020:06-2022:05 (T = 24)				
Dependent variable: uhat				
THQM	coefficient	std. error	t-ratio	p-value
const	2.3565	17.2100	0.1369	0.8930
NPT	0.0001	0.0020	0.0573	0.9551
NH	-0.0004	0.0037	-0.0984	0.9230
NC	0.0000	0.0010	-0.0074	0.9942
BGBX40	-0.0100	0.1047	-0.0959	0.9250
NPCSAC	0.0257	0.2494	0.1032	0.9193
PCSAC	-0.2394	3.2808	-0.0730	0.9429
PCSH	0.0345	0.4280	0.0807	0.9368
PCSR	0.1672	2.9034	0.0576	0.9549
uhat_1	-0.1919	0.3050	-0.6290	0.5395

Unadjusted R-squared = 0.027482
 Test statistic: LMF = 0.395620,
 with p-value = $P(F(1, 14) > 0.39562) = 0.539$
 Ljung-Box Q' = 0.556599,
 with p-value = $P(\text{Chi-square}(1) > 0.556599) = 0.456$

The equation for “Sopharma” takes the following form:

$$\begin{aligned}
 \text{MCAP}_{\text{SFA}} = & 58.8 - 0.00242 \cdot \text{NPT} + 0.00110 \cdot \text{NH} + 0.00192 \cdot \text{NC} + 0.264 \cdot \text{BGBX40} \\
 & (6.68) \quad (0.000807) \quad (0.00146) \quad (0.000389) \quad (0.0412) \\
 & + 0.0645 \cdot \text{NPCSAC} - 4.58 \cdot \text{PCSAC} + 0.582 \cdot \text{PCSH} + 4.10 \cdot \text{PCSR} \quad (4) \\
 & (0.0979) \quad (1.30) \quad (0.169) \quad (1.15)
 \end{aligned}$$

T = 24, R-squared = 0.963
(standard errors in parentheses)

For “Sopharma”, the results indicate that the **BGBX40** factor also has a positive influence at the 1% significance level. The data shows that its increase by one percentage point increases the market capitalization of the company by 0.2643 percentage points. For this company, the **PCSR** factor has the highest positive influence on market capitalization. An increase by one percentage point in the factor leads to an increase of **MCAP_{SFA}** by 4.0963 percentage points at a significance level of 1%. At the same level of significance, **PCSH** and **NC** have a positive influence. An increase by one percentage point of **PCSH** increases the market value by 0.5824 percentage points. An increase by one percentage point of **NC** increases the market value by 0.0019 percentage points. Two of the factors negatively affect the market capitalization of this firm at 1% significance level, namely **PCSAC** and **NPT**. Their increase by one percentage point leads to a decrease in **MCAP_{THF}** by 4.5824 percentage points, and respectively by 0.0024 percentage points. An explanation for this can be sought in the product specialization of the company, according to which lung drugs are in fifth place as a share. This clearly confirms that for the period of two years, the treatment of COVID-19 was a top priority at the expense of a number of other diseases.

The influence of the remaining two factors - **NH** and **NPCSAC** - is statistically insignificant.

MARKET CAPITALIZATION FACTORS OF THE BULGARIAN ...

Table 4.

Multiple regression model of the market capitalization of SFA

Model: OLS, using observations 2020:06-2022:05 (T = 24)					
Dependent variable: MCAP _{SFA}					
SFA	Coefficient	Std. Error	t-ratio	p-value	Signif.
const	58.8174	6.6824	8.8020	<0.0001	***
NPT	-0.0024	0.0008	-3.0000	0.0090	***
NH	0.0011	0.0015	0.7512	0.4641	
NC	0.0019	0.0004	4.9340	0.0002	***
BGBX40	0.2643	0.0412	6.4190	<0.0001	***
NPCSAC	0.0645	0.0979	0.6587	0.5201	
PCSAC	-4.5824	1.2964	-3.5350	0.0030	***
PCSH	0.5824	0.1689	3.4490	0.0036	***
PCSR	4.0963	1.1502	3.5610	0.0028	***

Significance codes: '***' <1%; '**' 1% to 5%; '*' 5% to 10%

Mean dependent var	112.5667	S.D. dependent var	7.4990
Sum squared resid	47.7335	S.E. of regression	1.7839
R-squared	0.9631	Adjusted R-squared	0.9434
F(8, 15)	48.9310	P-value(F)	0.0000
rho	-0.1778	Durbin-Watson	2.3082

Table 5.

