meat technology
Founder and publisher: Institute of Meat Hygiene and Technology, Belgrade

UDK: 637.5(497.11)
ID: 120992777
https://doi.org/10.18485/meattech.2023.64.1.4

Original Scientific Paper

The profitability of the meat industry in Serbia: Did the COVID-19 pandemic have any impact?

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A b s t r a c t: The COVID-19 pandemic changed the circumstances of the business environment, affecting almost every industry and company one way or another. The pandemic disrupted the global economy, leading to significant changes in the business landscape. The meat industry in Serbia was not an exception. The aim of this study was to examine the impact of the pandemic on the profitability of the meat industry in Serbia by using a causal comparative design. The research sample included 88 business entities with top market share from the meat industry, analyzed through five years (2016–2020) (440 financial statements were the units of observation). The normality of dataset distribution was tested by Shapiro-Wilk and Kolmogorov-Smirnov tests, while the Wilcoxon statistical tool was used to confirm the impact of the pandemic. Results showed the COVID-19 pandemic did have a positive impact on meat industry profitability in Serbia (so the null hypothesis was rejected). Findings from this paper add to the existing literature regarding the economic effects of the pandemic and could be useful for business entities' owners and investors in their decision-making processes.

Keywords: *Return on Assets (ROA), Wilcoxon test, financial statements, meat industry, investors*

Introduction

The meat industry is one of the largest sectors of the economy, as meat and meat products are considered agricultural products with the highest added value (*Charan*, 2022; *Sama-Berrocal and Martínez-Azúa*, 2022; *FAO*, 2020). Livestock production and processing of livestock products are significant drivers of agricultural production and are key factors in the development of agro-economy.

From Serbia's perspective, agriculture is considered one of the most important economic branches (*Djordjevic et al.*, 2022; *Mitic et al.*, 2018; *Mijić et al.*, 2014). Improving the entire meat production chain in Serbia would have positive effects on social stability in rural areas, while at the macro level, it would have a positive effect on the export income of the domestic agro-economy.

As in many other sectors around the world, global meat supply chains experienced drastic changes due to the onset of COVID-19 in early 2020 (*Vucenovic et al*., 2021; *Hashem et al*., 2020; *Maric and Djurkovic-Maric*, 2020). Namely, different countries around the world took different restrictive measures, such as closing sales facilities, quarantine and closing borders, but also relaxed measures to mitigate the socio-economic crisis. The pandemic triggered long-term social and economic crises, interrupted supply chains, limited access to essential services, but also increased the demand and therefore the price of food (*World Bank*, 2020; *Allain-Dupré et al.*, 2020). Although it can be concluded that the COVID-19 pandemic highlighted the vulnerability of food systems, their problems were also caused by other events and shocks from earlier periods, such as: the oil crisis in the 1970s, the scandal with cattle infected with the Creutzfeldt-Jakob virus in Great Britain in 1980s and then in the early 1990s (*Aday and Aday*, 2020); SARS epidemic in Hong Kong in 2003 (*Kumari and Sharma*, 2023; *Lau et al.*, 2005); Ebola in West Africa in 2014 (*Buseh et al.*, 2015); bird flu in China in 2013 (*Zhou et al*., 2016) and; African swine flu in China in 2019 (*You et al*., 2021). According to the Food and Agriculture Organization of the United Nations, in 2020, there

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Received: April 5th 2023; Accepted: April 25th 2023.
Published by Institute of Meat Hygiene and Technology — Belgrade, Serbia

was an increase in world meat production by 1% (from 325 Mt to 328 Mt), including pork and poultry meat production that increased due to a sharp rise in demand in China.

On the micro level, the rapid spread of SARS-CoV-2, the virus that causes COVID-19, led to enforcement of social distancing measures that affected meat processing plants. That caused significant disruptions to the food supply chain, although the measures were necessary to protect workers and slow down further virus spread (*Selyukh,* 2020). Additionally, closures resulted in significant reductions in the amount of meat being produced, which led to a shortage of meat in grocery stores and higher prices for consumers (*D'innocenzio,* 2020). Additionally, the virus has been detected in meat processing and production plants in numerous economies, such as the United States of America (US), Canada, Brazil and European countries (*Weersink et al.*, 2021). Regarding customer behaviour, the pandemic decreased demand for dining out, which resulted in a decrease in demand for certain cuts of meat, such as steaks. At the same time, the increased demand for comfort foods and meals cooked at home led to an increase in demand for ground beef and other types of meat that are easier to prepare. To soften the negative effects of the pandemic, some meat producers resourced alternative distribution channels, such as online ordering and home delivery (*Thilmany et al.*, 2021). Despite these efforts, the meat production industry is still facing significant challenges due to the ongoing pandemic.

