

# THE IMPACT OF ECONOMIC CRISES ON THE BUSINESS OPERATIONS OF PHARMACEUTICAL COMPANIES IN SERBIA AND THE COUNTRIES OF THE REGION

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## ABSTRACT

*This paper presents an analysis of the repercussions of economic crises on pharmaceutical companies located in Serbia and neighboring countries. The focal point of this research is to delineate the influence that economic crises, spanning the period from 2007 to 2021, have exerted on the operations of pharmaceutical companies. The primary objective of this study is to underscore the significance of economic crises in shaping the financial performance indicators of pharmaceutical companies. The fundamental hypothesis, validated in this paper, posits that economic crises have affected pharmaceutical companies, although in diverse manners and with varying degrees of intensity. Throughout the research, two pivotal questions guided the investigation. First, the study explored whether there is a correlation between the macroeconomic indicators of the countries in which the observed companies operate and their financial indicators. The second question addressed whether all observed financial indicators of pharmaceutical companies decline during periods of economic crisis. This research focuses on three distinct periods: the initial phase of the global economic crisis, the second period encompassing the year 2011, and the third period marked by the onset of the COVID-19 pandemic and the crisis it induced. The principal contribution of this paper lies in emphasizing that economic crises influence the operational dynamics of pharmaceutical companies; however, the origin of a crisis cannot serve as a reliable predictor of its potential impact on a company's operations.*

**Keywords:** economic crisis, pharmaceutical companies, COVID-19 pandemic, financial indicators

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## INTRODUCTION

The business operations of a company depend on numerous and diverse factors. A comprehensive understanding of these influences is crucial and can provide substantial value across all aspects of the company's operations.

This research is conducted on pharmaceutical companies operating in Serbia and the surrounding region. The following countries are included in the research: the Republic of Serbia (SRB), Bulgaria (BUL), Romania (ROM), Hungary (HUN), Croatia (HRK), Slovenia (SLO), North Macedonia (NMC), and Bosnia and Herzegovina (BIH). According to the Serbian market analysis, there are 20 pharmaceutical companies operating in Serbia with significant profits. Most of the aforementioned companies have their headquarters in countries of the region, or their main business centers are located in the Republic of Serbia. A portion of these 20 pharmaceutical companies constitutes the sample for this research [1].

In accordance with the defined research subject and objectives, the hypotheses are formulated as follows:

*H0: The observed economic crises have an impact on the business operations of pharmaceutical companies.*

*H1: Pharmaceutical companies in Serbia and the region that made significant investments in intangible assets (such as scientific and technological knowledge, intellectual property, patents, licenses, and software) will exhibit higher growth in the years following the end of the crisis.*

The principal hypothesis of this paper is that economic crises exerted an influence on pharmaceutical companies, albeit in varied ways and with differing degrees of intensity.

Accordingly, the subject of this research is the analysis of the impact of economic crises from 2007 to 2021 on the business operations of pharmaceutical companies. The primary objective of this study is to emphasize the substantial impact of economic crises on the financial indicators of pharmaceutical companies.

The aim of this study is to highlight the significance of economic crises in shaping the financial performance indicators of pharmaceutical companies and to compare the impact of three distinct crises over the past two decades on the business operations of these companies. The analysis encompasses a fourteen-year business period (2008–2021), covering a total of thirteen companies.

In the first part of the paper, observed macroeconomic data and the countries serving as headquarters for the selected companies are explained, followed by the presentation of the methodology. The second part of the paper is devoted to the presentation of results, analysis of the collected data, and the conclusion.

## MACROECONOMIC OBSERVED DATA

This paper undertakes an examination of one of the myriad external factors, as changes in the external environment exert a significant influence on various levels and facets of business operations, notably impacting managerial functions in addressing business challenges [2]. Gross Domestic Product (GDP) data for this analysis were sourced from the World Bank website. The graphical representation below displays GDP data for the observed countries, highlighting three pivotal downturns in their GDP levels [5].

