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RISK INSURANCE AGAINST COMMODITY PRICE FLUCTUATIONS ON THE EXAMPLE OF WHEAT FUTURES

Abstract. The purpose of the article is to substantiate the expediency of hedging the risk of a decrease in revenue based on derivative financial instruments using the example of wheat futures. The study used such methods of scientific research as analysis and synthesis, logical method and comparative analysis.

The possibility and expediency of risk insurance of agricultural enterprises using wheat futures contracts was investigated. An analysis of the wheat market of Ukraine was carried out. The main stages of selling and factors affecting the prices of wheat were studied. The process of selling includes such basic stages as assessment of grain quality and volumes, buyer's choice and determination the most successful time for sale.

The price of wheat is influenced by such main factors as productivity, the region and weather conditions, the geopolitical situation in the world, the activity of grain traders, the peculiarities of logistics and exchange rate fluctuations. For a profitable grain trade, it is important to forecast the future price. The expected prices are determined by grain export market trends, grain quality, supply and demand,
competition, wheat stocks in warehouses, and other factors. It was performed analysis of prices for agricultural crops in different regions of the world on FOB delivery terms, grain price dynamics in Ukraine on EXW delivery terms, as well as logistical problems with wheat transportation to foreign buyers.

A methodical approach for calculating the financial results of futures contracts with monetary settlement is investigated. The approach is concluded for the purpose of insuring the risk of a decrease in revenue from the sale of wheat due to a price decrease from the point of view of a seller who takes a short position. The practical value of the research is that its results can be used to justify the feasibility of using wheat futures for hedging purposes by agricultural enterprises.

**Keywords:** futures contracts, derivatives, commodity futures, wheat prices, hedging, risk insurance, wheat market, price fluctuations, investment.

**Formulation of the problem.** The international futures market is a market where participants buy and sell commodities and futures contracts for delivery on a specified future date. The world’s leading futures exchanges include the New York Mercantile Exchange, the Chicago Mercantile Exchange, the London Financial Futures and Options Exchange, the Australian Stock Exchange and the Singapore Exchange.

Unfortunately, the futures market in Ukraine is not very developed, despite the adoption of relevant legislative acts, in particular, the Law of Ukraine «On Capital Markets and Organized Commodity Markets» [1], which regulates the futures market in Ukraine. In recent years, such derivatives were traded in the Ukrainian Stock Exchange, as futures on the index of Ukrainian shares (UX), futures on the exchange rate of the US dollar – Ukrainian hryvnia (DX), futures on the exchange rate of the euro – US dollar (DE) and the gold price futures (GOLDU). In 2021, the National Securities and Stock Market Commission of Ukraine specified futures for foreign securities on the Ukrainian Stock Exchange [2].

Only in 2017, the first futures trading for the supply of grain became operational in Ukraine [3]. Wheat futures contracts can help agricultural producers insure against price fluctuations or negative trends in the agricultural market. At the same time, there is a large and developed wheat market in Ukraine. That’s why, an urgent task is to study the feasibility of hedging the risk of a decrease in the revenue of agricultural enterprises using wheat futures contracts.

**Analysis of recent research and publications.** The futures market and the use of futures contracts for hedging risks are considered by various researchers. Chen’s study [4] shows that the futures market is an auction market where participants buy and sell commodities and futures contracts for delivery on a specified future date. The article by Fernando & Stapleton [5] examines the applied value of derivative instruments for market players, which can be one of two (or a combination): insurance against financial risks, i.e. hedging (mainly engaged in by
real suppliers or consumers of goods); speculation for financial gain (experienced traders and investors are engaged).

The article by Hayes [6] discusses the features of commodity futures, in particular, futures for basic commodities, such as crude oil, natural gas, corn, and wheat. Futures contracts can be used to set prices for any commodity or asset if there is a large enough market for it. The most commonly traded types of commodity futures are agricultural futures. These were the original futures contracts available on markets such as the Chicago Mercantile Exchange. In addition to grain futures, there are also futures contracts for fiber (such as cotton), lumber, milk, coffee, sugar and cattle.