Taking into account these mixed effects of the COVID-19 pandemic, one may question whether the pandemic had any impact on the profitability level of Serbian business entities operating in the meat industry. Consequently, this paper will test the null hypothesis that *"Pandemic COVID-19 did not have an impact on the profitability of the meat industry in Serbia"*. To examine the normality of the dataset and confirm the pandemic's impact on the profitability of selected business entities, measured by the return on assets (ROA) financial indicator, the Shapiro-Wilk test and the Wilcoxon statistical test were utilized. The findings of this study should provide valuable insight into the economic impact of the pandemic and enhance the understanding of the financial implications to enable informed decision-making by key stakeholders in response to these challenges. Specifically, by analyzing the financial effects of the pandemic on meat industry businesses, it should be possible to identify areas of strength and weakness in terms of resilience to the pandemic. The paper is structured as follows: a brief review of the literature in this field is presented, followed by the methodology and results of the research. Finally, conclusions are drawn, and suggestions for future research endeavours are made.

Literature review

The COVID-19 pandemic highlighted the vulnerability of labour-intensive industrial sectors, such as the meat processing sector (*Amnim et al.*, 2021). Supply-side disruptions to the meat production chain included high employee absenteeism, social distancing, job swapping, and quarantine for workers, temporary closure of facilities, disrupted meat supply chains and processing blockages (*Hobbs,* 2021; *Luckstead et al.*, 2021). *Lusk et al.* (2021) report that during the last week of April and the first week of May 2020, daily beef and pork processing volumes in the US were about 40% below 2019 levels. That study found that in the two months under review, the volume of federally controlled cattle slaughter was on average 22% less than the same period in 2019, while pig slaughter was 13% less compared to the previous year (*Luckstead et al.,* 2021). The temporary closure of meat processing plants in the province of Alberta, Canada, caused disruptions in 75% of the meat supply chain (*Keogh*, 2020). The pandemic confirmed that the structure of food supply chains dominated by large and concentrated producers/sellers is more resilient than food supply chains with dispersed, small companies targeting localized markets. However, *Aday and Aday* (2020) believe that a concentrated oligopolistic industry with a small number of large companies creates holdups in the supply chain and, thus, causes drastic disruptions in the system. Due to COVID-19, the meat industry in the US suffered a loss of $US13.6 billion of total economic damage ($8.1 billion in the cow and calf sector, $2.5 billion in the storage sector, and $3 billion in the feedlot sector), and $9.2 billion of total revenue loss of $63 million of livestock (*Peel et al.*, 2020).

Various studies determined that the disruptions caused by the pandemic at the meat processing plants and at the market level were short-lived and had a limited impact only on agricultural holdings (*Almadani et al.*, 2022). It was established that disruptions in processing, declines in consumer purchasing power, and reduced volumes of business in the food service sector affected the global price

of meat production, which remained on the rise throughout 2020. Developed countries have introduced economic stimulation programs as a form of support for meat consumption per capita (*IMF Fiscal Affairs Department*, 2021).

Studies conducted in South America showed that the pandemic has exacerbated for meat producers their already existing problems, stemming from political instability, weak economic growth, low consumer purchasing power, high inflation rate and rapid currency depreciation (*Almadani et al.*, 2021). The decrease in demand for meat and meat products was also contributed to by the media, which highlighted the zoonotic source of SARS-CoV-2, and thereby the question of the safety of consuming meat (*Attwood and Hajat*, 2020). An example of this is the introduction of a ban on the use of wild animals for human consumption in China (*World Economic Forum*, 2020). Outside China, media reports on SARS-CoV-2 have fuelled public interest in the way meat is produced in general, particularly the risk of intensive livestock farming creating antibiotic resistance (*Samuel,* 2020). In this way, the COVID-19 pandemic has played a role in high-income countries in increasing the awareness of consumers who demand transparency in meat production, giving consumers the opportunity to choose meat from animals that have been raised organically or on a natural diet (*Morrison*, 2020).