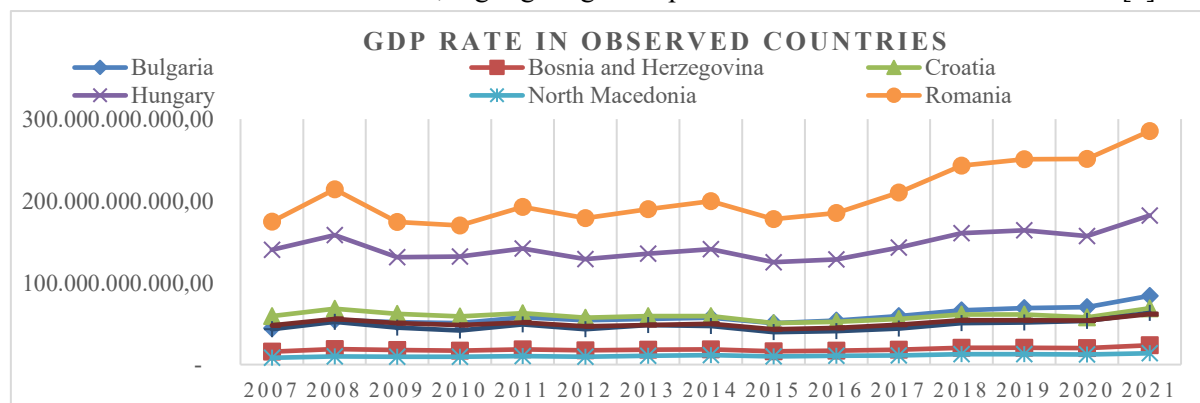


Figure 1. The scatter plot of GDP in observed countries over the observed period 2007–2021.  
Source: Author's graphic according to the data available at the World Bank

The initial decline occurred at the outset of Figure 1 during the World Economic Crisis, commonly referred to as the Great Recession. Following World War II, this downturn represented one of the most severe economic crises, impacting a considerable number of countries, with some sources indicating that approximately 52 countries within the observed scope were affected [6], [7]. The second downturn transpired in 2012, a period associated with the European debt crisis following the global Economic and Financial Crisis. The repercussions of this crisis, which affected specific countries, manifested in a delayed manner within the observed countries [8].

The third crisis unfolded during the COVID-19 pandemic in 2020. The global economy experienced a recession of unprecedented magnitude, representing the sharpest slowdown since the 1930s and the Great Depression. Contrary to expectations, recent studies focusing on trade companies in Serbia concluded that the impact of the COVID-19 pandemic was less severe than anticipated [9], [10].

A notable characteristic of the pharmaceutical market is its increasing globalization across various dimensions, including production, trade, research, and development [11]. This globalization is primarily driven by the trade in pharmaceuticals and the exchange of knowledge. Given the diverse product portfolio within the pharmaceutical market—encompassing drugs, medicines, and medical equipment—an important question arises regarding sales trends during crises originating from different sources. Differences in the sales of these various product categories are evidenced in the statistical report of the Organisation for Economic Co-operation and Development (OECD) Health Statistics 2023 [12]. The central research question examines whether different types of economic crises exert similar effects on the sales of distinct pharmaceutical products. Furthermore, pharmaceutical companies are closely integrated with the healthcare system. It is important to note that in the event of new environmental conditions, emerging diseases, or viral outbreaks, extensive research and analysis must precede the prescription of drugs. The associated costs include measures and analyses related to drug expenditure trends, as well as evaluations of the causes and consequences of prescribed therapies [13].

Data for the second observed macroeconomic indicator, the Consumer Price Index (CPI), were collected from the OECD database.

BIH is the only country for which CPI data were not available; consequently, the corresponding line is absent from the graph.

