PRODUCTION COSTS AND MARKET PRICE OF WHEAT BEHAVIOR ANALYSIS AS A SUPPORT FOR HEDGING STRATEGIES

Irena Janković[1], Vlado Kovačević[2], Marko Jeločnik[3]
Corresponding author E-mail: irenaj@ekof.bg.ac.rs

ABSTRACT

Information on the linkage between production costs and market price of wheat allows farmers to forecast the direction of the market price and reduce the immanent business risks on the farm - whether to sell before harvest, immediately after harvest or to store and sell later. The paper is in line with the hypothesis that market price for storable agricultural products has empirically confirmed bottom limit. If the market price reaches the level of operating costs, farmers will stop sales and store their product in anticipation of a higher price in the near future. This behavior is based on the premise that supply shortage will stop further decline in wheat price. The results of the analysis indicate a strong positive correlation between operating costs and market price of wheat. This indicator allows forecast of the future wheat price behavior and timely decision on the appropriate price risk hedging strategy.
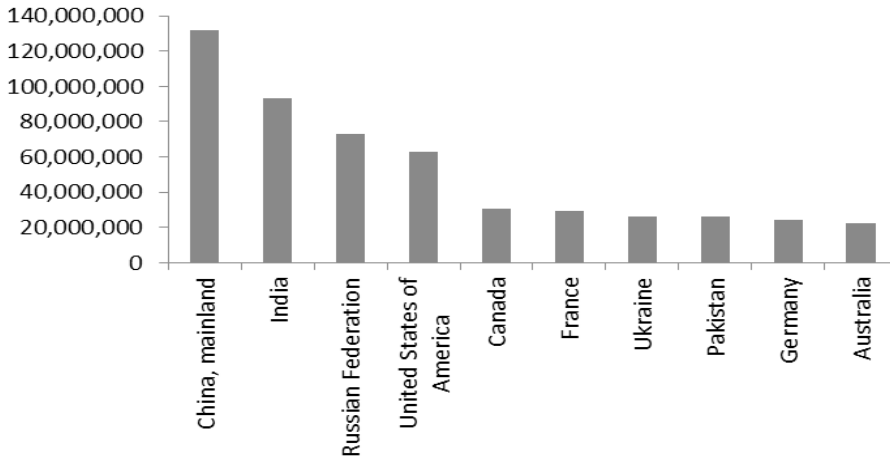
Introduction

On a global scale, wheat is one of the world's leading cereals and crops. Given the size of the arable land under wheat (over 220 million ha), it is the most widespread crop product (Kiss, 2011). According to the quantities produced, this cereal keeps up with maize and rice, but it should be noted that in the last three decades there was a moderate downward trend in harvested areas of about 0.25%, paired with an upward trend in yields of almost 1.5%, which is the consequence of the development of the used technology matrix (Enghiad et al., 2017).

1   Irena Janković, Ph.D., Associate Professor, University of Belgrade, Faculty of Economics, Kamenicka Street no. 6, 11000 Belgrade, Serbia, Phone no.: +381 11 3021 046, E-mail: irenaj@ekof.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-1115-4702)

2   Vlado Kovačević, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone no.: +381 63 55 44 41, E-mail: vlado_k@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0002-2902-6496)

3   Marko Jeločnik, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone no.: +381 64 66 88 357, E-mail: marko_j@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-4875-1789)

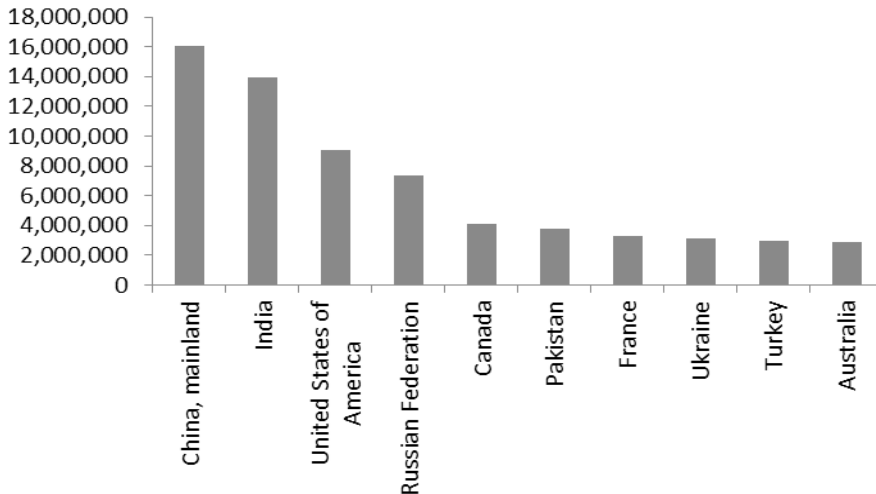Countries that are nowadays leaders in wheat production include China, India, Russian Federation and USA (*Figure 1.*).

Figure 1. Top 10 countries wheat producers in 2016, in tones

Net production value of wheat reaches the total amount of 66.5 billion of Int. USD for top 10 countries (*Figure 2.*).