The pandemic has long-term implications for agri-food supply chains, and adaption strategies have had to be devised to foster resilience, adopting a systemic perspective that the food processing sector is affected by developments throughout the supply chain. The pandemic has brought this into focus in relation to the demand and supply shocks that appeared in meat supply chains in the northern hemisphere spring and summer of 2020 (Hobbs, 2021). *Lusk et al.* (2021) argue the combined effect of rising wholesale meat prices and falling livestock prices leads to a widening of the price range, which would happen even without the anti-competitive behaviour of the processors. That is a natural outcome of the forces of supply and demand within these supply chains.

Some studies have evaluated the impact of the pandemic on the prices and sharemarket returns of companies with primary activities being the production, processing and sale of food. The main conclusion of *Ramelli and Wagner* (2020) was that the food sector was less affected than other sectors, since the volatility of this sector's shares was lower compared to the market index S&P 500 (*Höhler and Lansink*, 2021). The conducted analysis showed that the capital loss of agribusiness stocks during the first four months of 2020 was higher than that in the financial crisis of 2008. The consequences of the COVID-19 pandemic included increasing insolvency, rising unemployment and food insecurity. The high volatility of share prices was a consequence of rising financing costs and high-risk premiums. During the pandemic, share prices in the sub-sector of fertilizers and agrochemicals recorded the highest volatility, due to dependence on oil prices. Also, shares of food distributors were relatively volatile due to quarantine and distancing measures that led to drops in sales. The mentioned sub-sectors had negative operating profits. On the other hand, food retailers and manufacturers of vacuum-sealed food did not have high volatility of stock prices, which had a positive effect on the operational profits that increased compared to the previous observed period of the mentioned research. In contrast to the results of *Ramelli and Wagner* (2020), *Höhler and Lansink* (2021) found a positive and statistically significant effect on profitability in the pandemic outbreak phase, because investors perceived profitable companies as more resilient. In agreement with this, *Ramelli and Wagner* (2020) and *Höhler and Lansink* (2021) confirmed the negative influence of the market β-coefficient on stock returns in the phases of growth in the number of infected people. Stocks that were riskier than the overall market had low cumulative returns. Companies that financed themselves by issuing financial debt instruments achieved lower returns in the phases of the highest number of patients, which indicates the importance of liquidity in times of crisis.

Research carried out on the domestic market in Serbia in the period 2010–2012 showed that the current liquidity ratio and sales growth have significant positive impacts on the profitability (measured by ROA) of companies that produce meat in Serbia, while financial leverage had a significant negative impact. Independent variables such as company size, fixed asset ratio, and investment had no significant relationship with the profitability of the Serbian meat industry (*Mijić et al.,* 2014). On the other hand, taking into account the period 2011–2015, *Mijic et al.* (2017) showed that companies with a high liquidity ratio and sales growth achieved a better ROA, while a high debt ratio negatively affected the level of ROA. Also, the results showed that the size of the company, the fixed assets ratio and the investment rate had no influence on the profitability of the meat processing industry in Serbia.

Research methodology

Data for the research were collected from the website of the Serbian Business Registers Agency, and the sampled entities were engaged in the production and processing of meat and meat products. The companies that were selected held a total market share of 78.5% and operated during the period from 2016 to 2020 in Serbia. The sample comprised 440 observation units, with 88 companies for each reporting period. The sample was divided into two parts, from 2016 to 2019 (pre-pandemic), and the 2020 reporting year (during the pandemic).

The dataset was subjected to causal comparative design, also known as ex-post facto design. Causal comparative design is used to establish a relationship between an independent variable and a dependent variable in a non-experimental setting where two or more groups that already exist but that differ in the presence or absence of the independent variable are compared. The purpose was to determine whether the independent variable (pandemic) caused a difference in the dependent variable (profitability). The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test the normality of the small dataset. As the test results indicated that the dataset did not feature normal distribution, the Wilcoxon rank-sum test was selected to confirm the defined null hypothesis. In general, a standardized test statistic is considered large if it exceeds 1.96 or −1.96, so p-value of <0.05 indicated the relationship between the two variables was statistically significant.