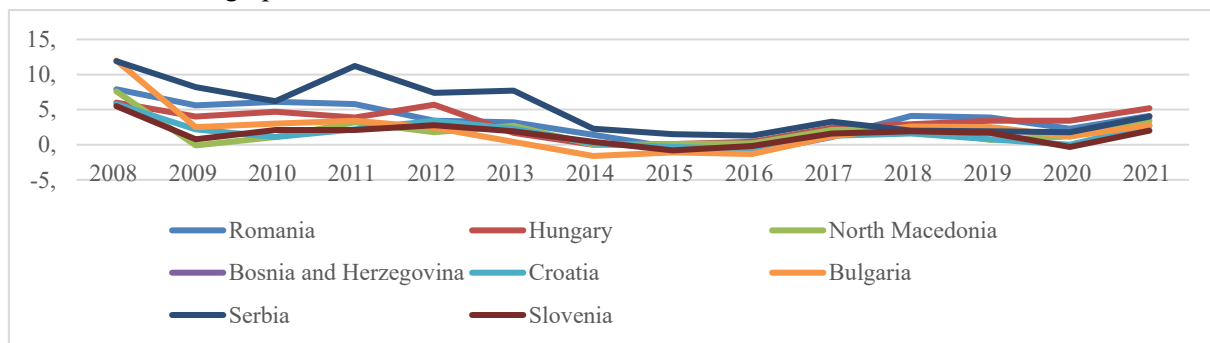


Figure 2. CPI index in observed countries.

Source: Author's graphic according to OECD (2024), Inflation (CPI) indicator

## METHODOLOGY

To evaluate the aforementioned hypotheses, it is necessary to conduct an analysis of selected indicators on a defined sample. The macroeconomic (independent) indicators selected for the analysis include GDP, expressed in million USD, and the CPI. These macroeconomic indicators were compiled for the following countries: SRB, BUL, ROM, HUN, HRK, SLO, NMC, and BIH. It should be noted that the CPI is not available for BIH, as the required data for this indicator are not accessible for this country.

The focus of this analysis is the economic crisis, categorized as a component of country risk within the framework of risk management. This study examines the business performance of pharmaceutical companies during the observed period in conjunction with the macroeconomic indicators of the countries in which these companies operate. The underlying assumption is that the effects of crises on companies require simultaneous consideration of the respective countries' macroeconomic conditions [3]. One aspect

of country risk is illustrated through the concept of risk aversion, which serves to clarify one of the reasons for the importance of closely examining a key macroeconomic indicator, namely GDP. This discussion relates to the emergence of risk aversion at the onset of the crisis, accompanied by various state interventions aimed at enhancing liquidity, which ultimately resulted in a pronounced aversion to risk. This situation contributes to an increase in country risk in developing economies, given their inherent vulnerabilities associated with lower levels of economic development [4]. The GDP values of all observed countries are expressed in USD and divided by millions to ensure consistency in presenting the entire research in million USD. Due to the use of different national currencies across the analyzed countries, all indicators are denominated in USD. Accordingly, data collected from multiple sources were first examined to identify the relevant country and currency, after which the values were converted using the annual mid-point USD exchange rate obtained from the World Bank database [20].

The business indicators analyzed include sales revenue, intangible assets, and profit, all expressed in million USD, with currency conversions performed using year-end mid-point exchange rates in accordance with the methodology applied for GDP [20]. The data used in this study were obtained from the official websites of the observed companies, primarily from sections containing consolidated financial statements or investor-related information.

Following these preparatory steps, the statistical analysis was conducted. First, the Pearson correlation coefficient was applied to examine the relationship between the selected variables, after which the coefficient of determination was calculated. The simple linear correlation coefficient was determined using the following formula [21]:

$$r = \pm \frac{\sum_{i=1}^n (x_i - \bar{x}) \cdot (y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 * \sum_{i=1}^n (y_i - \bar{y})^2}}$$

This coefficient was applied to assess three distinct correlations. One of the macroeconomic indicators particularly sensitive to crisis effects is the price level [14]. In this context, the CPI was analyzed to examine the relationship between macroeconomic price movements and the financial performance indicators derived from the annual reports of the observed companies. By analyzing the correlation between the CPI values of the observed countries and the profit levels of the observed companies, this study seeks to determine whether a reciprocal relationship exists between company profitability and changes in consumer prices over time [15].