Figure 2. Net production value of wheat in 2016, in constant 2004-2006 1000 Int. USD

The significance of wheat is recognized in its high consumption value for human and animal nutrition (by-products from wheat processing or vegetative parts of the plant), food

industry (baking industry and pasta industry, confectionery products, baby food, beer and alcoholic beverages, starch, gluten, etc.), pharmaceutical industry, etc. Global estimates suggest that, on a daily basis, wheat accounts for over 20% of the total calories and proteins in human nutrition (in India, over 50%), and, thus, ensures food security (Grewal, Goel, 2015; Jeločnik et al., 2017). This triggers strong wheat marketability and mobility (trading product), with a relatively high global export value, which in the past years, depending on climatic conditions and quantities produced, ranged from about 35 to over 50 billion of USD (Kefyalew, Henneberry 1997; Imexco, 2017). Main wheat exporters are presented by next Figure (*Figure 3.*).

Figure 3. Export value of wheat in 2016, in thousands of USD
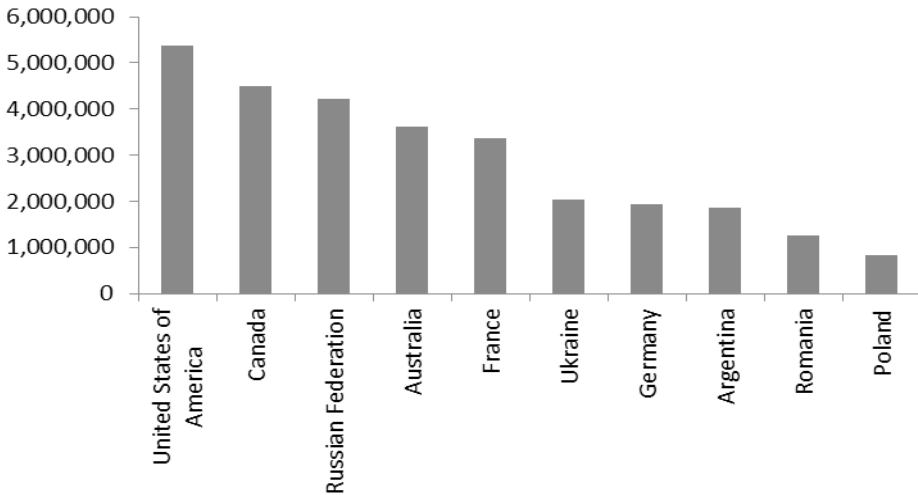
Source: FAO, 2018b.

The rest of the paper is organized as follows: section 2 provides literature review, section 3 offers description of used methodology and data sources, section 4 refers to results and discussions, while section 5 concludes the analysis.

Literature Review

The literature on forecasting soft commodities supply response on market price has a long history, even for organic products (Nerlove, 1956; Houck, Ryan, 1972; Lee, Helmberger, 1985; Tomas Simin et al., 2019). The production costs are main driver of wheat market price. Production costs per unit vary over the years (production cycle) and depend primarily on the amount of the variable production costs and yields. Price of oil has the largest impact on production costs (Vasiljević et al., 2008), while yields are highly dependent on the climatic conditions during the vegetation period. On the other hand, through direct applying of the concept of economies of scale the average cost per unit of production could be decreased as the size of the farm (total production) increases, meaning that farmer is able to spread more production over the same level of fixed expenses.

For storable agricultural products such as wheat, farmers have to decide whether to store the product and wait for a higher price or to sell it partially, i.e. immediately before or after the harvest (Pejovich, 1990; Shi et al., 2014).

Hassouneh et al. (2016) point out that besides wheat production costs increase in global stocks is reducing wheat market price, while higher interest rates increase the wheat price volatility.

Figure 4. Wheat price average annualized volatility, period 1961-2011
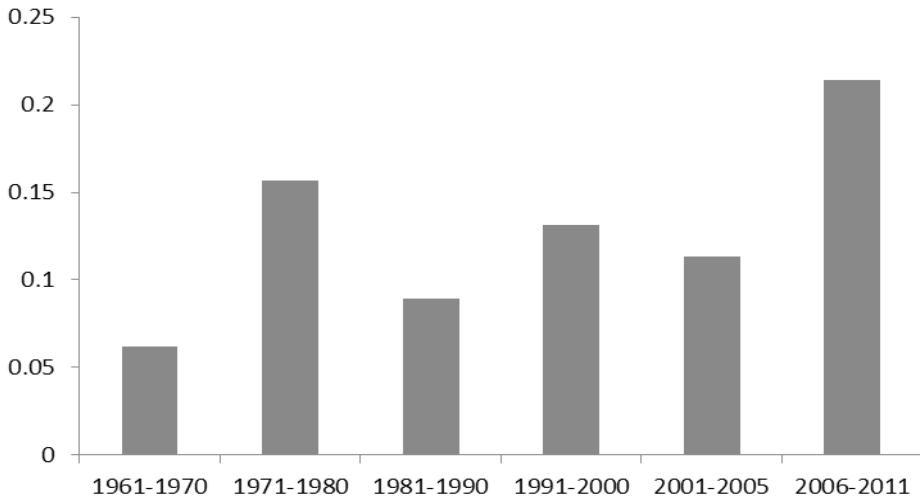
Source: Mekbib et al., 2016.