Selection of profitability indicators

Profitability can be described as a measure of an entity's ability to generate profits depending on the amount of its revenue, expenses and operating costs. It is often expressed as a percentage of revenue and can be used to evaluate the financial health of a company, its competitiveness and its potential for growth (*Lim and Morris*, 2023). A company's profitability can be influenced by many factors, including market conditions, competition, pricing strategy, cost structure and operational efficiency. The most common metrics used to evaluate the financial performance of a business entities and provide valuable insights into its profitability, efficiency and growth potential are the following: gross profit margin, operating profit margin, net profit margin, return on equity (ROE), ROA (*Ibrahim et al.,* 2023). In addition, other factors, such as market trends, consumer preferences and government regulations, can also have a significant impact on the profitability of a meat industry company.

Taking into account previous research, *Habiba* (2017) and *Brockman* (2015) measured profitability of public entities using net assets per share (NAPS), while *Amnim et al.* (2021) and *Oliveira et al.* (2015) used ROE. On the other hand, *Raheman and Chek* (2014), *Abd Hamid et al.* (2017) and *Rouf* (2016) used a combination of ROE and ROA indicators. Overall, the most common indicators used in such research are net and gross margins, ROA, and ROE (*Ledley et al*., 2020).

Specifically, in this paper, the following indicators were selected for consideration: ROE, ROA, and net margin. ROE was rejected since it is not uncommon for business entities in Serbia to have losses that exceed their capital, which can make it difficult to calculate this ratio and distort the image of their profitability. Moreover, the net result, which is used for net margin indicator calculation, as an income statement category is often subject to manipulation, either to report higher or lower results than achieved, or for tax evasion purposes. Therefore, selecting this indicator may not result in an objective presentation of the financial success of the selected entities. An indicator was needed that measures how much the observed entity earns on assets invested in the business. As a result, ROA was chosen as the dominant profitability indicator. This indicator shows how effective a company's management is in managing the entire assets with total invested capital in mind. ROA is obtained by dividing net profits, or similar income statement result line, by total or average assets. A higher ROA ratio indicates better performance, as it tells investors that the company is earning more with less investment.

Data distribution and applied tests

A test of normality is a statistical procedure used to determine whether a set of data is approximately normally distributed. This is important because many statistical techniques assume that the data is normally distributed. The choice of test often depends on the sample size and the level of normality that is desired.

Considering the fact that the research dataset was rather small (440 units of observations) compared to big datasets (more than 2,500 units of observations), the usual normality tests for small datasets, the Kolmogorov-Smirnov test and the Shapiro-Wilk test, were used for this research. The first is a relatively robust, nonparametric test that compares the sample data to a theoretical normal distribution, by comparing the sample's cumulative distribution function to the normal distribution's cumulative distribution function. Here, the test statistic value is used to meas-

ure the largest difference between the two cumulative distribution functions. The Shapiro-Wilk test is less sensitive to deviations from normality than the Kolmogorov-Smirnov test, which means it is more appropriate for smaller sample sizes. The Shapiro-Wilk test is based on the W statistic, which is a measure of the departure of the sample from normality. The W statistic ranges from 0 to 1, where values closer to 1 indicate a closer fit to a normal distribution. The result of W statistic is a p-value, which is the probability of observing a sample as extreme as the one being tested under the assumption of normality. If the p-value is small, it indicates that the sample is unlikely to have come from a normally distributed population, and the hypothesis of normality is rejected. It is recommended that quantile plots are used for interpretation of tests results and identifying outliers and non-normal patterns in the data. Namely, they can help determine if transformations or non-parametric methods are needed to better approximate the underlying distribution.

To confirm the hypothesis, the Wilcoxon rank-sum test, a non-parametric statistical test, was used in addition to the normality tests. This test is typically employed when the data fails to meet the assumptions for using a parametric test, such as the t-test, or when the sample sizes are small. It is used to compare the medians of two independent, yet related, samples. The test works by comparing the ranks of the values from each sample and determining whether there is a significant difference in the medians between the two groups. The test statistic U was calculated by summing the ranks of the values from one sample in the combined dataset:

$$U = W - \frac{n_2(n_2+1)}{2} \quad (1)$$

where W is test statistic, n_2 is the number of observations in the other group whose ranks were not summed.

Finally, the research date was processed and all tests conducted with SPSS IBM (*Statistical Package for the Social Sciences*).

Research result and discussion

First, the normality distribution of the data was checked. Table 1 shows results of normality tests for the two periods 2016–2019, and 2020.