The first correlation examines the relationship between sales revenue of the observed companies (dependent variable) and the GDP of the observed countries (independent variable). The second correlation focuses on the relationship between sales revenue (dependent variable) and intangible assets (independent variable). The third correlation analyzes the relationship between the CPI (independent variable) and profit (dependent variable). The companies included in the analysis due to their significant profit levels are: Hemofarm (SRB), Pharmaswiss (SRB), Galenika (SRB), Novo Nordisk (SRB), Actavis (SRB), Roche (SRB), Alkaloid (NMC), Sanofi (HRK), Pfizer (HRK), GlaxoSmithKline (SRB), Merck (HUN), Bayer (SLO), Boehringer (BUL), Krka (SLO), AstraZeneca (HUN), Berlin-Chemie (BUL), Novartis (SRB), Janssen (SLO), Sandoz (SRB), and Bosnalijek (BIH).

Throughout the research, two central questions guided the investigation. First, the study examined whether a correlation exists between the macroeconomic indicators of the countries in which the observed companies operate and the financial indicators of these companies. The second question sought to determine whether all observed financial indicators of pharmaceutical companies declined during periods of economic crisis. Two pivotal periods form the core of this research: the period from 2007 to 2009, corresponding to the global economic crisis, and the period associated with the COVID-19 pandemic and the crisis it induced. Initial findings regarding the short-term effects of the COVID-19 crisis indicate that pharmaceutical companies allocated more resources to research and development than to sales-related activities [16]. Furthermore, the production and development of new pharmaceuticals are complex processes characterized by long time horizons and substantial costs. The outcomes of such processes are inherently uncertain, as innovation follows a stochastic pattern [17]. The subsequent analysis aims to assess the impact of the COVID-19 pandemic on pharmaceutical companies in Serbia and the region, particularly in light of studies indicating suboptimal outcomes in various sectors during the period from 2018 to 2020 compared to initial projections [18]. This examination seeks to determine whether similar patterns are observable in the analyzed region.

## RESULTS

As explained above, Table 1 presents the first set of correlations, based on the Pearson correlation model, between sales revenue and GDP, sales revenue and intangible assets, and profit and the CPI.

The results of the Pearson correlation analysis shown in Table 1 indicate that the Pearson correlation coefficient is predominantly positive, suggesting that in the relationships between sales revenue and GDP, as well as sales revenue and intangible assets, the variables move in the same direction. However, in the case of the correlation between profit and the CPI, the indicators predominantly exhibit opposite directions.

The Pearson correlation coefficient, calculated using the formula presented above, reveals a positive correlation in 12 out of 13 observed companies between GDP levels in the countries where the companies operate and their sales revenue. This finding implies a strong dependence of financial performance on economic conditions and crises originating from various sources. Given the extended duration of the observed period, Pearson correlation coefficients were calculated separately for each of the three crisis periods and for all three observed relationships.

*Table 1. Pearson correlation coefficient for the observed data over the entire period 2008–2021.*

Company name	Country	Corr Sales revenue -> GDP	Corr Sales revenue -> Intangible assets	Corr Profit -> CPI index
SC Terapia	ROM	0.07	0.43	-0.27
Antibiotice	ROM	0.16	0.06	-0.28
Biofarm	ROM	0.83	0.88	0.76
Alkaloid	NMC	0.93	0.51	0.01
Bosnalijek	BIH	0.79	0.72	Not relevant
JGL	HRK	0.16	0.68	-0.34
Sopharma Trading	BUL	-0.53	0.52	0.17
Merck	HUN	0.13	0.69	-0.06
Gedeon Richter	SRB	0.82	0.48	-0.15
Hemofarm	SRB	0.80	0.00	-0.52
Krka	SLO	0.74	0.21	0.40
Novo Nordisk	SRB	0.47	0.53	-0.79
Medika	HRK	0.34	-0.45	-0.50

*Source: Author's table according to the calculated Pearson's coefficient of data collected from observed companies and macroeconomic indicators*

An analysis of Table 2 focusing on the relationship between sales revenue of the observed companies and GDP reveals a pronounced negative Pearson correlation coefficient during the first crisis period. This indicates that changes in one variable exerted a negative influence on the other. Specifically, the decline in GDP coincided with an increase in sales revenue. This trend is further illustrated by a comparison of Figures 1 and 2. In 2008, sales revenue reached its lowest level, while GDP exceeded the values recorded in 2007, suggesting that even during the initial crisis—unrelated to health factors—sales outperformed the preceding year.