LM test for autocorrelation up to order 1 of SFA

Null hypothesis: no autocorrelation				
Test statistic: LMF = 0.870916				
with p-value = P(F(1, 14) > 0.870916) = 0.366519				
Breusch-Godfrey test for first-order autocorrelation				
OLS, using observations 2020:06-2022:05 (T = 24)				
Dependent variable: uhat				
SFA	coefficient	std. error	t-ratio	p-value
const	-1.4249	6.8828	-0.2070	0.8390
NPT	-0.0003	0.0009	-0.3700	0.7169
NH	0.0004	0.0015	0.2500	0.8062
NC	0.0002	0.0004	0.4018	0.6939
BGBX40	-0.0155	0.0446	-0.3476	0.7333
NPCSAC	0.0114	0.0991	0.1155	0.9097
PCSAC	-0.6790	1.4915	-0.4553	0.6559
PCSH	0.0867	0.1934	0.4484	0.6607
PCSR	0.6080	1.3262	0.4584	0.6537
uhat_1	-0.3312	0.3549	-0.9332	0.3665

Unadjusted R-squared = 0.058565
 Test statistic: LMF = 0.870916,
 with p-value = P(F(1,14) > 0.870916) = 0.367
 Ljung-Box Q' = 0.848146,
 with p-value = P(Chi-square(1) > 0.848146) = 0.357

Conclusions

It can be concluded that the research outlines a strong relationship between the impact factors and the market capitalization of Bulgarian pharmaceutical companies in a pandemic environment in the multiple regression equation and a good descriptive power of the model. The coefficient of determination shows that 96% of the change in the market capitalization for both pharmaceutical companies can be explained by the change in the factors included in the model. Of the factors included in the model – the number of patients cured from COVID-19 and the change in the BGBX40 stock exchange index have the highest degree of significance of 1% and positive beta of influence. The other factors have a specific impact for each of the two companies.

The marked expectation for an increase of their capitalization in view of the demand for medical products (drugs and consumables) should definitely be in the view of the investment community's overall misgivings about the related uncertainty and risks. Regardless of the applicable hedging strategies (Ganchev, 2022), however, the leading public companies in the pharmaceutical sector retain their positive indicators and have the character of a benchmark for the Bulgarian stock market. The growth of the market capitalization of the studied Bulgarian companies over a period of 2 years is comparable to the world leading pharmaceutical companies that offer COVID-19 vaccines.

In summary, health care in pandemic conditions remains the highest civilizational priority. Successful research and innovation in the pharmaceutical sector, combined with good hospital treatment, are a prerequisite for long-term positive returns on investments in shares of pharmaceutical companies, both on the Bulgarian and the leading global capital markets. Future research could examine the post-epidemic market capitalization trends and factors for adding value for the pharmaceutical sector.

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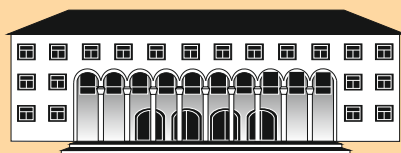
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CONTENTS

MANAGEMENT practice

SPILLOVER EFFECTS BETWEEN INDOCHINA METAL FUTURES MARKETS

Ravi Kumar, Babli Dhiman 5

HOUSEHOLD EXPENDITURE DURING A PANDEMIC: COVID-19 AND THE CASE OF BULGARIA

Lyudmil Naydenov 18

MARKET CAPITALIZATION FACTORS OF THE BULGARIAN PHARMACEUTICAL SECTOR IN PANDEMIC ENVIRONMENT

Galina Zaharieva, Onnik Tarakchiyan, Andrey Zahariev 35

INFORMATION and COMMUNICATIONS technologies

DETERMINATION OF THE EFFICIENCY OF IMPLEMENTING BLOCKCHAIN TECHNOLOGY INTO THE LOGISTICS SYSTEMS

Dilmurod Turdiboyevich Azimov, Mariana Petrova 52

EXPLAINING THE INTENTION OF SOFTWARE DEVELOPERS TO PERFORM ENTREPRENEURIAL COMPETENCIES

Mangair Karasi Manickam, Mohd Zaidi Abd Rozan 68