Since p-value = 0 (i.e., $p<0.05$) for both the Kolmogorov-Smirnov and Shapiro-Wilk tests, the sample was unlikely to have come from a normally distributed population, and the hypothesis of normality was rejected. Figure 1 shows the data distribution of ROA values in both periods on normal quartile plots, where y-axis shows the value of observed financial indicator. As it can be noticed, some ROA values

Table 1. Tests for normality of the dataset

Research period	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
2016–2019	0.240	88	0.000	0.670	88	0.000
2020	0.199	88	0.000	0.802	88	0.000

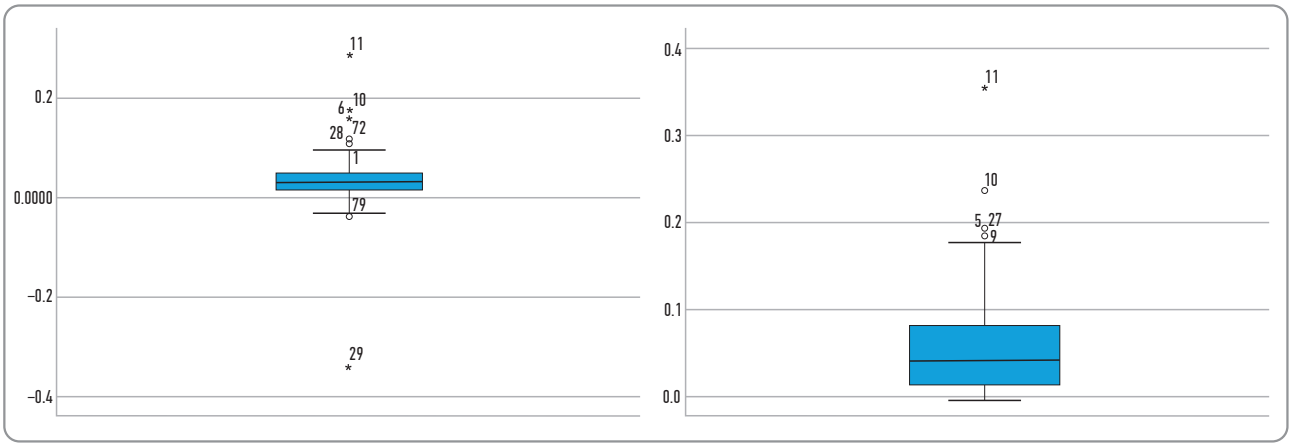

Figure 1. Quartile plots for 2016–2019 (left) and 2020 (right) research periods

Table 2. Null hypothesis test using Wilcoxon rank test

	Null Hypothesis	Test	Sig.	Decision
Asymptotic significances are displayed. The significance level is .050.	The median of differences between ROA 2016–2019 and ROA 2020 equals 0.	Related-Samples Wilcoxon Signed Rank Test	0.001	Reject the null hypothesis.

Table 3. Related summary of Wilcoxon test results

Total observations	88
Test Statistic	2,747.000
Standard Error	240.324
Standardized Test Statistic	3.283
Asymptotic Sig.(2-sided test)	0.001

were out of the normal distribution in both periods. Furthermore, it can be noticed that most companies in first period positioned themselves between 0 and 10%, with some of them having negative ROA. While in 2020 all companies had positive ROA, usually ranging between 0% and 20%.

The Wilcoxon test was used to test the null hypothesis. Table 2 shows $p<0.05$, which indicates that the there was a significant difference between ROA values of the observed entities before and during COVID-19 pandemic period. Therefore, the null hypothesis *"Pandemic COVID-19 did not have impact on profitability of meat industry in Serbia"* was rejected.

The descriptive statistics show the mean ROA before the pandemic was approximately 3.5%, but was approximately 6.1% during the pandemic. This suggests the pandemic had, on average, a positive effect on profitability measured by ROA of business entities from the meat industry in Serbia.

Figure 2 shows the positive and negative differences in ROA values calculated for the sampled entities when comparing the pandemic period of 2020 with the pre-pandemic period of 2016–2019. There were more positive than negative differences, indicating that the pandemic had a generally positive impact on the profitability of the observed entities, as measured by the ROA financial indicator. The following graphs (Figure 3) show ROA values in more detail for the observed reporting periods.