Further examination of Table 2 indicates that during the second crisis period, the correlation between sales revenue and GDP was generally positive, although weaker than during the first crisis. This finding suggests that the second crisis had a comparatively smaller impact on sales revenue than the initial crisis.

In the third crisis period, the results indicate a strong positive correlation between sales revenue and GDP in the observed countries, as reflected by the Pearson correlation coefficient. This strong positive relationship suggests that during the economic downturn caused by the COVID-19 pandemic, declines in GDP were accompanied by corresponding declines in sales revenue of the observed companies. As previously discussed, the negative effects of the COVID-19 pandemic on pharmaceutical companies may be attributed to factors such as medication shortages, increased investment in research and development, shifts in communication toward telemedicine, and the high costs and uncertain profitability associated with the lengthy process of developing new pharmaceutical products. These outcomes are consistent with broader trends observed across multiple economic sectors.

Table 2. Pearson correlation coefficient between selected indicators across crisis periods 2007–2021.

	Sales revenue - GDP			Sales revenue - Intangible assets			CPI index - Profit		
	First crisis	Second crisis	Third crisis	First crisis	Second crisis	Third crisis	First crisis	Second crisis	Third crisis
SC Terapia	-1	0.96	-0.17	-1.0	0.9	0.8	1.0	-1.0	-0.1
Antibiotice	-1	0.29	0.44	1.0	0.8	0.2	1.0	1.0	0.7
Biofarm	-1	0.38	0.95	-1.0	0.9	-1.0	1.0	0.2	-0.9
Alkaloid	-1	0.78	0.75	1.0	-0.3	-0.5	1.0	0.3	0.5
Bosnalijek	-1	-0.59	0.72	-1.0	-0.7	1.0	Not relevant	Not relevant	Not relevant
JGL	-1	-0.35	0.29	1.0	1.0	-1.0	-1.0	0.5	0.4
Sopharma Trading	-1	-0.81	-0.54	1.0	-0.9	1.0	1.0	-0.4	0.5
Merck	-1	0.16	0.60	-1.0	-1.0	-0.7	-1.0	0.7	0.9
Gedeon Richter	-1	0.57	0.99	1.0	0.2	1.0	-1.0	0.8	0.9
Hemofarm	1	0.45	0.90	-1.0	0.9	0.9	1.0	0.6	0.1
Krka	1	0.06	0.86	1.0	-0.2	1.0	1.0	-0.4	-0.5
Novo Nordisk	-1	-0.07	0.99	1.0	-0.6	1.0	-1.0	0.0	0.9
Medika	-1	1.0	-0.29	-1.0	0.7	0.2	-1.0	-0.5	0.1

Source: Author’s table according to the calculated Pearson’s coefficient of collected data from observed companies and macroeconomic indicators

One of the key findings of this analysis is that economic crises affect balance-sheet indicators in different ways. In addition, many pharmaceutical companies redirected resources toward increased research and development during crisis periods, which may have contributed to lower sales revenue in the short term. A potential direction for future research would be to examine the relationship between investments in research and development during different crises and their subsequent effects across the three observed periods. Based on the results of this analysis, hypothesis H0 is confirmed, indicating that economic crises have a significant impact on the business operations of pharmaceutical companies.