In the work of Yavorska [7] studied the economic essence of futures trading, considered the evolution of the development of the world market of futures contracts, performed an analysis of the indicators of world exchange trading of futures in modern conditions.

**Purpose of the study.** The purpose of the study is to substantiate the expediency of risk insurance (hedging) on the financial market using the futures for Ukrainian wheat.

**Presenting main material.** Wheat is a key crop that Ukraine exports abroad. Its supply depends on the price and directly affects the investment climate in the agricultural industry. Selling wheat on the domestic market or for export is a complex matter that requires consideration of many factors. The sales process can be divided into the following stages.

1. Preparation, assessment of grain quality and estimated volumes.
2. Choosing the buyer who gives the best price. You can try to sell wheat yourself or trust an experienced trader.
3. Choosing the time of sale. It is often unprofitable to sell wheat immediately after harvesting: the price per ton falls due to oversupply on the market. You can keep the grain if you have a good elevator, in which the wheat will retain all its properties. Otherwise, the price may drop significantly.

A review of the agricultural market shows that Ukrainian wheat remains in demand in many countries of the world, including countries in Africa and Asia [8]. The following factors affect the spot price of wheat:

- type and quality of grain;
- ratio of standard indicators (protein and gluten);
- productivity;
- region and weather conditions;
- geopolitical situation in the world;
- activity of grain traders;
- starting price of purchasing wheat in the new season;
- price calculation with / without VAT;
- processing, storage, transportation of wheat;
- fluctuations in exchange rates (mainly the US dollar and the euro);
• marketing;
• logistics features.

Ukraine transports grain mainly by sea, therefore, it is important to carry out modernization in ports, improving local infrastructure, reducing cargo handling time and transport costs. Cost optimization makes it possible to offer potential buyers a favorable price for wheat per ton.

Wheat prices in Ukraine are constantly changing. A comparison of recent indicators shows that the prices of wheat fluctuated throughout the year. For successful grain trading, it is important to know the nearest forecasts of the price of wheat. Many factors affect the expected price: grain export market trends, grain quality, supply and demand, competition, wheat stocks in storage and much more. One of the main characteristics on which the price per ton of wheat depends is the quality of the grain. But other factors also influence the formation of wheat prices. The following are considered the most important [8]:

• volumes of harvested wheat crop;
• competition and price behavior on the world market;
• behavior of prices for other grain crops;
• availability of last year's residues in granaries;
• forecasts for next year's harvest.

One of the factors shaping the price is the behavior of grain traders, who lend to wheat producers against the collateral of the future harvest. The purchase prices of grain traders, in particular, reflect price fluctuations on the world wheat market.

Many wheat buyers enter into forward and futures contracts to purchase grain several months before the actual harvest. Based on these contracts, producers can partially finance the cultivation of wheat for the future crop. The price of forward contracts is formed on the basis of market operators' expectations of demand for wheat from major world buyers, cost of cultivation, trends of past years and other parameters.

Table 1 shows the prices of agricultural crops in different regions of the world in 2023 on terms of FOB (Free on Board) delivery.

<table>
<thead>
<tr>
<th>Region</th>
<th>24.04.23</th>
<th>27.04.23</th>
<th>28.04.23</th>
<th>1.05.23</th>
<th>29.06.23</th>
<th>6.07.23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain Wheat Argentina</td>
<td>335</td>
<td>330</td>
<td>330</td>
<td>330</td>
<td>339</td>
<td>340</td>
</tr>
<tr>
<td>Grain Wheat France</td>
<td>273</td>
<td>274</td>
<td>269</td>
<td>269</td>
<td>248</td>
<td>247</td>
</tr>
<tr>
<td>Grain Wheat EU Black Sea</td>
<td>272,5</td>
<td>267,5</td>
<td>264,5</td>
<td>252,5</td>
<td>232,5</td>
<td>237,5</td>
</tr>
<tr>
<td>Grain Barley France</td>
<td>260</td>
<td>253</td>
<td>248</td>
<td>246</td>
<td>231</td>
<td>233</td>
</tr>
<tr>
<td>Grain Barley EU Black Sea</td>
<td>244,5</td>
<td>237,5</td>
<td>237,5</td>
<td>232,5</td>
<td>202,5</td>
<td>197,5</td>
</tr>
<tr>
<td>Grain Corn Argentina</td>
<td>265</td>
<td>245</td>
<td>245</td>
<td>258</td>
<td>209</td>
<td>215</td>
</tr>
<tr>
<td>Grain Corn EU Black Sea</td>
<td>277,5</td>
<td>277,5</td>
<td>277,5</td>
<td>240,5</td>
<td>240</td>
<td>217</td>
</tr>
</tbody>
</table>