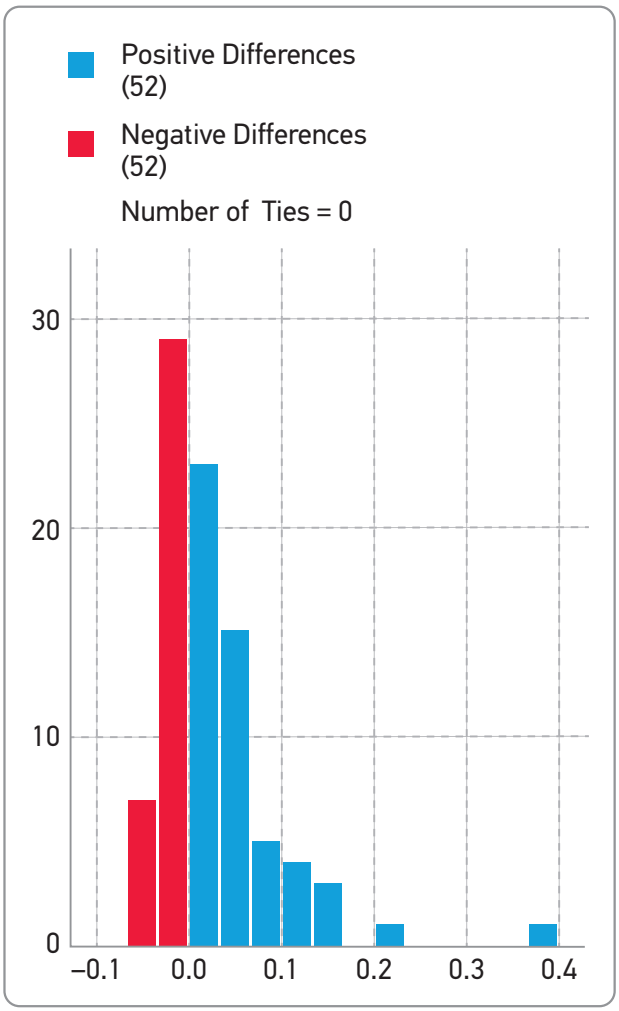

Figure 2. Related-Samples Wilcoxon signed rank test

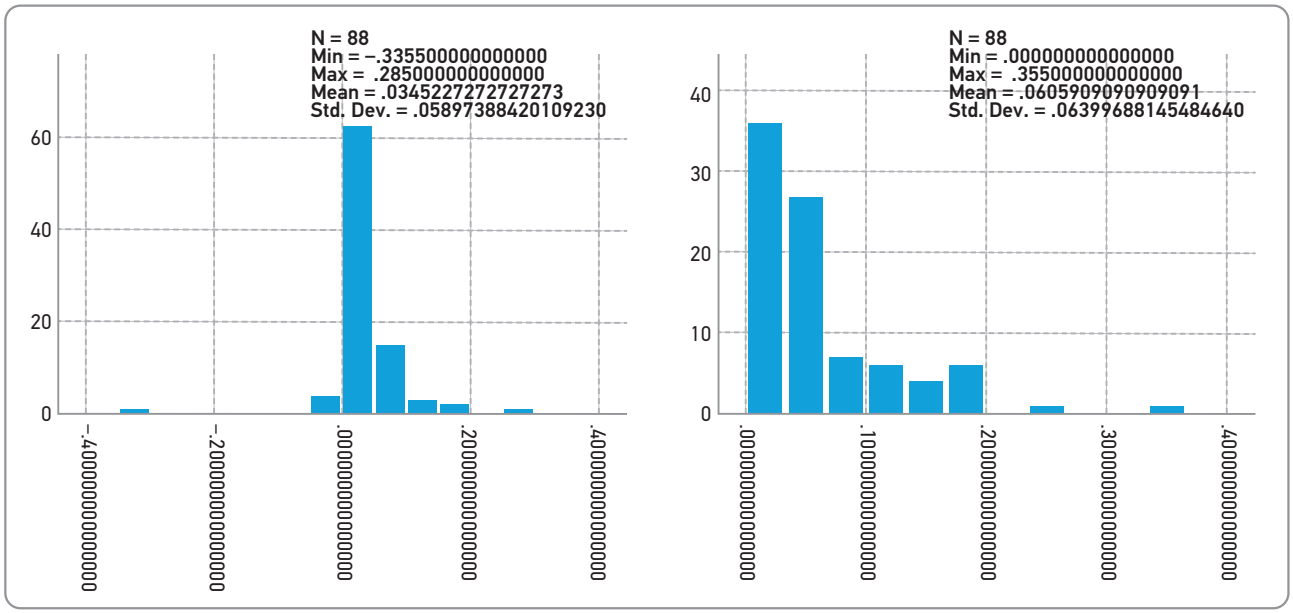

Figure 3. Descriptive statistics result for 2016–2019 (left) and 2020 (right) reporting periods

The mean ROA was higher in 2020 compared to in the pre-pandemic period, as were the minimum and maximum ROAs. Additionally, all sampled business entities recorded positive ROAs in 2020, which was not the case in the period before the pandemic. On the other hand, the standard deviation was higher in 2020 than in the pre-pandemic period, indicating that some business entities achieved above average ROAs after the pandemic started. Median values of ROA also shows difference between periods, with 3.9% in 2020 and 2.75% in 2016–19 period.

Conclusion

This study examined the impact of the COVID-19 pandemic on the financial performance of top grossing business entities from the meat industry. Research results can help businesses understand which aspects of their operations are most vulnerable to disruption and which areas they can focus on to improve their financial performance. By understanding the financial impact of the COVID-19 pandemic, businesses can develop effective recovery strategies to address the challenges posed by the pandemic. The research findings show the pandemic had a positive impact on the profitability of the meat industry, as measured by the ROA financial indicator. Specifically, there was a significant difference between the ROA values of observed entities before (2016–2019) and during the pandemic period (2020), with ROA average, minimum, and maximum values increasing by significant amounts. The average ROA value in 2020 was almost double the pre-pandemic value, while the standard deviation increased as well, indicating that some business entities adapted better to the changed circumstances than others and achieved higher than average ROAs. The explanation for the positive effect of the pandemic on the meat industry's profitability can be found in the increased demand and consumption of meat products, including exports, despite somewhat negative public media. As noted in the literature review section, the pandemic led to higher prices of meat products, which had a positive effect on the profitability of the meat industry and the overall returns of the food sector on worldwide stock markets. The findings of this study contribute to the current literature related to the economic impact of the pandemic and the challenges faced by businesses. They can also aid in enhancing public awareness of the wider consequences of the pandemic and support initiatives to address these difficulties. Future work in this area could focus on analyzing other aspects of business activities of entities from the meat industry sector or other sectors, such as liquidity or solvency. Such research could help to identify specific areas where businesses could improve their resilience and enhance their financial performance in the face of future crises.

Profitabilnost industrije mesa Republike Srbije: Da li je pandemija COVID-19 imala uticaj?

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A p s t r a k t: Pandemija COVID-19 je promenila okolnosti poslovnog okruženja, imajući pozitivan ili negativan uticaj na gotovo svaku industriju i privredno društvo. Naime, pandemija je poremetila globalnu ekonomiju, što je dovelo do značajnih promena u poslovnom okruženju. Samim tim, industrija mesa u Srbiji nije bila izuzetak. Cilj ovog rada je da se ispita uticaj pandemije na profitabilnost mesne industrije u Srbiji pomoću kauzalno-komparativnog dizajna. Uzorak istraživanja je obuhvatio 440 finansijskih izveštaja, kao jedinica posmatranja, odnosno 88 privrednih društava iz mesne industrije sa najvećim tržišnim učešćem analiziranih tokom pet godina (2016–2020). Distribucija normalnosti podataka je testirana pomoću Shapiro-Wilk i Kolmogorov-Smirnov testova, dok je Wilcoxon signed-rank test korišćen za potvrdu uticaja pandemije na uzorkovana društva. Rezultati ukazuju da je pandemija COVID-19 imala uticaj i to pozitivan na profitabilnost industrije mesa u Srbiji meren Prinosom na imovinu (ROA). Rezultati ovog rada doprinose postojećoj literaturi o ekonomskim efektima pandemije i mogu biti korisni vlasnicima privrednih društava i investitorima u procesu donošenja odluka.

Ključne reči: *Prinos na imovinu, Wilcoxon statistički alat, finansijski izveštaji, mesna industrija, investitori*

Disclosure statement: No potential conflict of interest was reported by the authors.

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