Note: Price volatility is measured by the standard deviation of logarithmic monthly prices using World Bank international prices. Prices are in real 2005 USD per metric ton. The figures in each bar refer to average values of the annualized volatilities over the respective decade.

After five decades of relative wheat prices stability, since 2005 the prices volatility has surged, driving the farmers' need for hedging strategies in order to manage price risk (Mekbib et al., 2016). Global crisis provoked investors' "flight to safety" behavior, shift from financial assets to commodities, that resulted in commodities prices increase. High wheat market prices led to supply response in which producers started to allocate more land to the wheat production and increased investments (and production costs) that were oriented to yields growth (OECD, 2008).

Besides production costs, increased demand and price volatility, the influence of other "non-production factors" is significant, i.e. speculative factors, which are affecting the wheat market (Zuppiroli, Revoredo Giha, 2016). Finally, climate changes are influencing soft commodity prices by decreasing yields, limiting supply, and affecting market prices, which might create additional spillover effects on the global market (Ziolkowska, 2016).

Methodology and Data Sources

During the analysis of research results, broad and in detail overview of scientific sources in the field of cereal price calculation and cereal prices forecast was carried out. During the research, and the results interpretation phase, in-depth interviews were conducted with relevant experts from the sphere of cereal production and markets. The research involved the use of statistical methods for data processing and analysis, such as descriptive statistics, coefficient of variation, correlation and regression analysis.

Empirical part of the analysis is based on the data from the United States Department of Agriculture (USDA), obtained from the Commodity Costs and Returns database for a twenty-year period (1996-2015). The reliance on USDA data for the analysis is based on the fact that the United States is one of the world's largest wheat producers, with the pronounced impact on the global wheat market. Even though the analysis was carried out based on production conditions on the territory of the USA, the method also has a high level of applicability on other markets.

The dominant goal of the market-oriented agricultural producers is to make profits. Profit per unit of product in agricultural production can be expressed as (Urfi et al., 2011; Hubbard et al., 2013):

$$P = MP - TCP \qquad (1)$$

where:

P - Profit; MP - Market price; TCP - Total production cost.

Total production cost per unit of product can be expressed as:

$$TCP = OC + FC \qquad (2)$$

where:

OC - Operating costs; FC - Fixed costs.

In plant (crop) production, in this case wheat production, operating costs represent: seed, mineral fertilizers and manure, pesticides and agro-chemicals, custom operations, water, motor fuel, lube, electricity and repairs for used mechanization and equipment, interest on operating inputs, buildings and machines upkeep and some other variable expenses (Subić et al., 2010; DGARD, 2016).

On the other hand, fixed costs in plant (wheat) production include: hired labor, costs of purchased mechanization, opportunity cost of unpaid labor, opportunity cost of land (rental rate), certain taxes, fees and insurance, general farm overhead (general farm utilities, office equipment, business travel and other costs), etc. (Hallam et al., 1998).

Information on the correlation between wheat's production costs and market price can be helpful when deciding on potential sales terms. Furthermore, predicting wheat market

prices based on expected or projected production costs and price/costs relationship allows a farmer to decide whether to perform hedging strategies on derivatives' market.[4]

Determining the correlation between production costs and market prices of wheat and their connection to other grains (Kovačević et al., 2017) is very useful in analyzing the wheat production profitability over a longer period of time. It should be emphasized that by using market price to production cost indicators the effect of inflation is avoided, i.e. the obtained indicators can be directly compared in different years. Additionally, price risk hedging strategies may be chosen more effectively.

Results and Discussion

The main goal of the paper was to determine the linkage between operating/total cost and market price of wheat. Initial assumption of the research was that production costs of wheat are significantly correlated with the market price. The initial hypothesis referred to the idea that since wheat is a storable product, in the case of low prices on the market, the farmers will store the product rather than sell it immediately (at harvest time), causing a contraction of market supply, i.e. stopping further decline in wheat prices.

In next tables (*Tables 1a/b.*) are shown the data on production costs and market prices of wheat, valid for the territory of the United States during the observed period. The summarized data for Operating costs and Overhead costs were used for calculation of Total wheat production costs on annual level. Based on the USDA data, the following parameters were subsequently calculated: Operating costs per bushel; Market price/operating costs per bushel; Profit/operating costs; Total costs per bushel; Market price/total costs per bushel and Profit/total costs.

Table 1a. Wheat costs of production and profitability indicators for the period 1996-2015, excluding government payments

Element/Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total, operating costs	70.0	70.5	57.4	54.8	58.4	64.9	57.1	67.7	70.8	79.5
Total, allocated overhead	25.5	27.2	107.8	111.3	115.5	118.4	118.6	123.4	119.8	128.0
Total, costs listed	95.5	97.7	165.2	166.2	173.9	183.3	175.6	191.1	190.6	207.5
Yield (bushels per planted acre)	30.4	35.9	41.4	38.6	37.6	34.5	27.9	40.7	39.8	39.9
Price (USD per bushel at harvest)	4.8	3.5	2.7	2.5	2.5	2.8	3.3	3.1	3.4	3.2

4   Commodities represent the fastest growing market within the worldwide globalised economy. Globalisation has brought many new benefits to the participants involved in agricultural production. However, it also implies potential risks. For example, the increased price volatility and its impacts became one of the major global issues during the previous period. Usually the producers' low income and market fluctuations lead to price instability, which generally impedes the growth of grains market. Consequently, producers oriented to commodity markets tend to be more focused on the commodity price risk and potential hedging activities (Rusnakova, 2015; Yu et al., 2016).

Element/Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Operating costs per bushel*	2.3	1.8	1.3	1.3	1.5	1.8	1.9	1.6	1.6	1.8
Market price/ operating costs per bushel*	2.3	1.9	2.1	1.9	1.7	1.5	1.7	2.0	2.1	1.7
Profit/operating costs* (in %)	127	93	105	85	68	54	71	97	110	73
Total costs per bushel*	3.0	2.6	3.9	4.2	4.5	5.2	6.2	4.6	4.7	5.0
Market price/total costs per bushel*	1.6	1.4	0.7	0.6	0.5	0.5	0.5	0.7	0.7	0.6
Profit/total costs* (in %)	63.1	36.0	-31.5	-41.3	-45.8	-47.2	-46.8	-32.6	-26.0	-37.2
* Author's calculation based on the USDA data.										

Source: USDA, 2017.

Table 1b. Wheat costs of production and profitability indicators for the period 1996-2015, excluding government payments (continuation)

Element/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total, operating costs	85.0	93.0	125.7	112.9	102.8	121.9	126.7	128.2	126.5	115.5
Total, allocated overhead	131.8	139.0	151.7	150.3	154.6	165.7	175.3	183.9	189.3	193.5
Total, costs listed	216.8	232.0	277.4	263.2	257.4	287.6	302.0	312.0	315.8	309.0
Yield (bushels per planted acre)	33.2	37.4	41.3	40.0	45.3	37.6	43.8	38.9	36.9	40.1
Price (USD per bushel at harvest)	4.1	5.3	7.9	5.5	4.8	7.4	7.6	7.1	6.4	5.1
Operating costs per bushel*	2.3	2.3	2.8	2.7	2.1	3.0	2.7	3.0	3.2	2.7
Market price/ operating costs per bushel*	1.8	2.3	2.8	2.1	2.3	2.5	2.9	2.4	2.0	1.9
Profit/operating costs* (in %)	76	130	179	109	125	146	186	135	104	94
Total costs per bushel*	6.3	6.0	6.5	6.4	5.5	7.4	6.7	7.7	8.3	7.5
Market price/total costs per bushel*	0.7	0.9	1.2	0.9	0.9	1.0	1.1	0.9	0.8	0.7
Profit/total costs* (in %)	-34.7	-12.4	21.0	-13.5	-14.1	-0,7	14.0	-8.4	-22.3	-31.5
* Author's calculation based on USDA data.										

Source: USDA, 2017.

Next Figure (*Figure 5.*) shows movements of the operating costs, total costs and market price at harvest time (per bushel, as annual averages) for the wheat in USA during the period 1996-2015.