Source: [8, 9].
At the beginning of May 2023, the price of fodder wheat in Ukraine was UAH 5,400 per ton, and at the beginning of July – UAH 5,000 per metric ton (Table 2).

Table 2.

<table>
<thead>
<tr>
<th>Grains</th>
<th>13.03</th>
<th>27.03</th>
<th>03.04</th>
<th>18.04</th>
<th>01.05</th>
<th>22.05</th>
<th>12.06</th>
<th>19.06</th>
<th>04.07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>5575</td>
<td>5575</td>
<td>5575</td>
<td>5750</td>
<td>5400</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>Barley</td>
<td>5500</td>
<td>5500</td>
<td>5500</td>
<td>5500</td>
<td>5400</td>
<td>4850</td>
<td>4250</td>
<td>4250</td>
<td>4250</td>
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<tr>
<td>Corn</td>
<td>6150</td>
<td>6150</td>
<td>6150</td>
<td>6400</td>
<td>6125</td>
<td>5400</td>
<td>5400</td>
<td>5400</td>
<td>5400</td>
</tr>
</tbody>
</table>

Source: [8].

Figure 1 shows the dynamics of prices for agricultural crops in Ukraine in 2023 on terms of EXW (Ex Works) delivery.

Fig. 1. Dynamics of grain prices in Ukraine, EXW UAH/ton

Source: built by the authors based on data [8].

The export price increased significantly in spring and amounted to USD 350–380 per ton at the beginning of May. Wheat has become more expensive for foreign buyers due to both a reduced crop and shipping problems. At the present
time, no Black Sea port is able to provide full shipment and transportation of wheat, which was usual for past years. It is impossible to predict exactly how the price of agricultural crops will behave in such conditions. According to analysts, 2023 will be marked by a harvest of grain and oil crops in the volume of about 66 million tons. According to preliminary calculations, wheat will be actively harvested on an area of about 19 million hectares [8]. The projected export should be up to 30 million tons of raw materials. A mandatory condition for this is the growth of bandwidth at the border. It should increase at least twice.

According to experts, the wheat harvest will not be able to break the record level that marked 2021. The volume of the harvest of this agricultural crop will decrease by one and a half times on average. However, it still exceeds three times the amount of raw materials needed to cover the country's needs. The price for domestic consumers remains acceptable.

In order for wheat to become available to foreign buyers, a powerful alternative to shipping by sea must be found. For this, both technical and organizational obstacles should be eliminated. Due to the integrated approach, the price of raw materials will not change significantly.

Hedging the risk of a decline in revenue (hedging against a decline in the price of the underlying asset) from the seller's point of view is a short position. The seller makes a profit in the futures market when the price of the underlying asset falls.

Consider a futures contract for the purpose of hedging a farm enterprise on the futures market – a cash-settled futures contract. A farmer expects to sell 3,000 tons (110,229 bushels) of wheat over the next 6 months. The volume of one futures contract is 5,000 bushels of wheat. The execution time of the futures agreement is in 6 months. One bushel corresponds to the weight of wheat – 27.216 kg. The spot price of a bushel of wheat on March 1 at the rate of 335 USD/ton: 335 · 27.216 / 1000 = USD 9.1 / bushel.

One futures contract is 5,000 bushels of wheat. The futures price is USD 9 per bushel. The farmer decides to lock in the price at $9 per bushel by selling enough contracts to cover all or nearly all of the proceeds from the sale of the crop. The farmer needs 22 futures contracts (110,229 bushels / 5,000 bushels per contract ≈ 22 contracts). Expiration: March, May, July, September and December.