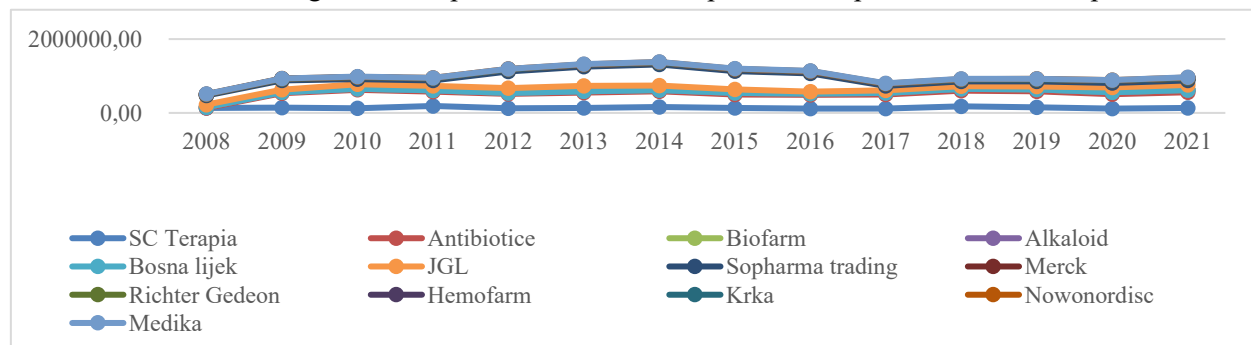


Figure 3. Sales revenue of observed pharmaceutical companies during the period 2008–2021.

Source: Author’s graph based on sales revenue data from the consolidated financial reports of the observed companies

Based on the analysis, the highest values of the observed indicators were recorded by companies operating in ROM and HRK.

With respect to the relationship between intangible assets and sales revenue, hypothesis H1 can be partially confirmed. The positive correlation indicated by the Pearson correlation coefficient suggests that increases in one variable are associated with increases in the other. This finding is consistent with the trend illustrated in Figure 3, where sales revenue increased in the period following the crises, indicating that higher investment in intangible assets is linked to growth in sales revenue.

## CONCLUSION

Based on the comprehensive analyses conducted, it can be concluded that the observed economic crises exerted an influence on the business operations of pharmaceutical companies operating in Serbia and the surrounding region (SRB, BUL, ROM, HUN, HRK, SLO, NMC, BIH). The examination of the entire observed period reveals relatively stable values, with correlations predominantly displaying positive trends. However, the primary focus of this study was the examination of correlations during three distinct crisis periods, which revealed variations in the relationships among different variables. These findings support the confirmation of hypothesis H0.

Hypothesis H1 is only partially confirmed, primarily due to the predominantly positive correlation observed in most cases, indicating that sales revenue tends to increase alongside investments in intangible assets. The highest values of intangible assets were mainly recorded among the observed companies headquartered in ROM and HRK.

The results of this study confirm that economic crises influence the sales revenue and profit of pharmaceutical companies operating in Serbia and the wider regional context. This conclusion is supported by the empirical findings presented in this paper.

A more detailed examination of individual relationships reveals distinct patterns across crisis periods. During the first two crises, which were not driven by health-related factors, pharmaceutical companies experienced growth across most observed variables. In contrast, the final crisis, triggered by the COVID-19 pandemic, had the most pronounced negative impact on pharmaceutical companies in Serbia and the surrounding region. Despite being directly related to the pharmaceutical and healthcare sectors, this crisis was accompanied by a decline in sales revenue. This finding supports the conclusion that the impact of a crisis is not determined solely by its origin.

Future research could further examine the relationship between the magnitude of growth and the level of investment in intangible assets. An additional area for deeper investigation could involve analyzing the relationship between the EBITDA indicator, as a measure of operating cash flow, and retained earnings. It is important to note that these two indicators are not equivalent, which warrants further analytical attention [19].

Further studies could also focus on a more detailed analysis of the relationships among GDP, intangible assets, and sales revenue, with the aim of testing the strength and direction of their interdependence. Moreover, comparative analyses across different industries over the same time period could be conducted to determine whether similar patterns emerge during different types of economic crises. Such analyses could incorporate additional indicators from consolidated financial statements, including research and development expenditure, EBITDA, and various cost categories. Future research may also explore the effects of different economic crises on other balance-sheet indicators, with particular emphasis on research and development activities.

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