Figure 5. Comparative presentation of operating costs per bushel, total costs per bushel and market price per bushel (at harvest) in USA, in period 1996-2015
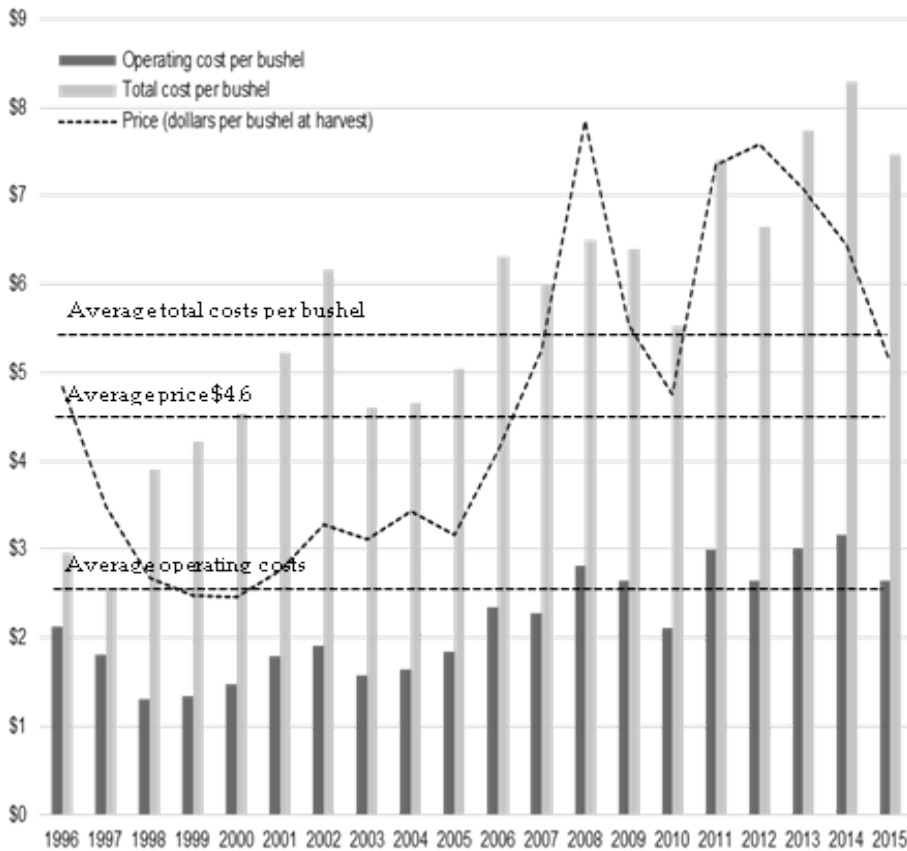
Source: Authors' calculation and presentation based on USDA, 2017.

It is illustrative that market price is highly correlated with operating costs, as well as that it has never been under the level of operating costs. The price of the wheat reached two peaks in recent history, at the beginning of global financial and subsequent debt crisis in Eurozone, in 2008 and 2012 respectively. The first reason for this may lie in the, so called, "flight to safety" behavior of market participants that ran away from financial towards real assets in times of distress, increasing the demand and price of commodities. The second reason was the rise in oil prices that increased the input costs and in addition demand for substitute biofuel agricultural commodities. Furthermore, the data from previous tables (*Tables 1a/b*.) indicate that the highest profit/operating costs ratio was reached in these two years (wheat price significantly increased, while the rise in operating costs was less pronounced).

The positive co-movement of total costs and market price is also present but, to a certain extent, weaker. The ratio of profit/total costs was mostly negative over time. The farmers are often willing to sell the products under the total costs because they are not taking into account own labor costs, opportunity costs, lost land rent, etc. In addition, government subsidies were

not taken into account when calculating profitability. In 2008 and 2012 ratio had positive value because of significant increase in wheat market price that surpassed the level of total production costs.

For the purpose of wheat price forecast the ratio of market price /operating costs may prove to be more reliable in comparison to market price/total costs due to higher positive correlation between operating costs and price of wheat.

Figure 6. Regression analysis between the total costs per bushel and market price per bushel (in USD) at the harvest time
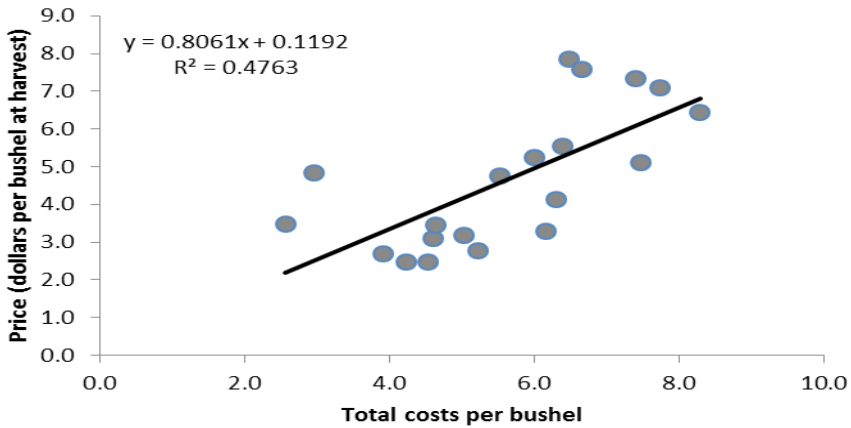
Source: Authors' calculation based on USDA, 2017.

Figure 7. Regression analysis between the operating costs per bushel and market price per bushel (in USD) at harvest time
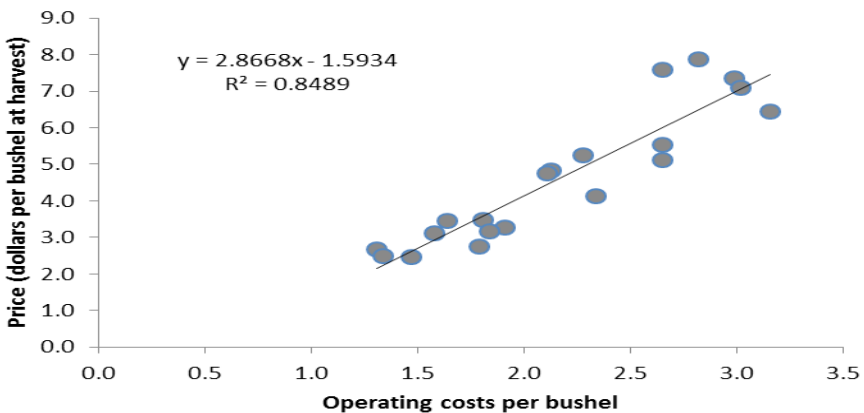
Source: Authors' calculation based on USDA, 2017.

The previous harts (*Figures 6. and 7.*) present regression analysis for total (operating costs) and market price. High positive correlation was expected, and higher portion of explained variability in total is got for operating costs as explanatory variable. The values of correlation coefficients are presented in next table (*Table 2.*).

Table 2. Correlation matrix

Wheat	Total costs/bushel	Price (USD/bushel at harvest)	Operating costs/ bushel
Total costs/bushel	1		
Price (USD/bushel at harvest)	0.690	1	
Operating costs/bushel	0.821	0.921	1

Source: Authors' calculations

The previous table shows that the correlation between total costs, operating cost and market price is high and positive.

Standard deviation, average values and coefficients of variation for market price/operating cost per bushel and market price/total cost per bushel are provided in next table (*Table 3.*), while log changes of ratios are presented in next Figure (*Figure 8.*).

Table 3. Standard deviations, mean values and coefficients of variation

Element	Standard deviation (%)	Average	Coefficient of variation (%)
Market price/operating cost per bushel	35.29	2.08	16.94
Market price/total cost per bushel	29.63	0.84	35.10

Source: Authors' calculations

Figure 8. Market price/operating (total) costs log changes

Source: Authors' calculations

In previous table and Figure (*Table 3.* and *Figure 8.*) are shown the relative dispersion indicators for market price/operating costs per bushel and market price/total costs per bushel. Operating costs are characterized by higher correlation to market price. The ratio market price/operating costs has lower variability, and thus appears to be a more reliable indicator in the forecast of market price of wheat compared to the ratio of market price/total cost per bushel. Furthermore, the value of operating costs per bushel had always had a lower value than the market price of wheat during the observed period, which was not the case with total costs per bushel.

The explanation for such results is that farmers for storable products, such as wheat, usually take into consideration only direct operating costs, which is equivalent to money invested in seeds, fuel, chemicals, etc. Therefore, if the market price approaches operating costs, farmers will instinctively try to avoid a visible loss, and will store wheat, expecting a higher price in the near future. As a result, decrease in spread between market price and operating costs leads to increasing storage and withdrawal of wheat from the market which slows down further decrease in wheat price and ultimately leads to the subsequent price increase due to reduced supply.

The reason producers are willing to sell the wheat below the level of total production costs lies in the fact that government subsidies and supports within the various timeframes are not taken into account in profitability calculation. In addition to direct payments to farmers, current USA farm programs are more and more insurance based (Keeney, 2013). These may be rational behind the predominantly negative spread between total production costs and market price, as previously shown.

On the other hand, overhead costs are "less visible" and understandable to farmers as the opportunity costs, lost rent for plots that could have been leased or the value of hiring own labor. Thus, when market price approaches and even falls below the total production cost of wheat that has a weaker effect on farmers' decision to sell or store the product than market price approaching the operating costs.

Wheat price behavior and price risk hedging effectiveness

Stated characteristics of wheat price behavior and presented ratio of market price/ operating costs offer simple tool for future price forecast and timely and effective hedging of price risk.

The following Figure 9 illustrates the historical market price/operating costs ratio for USA wheat producers and turning points of this time series. It can be noticed that minimum and maximum levels reached by the ratio in the past present the form of support and resistance levels for price to costs relation.

Figure 9. Boundaries for market price/operating costs ratio movements
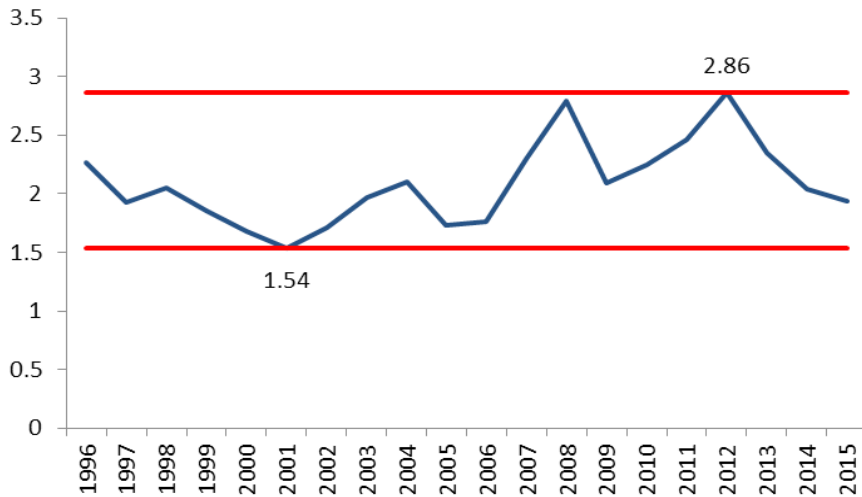
Source: Authors' calculations

Practical applications of the ratio market price/operating costs of wheat in farmers hedging activities decisions are shown in the following two examples.

Example 1. An example of the practical application of the low wheat market price/operating costs ratio to decision making process for hedging strategies on the futures market.

Let's assume that in January, a milling company has the need to purchase certain quantities of wheat in July. Based on the forecasted producer price and wheat price on the futures market for delivery in July, the company calculated that the ratio futures contract price/operating costs is 1.54. According to the results of the analysis in this paper, this would be an excellent opportunity for opening long positions in July wheat futures, since during the period covered by the analysis, the ratio of market price/operating costs showed this to be the lowest level in previous two decades. Therefore, rise in wheat price is expected and in this case it is a good business decision to use hedging strategies with futures. The similar hedging strategy can also be applied by purchasing July wheat call options.

Example 2. An example of the practical application of the high wheat market price/operating costs ratio to decision making process for hedging strategies on the futures market.

Assuming the case opposite to the case in Example 1, a farmer in January forecasts the production costs of wheat, and on the basis of known futures price at harvest time (futures in July), using the methodology shown in this paper, determines that futures contract price/operating costs is 2.86. Farmer decides, based on this ratio, to open short position on July futures contract since according to the results of the analysis, that would be a perfect moment for the wheat sale, as the market price/operating costs ratio in the past twenty years has never been higher, and therefore decrease in market prices is expected. The similar hedging strategy can also be applied by purchasing July wheat put options.

Conclusions

The aim of the paper was to analyze wheat market price to costs behavior in order to provide decision support tool for hedging strategies in agribusiness sector. The analysis was carried out based on the United States Department of Agriculture data for the twenty years period. The obtained results showed a high positive correlation between operating costs and market price and lower but significant correlation of total production costs and market price.

The observed difference in the correlation between the two costs categories and market price could be explained by the greater ''visibility'' of the direct operating costs to the farmers. In the case of market price approaching operating costs, farmers start to withdraw wheat from the market and store it which reduces the current market supply. Resulting supply shortage slows down and, ultimately, stops further decline in wheat price.

In the case of market price/total production costs, the overhead costs - opportunity costs, lost rent that could be charged when leasing land and the costs of own labor, are less ''visible'' to farmers. As a result farmers are willing to sell wheat below the total production costs, while they are reluctant to sell below clearly visible operating costs.

Presented ratio of wheat market price/operating costs proved to be simple and effective tool for price risk management. Advantage of this approach in macroeconomic and profitability analyses, lies in the fact that mentioned ratio can be directly compared over different time periods without the need to calculate the effect of inflation. Finally, this methodology can be used for other storable soft commodities such as corn, rice, soybeans, etc.

Further research in this area could take into account other factors affecting wheat market price behavior such as price of substitute commodities, the currency exchange rates, the interest rates, the wheat transitional stocks, the projected demand for wheat, etc.

Acknowledgements

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. DGARD (2016). Farm Economy Overview: Cereal Sector. EU Agricultural and Farm Economics Briefs, no. 11, July 2016, European Commission (EC), Directorate General for Agriculture and Rural Development (DGARD), Brussels, Belgium, 1-5.

2. Enghiad, A., Ufer, D., Countryman, A., & Thilmany, D. (2017). An Overview of Global Wheat Market Fundamentals in an Era of Climate Concerns. *International Journal of Agronomy*, 19, Article ID 3931897, 1-15, https://doi.org/10.1155/2017/3931897

3. FAO (2018a). Top 10 Country Production of Wheat. Database of FAO, Rome, Italy. Retrieved from: www.fao.org/faostat/en/#rankings/countries_by_commodity (March, 2018)

4. FAO (2018b). Top 10 Country, Export Value of Wheat. Database of FAO, Rome, Italy. Retrieved from: www.fao.org/faostat/en/#rankings/countries_by_commodity_exports (March, 2018)

5. Grewal, S., & Goel, S. (2015). Current Research Status and Future Challenges to Wheat Production in India. *Indian Journal of Biotechnology,* 14, 445-454.

6. Hallam, A., Eidman, V. R., Morehart, M., & Klonsky, K. (1998). *Commodity Costs and Returns Estimation Handbook: A Report of the AAEA Task Force on Commodity Costs and Returns*. Iowa State University, Department of Economics, Ames, USA.

7. Hassouneh, I., Serra, T., Bojnec, S., & Gil, J. M. (2017). Modelling Price Transmission and Volatility Spillover in the Slovenian Wheat Market. *Applied Economics*, 49(41):4116-4126.

8. Houck, J. P., & Ryan, M. E. (1972). Supply Analysis for Corn in the United States: The Impact of Changing Government Programs. *American Journal of Agricultural Economics*, 54(2):184-191.

9. Hubbard, G., Garnett, A., Lewis, P., & O'Brien, A. (2013). *Essentials of Economics*. 2nd edition, Pearson Australia, Frenchs Forest, Australia.

10. Imexco (2017). Wheat exports by country. Portal of the Import-export & global supply chain (Imexco Int. Ltd.), Retrieved from: https://imexco-int.com/2017/12/25/wheat-exports-by-country/ (15th January, 2018).

11. Jeločnik, M., Zubović, J., & Zdravković, A. (2017). Procena šteta u proizvodnji pšenice izazvanih klimatskim faktorom. *Ecologica*, 87, 501-506.

12. Keeney, R. (2013). The End of the Direct Payment Era in U.S. Farm Policy. Expert paper no. EC-774-W, APEX - Ag. Policy Explained, Purdue Extension, 1-3. Retrieved from: www.extension.purdue.edu/extmedia/ec/ec-774-w.pdf

13. Kefyalew, A., & Henneberry, D. (1997). Wheat and Value-Added Wheat Export Market Segmentation. *Journal of International Food & Agribusiness Marketing*, 8(4):1-35, https://doi.org/10.1300/J047v08n04_01

14. Kiss, I. (2011). Significance of Wheat Production in World Economy and Position of Hungary in it. *Applied Studies in Agribusiness and Commerce - APSTRACT*, 5(1-2):115-119.

15. Kovačević, V., Jeločnik, M., Subić, J., Zekić, V., Milić, D., & Zubović, J. (2017). Causality Between Corn Production Cost and Cash Corn Price. *Custos e @ gronegócio,* 13(4):2-16.

16. Lee, D. R., & Helmberger, P. G. (1985). Estimating Supply Response in the Presence of Farm Programs. *American Journal of Agricultural Economics*, 67(2):193-203.

17. Mekbib, G. H., Kalkuhl, M., & Braun, J. (2016). Worldwide Acreage and Yield Response to International Price Change and Volatility: A Dynamic Panel Data Analysis for Wheat, Rice, Corn, and Soybeans. *American Journal of Agricultural Economics*, 98(1):172-190.

18. Nerlove (1956). Estimates of the Elasticities of Supply of Selected Agricultural Commodities. *Journal of Farm Economics*, 38(2):496-509.

19. OECD (2008). Rising Food Prices: Causes and Consequences. OECD, Paris, France, Retrieved from: www.oecd.org/trade/agricultural-trade/40847088.pdf

20. Pejovich, S. (1990). *The Economics of Property Rights: Towards a Theory of Comparative Systems*. Kluwer Academic Publishers, Dordrecht, the Netherlands.

21. Rusnakova, M. (2015). Commodity Price Risk Management Using Option Strategies. *Agricultural Economics,* 61(4):149-157.

22. Shi, J., Zhao, Y., & Kiwanuka, R. (2014). Managing Inventories for Agricultural Products: The Optimal Selling Policies. *Operations Research* (under review), manuscript OPRE-2014-03-142, pp. 1-51, Retrieved from: https://web.njit.edu/~jshi/Shi-Zhao-Kiwanuka-OR.pdf (Jun, 2018)

23. Subić, J., Ivanović, L., & Jeločnik, M. (2010). The Impact of Subsidies on Variable Costs Covering in Field Cultures Production. *Proceedings of XXIV Conference of Agronomists, Veterinarians and Technologists,* 16(1-2):251-264.

24. Tomas Simin, M., Glavaš Trbić, D., Petrović, M., & Komaromi, B. (2019). Prices of Organic Products in the Republic of Serbia. *Western Balkan Journal of Agricultural Economics and Rural Development*, 1(2):93-100.

25. Urfi, P., Kormosne Koch, K., & Bacsi, Z. (2011). Cost and Profit Analysis of Organic and Conventional Farming in Hungary. *Journal of Central European Agriculture,* 12(1):103-113.

26. USDA (2017). *Elements from Wheat Production*. Data from the Commodity Costs and Returns Database, USDA, Washington DC, USA, Retrieved from: www.ers.usda.gov/data-products/commodity-costs-and-returns.aspx (24th June, 2017).

27. Vasiljević, Z., Todorović, S., & Popović, N. (2008). An Influence of the Fuel Price Change on Optimization of Total Operating Costs of the Tillage Agricultural Machinery. *Agricultural Engineering,* 33(4):69-77.

28. Yu, X. T., Zhang, Z., & Yu, X. (2016). Using Financial Control to Answer Dilemma in Chinese Corn Market. *3rd International Conference on Social Science (ICSS, 2016),* Shanghai, China, DEStech Publications Inc., Lancaster, USA, 458-464.

29. Ziolkowska, J. R. (2016). Socio-Economic Implications of Drought in the Agricultural Sector and the State Economy. *Economies*, 4(19):1-11. doi:10.3390/economies4030019

30. Zuppiroli, M., & Revoredo Giha, C. (2016). Hedging Effectiveness of European Wheat Futures Markets: An Application of Multivariate GARCH Models. *International Journal of Applied Management Science*, 8(2):132-148