On September 1, the seller's forecast spot price for wheat is USD 8.6 per bushel. A farmer believes that the price of wheat will decrease, and on March 1st he sells 22 futures contracts at USD 9 / bushel. A buyer of wheat, who believes that the price of wheat will rise, decides to buy 22 contracts with a price of USD 9. The farmer and the buyer of wheat do not enter into direct transactions between themselves, but through the exchange. Reduction of the farmer's revenue on the physical wheat market: (9.1 – 8.6) · 100,229 = USD 55,115.

The result of the futures trading for the farmer may be presented like this:
March 1: sale of 22 futures: 9 · 110,000 = USD 990,000.
September 1: purchase of 22 futures: \(8.6 \times 110,000 = \text{USD} \, 946,000\).

Farmer's profit from the futures trading: USD 44,000.

But in practice, only mutual settlements through the stock exchange are carried out between the parties. In futures trading, the initial contract value for each party is zero, but the farmer must deposit USD 0.1 per bushel (9 – 9.1) through the exchange, and the exchange places this money into the wheat buyer's account. In addition, everyone is obliged to deposit an additional amount as collateral to protect the exchange, which assumes the risk of non-fulfillment of the contract by the counterparty.

Wheat fell by USD 0.5 from the initial spot price of USD 9.1 to USD 8.6 per bushel. The farmer's bill increases by USD 0.4 per bushel and the wheat buyer's bill decreases by USD 0.4 per bushel. Farmer's income on the physical market on the expiration date: \(8.6 \times 110,229 = \text{USD} \, 947,969\).

Farmer's profit in the futures market: \((-0.10+0.50) \times 110000 = \text{USD} \, 44,000\).

Actual revenue for the farmer from the sale of a bushel of grain (futures strike price): \((947,969 + 44,000) / 110,229 \approx \text{USD} \, 9\). The farmer received a net USD 0.40 \((-0.10 + 0.50)\) per bushel. The wheat buyer paid USD 0.40 \((0.10 – 0.50)\). Everyone will get back the extra amount deposited as collateral to protect the exchange. A farmer can sell wheat in the spot market for USD 8.6 per bushel and receive USD 0.4 per bushel as profit on the futures contract. Similarly, a wheat buyer may buy wheat in the spot market for USD 8.6 per bushel and pay USD 0.4 per bushel to settle the futures contract. So the wheat buyer has a net cost of USD 9 per bushel. Therefore, as a result of hedging, the farmer covers the decrease in revenue in physical wheat market by approximately 80%. Increasing the number of futures contracts can provide better result.

Conclusions. A review of the grain market shows that Ukrainian wheat remains in demand in many countries of the world, including countries in Africa and Asia. Comparison the indicators for different periods demonstrates that the price of wheat changes significantly during the year. The process of selling wheat includes such basic stages as assessing grain quality and estimated volumes, choosing a buyer, and determining a good time to sell. The price of wheat is influenced by such main factors as productivity, the geopolitical situation in the world, the region and weather conditions, the activity of grain traders, the peculiarities of logistics and exchange rate fluctuations.

The forecasting of the expected price of wheat is influenced by its quality, as well as the volume of the harvested wheat crop, competition and behavior of prices on the world market, behavior of prices for other grain crops, the presence of last year's residues in granaries; analysts' forecasts for next year's harvest, etc.

The use of the futures contracts with monetary settlement for hedging the risk of a decrease in the revenue of farm growing wheat is justified. The research shows that as a result of hedging, the farmer can cover a significant part of the decrease in revenue in the physical wheat market.
The advantages of wheat futures contracts are that enterprises can hedge the price of their product to protect against adverse price fluctuations. Futures contracts may require a deposit of a small fraction of the contract amount. Buyers and sellers do not enter into agreements with each other, but work with the exchange. It is a very liquid instrument, since there is no need to look for counterparty.

Disadvantages of futures contracts are the risk of losing more than the original margin amount, as futures use leverage, and the hedging enterprise will lose opportunities to take advantage of favorable price movements.

The practical value of the study is that agricultural enterprises can use the proposed method of analyzing the feasibility of using wheat futures to insure the risk of a decrease in revenue in the physical market.

References: